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der Schweizerischen Gesellschaft für Kardiologie (SGK) und
der Schweizerischen Gesellschaft für Herz- und thorakale Gefässchirurgie (SGHC)

Lausanne, 13–15 juin 2012
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Never say never again – Single ventricle correction in an adult patient

Background: Current concepts for correction of patients with single ventricles incorporate creation of a total cavopulmonary connection. However, a failing Fontan circulation is associated with poor quality of life and high mortality. Decision-making in late Fontan conversion is especially demanding.

Patient and Method: A 20y/o female patient with tricuspid atresia palliated by pulmonary artery banding during infancy was known to have increased pulmonary resistance, confirmed by repeated invasive hemodynamic evaluation. Therefore no further surgical interventions towards a total cavopulmonary connection were considered. As she grew up, oxygen saturation declined over the years due to more effective pulmonary artery banding. At age 17, the SO2 dropped to 75%, and another cardiac catheterization was performed. Mean pulmonary pressure was still rather high at 18 mm Hg, and the patient was considered unsuitable for Fontan conversion. She was assessed for cardiac transplantation. At age 21, functional class worsened again to NYHA III-IV, and invasive hemodynamic re-evaluation showed now a rather low mean pulmonary artery pressure of 13 mm Hg and a low LVEDP. In light of these findings, late Fontan conversion was re-considered.

Results: Post-operative course was generally uneventful but complicated by the need for repeated pleurocentesis. The patient is now in functional class II and still improving.

Conclusions: Periodic re-evaluation of adult patients with congenital heart disease deemed inoperable years ago needs active follow-up strategies provided by specialized centers, lead by an interdisciplinany team.

Ventricular septal defect originating from an apical left ventricular pseudoaneurysm
J. Vontobel, U. Hufschmid, M.J. Zellweger, B.C. Friedli (Baden, Basel)

Case: A 63-year-old man and passionate cyclist presented with a regular follow-up control in our outpatient clinic. His only cardiovascular risk factor was arterial hypertension. Cardiac auscultation revealed a 3/6 systolic murmur at the left ventricular (LV) apex. The 12-lead-ECG was normal. In a treadmill ergometry the patient showed an excellent exercise capacity and no ischemia. A transthoracic echocardiography revealed an apical trabecular ventricular septal defect (VSD) with a restrictive unidirectional left-to-right shunt (peak gradient 80 mm Hg). It originated from a perfused, dyskinetic apical pouch into the pericardium. The communication to the LV cavity was narrow. Pulmonary artery pressure was normal. A cardiac magnetic resonance imaging confirmed the described LV apical lesions. With a shunt-fraction of Qp/Qs 1,15 the shunt volume was small. Correspondingly the right ventricle was slightly hypertrophied with good function and the LV showed no signs of volume overload. LV ejection fraction was normal (LVEF 59%). Since the apical pouch did not contain muscular tissue, a pseudoaneurysm (PA) was diagnosed. Surprisingly, late gadolinium enhancement images revealed no abnormal findings and a coronary angiography showed no significant coronary artery disease (CAD). In the patient history there was no hint for trauma, but a cardiac murmur was diagnosed when undergoing the medical examination for military service at the age of twenty. After discussion with the cardiac surgery we opted for a conservative approach with antihypertensive medication and endocarditis prophylaxis.

Discussion: We report the case of a restrictive VSD originating from an apical LV PA which is a very rare coincidence. PAs normally are the result of a healed myocardial free wall rupture after myocardial infarction. Additional causes include local or systemic inflammation, trauma or cardiomyopathies. Despite extensive diagnostic work-up our patient did not show any of them. The patient’s history suggests a congenital aetiology of both the PA and the VSD. The therapeutic approach was discussed controversially because the risk of myocardial rupture remains up to speculation. A transcatheter closure of the defect was not an interventional option. In an asymptomatic patient without CAD, a small restrictive VSD and a long history of cardiac murmur, a clinical follow-up after one year without cardiac surgery seems to be the most reasonable approach.

LVADs as destination therapy in Switzerland – description of a case and perspectives
S. Reverdin, P. Meyer, D. Vala, F. Mach, A. Kalangos (Genève)

Background: Left ventricular assist devices (LVADs) play a growing role in clinical practice in Swiss centers. With recent technological developments and the advent of fully implantable continuous flow devices they became safer, more reliable and offer a better quality of life. While they have been extensively used as bridge to transplantation with good results, their use in patients amenable to transplantation, referred to as destination therapy (DT), is emerging as a lifesaving option for carefully selected patients.

Case description: We report the first case of LVAD use as DT at our institution. A 73 yo woman in good general health was not weanable from support with an intraaortic balloon pump and catecholamines 11 days after a massive anterior myocardial infarction. There was good preservation of right ventricular function. She was implanted with a Heartmate II (Thoratec Corporation, Pleasanton, CA) LVAD. She had an uneventful hospital course. She was hospitalized once during follow-up for gastrointestinal hemorrhage 10 months after implantation. She currently is in NYHA class I–II. She is independent, takes care of her grandchildren at home and attends monthly follow-up visits.

Discussion: This case illustrates the potential of DT to offer both quantity and quality of life to selected patients in Switzerland. As results improve, we can expect the main centers to start offering this option increasingly. It is a challenge as the target population is substantial and LVAD use as DT currently has no insurance coverage in Switzerland. It therefore requires special funding, setting the ground for economical and ethical dilemmas. DT also is a technical challenge. First, as we do not have validated options...
available that can offer biventricular support with an acceptable quality of life, DT patients have to do well on left ventricular support alone. Risk stratification for right ventricular failure is therefore of crucial importance. Second, DT implies a longer period of support and requires optimized strategies to prevent the occurrence of the main limiting adverse events in the long run, infection and stroke.

Conclusion: The use of LVADs as destination therapy is emerging as a promising new option for carefully selected patients. It has been validated in trials conducted in high volume centers, and should be progressively included in the treatment options for advanced heart failure in Switzerland, setting new clinical, economical and ethical challenges.

Do not forget Kawasaki Disease

Y. Roux, S. Qanadli, G. Girod, C. Sierro (Sion, Lausanne)

Introduction: Kawasaki disease (KD) is well-known in young children. However it can affect children over 8 years and young adults as well, with a worse prognosis. The main factor of poor prognosis is the delayed diagnosis because clinicians do not consider that diagnosis in this age groups.

Case report: We report the case of a 13 years old boy in good health, admitted to our hospital after 2 days fever at 39°C, vomiting, diarrhea and abdominal pain. Because of asthenia and systemic inflammatory reaction (CRP 254 mg/l), intravenous hydration and antibiotic treatment with ceftriaxone and metronidazol were started. After 3 days abdominal pain subsided, but fever continued, with spikes up to 39.5°C. On the fifth day he developed bilateral conjunctival injection, sore throat, redness and fissuring of the lips and fingers' desquamation. These new findings suggested a KD and intravenous immunoglobuline therapy (IVIG) was started with rapid resolution of symptoms. Transthoracic echocardiography (fig. 1) revealed normal biventricular size and function, without hypokinesia. No pericardial effusion. No valvular disease. Proximal enlargement of the left anterior descending coronary artery (LAD) was visualized. Cardiac CT (fig. 2) showed a three vessels aneurysmal coronary artery disease (CAD) including a giant aneurysm of proximal LAD (9 mm), an aneurysm of the circumflex artery (6 mm) and 2 aneurysms of 4 and 5 mm of the right coronary artery. The patient was discharged with combined therapy of Aspirin 100 mg/d and oral anticoagulation.

Conclusions: 1. The diagnosis of KD must be suspected in the presence of fever lasting 5 days or more without any other explanation and if 4 of the 5 following criteria are met: bilateral conjunctival injection; oral mucous membrane changes (injected or fissured lips or strawberry tongue); peripheral extemity changes, characterized in acute phase by erythema of palms or soles, followed during convalescent phase by perlingual desquamation; cervical lymphadenopathy (at least one lymph node >1,5 cm in diameter); polymorphous truncal exanthem. 2. CAD involvement is the major cause of morbidity and mortality of KD. Aneurysms develop in 15–25% of untreated patients. Treatment with IVIG within 10 days of illness onset reduces the prevalence of aneurysms to 4%. 3. Echocardiography is a good diagnostic tool to assess cardiac involvement and look for proximal enlargement of the coronary arteries, without any radiation exposure.

Symptomatic pulmonary hypertension in a case of partial abnormal pulmonary venous connection: look for an alternative cause!


Case: A 61-yo women complained of progressive dyspnea for one year, poorly responding to bronchodilator treatment. Due to suddenly worsening symptoms to NYHA class III, and an episode of chest pain, a pulmonary embolism was suspected. A venous ultrasound scan diagnosed a deep venous thrombosis and anticoagulation was started. Symptoms did not improve under treatment and further respiratory workup was performed one month later. Lung function tests showed no significant anomaly. CT-pulmonary angiogram (CTPA) detected no pulmonary embolism (PE) but a partial abnormal pulmonary venous connection (PAPVC) was incidentally detected, the left superior pulmonary vein draining to the left innominate vein via an anomalous left vertical vein. The echocardiogram revealed right ventricle dilatation with dysfunction and ruled out atrial septal defect. The estimated systolic PA pressure was 60 mm Hg (fig. 1). Invasive haemodynamics revealed a pre-capillary pulmonary hypertension (PH) (PA pressure 59/12 – 31 mm Hg; PCWP 9 mm
Anatomical predictors to improve the outcome of cryoballoon ablation for pulmonary vein isolation using the 28 mm balloon


Introduction: The anatomy of the left atrium (LA) may be critical for success of balloon-based technologies for pulmonary vein isolation (PVI). Pre-procedural predictors to improve outcome of cryoballoon (CB) ablation are still lacking. Our aim was to identify anatomical exclusion criteria for the single big balloon technique with the 28 mm CB to improve acute and mid-term (>6-month) success rate based on 3D reconstructed pre-procedural cardiac images.

Materials and methods: We included 47 patients (35 male, mean age 59 ± 11, LA 40 ± 6 mm) with symptomatic drug-refractory paroxysmal atrial fibrillation treated with CB ablation with 2 to 6 applications of 5 minutes (median: 2). All patients underwent pre-procedural cardiac magnetic resonance or computed tomographic imaging. Quantitative geometrical measures were diameter of PV (long and short axis), length of the left-sided common ostium (CO), and LA dimension in the coronal, transversal, and sagittal plane. Theoretical balloon-centric views on CB PVI procedure in combination with 3D visualization of the CB within the LA (figure) were used to deduce additional vein specific parameters for acute and mid-term CB PVI failure.

Results: Acute CB only success rate was 88% (32/ 47 pts) and per vein 88%, 85%, 93%, and 76% for left superior (LSPV), left inferior (LIPV), right superior (RSPV) and right inferior PV (RIPV), respectively. Acute procedural success including radiofrequency ablation (if needed) was 100%. Mid-term single-procedure success rates for CB only and the combined CB and RF approach were 40% and 60%, respectively, with a mean follow-up of 21 ± 9 months. We found a short CO (5 to 15 mm) in 40% and a long CO (>15 mm) in 8% of the patients. For pooled left pulmonary veins (LPV), a sharp-edged carina between LSPV and LIPV or between LPV and left atrial appendage (LAA) were identified as significant predictors for acute and mid-term PVI failure (p = 0.04). A non-perpendicular angle between RIPV ostium and vein axis was identified as predictor for acute PVI failure of RIPV (p = 0.03).

Severe mitral stenosis during pregnancy: how to manage it?
S. Noble, P. Meyer, N. Jastrow, H. Muller, M. Roffi (Genève)

A 36-year-old Pakistani woman was admitted at the 20th week of her third pregnancy for heart failure in the presence of a severe rheumatic mitral stenosis. She had no treatment before admission. She reported dyspnea class III, paroxysmal nocturnal dyspnea and orthopnea. Clinical exam revealed a heart rate of 90 bpm, a blood pressure (BP) of 105/73 mm Hg, limb edema, hepato-jugular reflux and basal pulmonary rales. There was an opening snap with a 2/6 mitral diastolic rumble. ECG showed a sinus rhythm. On the first transthoracic echocardiography (TTE) with a heart rate of 90 bpm, mean transmural gradient was 24 mm Hg and mitral area was 1.1 cm² according to pressure half-time. The estimated systolic pulmonary pressure was 45 mm Hg. Wilkors score was 7/16 and there was only trace of mitral regurgitation (MR). Diuretics and metoprolol 100 mg were started. At rest patient symptoms improved, but she was still complaining of lightheadedness and dyspnea during effort. Heart rate was reduced to 70 bpm. Her systolic BP was around 90 to 100 mm Hg. Blood tests revealed microcytic anemia (hemoglobin 96 g/l) with iron deficiency (ferritin 8 ng/ml). NT-proBNP was in the normal range. At 22 weeks of pregnancy with a mean maternal CO of 21 ± 9 mm Hg, mean transmural gradient decreased to 15 mm Hg as a result of better heart rate control. However since the targeted heart rate was below 60 bpm, dosage of metoprolol was increased up to 150 mg tid because of metoprolol shortened half-life during pregnancy and iron substitution was prescribed. Even though valve anatomy was favorable for percutaneous balloon valvotomy, our objective was to perform this procedure ideally only after delivery. A cesarean section was performed in the 34th week due to pathologic umbilical and uterine doppler signals with uncomplicated maternal and neonatal outcomes. Notably for her first 2 pregnancies, delivery by cesarean section was also required for obstetrical reason. At the end of breastfeeding, percutaneous balloon valvotomy was successfully performed 6 months after delivery. TTE at 3 months post procedure showed a 3.5 mm Hg transmitral gradient with mild MR.

Conclusion: Medical management should be favored whenever possible in pregnant women with severe mitral stenosis and the indication for percutaneous balloon valvotomy should be constantly reassessed. Following delivery, close monitoring should be performed during the first 72h with regards to postpartum fluid shift and subsequent risk of acute lung edema.
Conclusion: Exclusion of patients based on specific geometrical parameters obtained from pre-procedural CT/MR images for the left PVs and the RIPV has the potential to improve the mid-term outcome for CB ablation of AF.

Quantification of and Predictors for Left Atrial Fibrosis with Voltage Mapping in Atrial Fibrillation Patients

D. Altmann, L. Fiedler, P. Sommer, G. Hindricks, C. Piorkowski, A. Arya (Leipzig, DE)

Objectives: Left atrial (LA) fibrosis predicts the success of catheter ablation for atrial fibrillation (AF). Pulmonary vein isolation (PVI) is thought to be sufficient in paroxysmal AF patients with assumed low prevalence of LA fibrosis, while additional LA linear ablation increases the success rate in patients with persistent AF, where LA fibrosis is more prevalent. We sought to investigate the extent of left atrial low-voltage areas (LVA) in patients undergoing catheter ablation for AF, as well as possible predictors for the presence of LVA.

Methods: 99 patients (35 females; mean age 62 ± 9 years) with drug refractory AF (50 paroxysmal, 49 persistent) were investigated. Following PVI bipolar voltage was analysed during sinus rhythm using a non-fluoroscopic 3D electroanatomical mapping system (83 NavX; 16 CARTO). Areas with voltage <= 0.5 mV were defined as LVA. The relative extent of LVA was assessed manually using the area measurement tool of the 3D electroanatomical mapping systems and graduated as follows: no or minimal (<5% LVA), moderate (5–35% LVA) and extensive (>35% LVA). Significant LVA was considered if >= 5% of the LA surface was affected. Predictor variables for the presence of LVA were assessed by multivariable logistic regression analyses reported as odds ratios (OR) with 95% confidence intervals (CI).

Results: LVA was present in 28 (28%) patients. No or minimal LVA was present in 71 (72%), moderate and extensive LVA in each 14 (14%) patients. LVA was present in 11/50 (22%) patients with paroxysmal and in 17/49 (35%) patients with paroxysmal and in 17/49 (35%) patients with paroxysmal AF (p = 0.2). Demographic parameters are presented in table 1. Independent predictors for the presence of LVA were female gender (OR 3.53, 95% CI 1.06–11.72, p = 0.04), AF-duration (OR 0.98, CI 0.96–0.99, p = 0.02) and age (OR 1.12, CI 1.03–1.24, p = 0.008), while the type of AF did not predict the presence of LVA (p = 0.6).

Conclusion: Low-voltage areas in the left atrium are present in less than one-third of atrial fibrillation patients undergoing pulmonary vein ablation. The presence of low-voltage areas may be predicted by basic baseline parameters. Voltage mapping may help select the proper strategy in catheter ablation independent of the type of atrial fibrillation (paroxysmal or persistent).

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Hybrid Percutaneous Endocardial and Thoracoscopic
Epicardial Radiofrequency Ablation of Long Standing
Persistent Atrial Fibrillation: Initial Experience in
Switzerland.
A. Weber, J. Fuhrer, T. Carrel, B. Parlar, H. Tanner (Bern)

Background and Objectives: To overcome the shortcomings of
percutaneous catheter ablation and of minimal invasive surgical
ablation, the hybrid ablation procedure has recently been
introduced in order to combine the advantages of both techniques
in the treatment of long standing persistent atrial fibrillation (AF).
Our objective was to evaluate feasibility, safety and efficacy of this
technique in our first cases.

Methods: Between May 2010 and December 2011, 5 male
patients with long standing persistent AF, mean age 50.8 years
(range 42–62 years), underwent a single step hybrid minimally
invasive surgical treatment of persistent AF combined with a
percutaneous endocardial ablation. Both techniques employed
radiofrequency energy during general anesthesia in the EP lab.
Preoperative patient characteristics are depicted in table 1. The
surgical procedure is a closed-chest video assisted right
monolateral thoracoscopic epicardial ablation encircling all
pulmonary veins in a box lesion. Two ablation sequences were
carried out at target temperatures of 65 and 75 °C, 120 sec per
each ablation; the power is adjusted according to the target
temperature (max 150W). In addition, percutaneous catheter
assessment of pulmonary vein isolation and additional lesions
if necessary were performed. Rhythm follow-up using 7-day
ECG recording was performed at 3, 6 and 12 months.

Results: There were no intraprocedural complications. All
patients were extubated in the EP lab. Median procedure time
was 240 min (range 120–395 min). Median total X-Ray time was
19.4 (range 11.4–59.6 min). No patient required intensive care or
blood transfusion. One patient presented a transient diaphragmatic
paresis and one patient suffered a post-interventional transient
bradycardia. Mean in-hospital length of stay was 6 days.

Results of AF assessment are depicted in table 2. The single step hybrid surgical-epicardial
and percutaneous-endocardial ablation treatment of long persistent
AF is feasible and seems to be safe in an initial small series.

Conclusion: This preliminary report shows reasonable success for
suppressing AF after ablation at 5 years and beyond. However,
additional data is necessary in order to confirm these preliminary
outcomes and to identify predictors of long term success.

Long term outcomes after atrial fibrillation ablation
(LETITIA study), a preliminary report
N. Tran, P. Genti-Baron, E. Tessitore, C.-i. Park, H. Burti,
H. Sunthorn, D. Shah (Genève)

Introduction: Little data is available regarding long term follow
up of atrial fibrillation (AF) ablation. This latter is of particular
importance, as the prognostic significance of the suppression of
AF is not known. The aim of this study is to assess the efficacy
of AF ablation at 5 years and beyond.

Method: The study included all patients who underwent AF
ablation from January 2002 until December 2005 at the University
Hospital of Geneva. Patients were recontacted for follow up,
echocardiography and rhythm monitoring (Holter monitor from
24 h to 7 days).

Results: Among the 267 eligible patients, 70 (26%) have
completed the study to date (51 patients with paroxysmal AF and
19 with persistent AF at time of first ablation). The mean age was
63.7 (± 12.6) years and the follow up since the first procedure
was 81.7 (± 12.8) months and the follow up since the last ablation
procedure 59.9 (± 31.4) months. A total of 55 patients (79%)
underwent a first RCA in paroxysmal AF (X² = 2.876, P <0.10). The association
structural heart disease in 13/87; hypertension in 34/87;
antiarrhythmic drug therapy in 59/87) underwent a first RCA
ablation from January 2002 until December 2005 at the University
Hospital of Geneva. Patients were recontacted for follow up,
echocardiography and rhythm monitoring (Holter monitor from
24 h to 7 days).

Results: Among the 267 eligible patients, 70 (26%) have
completed the study to date (51 patients with paroxysmal AF and
19 with persistent AF at time of first ablation). The mean age was
63.7 (± 9.3) years of age, the follow up since the first procedure
was 81.7 (± 12.8) months and the follow up since the last ablation
procedure 59.9 (± 31.4) months. A total of 55 patients (79%) were
found in stable sinus rhythm (SR). Among those patients, 36
(65%) required only a single ablation procedure, 47 (85%) were
off oral anticoagulation and 50 (91%) off antiarrhythmic drugs.

Then, 84% (43) of patients with paroxysmal AF and 68% (13)
with persistent AF were in stable SR (X² = 0.106, P >0.5). The
left atrium size reduced to normal size in 50% after successful
ablation of paroxysmal AF (X² = 2.876, P <0.10). The association
of hypertension (HTN) and dyslipidemia (DYL) was significantly
higher by 2.3 times in patients with unsuccessful AF ablation
(X² = 4.248 P <0.05). Among patients with initial paroxysmal AF,
6 developed persistent AF over 22.5 (±18.4) months and 5 had
HTN associated with DYL. Conversely, only one patient with initial
persistent AF developed paroxysmal AF, 61 months after initial
successful ablation. During follow up, 1 patient had pulmonary
veins stenosis, 4 had AV node ablation with pacemaker
implantation, 2 had late stroke and one patient died from cancer.

Conclusion: This preliminary report shows reasonable success for
suppressing AF after ablation at 5 years and beyond. However,
additional data is necessary in order to confirm these preliminary
outcomes and to identify predictors of long term success.

Prediction of atrial fibrillation recurrences after
radiofrequency pulmonary vein isolation according to
the p-wave signal averaged electrocardiogram
C. Blanche, N. Tran, F. Rigamonti, H. Burti, M. Zimmermann
(Meyrin/Genève)

Background: Recurrences of atrial fibrillation (AF) after
radiofrequency catheter ablation (RCA) are frequent and usually
carried out by pulmonary vein (PV) re-conduction, by foci outside
the PV or by previous electrical remodelling. Substrate alterations
with conduction delays may be detected by signal-averaged
P wave analysis (SAPW). This study was conducted to assess the
value of the SAPW to predict recurrences after RCA in patients
(pts) with paroxysmal or persistent AF.

Methods: Eighty-seven pts (59 ± 11 years, 70 males, 17 females;
structural heart disease in 13/87; hypertension in 34/87;
antiarrhythmic drug therapy in 59/87) underwent a first RCA
procedure for paroxysmal (n = 51) or persistent/long-standing
persistent (n = 36) AF. A SAPW recording (Phy-Res analysis –
Marquette Medical system; measurement of total filtered P wave

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**Introduction:** The crucial role of pulmonary veins as drivers of atrial fibrillation has been established and their isolation is one of the steps of AF ablation. Despite high rates of acute pulmonary vein isolation (PVI) during first ablation, PV reconnection is the most common mechanism of ablation failure and AF recurrence. We evaluated if acute (under Adenosin injection) or long-term PV-recovery sites correlated to ablation sites with low contact force (CF) or low force time integral (FTI), in patients undergoing PVI for AF.

**Methods:** Multi centre trial including 80 AF patients. Wide 3D-guided PVI was performed using the Smart-Touch and CARTO3 system (BiV). The 1st 40 patients were ablating with the operator being blinded to the CF/FTI data. Acute PV-reconnection sites under Adenosin (or during waiting period) were marked on the 3D-map for later comparison to regional CF and FTI data that were recorded during index RF-ablation for PVI.

**Results:** From June 2011, 20 patients (65 ± 8 yo, 38% persistent AF) were included. Adenosin-mediated acute PV-reconnection was assessed after a 20-minute waiting period post isolation of all PVs: PV-reconduction occurred under Adenosin in 9/20 (45%) patients and at 27 PV-sites. Acute PV-reconnection sites located in 81% to ablated LA sites with a contact force <9 g and in 87% to ablation sites with FTI-values <420 gs. Contact force-time integral (FTI) was significantly higher at LA sites without PV-reconnexion than sites with PV-recovery: 449 ± 488 gs vs. 240 ± 193 gs, p <0.0007 and median: 585 (Q1:137, Q3: 324gs) vs. 342gs (Q1:75gs, Q3:202gs), respectively.

We observed a low ablation point density at the remaining PV-reconnection sites with higher FTI-values.

**Conclusions:** Low contact force during pulmonary vein isolation is the underlying mechanism of Adenosin-mediated acute PV-reconnexion in 87%. Prospective use of CF measurement for PVI may significantly reduce the current high rates of PV-reconnexion.

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**Adenosin-mediated Acute Pulmonary Vein reconnection occurs at regions of low Contact-Force-Time Integral – A Randomized Trial**


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**Risk factors and incidence for delirium in patients undergoing cardiac surgery with cardiopulmonary bypass support vs. beating heart (off pump) surgery**


**Objective:** To determine the incidence and risk factors for delirium a retrospective analysis on 454 patients undergoing cardiac surgery with the support of cardiopulmonary bypass (CPB) versus off-pump coronary artery bypass (OPCAB) was performed.

**Methods:** Risk parameters were identified for all patients. CAM ICU assessment for delirium was performed post-operatively. The patients were allocated into two groups: Group 1, 245 patients requiring CPB support and Group 2, 175 patients receiving OPCAB procedures. Micro-emboli activity was measured on CPB patients with the BCC200 Bubble Counter. 34 patients could not be allocated into these two groups and were excluded from the group totals.

**Results:** The total incidence of delirium for all cardiac patients (454) was 14.76% (65 pts), for Group 1 (CPB, 21.22%, 52 pts), and Group 2, (OPCAB 7.43%, 13 pts). Significant risk factors for group 1 were age (p = 0.0001), Euroscore (p = 0.0199), CPB time (p = 0.0033), aortic clamp time (p = 0.0241), MEG volume (p = 0.0103) and transfusion of erythrocytes (p = 0.005). For group 2 risk factors were age (p = 0.0014), Euroscore (p = 0.0261), Cell-
Saver volume (p = 0.0146) and transfusion of erythrocytes (p = <0.0001). Areas of postoperative morbidity for delirium for time, pneumonia, new atrial fibrillation, ICU and hospital stay. Cardiopulmonary bypass are significant risk factors for delirium. Off pump coronary artery bypass surgery significantly reduces the incidence of postoperative delirium by avoiding the use of cardiopulmonary bypass.

Risk factors for sternal wound infection in patients undergoing off pump coronary bypass surgery with BITA

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Purpose: The use of bilateral internal thoracic artery (BITA) grafting has shown a better survival benefit when compared to single internal thoracic artery (ITA) grafting. Previous studies have provided conflicting evidence as to whether an increased risk of sternal infection is associated with the use of bilateral internal mammary artery as a coronary bypass graft (CABG) in patients with diabetes, COPD and obesity. This study was undertaken to evaluate the risk factors for sternal wound infection in patients undergoing off pump ACBP with BITA grafting.

Method: The data of all patients who underwent off pump CABG between 1/2009–12/2010 were retrieved from our data bank. The preoperative and postoperative risk that may predispose to sternal wound infection were evaluated. Sternal wound infections were classified according to the guidelines of the Centre of Disease Control and Prevention.

Result: 384 patients underwent off pump ACBP and of those 48.4% received BITA grafting, 6.4% prestenal wound infections and no mediastinitis occurred in those who received BITA grafting. With BITA grafting there was no correlation between prestenal wound infections and gender, age, body mass index, Euro Score, diabetes mellitus, HbA1c, preoperative albumin, history of smoking, extra cardiac arteriopathy, number of coronary vessel disease, left main disease, re-operation/urgent surgery, number of graft used, surgical time, surgical room temperature and humidity, ICU days, postoperative atrial fibrillation and blood transfusion. There was a significant correlation between both deep sternal wound infection and COPD (P = 0.003, C2D.0.17;0.019).

Conclusion: Our analysis shows that only patients with COPD are at risk for developing prestenal infection with off pump BITA grafting. The rest of the patients solely based on the risk sternal infection should not be denied from receiving off pump BITA grafting.

Aortic No-Touch Off-Pump Surgery reduces Stroke in patients with Left Main Disease


Background: Surgical revascularization is still considered to be the most appropriate therapy for patients with Left Main Disease (LMD). A high mortality issue when compared to PCI. This study evaluates the safety and impact of standardized off-pump surgery (OPCAB) applying "aortic no-touch strategy" for stroke-reduction in patients with LMD.

Methods: From 2002–2010, 1256 patients suffering from significant Left Main Disease underwent surgical-revascularization at our institution. Patients either received aortic no-touch OPCAB (n = 722) or conventional on-pump CABG (n = 534). Data-collection was performed prospectively and a propensity-adjusted regression-analysis was applied to balance patient characteristics. Endpoints were mortality, stroke, a cardiac-composite (including death, stroke and myocardial-infarction), a non-cardiac composite and complete-revascularization.

Results: For OPCAB patients, stroke (0.3% vs. 2.9%; Propensity-Adjusted Odds-Ratio (PAOR) = 0.028; p = 0.008) and the cardiac-composite (2.3% vs. 7.8%; PAOR = 0.22; p = 0.001) were significantly lower while the mortality-rate was comparable to on-pump CABG (LMD: 1.4% vs. 2.5%; PAOR = 0.36; p = 0.15). The Non-Cardiac Composite was also significantly decreased after OPCAB and complete revascularization was achieved similarly when compared to on-pump CABG (94.2% vs. 93.7%; p = 0.41).

Conclusions: This study shows the superiority of OPCAB for patients with LMD with regards to risk-adjusted outcomes other than mortality. An "aortic no-touch strategy", effectively reduces stroke yielding similar results as achieved with PCI.

Gender differences in secretion of adipokines off pump coronary bypass surgery (OPCAB)

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Purpose: Previous studies have suggested that women have a less favorable outcome after coronary bypass surgery when compared to men. This study was undertaken to examine the postoperative time course of serum inflammatory markers and anti-inflammatory responses to off pump coronary bypass surgery stratified by gender.

Method: The time course of fasting level of tumour necrosis factor alpha (TNF-alpha), interleukin 8 (IL-8), soluble IL-1 type I receptor (sIL-1RI), soluble IL-1 type II receptor (sIL-1RII), c-reactive protein (CRP), monocyte chemo-attractant protein-1 (MCP1), Interferon-gamma induced protein (IP-10), vascular endothelial growth factor (VEGF) at baseline on day 0 and at postoperative days 1,2,3,4,5,6,7 was measured on 65 consecutive patients undergoing elective off pump coronary bypass surgery. The exclusion criteria consisted of the use of anti-inflammatory medications, history of inflammatory disease, acute infection, acute myocardial infarction, and use of antibiotics within two weeks of surgery.

Result: 11% were female. At baseline TNF-alpha was higher in women compared to men (p = 0.008). Postoperative days 1 and
2 there were no differences in adipokines secretion between the two genders. Postoperative day 3-7 there was significantly higher sIL-1RI (p = 0.011, 0.031, 0.041, 0.014, 0.004) and significantly higher value of TNF-alpha (p = 0.021, 0.003, 0.052, 0.021, 0.052) in the female gender. There was no difference between the two groups in the time course of the serum levels of IL-8, soluble IL-1(R), IP-10, CRP, VEGF and MCP1.

Conclusion: Off pump coronary surgery in females produces significantly higher inflammatory states as compared to males. Both TNF-alpha and sIL-1RI production were higher in the female gender.

Natural History of Optical Coherence Tomography-Detected Edge Dissections 12 Months Following Drug-Eluting Stent Implantation.

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Background: Angiographic evidence of edge dissections has in some studies been associated with an increased risk of early stent thrombosis. Optical coherence tomography (OCT) is a high-resolution imaging modality which is increasingly being used during coronary interventions. In relation to the high resolution, OCT detects a greater number of edge dissections as compared to angiography. The natural history of these OCT-detected disruptions and their clinical implications remain however, unclear.

Methods: Edge dissections were defined as disruptions of the luminal surface in the 5 mm segments proximal and distal to the stent, and categorised as flaps, cavities, double-lumen dissections or fissures. Qualitative and quantitative OCT analyses with regards to longitudinal, lateral, and axial extension were performed every 0.5 mm at baseline and 12 months, and clinical outcomes were assessed.

Results: A total of 63 lesions from 57 patients were studied with OCT after stent implantation and at 12 months follow-up. Twenty-two edge dissections in 21 lesions from 20 patients were identified by OCT; only two (9%) were angiographically visible. Flaps were found in the majority (90%) of cases. The average longitudinal dissection length was 2.9 (interquartile range (IQR) 1.6–4.2) mm, whereas the lateral and axial extensions amounted to 1.2 (0.86–1.67) mm and 0.61 (0.38–0.7) mm, respectively. Dissections extended into the media in 7 (33%) and into the adventitia in 4 (20%) cases. Eighteen (81%) edge dissections were also evaluated with IVUS which identified 9 (50%) of the OCT-detected dissections. No stent thrombosis or target lesion revascularisation occurred up to 12 months. At follow-up, 20 (90%) edge dissections were completely healed on OCT (fig. 1). The two cases showing signs of previous dissection exhibited at baseline the longest flaps (2.81 mm and 2.42 mm) in the cohort. One of these additionally showed the longest longitudinal extension (6.0 mm).

Conclusion: OCT-detected edge dissections which were most often angiographically silent appeared to be healed at 12 months with no adverse clinical events. A conservative approach to the treatment of OCT-detected edge dissections should be considered.
but in the RG group we were able to reduce it up to trivial (1+)
releasing the pull-string suture.

Conclusions: Both models induced consistent and reproducible
MR keeping normal left ventricle function. However the reversible
method could affect the evaluation of the MR repair technique
because the severity of the MR could change at any time due
to accidental displacement of the pull-string suture. The fixed is
more reliable and reproducible which are the main characteristics
of excellent animal models.

Patient-Specific Mitral Annuloplasty Ring
Implantation
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Objective(s): Implantation of an annuloplasty ring is an essential
component of mitral valve repair. The commonly used off-the-
shelf rings do not account for the individual variability of the
mitral annulus. Based on the availability of 3D imaging
modalities with sufficient resolution and accuracy for modeling
the mitral annulus, the concept of a patient-specific annuloplasty
(PSA) ring was developed. The objective of this feasibility trial
was to proof the concept of PSA in an acute animal model.

Methods: ECG-gated CT-Angiography (CTA) was performed
in six healthy pigs. The 3D shapes of the mitral annuli were
extracted from the CTA images. Based on the individual shape of
the mitral annulus in systole, a solid ring with integrated suturing
holes and indentations to mark the position of the commissures
was modeled and produced for each pig out of a biocompatible
aluminium alloy using rapid prototyping technology. Each ring
was implanted through a left sided thoracotomy using cardopulmonary
bypass (CPB) on the beating heart. After closure of the left atrium,
the annulus were weared off bypass and valvoplasty was
assessed by epicardial echocardiography.

Results: The modeled ring shapes differed strongly from any
annuloplasty ring available on the market. Both rings in stage
one were severely over sized. Systematic errors in the modeling
process were identified as sources for the mismatch. The modeling
process was adjusted accordingly for the second stage. All rings in the second stage matched the annuli and valves
appeared competent in Echo after implantation. One out
of four rings in that stage showed a slight deviation from the
circumference macroscopically. Ring suturing time was comparable to conventional rings but no time for sizing was necessary.

Conclusion: Planning, production, and implantation of
individually built annuloplasty rings is feasible. Image quality
and accuracy of the extracted annular models are sufficient for
providing a basis for modeling and rapid prototyping of mitral
rings. The chosen design consisting of a biocompatible
aluminium alloy with embedded suturing holes ensured firm
implantation and facilitated positioning of the ring.

Endothelial Cx40 is down-regulated by oscillatory
shear stress: Possible intersection with the
NF-kappaB pathway
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Connexin40 (Cx40) is a gap junction protein essential for cell-cell
communication in the vasculature. Endothelial cells (ECs) of
healthy arteries express high levels of Cx40, but this expression
is lost in ECs overlying atherosclerotic plaques. The development
of atherosclerosis is accelerated in apoE-/- mice without endothelial-
specific deletion of Cx40, which suggests that Cx40 has anti-
atherogenic properties. The spatial distribution of atherosclerotic
lesions is governed by shear stress (the frictional force exerted
on ECs by flowing blood). Low/oscillatory shear stress observed
in bends and bifurcations of arteries, induce inflammatory
activation of ECs via the activation of the nuclear factor (NF)-kB
pathway. In this study, we have investigated the relation between
shear stress, Cx40 and NF-kB. Shear stress-modifying vascular
casts were placed around the right common carotid artery of mice
expressing eGFP under the promoter of Cx40. Cx40 and eGFP
expression in response to flow were assessed by en face
immunofluorescence in heterozygous Cx40/eGFP mice. We found
that Cx40 expression is down-regulated in regions of oscillatory
flow (0.45 ± 0.13), but is conserved in regions of high and low
laminar flow (0.85 ± 0.11 and 1.45 ± 0.48, respectively, n = 8).
To identify potential binding partners for the regulatory
intracellular C-terminal of Cx40 in Cx40(CT) we performed phage
display experiments. After 4 rounds of selection, 22 different
peptide sequences were isolated. Twelve peptides contained the
4-residue motif HSLR[LV][KR] starting with a Histidine and a
Serine, and followed by a Hydrophobic residue (Isoleucine, Leucine or Valine) and a basic residue (Lysine or Arginine).
Twelve peptides shared 4 or more residues with one of the
retrieved peptides. HSLRPEWRMPGP, Sequence alignment
against the NCBI protein database indicated 58.3% homology
of this peptide with N-terminal residues 5 to 16 of IkappaB alpha,
a member of the family of inhibitory proteins that control the
expression of NF-kB. Therefore, IkappaB alpha and Cx40 are
both modulated by the same regulatory pathway. We concluded
that the homologous IkappaB alpha sequence to Cx40CT was
confirmed by crosslinking experiments using the chemical
crosslinker BS3 at physiological condition. The first time a functional interaction between IkappaB alpha and
Cx40. This interaction may be relevant for the control of NF-kB
activation by shear stress.

The endothelial gap junction protein connexin40
limits myocardial infarct size after ischemia-
reperfusion in mice
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Purpose: Intercellular channels formed by connexins (Cx) have
been shown to play a critical role in cardiovascular disease. For
instance, vascular Cx43 influences atherosclerosis development
and plaque stability, and cardiac Cx43 may determine the
development of arrhythmias after myocardial infarction. As a
result, Cx40 is expressed in atrial cardiomyocytes, the conduction
system and in endothelial cells, whereas Cx37 is only found in
the endothelium. Here, we study the implication of the endothelial
connexins during ischemia and reperfusion in mice.

Methods and results: We used the Cre-loxP system to create a
dmouse line in which Cx40 is deleted from the endothelium only.
Immunostainings on Tie2Cre+ Cx40fl/fl ApoE-/- mice confirmed
the absence of Cx40 in the endothelium, whereas the protein was
normally expressed in the atria and cardiac conduction system.
Moreover, Cx40 was normally expressed in the coronary
atria and conduction system of Tie2Cre+ Cx40wt/wt ApoE-/- and
Tie2Cre- Cx40fl/fl ApoE-/- control mice. Sixteen-week-old mice
were subjected to in vivo left coronary artery occlusion for 30
minutes and sacrificed 24-hours after reperfusion for analysis
of infarct size. Myocardial surfaces at risk and infarcted
areas were measured from computed images using NIH Image
software. Areas at risk, normalized to total left ventricle surfaces
areas, were similar between the experimental groups, i.e.
Tie2Cre+ Cx40wt/wt ApoE-/- 29.2 ± 1.2% (N = 11), Tie2Cre-
Cx40fl/fl ApoE-/- 33.7 ± 3.7% (N = 9), and Tie2Cre+ Cx40fl/fl
ApoE-/- 31.7 ± 2.2% (N = 7). Interestingly, the infarct area,
normalized to areas at risk, was significantly increased in
Tie2Cre+ Cx40fl/fl ApoE-/- (20.2 ± 3.1%, P <0.05) mice as
compared to controls (10.1 ± 2.0% and 11.3 ± 1.8%). To
investigate the possible implications of another endothelial
connexin in myocardial infarction, Cx37-/- ApoE-/- mice were
submitted to the same protocol of in vivo ischemia-reperfusion.
Areas at risks were similar between Cx37-/- ApoE-/- and control
ApoE-/- mice (44.9 ± 3.3% (N = 10), 38.4 ± 3.8% (N = 12), n.s.),
and the infarct area appeared not affected by the deletion of
Cx37 (Cx37-/- ApoE-/- 13.8 ± 1.3%, ApoE-/- 14.7 ± 2.7% n.s.).

Conclusions: We conclude that endothelial Cx40, but not Cx37,
is implicated in resistance of the heart to ischemia-reperfusion
injury. These findings may point towards a specific novel
therapeutic target to limit the cardiac injury after coronary
interventions.
Depletion of cardiac side population (CSP) progenitor cells in the absence of a functional Fms-like tyrosine kinase 3 (flt3)/flt3 ligand (FL) system

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Introduction: Side population (SP) cells, a primitive stem cell-like population consisting of various cellular subsets, have been isolated from various tissues including the heart. Along with the ability of self-renewal, Sca1+/CD31- cardiac SP (CSP) cells exhibit cardiomyogenic potential as they can differentiate into mature cardiomyocytes. CSP cell fate is largely determined by the surrounding environment. Fms-like tyrosine kinase 3 (flt3) ligand (FL) is an early-acting cytokine involved in the regulation of proliferation, differentiation and survival of progenitor cells of hematopoietic and non-hematopoietic origin. FL and its specific receptor flt3 are expressed in the heart, and we previously uncovered a protective effect of flt3 in oxidative stress-induced cardiomyocyte injury. In the current study, we hypothesize that the flt3/FL system is involved in the regulation of the CSP.

Methods: Hearts from 12 weeks-old wild-type (wt) C57Bl/6 mice and from age-matched flt3-/- and FL-/- mice were digested with collagenase B and treated with Red Blood Cell lysis buffer. The resulting cardiomyocyte-free cell suspension was subsequently stained with Hoechst 33342 (90%) and with Sca1-PE and CD31-APC (30%), respectively. CSP cells, characterised by their intrinsic capacity to efflux Hoechst, were analysed regarding quantity as well as expression of Sca1 and CD31 by FACS using FlowJo software.

Results: Matched isolations revealed a significant reduction of the CSP in flt3-/- as compared to wt hearts (0.87 ± 0.20% vs. 1.53 ± 0.25%; p < 0.01, n = 7). Similarly, FL-/- hearts exhibited markedly lower amounts of CSP cells as compared to wt (0.87 ± 0.36% vs. 1.50 ± 0.30%, p < 0.05, n = 4, respectively). Although paired analysis of Sca1 and CD31 showed a concomitant decrease of Sca1+/CD31- cells in flt3-/- and FL-/- hearts in absolute numbers, the relative proportion of the Sca1+/CD31- fraction within the CSP was mostly preserved (1.61 ± 0.42% vs. 1.54 ± 0.52% for wt vs flt3-/-, n = 7, p = n.s.; and 1.04 ± 0.54% vs. 2.00 ± 0.72% for wt vs FL-/-, n = 4, p = n.s.), suggesting that depletion of the CSP occurs proportionally across all cellular subsets.

Conclusion: Disruption of the flt3/FL system causes depletion of CSP cells, suggesting that flt3/FL is involved in the regulation of cardiac progenitor cells. Depending on the underlying mechanism, stimulation of flt3 via its ligand may offer a therapeutic strategy to enhance intrinsic regenerative capacities of the heart.

Progenitor cells expressing stage-specific embryonic antigen-1 (SSEA-1) can be isolated from human adult hearts and show mesenchymal progenitor cell characteristics

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Aim: Mesenchymal stem cells (MSC) are multipotent stromal cells that can be isolated by plastic adherence from many tissues and are able to differentiate along mesenchymal lineages. They share by cardiac fibroblasts, however, and there is no single MSC marker that could be used to identify the most primitive mesenchymal stem cell that reatins the highest differentiation potential. Stage-specific embryonic antigen-1 (SSEA-1/CD15) is expressed by embryonic cells as well as by multipotent cardiovascular progenitor cells in nonhuman primates. The latter are able to engraft in infarcted myocardium and generate cardioma muscle, vascular smooth muscle and endothelial cells. We aimed to assess whether SSEA-1 would also be expressed by progenitor cells derived from human adult hearts.

Methods: Right atrial appendage samples were obtained from 6 patients who underwent heart surgery for coronary artery disease or heart valve disease. They were enzymatically digested and cultured as “explants” giving rise to stromal-like cells that were harvested and seeded on poly-D-lysine-coated dishes in cardiosphere medium. Several days later, cardiospheres (spherical cell aggregates) were plated on fibronectin-coated flasks and expanded as cardiosphere-derived cells (CDCs). Cell surface markers were analyzed by flow cytometry. SSEA-1+ cells were purified by magnetic immunosorting (MACS).

Results: Cell outgrowths from myocardial explants contained 17% of SSEA-1+ cells on average (an example is shown in the Figure’s left panel). These cells were CD105+ but negative for other markers known to be expressed in cardiospheres (c-Kit, CD309) and for the hematopoietic markers CD14 and CD34 (3% cells were CD45+). SSEA-1+ cells could be enriched up to 88% purity by MACS (middle panel) and expanded as clonal outgrowths and in cells cultured as cardiospheres (right panel) or CDCs.

Conclusions: The human adult heart harbors SSEA-1+ cells that express MSC markers, form spheres and can be clonally expanded. These characteristics indicate these SSEA-1+ cells are mesenchymal progenitors. Their differentiation potential is currently being addressed. These results, together with previous data in nonhuman primates, suggest human SSEA-1+ cardiac progenitors may be an attractive cell source for therapeutic applications.

Flowcytometric analysis of SSEA-1/CD15 expression in unsorted CPC outgrowths

Flowcytometric analysis of SSEA-1/CD15 expression in sorted CPCs (by MACS)

Human cardiosphere in culture
Invasive findings in patients with angina equivalent symptoms but no coronary artery disease; results from the heart quest cohort study

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Background: This study aimed to identify the cause of angina in patients who underwent coronary angiography for angina equivalent symptoms, but had no significant coronary artery disease (CAD).

Methods: This prospective cohort comprised 718 consecutive patients with angina equivalent symptoms and no CAD (defined as no coronary stenosis $\geq 50\%$) between January 1st 1997 and July 31st 2008. All patients underwent additional invasive testing (intracoronary acetylcholine administration, fast atrial pacing).

Small vessel and vasospastic disease were diagnosed according to symptoms and vessel reaction during testing.

Results: A majority of 431 patients (60.0\%) had small vessel and/or vasospastic disease (233 patients had small vessel disease, 145 patients of vasospastic disease and 53 a combination of both).

Additional 87 patients (12.1\%) had another cardiac disease as cause for their angina (e.g. hypertensive heart disease, rhythm disorders, endothelial dysfunction). Only in a minority of 200 study participants (27.9\%) the angina model was attributed to an extracardiac problem. Patients with small vessel disease were more likely to be female, to have hypertension, to have a family history of premature coronary artery disease, and to have effort-related symptoms. Patients with vasospastic disease were more likely to be current smokers, to have angina at rest or to present as myocardial infarction, and to have coronary sclerosis and/or endothelial dysfunction.

Conclusions: In a majority of patients with angina but no significant CAD, a cardiac cause of their symptoms can be found. Systematical invasive testing may help optimizing the medical management of these patients.

Study registered at ClinicalTrials.gov (NCT01318629)

Premature atrial contractions in the general population: prevalence and risk factors


Introduction: Premature atrial contractions (PACs) are independent predictors of ventricular fibrillation and other adverse outcomes, including stroke and death. However, little is known about PAC prevalence in the general population and risk factors for PAC occurrence.

Methods: We performed a cross-sectional analysis among participants of the population-based Swiss cohort Study on Air Pollution and Lung Diseases in Adults (SAPALDIA). At the SAPALDIA follow-up visit in 2002, 24-hour Holter electrocardiograms were performed in 1742 participants aged 50 years or older. PACs were identified by a coupling interval to the preceding QRS complex $<80\%$ of the mean RR interval to the preceding QRS complex.

Results: 18 of 1742 (1.0\%) participants did not have at least 1 PAC on average per hour (log-transformed).

Mean age was 20.3 ± 6.5 years, 74\% were men. Football (33\%) and ice hockey (13\%) were the sports most often represented.

Conclusion: PACs are independent predictors of ventricular fibrillation and other adverse outcomes, including stroke and death. However, little is known about PAC prevalence in the general population and risk factors for PAC occurrence.

Cardiovascular screening with ECG in young athletes is feasible at low cost. Intermediate results of a prospective study

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Introduction: adding ECG to cardiovascular screening in young athletes is controversial mainly because of low specificity of ECG depending on criteria utilized. The 2010 recommendations of the European Society of Cardiology (ESC) for interpretation of ECG in athletes should increase specificity but prospective data are limited. The aim of this study was to assess the number of additional cardiac examinations and the total costs of a program of cardiovascular screening with ECG in young athletes using basically the 2010 ESC criteria for interpreting ECG.

Methods: in this observational prospective study, competitive athletes from 14 to 35 years were examined following the ESC proposal (history, physical examination, ECG). ECG was interpreted based on the ESC 2010 recommendations (adapted). Further examinations were proposed in cases of positive findings. The costs of the screening and all subsequent examinations was calculated for each athlete according to the Swiss medical rates. We present the intermediate results of this study.

Results: from 02/2011 to 12/2011, 809 athletes were examined. Mean age was 20.3 ± 6.5 years. 74\% were men. Football (33\%) and ice hockey (13\%) were the sports most often represented.

Conclusion: The costs of the screening and all subsequent examinations was calculated for each athlete according to the Swiss medical rates. We present the intermediate results of this study.
premature beats, 3 Wolf-Parkinson-White ECG-pattern, 1 mitral valve prolapse with mild regurgitation, 1 bicuspid aortic valve with mild regurgitation and mild aortic ectasia and 1 systemic hypertension. Mean cost per athlete was 136 Swiss Francs (102–1581 Swiss Francs).

Conclusion: preliminary data of this study indicate that cardiovascular screening with ECG in young athletes is feasible with few subsequent examinations and accordingly at low cost. These data should aid the implementation of this policy.

Comparison of pre-operative continuation and discontinuation of aspirin in patients undergoing elective hip and knee arthroplasty


Background: Discontinuation of aspirin while reducing bleeding risk may increase the risk of perioperative cardiovascular events. However, data on this topic is retrospectively. We therefore assessed the impact of pre-operative continuation or discontinuation of aspirin on local complications, bleeding risk, and cardiovascular outcome in a cohort of 739 consecutive patients undergoing elective hip (n = 396) and knee arthroplasty (n = 343).

Results: From our patients, 465 did not receive any antithrombotic or full-dose anticoagulatory medication, 71 received vitamin K antagonists, 14 clopidogrel, 175 aspirin, and 14 combinations of ≥2 antithrombotic/anticoagulatory medications. Of those on aspirin, 139 discontinued aspirin at least 10 days before surgery and 36 continued aspirin intake. Compared to those discontinuing aspirin, patients who continued aspirin more frequently received minimal-invasive hip surgery (24.1 vs. 92.1%; p = 0.025) and more frequently showed knee swelling after one week (35.1 vs. 81.3%; p = 0.001). However, knee mobility at hospital discharge did not differ between the two groups. Local bleeding complications, perioperative blood loss, the amount of substituted blood products, and the perioperative drop in hemoglobin were similar in the two groups. There was a statistically non-significant trend towards an increased risk of cardiovascular complications in patients who discontinued aspirin (6.5 vs. 0.0%; p = 0.117).

Conclusion: Pre-operative continuation of aspirin in patients undergoing elective hip and knee arthroplasty is associated with a transitory increase in knee swelling, but does not negatively affect orthopedic outcome at hospital discharge nor the risk of relevant perioperative cardiovascular events. This data support perioperative continuation of aspirin intake in patients undergoing knee or hip arthroplasty.

Long-term clinical outcomes of percutaneous coronary intervention with drug-eluting stents in patients with mechanical heart valves


Aims: Clinical outcomes following percutaneous coronary revascularization (PCI) with the unrestricted use of drug-eluting (DES) stents in patients with mechanical heart valve prostheses (MP) – requiring life-long oral anticoagulation – have not been previously described. We therefore sought to investigate long-term clinical outcomes of PCI with DES in patients with MP.

Methods and results: Among 6,308 consecutive patients undergoing PCI with DES, 41 patients (0.7%) were taking oral anticoagulation at baseline because of a previously implanted MP (aortic position: 28 [86%], mitral position: 13 [32%]) and were prospectively followed up to four years in the Bern DES registry (mean duration of follow-up 3.0 ± 1.6 years, no patients were lost to follow-up). All patients were discharged on triple antithrombotic therapy – comprising aspirin, clopidogrel, and oral anticoagulation – for a minimum period of 3 months, after which clopidogrel was stopped. Our pre-specified primary endpoint was a composite of all-cause mortality, myocardial infarction, ischemic stroke, or bleeding type 3 and 5 according to the guidelines by the academic research consortium (BARC). Mean age at baseline was 70.5 ± 8.8 years, 24.4% of patients were female, and 9.8% and 22.0% had a history of renal impairment or diabetes, respectively. Indication for PCI was an acute coronary syndrome in 29.3% of patients. Mean left ventricular ejection fraction was 47 ± 17%. 90.2% patients and 95.1% of patients were discharged on aspirin and clopidogrel, respectively. The primary endpoint was observed in 16 patients (39.0%) at four years. All-cause mortality and myocardial infarction occurred in 11 (26.8%) and 2 (4.8%) patients, respectively. Three patients (7.3%) had BARC bleeding type 3/5, two of which occurred on the day of the index PCI. One patient (2.4%) suffered an ischemic stroke. Repeat revascularization rates were low with respect to target-vessel (3 patients, 10%) and target-lesion revascularization (3 patients, 10%). In-hospital outcomes (e.g. mean drop in hemoglobin were similar in the two groups. There was a statistically non-significant trend towards an increased risk of cardiovascular complications in patients who discontinued aspirin (6.5 vs. 0.0%; p = 0.117).

Conclusion: Despite a high risk of adverse outcome, the unrestricted use of DES among patients with MP was associated with modest rates of significant bleeding events.
duration of intubation, length of stay in the intensive care unit and in the hospital, rethoracotomy) and outpatient follow up (e.g., rejection, vasculopathy, infection, lymphoid, skin and solid tumors, renal insufficiency) were comparable between the groups without significant differences.

Conclusions: This series shows that patients listed urgently or supported by a ventricular assist device have a comparable outcome to electively transplanted patients following heart transplantation. These data may support the effectiveness of the current practice of heart transplantation listing.

Impaired left ventricular function, is it a predictive factor for mid-term survival in octogenarians following aortic valve replacement

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Objectives: The functional benefit of aortic valve replacement (AVR) in octogenarians has been well-proved; however, some doubts exist in reference to elderly patients with lower ejection fraction. AVR in this patient group is frequently not performed because of an overestimated risk and underestimated benefit.

As such, the aim of this study was to evaluate operative mortality and mid-term outcome in this high-risk group of patients.

Methods: This single-center retrospective study included 232 octogenarians operated on for isolated AVR between January 1999 and December 2005 (mean age 82.25 ± 2.22 years, 129 females). Perioperative mortality, morbidity, and mid-term outcomes were investigated and compared to normal left ventricular ejection fraction (LVEF >50%) (Group A) and lower LVEF <50% (N = 97) patients group (Group B).

Results: Perioperative mortality (<30 days) was 11% in Group B and 3.7% in Group A (p = 0.05). After median follow up (FU) of 70 months, the mortality of the two groups was not different; 40% in Group B and 32% Group A (p = 0.05). During FU, there was no significant difference regarding neurological complications (p = 0.2), impaired renal functioning (p = 0.497), or myocardial infarction (p = 0.57) for both groups.

Conclusion: In the current study, short and mid-term mortality and morbidity was acceptable in Group B. Therefore we suggest that isolated AVR need not to be restricted to patients with normal preoperative left heart functioning. In case of the significant higher mortality of Group B we recommend to discuss the TAVI-technik as a rational performance.

N-Terminal-B-Type natriuretic peptide-guided treatment in patients with heart failure with preserved versus reduced ejection fraction – Insights from TIME-CHF

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Background: The role of biomarker-guided treatment in patients with heart failure (HF) and preserved left ventricular ejection fraction (LVEF; HFPEF) is unknown. We compared the effects of N-terminal-pro-B-type natriuretic peptide (NT-proBNP)-guided management on 18 months outcomes in patients with HFPEF versus HF and reduced LVEF (HFREF).

Methods: Patients with HFPEF (LVEF >45%; n = 123) and HFREF (LVEF <45%; n = 499) from the Trial of Intensified Medical therapy in Elderly patients with Congestive Heart Failure (TIME-CHF) with age >= 60 years, NYHA class >=II, previous HF hospitalization, and NT-proBNP >= 400 ng/L (60–74 years) or 800 ng/L (>=75 years) were randomized to NT-proBNP-guided or symptom-guided management.

Results: HFPEF patients were older (80.1 ± 7.0 vs. 76.1 ± 7.5 years; p <0.001) and more likely to be female (66% vs. 34%; p <0.001) and to have a non-ischaemic HF aetiology (65% vs. 42%; p <0.01) and to have a non-ischaemic HF aetiology (65% vs. 42%; p <0.01) and to have a non-ischaemic HF aetiology (65% vs. 42%; p <0.01) and to have a non-ischaemic HF aetiology (65% vs. 42%; p <0.01) and to have a non-ischaemic HF aetiology (65% vs. 42%; p <0.01) and to have a non-ischaemic HF aetiology (65% vs. 42%; p <0.01) and to have a non-ischaemic HF aetiology (65% vs. 42%; p <0.01) and to have a non-ischaemic HF aetiology (65% vs. 42%; p <0.01) and to have a non-ischaemic HF aetiology (65% vs. 42%; p <0.01) and to have a non-ischaemic HF aetiology (65% vs. 42%; p <0.01) and to have a non-ischaemic HF aetiology (65% vs. 42%; p <0.01) and to have a non-ischaemic HF aetiology (65% vs. 42%; p <0.01). At baseline, HFPEF patients had lower NT-proBNP (median [interquartile range], 2210 [1514-4513] ng/L vs. 4194 [2277-814] ng/L, p <0.001) but were more symptomatic than HFREF patients (83 vs. 74% with NYHA class >= III, six minute walking distance 222 ± 115 vs. 270 ± 123 m, p <0.001).

Despite similar adjustment of medical treatment the reduction in NT-proBNP was less (p = 0.04), and hospitalization free survival was worse in HFPEF compared to HFREF patients (hazard ratio [95%-confidence interval], 1.34 [1.05–1.72], p = 0.02). Mortality (p = 0.31) and HF hospitalization free survival (p = 0.28) did not differ between HFREF and HFPEF patients. In HFPEF patients randomized to NT-proBNP-guided management (n = 59), adjustment of both inhibitors of the renin-angiotensin aldosterone system and betablockers was more common compared to those randomized to symptom-guided management (n = 64) but improvement in symptoms and NT-proBNP did not differ between the groups. Opposite effects of NT-proBNP-guided management were observed in HFPEF and HFREF patients with a trend towards worse hospitalization-free survival (p for interaction = 0.2), survival (p = 0.03) and HF hospitalization-free survival (p = 0.01) in HFPEF patients undergoing NT-proBNP-guided management and better outcomes in HFREF patients undergoing NT-proBNP-guided management (figure).

Conclusions: Prognosis in HFPEF remains poor, HFPEF and HFREF patients display opposite responses to NT-proBNP-guided management. NT-proBNP-guided treatment does not improve outcomes and may even be harmful in HFPEF.

MicroRNA-126-mimic treatment improves cardiac repair capacity of angiogenic early outgrowth cells from patients with chronic heart failure


Background: MicroRNAs, small non-coding RNAs, have been identified as key regulators of angiogenesis. Accumulating data suggest that vascular and pro-angiogenic effects of angiogenic early outgrowth cells (EOCs) are critical for their capacity to improve cardiac function. Recently, several studies have shown
dysregulated microRNAs in EOCs derived from patients with cardiovascular disease, leading to EOC dysfunction and therefore may critically impair endogenous repair response. However, the functional consequences of dysregulated microRNAs in EOCs of patients with chronic heart failure (CHF) remain to be determined.

**Methods and Results:** Early outgrowth cells were isolated from patients with CHF due to ischemic cardiomyopathy (ICM; n = 45) and healthy subjects (HS; n = 35). Real-time PCR analysis revealed a pronounced reduction of angiomiR-126 levels in EOCs from patients with CHF as compared to EOCs from HS. SPRED1, a target of miR-126, was significantly upregulated in EOCs from patients with CHF due to ICM on both, mRNA and protein level. Silencing of SPRED1 in EOCs from patients with CHF due to ICM significantly improved their pro-angiogenic capacity, whereas anti-miR-126 transfection of EOCs from HS markedly impaired their capacity to stimulate tube formation. Conversely, miR-126-mimic transfection of EOCs from patients with CHF due to ICM enhanced the tube formation capacity. Moreover, in vivo cardiac repair capacity was improved in miR-126-mimic as compared to scramble transfected EOCs from patients with CHF, as determined by transplantation into nude mice with myocardial infarction and determined by magnetic resonance imaging (MRI) and hemodynamic analysis (MILLAR catheter).

**Conclusions:** Our studies suggest a substantially impaired capacity of EOCs from patients with CHF due to ICM to stimulate cardiac repair after myocardial infarction, associated with a marked loss miR-126 levels. Moreover, miR-126-mimic transfection markedly improved the capacity of EOCs to stimulate cardiac repair and cardiac neovascularisation in vivo.

**Chronotropic response and heart rate recovery in heart failure with preserved ejection fraction**

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**Background:** The exercise response in heart failure with preserved ejection fraction (HFPEF) is still a matter of debate. In particular, the chronotropic response and heart rate recovery post exercise in HFPEF are incompletely understood. In the present study we performed a comprehensive assessment of the chronotropic response and heart rate recovery (HRR) in patients with HFPEF and healthy controls.

**Methods:** HFPEF patients (n = 10) and asymptomatic controls (n = 8) underwent tissue Doppler echocardiography at rest and during exercise, supine resting and exercise right heart catheterisation, and upright cardiopulmonary exercise testing. Resting and peak heart rate (HR) were measured during supine and upright exercise. HRR was assessed one to five minutes post upright exercise and expressed in absolute (HRR-1 = peak HR – HR one minute post exercise; analogue definitions for HRR-2 to HRR-5) and relative (% rather than absolute HR reduction, HRR-1% to HRR-5%) terms.

**Results:** During maximal upright exercise, peak HR (124 ± 23 vs. 155 ± 19 bpm; p = 0.003) and %HR reserved used (56 ± 26 vs. 91 ± 15%; p = 0.003) were lower in HFPEF patients compared to controls. During supine exercise (not maximal in all subjects), peak HR (105±23 vs. 112 ± 20 bpm; p = 0.52) did not significantly differ between groups. However, as shown in figure 1, the slope of the HR/VO2 relationship did not differ between groups during upright exercise and was even steeper in HFPEF patients during supine exercise. All measure of HRR including HRR-1 to HRR-5 (fig. 2) as well as HRR-1% to HRR-5% (data not shown, p <0.05 for all) were significantly slower in HFPEF patients compared to controls. Slower HRR-1 was related to a lower peak exercise left ventricular peak early diastolic mitral annular velocity (r = 0.77, p = 0.0008), lower peak exercise stroke volume index (r = 0.67, p = 0.007), and a higher ratio of the change in pulmonary capillary wedge pressure per change in work rate (r = –0.58, p = 0.02) as a measure of the left ventricular pressure—volume relationship.

**Conclusions:** In HFPEF patients, the HR rise during exercise is reduced but the HR/VO2 relationship is similar or even steeper in HFPEF indicating that the chronotropic response is not the mediator but an epiphenomenon of the reduced peak VO2 in HFPEF. In contrast, HRR is impaired and a marker of key hemodynamic parameters in HFPEF patients suggesting that HRR might be a useful non-invasive marker for diagnosis and follow-up of patients with HFPEF.

Background: Red blood cell distribution width (RDW), a measure of variation of red blood cell size, has been shown to predict adverse outcome in patients with cardiovascular disease. However, its prognostic value in specific patient populations is poorly explored. We determined the association between baseline RDW and all-cause mortality, appropriate ICD-therapies and left ventricular ejection fraction (LVEF) improvement in heart failure patients undergoing ICD-CRT implantation.

**Methods and results:** In 203 consecutive patients baseline characteristics such as medical history, LVEF and routine blood tests were assessed. Appropriateness of ICD therapies was determined by a senior electrophysiologist. Cox proportional hazard models were used to determine the association of RDW with all-cause mortality, appropriate ICD-therapies and LVEF improvement. During a median follow-up of 35.9 months, 44 patients (22%) died, 71 (35%) died or had an ICD-therapy and 53 patients (26%) had an ICD-therapy only. In 81 (48%) out of 170 patients with available follow-up echocardiography, LVEF improved by ≥10%. Patients who died had higher NYHA class (3.0 ± 0.4 vs. 2.6 ± 0.6; p <0.0001), lower systolic blood pressure (110 ± 19 mm Hg vs. 121 ± 19 mm Hg; p = 0.002), lower LVEF
(22.3% vs. 25.3%, p = 0.012) and higher RDW (15.2% vs. 14.1%, p = 0.0001) at baseline. In a multivariate analysis, higher RDW (chi-square: 13.4, 13% in RDW<14.1; 22% in RDW>14.1, 42% in RDW>15.1, p <0.0001). In contrast, RDW was not independently associated with appropriate ICD-therapies or LVEF improvement >= 10%.

Conclusion: RDW measured before ICD-CRT implantation independently predicts mortality but not ICD-events or LVEF improvement in heart failure patients. If RDW exceeds 15.1%, mortality risk is >40% within 35.9 months, despite optimal medical and device therapy.

Treatments with chemokine-binding protein Evasin-3 and -4 improve post-infarction myocardial injury and cardiac remodeling in mice


Background: Chemokines are known to trigger and direct leukocyte trafficking from the blood stream towards inflamed tissues. They are implicated in several cardiovascular diseases, such as atherosclerosis, stroke, myocardial infarction and reperfusion injury. Chemokine-binding proteins, called Evasins have recently been identified from tick salivary glands and shown to inhibit chemokine-mediated leukocyte infiltration. In this study, we investigated whether the anti-inflammatory treatment with Evasin-3 (CXC chemokine inhibitor) and Evasin-4 (CC chemokine inhibitor) could influence post-infarction myocardial injury and remodeling.

Methods and results: C57Bl/6 mice were submitted in vivo to left coronary artery permanent ligation for different times (up to 21 days). After coronary occlusion, intraperitoneal injection of Evasin-3 or Evasin-4 reduced the infarct size as compared to vehicle-treated control group. This beneficial effect was associated with a decrease in myocardial leukocyte infiltration and in circulating levels of CXCL1 and CCL2. At 21 days, mouse survival and cardiac function were improved by treatments with Evasins as compared to vehicle.

Conclusion: In this study, we showed that treatments with Evasin-3 or Evasin-4 improved cardiac injury and remodeling in a mouse model of chronic myocardial ischemia. Therefore, Evasins might represent a promising therapeutic approach to reduce development of post-infarction heart failure in mice.

Quantification of endothelial dysfunction using C-terminal pro-endothelin in the early diagnosis and risk-stratification of patients with suspected acute myocardial infarction


Background: Identifying chest pain patients with acute myocardial infarction (AMI) and those at risk for death remains a clinical challenge. Endothelial dysfunction plays a major role in cardiovascular diseases including AMI. However, its quantification has not been available as a clinical tool. Endothelins are known to induce transient vasodilatation due to nitric oxide and prostacyclin release, before the development of sustained vasoconstriction. The vasoconstrictive effect predominates in particular in vessels with dysfunctional endothelium. We analyzed the diagnostic and prognostic ability of c-terminal pro Endothelin-1 (CT-pro-ET-1) in these patients.

Methods: In a prospective, international multicenter study, CT-pro-ET-1 was measured at presentation in 675 consecutive patients with acute chest pain. The final diagnosis was adjudicated by two independent cardiologists according to the universal definition of acute myocardial infarction. Patients were followed 24-months regarding mortality.

Results: The adjudicated final diagnosis was AMI in 18%; (30% STEMI and 70% NSTEMI). Both, cardiovascular risk factors and previous cardiovascular events, were more common in patients with higher CT-pro-ET-1 quartiles. The diagnostic performance of CT-pro-ET-1 for myocardial infarction, as quantified by the area under the receiver operating characteristic curve (AUC), was moderate (AUC 0.673, 95% confidence interval [95%CI] 0.618–0.728, p <0.001). There was no significant increase in the AUC when CT-pro-ET-1 was added to either cardiac Troponin T or high-sensitive cardiac Troponin T. 73% of patients (38 of 52) who died during the first 720 days were in the fourth quartile of CT-pro-ET-1 presentation value (>82.1 pmol/l). Adding CT-pro-ET-1 to TIMI risk score increased the AUC as to the prediction of death during the first 720 days from 0.79 (95% CI 0.74–0.84) to 0.84 (95% CI 0.79–0.89; p <0.001) and led to a better risk stratification
of patients at presentation (probability of dying: I: <5%, II: 5–20%, III: >20%) as shown by a net reclassification improvement of 21% (p = 0.004) and an integrated discriminatory improvement of 5.7% (absolute improvement) (p = 0.005).

Conclusions: Use of CT-proET-1 improves risk stratification in unselected chest pain patients but has no additional value in the diagnosis of AMI beyond cTnT and hs-cTnT.

Evolution of the coronary microcirculation in ST-elevation myocardial infarction
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Aims: The aim of this study was to describe the evolution of the coronary microcirculation (CM) in three different phases of ST-Elevation Myocardial Infarction (STEMI).

Methods: Patients with acute STEMI were treated with primary percutaneous coronary intervention (PPCI) and underwent assessment of the CM using the Pressure Wire (Certus, SJM). Coronary Flow Reserve (CFR) and Index Of Microcirculatory Resistance (IMR) were calculated using the thermodilution method. Hyperaemia was induced using intravenous adenosine at 140 mcg/kg/min. The measurements were performed at PPCI, 24–48 hours post PPCI and at 6 months.

Results: Post-PCI assessment was performed in 82 patients (mean age 62 ± 12). Repeat catheterization at 24–48 hours was performed in 82 patients (76%) and further catheterization at 6 months was performed in 47 patients (57%). Median CFR at PPCI was 1.5 (Interquartile Range, 1.1–2.2) and increased to 2.3 (1.8–2.8) at 24 hours (p = 0.002) and further increased to 3.4 (2.2–3.8) at 6 months (p <0.001 compared to 24 hours). Median IMR at PPCI was 33 (21–58) at PPCI and decreased to 25 (17–38) at 24 hours (p = 0.004) and further decreased to 18 (16–27) at 6 months (p = 0.08 compared to 24 hours).

Conclusions: This study describes the recovery of the CM in patients with STEMI undergoing PPCI. CFR and IMR partially improve within the first 48 hours and in most patients completely normalize at 6 months.

Differential healing response in acute coronary syndrome versus stable coronary artery disease patients 5 years following early generation DES implantation: an optical coherence tomography study
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Background: Patients with acute coronary syndromes (ACS) have a higher risk of very late stent thrombosis after implantation of early generation drug-eluting stent (DES) compared with patients with stable coronary artery disease. Post-mortem studies of patients treated with DES observed less complete strut coverage, more inflammation and fibrin deposition among ACS compared with stable CAD patients. Using optical coherence tomography, we compared strut coverage, protrusion, and malapposition as markers of vascular healing (OCT) between ACS and stable CAD patients 5 years after implantation of early generation DES.

Methods: A total of 88 patients with one lesion were suitable for final OCT analysis five years after DES implantation. The analytical approach was based on a hierarchical Bayesian random-effects model and compared strut coverage, protrusion and malapposition between ACS and stable CAD patients.

The analysis was adjusted for differences in baseline patient characteristics (hypertension, hyperlipidaemia, left ventricular function) and stent type.

Results: OCT analysis was performed in 53 ACS culprit lesions with 7864 struts, and in 35 stable lesions with 5298 struts. A total of 284 (1.73%) struts were uncovered in ACS culprit lesions compared to 97 struts (0.7%) in stable lesions, (adjusted p = 0.041). Malapposed struts were present in 303 (1.33%) of ACS culprit lesions as compared with 106 (0.45%) of stable lesions (adjusted p = 0.072). Protruding struts were more frequent among ACS culprit lesions (0.50%) than stable lesions 0.34 (0.13%), (adjusted p = 0.038).

Conclusion: Uncovered, malapposed and protruding struts are more frequent in culprit lesions of ACS patients compared with lesions of stable CAD patients 5 years after implantation of early generation DES. These findings suggest a differential healing response of ACS compared with stable CAD patients.

Competitive sports and myocardial infarction in men

Background: Marathon running has been associated with coronary artery calcification and subendocardial myocardial infarction (MI) in middle aged men. To date, it is largely unknown whether the cardiovascular risk profile differs among patients...
with different levels of sports practice and whether there are differences in the onset of the event. Methods: A consecutively enrolled cohort of patients undergoing percutaneous coronary interventions of the Bern University Hospital was analyzed. Male patients with MI, aged 65 years or younger with a body mass index (BMI) of less than 25 kg/m² were included. A telephone interview was performed and sports history was ascertained with a comprehensive questionnaire. Patients were stratified in three groups according to their level of sports activity: Group 1, non-athletes (NA) without regular exercise; group 2, leisure time athletes (LA) with regular exercise but no participation in competitions; and group 3, competitive athletes (CA) with regular exercise to improve performance and participation in competitions. Results: A total of 2395 patients were screened. 133 patients (5.5%) met the inclusion criteria and 128 of them were successfully interviewed (96%). The study population comprised of 58% NA, 30% LA and 12% CA. CA were significantly younger than LA and NA at the timepoint of the index MI. BMI showed no difference between the groups. Although CA had significantly more average weekly training hours as compared to LA, they did not differ with respect to average training years. Cardiovascular risk factors were equally distributed among groups, except for fewer smokers in CA. The three groups showed no differences in the proportion of ST-elevation MI, initial left ventricular ejection fraction, number of vessels and lesions treated, and average stent diameter and total stent length as indicator of lesion complexity (table 1). Conclusion: In non-obese men, competitive sports was associated with an earlier occurrence of MI despite a lower cardiovascular risk profile.

Acute myocardial infarction in stationary patients following admission for non-ACS pathologies

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Introduction: There are few studies of patients suffering acute myocardial infarction (MI) when already in hospital for other reasons. Devereaux et al reported that monitoring non-cardiac-surgery patients for MI in the first few days after surgery could significantly reduce their short-term mortality risk. Methods: Patients enrolled in the AMIS Plus registry from 1997–2011 who had an MI in hospital were assessed using logistic regression analysis. Results: Among 35344 patients with either ST-elevation MI (STEMI) or non-STEMI, 316 suffered an MI following admission due to pathologies unrelated to an ACS (Acute Coronary Syndrome). Primary hospitalization reasons were known for 195 patients: 40.5% had a gastric, pulmonary, urological or neurological pathology, 29.6% had chemotherapy, 47.2% were admitted for surgery (obstetric, orthopedic, visceral, or vascular), and 9.7% for various diagnostic procedures. Compared to other MI patients, in-hospital MI patients were older (74y vs 66y; P <0.001), more often female (39% vs 27%; P <0.001), hypertensive (79% vs 59%; P <0.001) and diabetic (29% vs 20%; P <0.001), with more comorbid conditions (Charlson Score = >2 in 53% vs 24%; P <0.001). Patients who suffered in-hospital MI less frequently underwent percutaneous coronary intervention (40% vs 72%; P <0.001), and were less likely to receive aspirin (88% vs 95%; P <0.001), thienopyridines (46% vs 61%; P <0.001) and statins (60% vs 74%; P <0.001). Crude in-hospital mortality in patients with in-hospital MI was markedly higher than that of MI patients with symptoms before admission (17.4% vs 6.6%; P <0.001). Logistic regression showed that even after adjusting for all baseline differences, including the comorbidity score, having a MI while in hospital was an independent predictor of in-hospital mortality (OR 48.95% CI 1.71–3.61; P <0.001). A subgroup of patients (N = 6468) were followed-up after a mean duration of 357 days (SD 92 days). Of 48 patients with in-hospital MI, 4 (8.3%) died during the follow-up period compared with 214 deaths among the 6420 MI patients with symptoms before admission (3.3%; P = 0.07).

Conclusions: Stationary patients who suffer an MI after admission for a non-ACS related diagnosis are at high-risk of death, both during their index hospital stay and during a 1-year follow-up period. Further work is needed to identify those hospitalized patients who are at risk of MI in order to improve treatment of associated coronary artery disease. 1 Ann Intern Med 2011;154:523.

Four year experience with transcatheter aortic valve implantation: results from a 400 patient single center cohort


Aim: Transcatheter Aortic Valve Implantation (TAVI) via femoral and apical access has been established as a treatment option for high risk patients with valvular aortic stenosis. We report our experience of 400 cases.

Methods: From 2007 until 2011, 400 consecutive patients with severe symptomatic valvular aortic stenosis have been treated by transfemoral (TF AVI, n = 313) or transapical (TA AVI, n = 77) TAVI.

Results: Mean age was 82.5 ± 6.0 years, aortic valve area 0.6 ± 0.2 cm² and left ventricular ejection fraction (LV-EF) 52 ± 15%. At 30 days, all-cause mortality amounted to 6.5%, major stroke to 2.8%, life-threatening bleeding to 10.8%, major vascular complications to 6.3%, kidney injury Grade III to 3.8%, and need for permanent pacemaker (PPM) implantation to 24.3%. Kaplan-Meier event-free survival rates were 81% after 1, 72% after 2, 57% after 3 and 50% after 4 years. In a subanalysis of the first 200 vs. the second 200, we observed a similar all-cause mortality (7.5% vs. 5.5%, p = 0.54), major stroke (4.0% vs. 1.5%, p = 0.12), and major vascular complications (8.0% vs. 7.0%) rate at 30 days, but a significant reduction in life-threatening- (14.9% vs. 7.5%, p = 0.036) and major bleeding complications (32.0% vs.19.0%, p = 0.003). This reflects a learning curve without impact on one-year survival rates (78% vs. 83%, p = ns). Comparing TF AVI (n = 313) with TA AVI (n = 77), the combined safety endpoint was similar between the groups (28.5% vs. 29.5%, p = ns) with no difference with respect to stroke (3.2% vs. 2.6%, p = ns) and all-cause mortality (p = ns). Comparing TF AVIs with either the Medtronic Corevalve® (n = 225) or the Edwards Sapien® (n = 88) bioprostheses (n = 88), the rates for the 30-day safety endpoint were similar (25.0% vs. 30.7%, p = ns). Differences in life-threatening bleeding (6.7% vs. 15.9%, p = 0.01) and major vascular complications (5.3% vs. 15.9%, p = 0.002) in favor of patients treated with the Edwards Sapien prosthesis were related to the larger introducer sheath sizes. Systematic use of smaller sheath sizes (16/18/19French) abolished the difference in life-threatening bleedings and major vascular complications between the two systems: 5.6% vs. 11.5%, p = 0.19 and 6.7% vs. 13.1%, p = 0.18, respectively.

Conclusions: TAVI yields favorable short- and mid-term clinical outcomes in this single center experience. TF and TA patients had similar outcomes. With growing experience, rates of vascular and bleeding complications could be reduced, independent of device type.
Preliminary results with a novel off-pump apico-aortic conduit in case of severe aortic stenosis

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Objectives: To offer surgical treatment in patients with aortic valve stenosis and contraindications for aortic valve replacement (e.g. ostial encroachment, previous mitral valve replacement). A novel aortic valve bypass (AVB) was implanted from the apex of the heart to the descending aorta without need for circulatory assist. Aim of this study was to show feasibility and efficacy of this innovative off-pump technique to serve as an extension for conventional and interventional valve replacement.

Method: The bipartite conduit consists of an 18 mm woven valve tube containing a stentless porcine aortic valve as well as a flexible semi rigid and curved ventricular connector. Via left lateral thoracotomy the descending aorta is partially clamped and the valved conduit sutured in an end-to-side fashion. The ventricular connector comes along with a specially designed gun-like applicator that allows insertion into the apex of the left ventricle without cardiopulmonary bypass with minimal blood loss. With both ends connected, the detour circulation is established.

Results: Between March and December 2011 seven pts. (5M/2F) with a mean age of 62 y.o. (79–89 y.o.) were operated. Mean preoperative transaortic gradient was 14 mm Hg. Three pts. had previous mechanical mitral valve replacement, one a porcine aortic valve, three pts. had previous limited CPB in only one patient. Postoperative transaortic gradient was 14 mm Hg. Approximately 60% of stroke volume were bypassed as measured in postoperative MR. One patient died in-hospital due to respiratory failure after severe pneumonia with underlying asbestosis. NYHA class in the other patients lead an independent life at home.

Conclusion: With this novel conduit we observed excellent hemodynamic results. We feel this additional surgical approach to aortic stenosis in elderly, high-risk patients can extend favorably the relation between FORECAST and one-year mortality. The FORECAST was applied to 65 patients treated by transcatheter aortic valve implantation (TAVI). The objective for this study was to analyse the performance of the FORECAST in this patient cohort.

Methods: 65 patients were treated by TAVI and included in the anaylsis. One-year mortality was assessed by telephone interview for 60 patients. 5 Remaining lost of follow-up. To assess the relation between FORECAST and one-year mortality, logistic regression was performed. Predictive ability of the test concerning mortality was assessed by receiver operation characteristics analysis.

Results: 25 male and 40 female patients were assessed. Mean FORECAST-Score was 6.5 ± 3 points. Logistic EuroSCORE was 19.3 ± 12%.STS-Score for mortality was 5.8 ± 3.2%. One-year mortality was 18.3%. A good predictive ability for FORECAST can be reported: The AUC of the ROC-Curve was 0.73 (0.6–0.9). Logistic regression showed a good relation of FORECAST and one-year mortality.

Conclusions: The FORECAST is an additional tool to evaluate elderly patients adequately before TAVI and showed good relation to one-year mortality. The FORECAST is an useful tool for clinical routine to assess the risk of one-year mortality in this patient group within a few minutes. Further assessment in a larger patient population is warranted and ongoing to validate the test.
was to categorize indications leading to implantation of a PM after TAVI using the Medtronic CoreValve Revalving System (MCRS) or Edwards Sapien Valve (ESV), to determine predictors for AV conduction disturbance and to document the need for ventricular pacing during follow-up.

Methods: After exclusion of 8 pts with a previously implanted PM and 3 peri-procedural deaths, we studied 85 pts (median age 84 (IQR 81–86) years, 58% female) after TAVI using the MCRS in 52 and ESV in 33 pts. Indications for PM implantation were categorized based on 12-lead ECG and telemetry. During follow-up, no need for ventricular pacing was defined as <1% ventricular pacing and intrinsic 1:1 AV conduction with the device programmed to VVI 30 bpm.

Results: Thirty-one of 85 pts (36%) underwent PM implantation, 29/52 pts (56%) after MCRS compared to 2/33 pts (6%) after ESV (p <0.0001). Three indication categories for PM implantation were identified: (1) transient or persistent third-degree AV block or second-degree AV-block Mobitz type II, (2) new onset left bundle branch block (LBBB) with a prolonged PR interval (>200 ms), and (3) new onset LBBB (fig. 1). The use of MCRS was the strongest predictor of subsequent PM implantation after TAVI (odds ratio 19.5; 95%CI 4.2–90.4). All 7 pts with right bundle branch block (RBBB) receiving MCRS developed complete AV block, but none of the 5 pts with RBBB using ESV (p = 0.001). AV conduction impairment in category (1) patients resolved in only 18% of cases (3/17). However, in category (2) and (3), no patient required ventricular pacing >1% during follow-up and all showed intrinsic 1:1 AV conduction during device interrogation (fig. 2).

Conclusion: The use of MCRS is associated with a significantly higher PM implantation rate compared to ESV, especially in the presence of pre-existing RBBB. Whereas AV conduction resolved in the minority of cases in category (1), patients in category (2) and (3) showed no signs of AV conduction impairment during post-procedural follow-up. This suggests a more conservative approach with regards to pacemaker implantation in patients with new onset LBBB with or without PR prolongation after TAVI.

Percutaneous mitral valve repair in high risk patients – Insights from the mitra-swiss registry after the first 100 patients treated in Switzerland


Introduction: Percutaneous mitral valve repair (MVR) utilizing the MitraClip®-system has become a valid alternative for patients with severe mitral regurgitation (MR) and high operative risk. However, predictors or factors predisposing for long term clinical success are still widely unknown. Presenting the 12-months results of the first 100 consecutive patients treated with the MitraClip®-system in Switzerland, we aim to learn more about this.

Methods: The Mitra Swiss Registry aims to include all patients treated in Switzerland. Clinical, echocardiographic and procedural data are prospectively collected and centrally stored in an online database. After assessment of all parameters, survival time of the first 100 patients, treated with the MitraClip system in Switzerland has been associated to 6 nominal variables using log-rank test and to a 30 continuous variables using Cox regression. In addition, a Kaplan-Meier curve estimate has been provided for all patients.

Results: Acute procedural success (defined as a successful Clip-implantation with a residual MR grade of ≤ 2+) was achieved in 85%. MR grade remained stable for most of the patients over follow up and functional class decreased from a median NYHA class 3 to class 2, stable over follow up. Mean stay in ICU and total hospital stay was 1.6 days ± 2.6 and 6.6 ± 7.9 days, respectively. Mortality at 30 days and 12 months was 5% and 16% respectively. Cox regression analysis indicated an association between the following parameters and overall survival:
- early echocardiographic result (discharge MR grade) – p = 0.0042 (see figure).
- occurrence of congestive heart failure following the percutaneous MVR – p = 0.0025
- Acute procedural process – p = 0.0018

There was no association with survival depending on whether patients had functional MR or degenerative MR.

Discussion: In this swiss series of 100 high-risk patients with severe MR, treated percutaneously with the MitraClip®-system, acute procedural process was achieved in 85%. MR reduction appears to be stable in most patients with initially good results. Strong predictors of survival were absence of congestive heart failure after the clip implantation and a low MR grade at patient’s discharge. This purely hypothesis generating analysis may underscore the necessity to achieve the best (surgical like) final result after also after percutaneous MVR.
Recurrent syncope in the child – don't forget the coronary arteries. Atresia of the left coronary artery in a 9 years-old boy

Background: Syncope is one of the most frequent reasons for referral for evaluation in pediatric cardiology. Whereas vaso-vagal syncope are usually harmless, potentially life-threatening aetiologies, including arrhythmias, structural heart disease, anomalies of the coronary arteries (CA) and myocardial ischemic disease need to be ruled out.

Methods: Case report and review of the literature.

Results: This boy presented with recurrent syncope following physical activity since the age of 5. Repetitive cardiac evaluations including clinical examination, electrocardiogram (ECG), 24h-ECG, stress ECG, event recorder, echocardiogram and stress echocardiogram were unremarkable. Neurological and gastroenterological evaluations were normal. At the age of 9 years the boy experienced sudden cardiac arrest during a soccer game. Cardiopulmonary resuscitation was immediately started and was successful after threefold defibrillation of ventricular fibrillation. Again all non-invasive examinations were unremarkable, except a slightly diminished ventricular function, which quickly normalized under milrinone. Invasive electrophysiological study was normal. Coronary angiography showed a prominent right CA and retrograde perfusion of the left sided CA system, with small left anterior descending (LAD) CA and ramus circumflexus (figure). The ostium and the first segment of the left main CA were missing and atresia of the left coronary artery was diagnosed. Myocardial perfusion studies consisting of SPECT and perfusion magnetic resonance showed no ischemia under adenosine stress and absence of scarring. Prophylactic medication with metoprolol was started and surgical revascularisation with a left internal mammary artery to proximal LAD bypass grafting performed without complications. The patient was discharged 10 days postoperatively in good clinical conditions with acetylsalicylic acid.

Conclusions: CA anomalies are rare, but a frequent cause of sudden cardiac death in adolescents and young adults. In patients with exercise related syncope, CA anomalies need to be ruled out. Atresia of one CA is exceedingly rare with only 28 reported cases. This is usually an isolated lesion, but can be related to other cardiac defects in up to 30% of the cases. Surgical revascularization using internal mammary artery is the therapy of choice providing good results and growth of the left CA system.

Unusual ECG presentations of right ventricular infarction: correlation with delayed gadolinium enhancement cardiac magnetic resonance

Background: Right ventricular (RV) infarction is characterized by ST-elevation (STE) in the right-sided chest leads, usually with signs of inferior myocardial infarction (MI). Right-sided ST changes are classically transient.

Case 1: A 42-yo smoker with hypertension (HT) presented with resting chest pain (CP). ECG showed a 8 mm STE in lead V2 and minor reciprocal ST-depressions in leads II-III-aVF. No STE was seen in the right chest lead V4R. Coronary angiogram (CA) showed an proximal right coronary (RCA) occlusion, with large collaterals from the left circumflex (LCX). The left coronary artery was unobstructed and co-dominant. CP resolved spontaneously one hour later, only leaving a profound 20 mm-S wave in V2. Four days later, a CMR study showed a localized basal inferoseptal left ventricular (LV) MI. Akinesia and transmural...
fibrosis were seen in the mid to apical RV free wall. The RV infarction was facing the 4th intercostal space on the left sternal border, which is the location of the electrode V2. No MI was seen in the anteroseptal LV wall (fig. 1).

Case 2: A 54 yo smoker with HT and high cholesterol was admitted for atypical abdominal discomfort. ECG showed Q waves in leads II–III–aVF and in all the chest leads (V1–V6) with low voltage. Troponin I was 18.4 mcg/l. With resolution of symptoms and no STE, CA was not performed emergently. An echocardiogram showed mild LV dysfunction with inferior akinesia, a diluted RV with moderate dysfunction. On the CA, the RCA was proximally occluded and LCX had an intermediate stenosis. LAD was unobstructed. ECG changes in the chest leads completely disappeared within 48 hours, only leaving broad Q waves in the inferior leads. A cardiac MRI showed a transmural inferior MI with involvement of the inferior and lateral RV wall. Infarcted areas showed a high T2 signal indicating myocardial oedema and confirming a recent RV insult. No infarction was seen in the anterior and septal LV walls (fig. 2).

Discussion: RV infarction may mimic anterior LV infarction as shown in those 2 cases. Case1 shows an isolated RV infarction only presenting with transient severe isolated STE in lead V2 but no STE in lead V4R. Case2 was a large RV infarction presenting with widespread Q waves in V1–V6 but no STE. Permanent anterior QS waves have rarely been reported in RV infarction, but the transient nature of these changes, without reperfusion, is unique to this case.

Arrhythmogenic cardiomyopathy suspected by ECG – Confirmed by angiography
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A 58-year-old woman was hospitalized for recurrent presyncopes. The 12-lead surface ECG in the emergency room showed a sustained ventricular tachycardia (VT) at a rate of 143 bpm with a left bundle branch block (LBBB) morphology and inferior axis (II, III and aVF positive, aVL negative (Panel A)). The ECG was also remarkable for pronounced notching of the QRS complexes across multiple leads. Idiopathic right ventricular (RV) outflow tract tachycardia (RVOT-VT) was initially suspected. Intravenous metoprolol, verapamil and amiodarone were administered without success. Electrical cardioversion (150 Joules biphasic) converted the arrhythmia into sinus rhythm at a rate of 57 bpm and first degree atrioventricular (AV) block, further showing late potentials suggestive of epsilon waves as well as ST-T wave changes in various leads (Panel B). Transthoracic echocardiography raised a high suspicion for arrhythmogenic right ventricular cardiomyopathy (ARVC) due to the presence of regional wall motion abnormalities, a dilated RVOT (22.7 mm² at parasternal long axis) and reduced fractional area change (18%) with extensive left ventricular (LV) involvement (ejection fraction bpline 26%) (Panel C). Invasive coronary angiography was unremarkable, but angiography showed a reduced global RV function and RV dilatation. Regional wall motion abnormalities were confirmed, namely dyskinesis and aneurysm of the inferior RV wall and the apex (Panel D, arrows). The “pile d’assiettes sign” – a pathognomonic angiographic sign for advanced RV dilatation was documented (Panel E, arrows). Invasive coronary angiography was performed (Panel F).
involvement in ARVC due to sacculations and trabeculations – was visible (Panel D, arrowhead). The diagnosis of ARVC was made on the basis of two major (epsilon wave and RV aneurysm) and one minor criterion (LBBB-VT with inferior axis) according to the 2010 Revised Task Force Criteria. The presence of multiple QRS notches across several leads during VT with LBBB morphology and inferior axis represents conduction delay due to fibro-fatty replacement and is highly suggestive for the presence of ARVC as compared to idiopathic RVOT-VT.

A fatal case of human herpes virus myocarditis: insights from cardiac magnetic resonance and necropsy

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Case report: A 28-year-old male was admitted for syncope. He did not report chest pain or other symptoms. Physical exam revealed only bradycardia. The ECG showed a complete heart block with ventricular escape rhythm at 30 bpm. There was a mild inflammatory syndrome and troponin I at 0.7 ng/mL (normal value <0.15 mg/l). Transthoracic echocardiography showed a normal left ventricular ejection fraction (LVEF) with global hypertrophy and normal regional wall motion. The patient was admitted to the coronary care unit, and intravenous isuprenaline was started with a good ventricular response (55 bpm). On day 2, troponin I was at 7 ng/mL. Cardiac magnetic resonance (CMR) showed severe asymmetric hypertrophy with marked predominance in the anterior basal region of the inter ventricular septum (thickness 22 mm) and systolic anterior movement mimicking hypertrophic cardiomyopathy (fig. 1). LVEF was normal. The patient then developed fever and an eruption of the face and trunk. Complete bacterial and viral blood tests were ordered. On day 3, the patient complained of epigastric pain. The physical exam remained normal. LVEF was 40% on the echocardiogram. A coronary angiogram showed normal coronary arteries. The patient suffered from several episodes of sustained ventricular tachycardia. Isuprenaline was discontinued and a temporary pacemaker probe was placed through the internal jugular vein. Intravenous antibiotic therapy was initiated for suspicion of Lyme disease. On day 4, he complained of acute abdominal pain. Troponin I was increased to 112 ng/mL, and there were markers of acute hepatic failure. This was followed by cardio-pulmonary arrest due to pulseless electrical activity. Cardio-pulmonary resuscitation was performed and he was put on extracorporeal life support. He died 2 hours later. Necropsy revealed massive hemorrhagic myocardial necrosis. Histology showed lymphocytic myocarditis with plurifocal lesions, along with inflammation and necrosis of the His bundle (fig. 2). Myocarditis due to human herpes virus 6 (HHV6) was diagnosed following polymerase chain reaction analysis.

Discussion: HHV6 myocarditis is not uncommon (23–35% of myocarditis in series with biopsies), and frequently associated with acute of chronic heart failure. Chest pain is infrequent, often leading to late diagnosis. CMR aspect, with edema localized to the septum and areas of necrosis, may be suggestive of this disease, and prompt aggressive therapy for prevention of acute heart failure.

Eosinophilic myocarditis: dramatic response to steroids

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A 22-year-old previously healthy female was referred with a progressive maculopapular rash, malaise, abdominal pain, cough, and fever. On admission, there was lower leg edema, bilateral pleural effusion, hepatomegaly, and ascites. Blood pressure was 90/50 mm Hg, and heart rate was 120 bpm. Laboratory testing revealed an elevated leukocyte count (22.6 G/l) with massive peripheral eosinophilia (51% of leukocytes), elevated liver enzymes, significantly elevated B-type natriuretic peptide (BNP, 1560 ng/l, normal <50 ng/l), and detectable cardiac troponin I (1.23 mcg/l, normal <0.5 mcg/l). A transthoracic echocardiogram showed a normal-sized left ventricle with significantly and symmetrically increased wall thickness (septum 13 mm, posterior wall 12 mm, figure, panel A; parasternal long axis view, B; apical four chamber view), diffusely impaired left ventricular ejection fraction (LVEF 40%), and reduced systolic (s', 6.5 cm/s) and early diastolic (e', 6 cm/s) tissue velocities (figure, panel C). There was a small pericardial effusion. Treatment with steroids was initiated. After the first oral dose of 2 mg/kg body weight of prednisone, BNP fell to 576 ng/l, and cardiac troponin I fell to 0.25 mcg/l within 24 hours. A repeat echocardiogram four days after the initial study revealed a significant reduction in left ventricular wall thickness (septum 10 mm, posterior wall 8 mm, figure, panel D and E), normalisation of LVEF to 70%, and significant improvement in systolic (s' = 8 cm/s ) and early diastolic (e' = 10 cm/s) tissue velocities (figure, panel F). Skin biopsy was compatible with severe drug rash. The rash disappeared within days. Bone marrow biopsy did not reveal evidence of a malignant disease. The patient made an uneventful recovery. Although an endomyocardial biopsy was not obtained,
Microangiopathic hemolytic anemia due to hypertensive crisis
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Background: The association between hypertensive crisis and microangiopathic hemolytic anemia is well described. It is unclear, however, whether hypertensive crisis is cause, trigger factor or complication of hemolysis. Here, we discuss potential mechanisms and implications of this probably underrecognised condition.

Case report: A 80-year old woman was seen for unclear weakness and dizziness within the last days. Prior to hospitalization, the patient was treated for an activated osteoarthritis of the knee with diclofenac over a period of two weeks. Vital parameters at admission revealed hypertensive crisis (BP 236/100 mm Hg left upper arm, 220/98 right), physical examination was otherwise unremarkable. Blood analysis showed acute renal insufficiency and hemolytic anemia (Hb 87 g/l, LDH 1114 U/l, sporadic schistocytes) with leukocytosis (Lc 10.85 G/l). Levels of haptoglobin were undetectable (<0.10 g/l). Levels of ferritin, vitamin B12 and folic acid were normal; a protein electrophoresis showed no pathologic findings. Hypertensive crisis and renal insufficiency were interpreted in the context of the treatment with the non-steroidal anti-inflammatory drug. A diagnosis of hypertensive-induced microangiopathic hemolytic anemia was made. Prompt correction of elevated blood pressure might disturb endothelial permeability leading to vascular fibrin deposits, which, in turn, result in consumption of erythrocytes and platelets. Novel studies have implicated the importance of the Renin-Angiotensin-Aldosteron-System for the development of such vicious cycle; it remains unclear, however, whether hypertensive crisis is the cause or the complication of hemolysis. Rapid correction of elevated blood pressure is essential for reversibility of this condition.

Outcome of the Ross procedure in 100 children and adults: low mortality, excellent survival but frequent reinterventions during mid-term follow-up

Background: Ross procedure (RPR) offers excellent hemodynamic and clinical outcome but questionable long-term durability. There are little data on long-term outcome and predictors of reintervention after this procedure.

Methods: Between 1993 and January 2011 (89 interventions after Jan 1, 2000), 100 children and adults (76 males; mean age 17 ± 12 years) underwent a RPR consisting in a root replacement at our center. In all patients (pts), pre- and postoperative clinical and echocardiographic data were analyzed as well as surgery reports, and mid-term follow-up (survival, NYHA class, frequency of reinterventions or endocarditis).

Results: Aortic valve (AV) pathology leading to RPR were congenital heart disease (including 64 bicuspid AV, 12 monocuspid AV, 12 tricuspid, 3 quadricuspid, 9 indeterminate); a history of prior endocarditis (6 pts) and rheumatic heart disease (2 pts). 52 pts had previous cardiac interventions, including coarctation surgery (5 pts). RVOT replacement was made with a pulmonary homograft (56 pts) or a Contegra graft (31 pts) in most. Procedures included reduction surgery of the ascending aorta (19 pts), and resection of subaortic stenosis/myectomy (9 pts). Perioperative mortality was 1%; one 8 year old pt with postoperative stroke died 3 weeks postoperatively of ventricular fibrillation. Mid-term follow-up was available in 97 pts (98%) after 5.6 ± 3.8 years. 94 of 95 pt were in NYHA class I or II. Any dilatation of the aortic root or ascending aorta (2 score ≥4) was observed in 32 of 94 pts (34%). Postoperative endocarditis occurred in 2 pts (1x Contegra graft, 1x autograft). Reinterventions were necessary in 23 pts (24%); most frequently valvuloplasty of the RVOT (7 pts), percutaneous valve replacement (6), aortic root procedures (3) and homograft replacement (3 pts). Death occurred in 2 pts (heart failure in both), 5 year freedom from reintervention was 83.8 ± 4.5%.

Conclusion: Ross procedure in pts with predominantly congenital aortic valve disease has low morbidity and mortality. Mid-term follow-up shows an excellent functional class, however, besides aortic dilatation (34%) also reinterventions are frequent (24%) especially in the RVOT. This necessitates regular postoperative surveillance after RPR.

Ross procedure: prevalence and predictors of aortic autograft dysfunction and aortic dilatation in 97 patients during mid-term follow-up

Background: The ideal prosthesis for aortic valve replacement in children and adolescents remains controversial, thus, the Ross procedure (RPR) using pulmonary autograft (AG) implantation seems a good alternative. However, there are concerning reports on AG dysfunction and aneurysmal dilatation of the neo-aortic root and ascending aorta. Data on incidence and predictors of aortic dilatation are scarce.

Methods: Between 1993 and 2011, RPR was performed in 100 patients (pts; mean age 17 ± 12 years; 41 pts <14 years old); 97 of 99 survivors (98%) had a clinical and echocardiographic follow-up after 5.6 ± 3.8 years. Pre- and postoperative clinical and echocardiographic data were analyzed. In 89 pts, detailed measurement of the aortic root including Z scores were available. Z score of >4.0 defined aortic root dilatation.

Results: In 78 of 97pts, congenital aortic valve disease was present: bicuspid (63pts), monocuspid (12), quadricuspid (3); tricuspid (10), indeterminate (9) valve morphology. Associated congenital heart disease included subaortic stenosis (SAS; 12 pts), aortic coarctation (9), and ventricular septal defect (2). Previous cardiac surgery included aortic valve surgery in 26 pts and/or balloon valvuloplasty in 24 pts. Preoperative aortic dilatation was described in 28 pts (29%). In the 97 pts RPR included reductionplasty of the ascending aorta (19 pts) and subvalvular resection of membrane/myectomy (9 pts). At mid-term follow-up, moderate or severe aortic regurgitation was present in 7 pts (7%), moderate or severe aortic stenosis in 3 (3%), and any aortic dilatation (root and/or ascending aorta) in 32 pts (33%). Median Z-score of the aortic root was 2.4 ± 1.7, of the ascending aorta 2.7 ± 1.9. In 23 of 89 pt (26%), at least one Z score of
>4.0 was observed. Predictors of aortic dilatation were previous coarctation surgery (p = 0.02), SAS (p = 0.04), suggestive a history of hypertension (HTN; p = 0.08). Age at surgery, preoperative dilatation of the aorta, gender, and morphology of the aortic valve did not predict aortic dilatation (p > 0.05).Reoperation on the AG was necessary in 7 pts (7%) including AG replacement in 5.

**Conclusion:** Although aortic dilatation during mid-term follow-up after RPR is frequent (at least 26%), reoperation due to autograft dysfunction is rare (7%). Besides assessment of the right ventricular outflow tract, careful assessment of the aortic root after RPR is important, especially in pts with complex LVOT, prior cardiac surgery and a history of HTN.

**The right ventricle predicts the race results in ironman triathletes**

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**Background:** The ironman (IM) triathlon consists of a 3.8 km swimming, 180.2 km cycling, and a 42.2 km run. IM ATHL are the prototype of ultra endurance athletes. There are few data on prediction of race time comparing echocardiographic findings (echo) and anthropometric measures.

**Methods:** Amateur ATHL participating in the Zurich IM race in 2010 were examined the day before the race. A complete echo including tissue Doppler imaging (TDI) and 2D speckle tracking to assess global right ventricular (RV GLS) and left ventricular strain (LV GLS) was performed. All IM ATHL underwent anthropometric measurements: body mass index (BMI), percent body fat (PBF), hematocrit and skeletal muscle mass (SMM) were determined. During the 3 months before the race, each ATHL maintained a training diary consisting of daily workouts in hours (hrs) with distance and duration per discipline.

**Results:** There were 38 IM ATHL, mean age 38 ± 8 years; 32 males (84%), body weight 73 ± 10 kg, a SMM of 39 ± 6 kg and PBF of 15 ± 6%. They had performed 6.5 ± 4.4 years as IM ATHL. Their hours (hrs) training per week (TPW) averaged 13.5 ± 3.5 hrs consisting of 7.3 ± 2.7 hrs bicycle, 3.7 ± 0.9 hrs running, and 2.4 ± 1.1 hrs swimming. The hematocrit was 43 ± 2%. Table 1 shows correlations between clinical and echo variables with race time (simple regression analysis: p values and R² values if p < 0.05). Table 2 shows the results in IM ATHL comparing those with a race time of more/less than 10.5 hours. Race time was associated with right ventricular (RV) area, LV enddiastolic volume index (LVEDVI) and regional right ventricular function assessed by tissue Doppler imaging (TDI) of the RV of the basal free wall and of the basal left ventricular septum (base). The best predictor for race time was RV area. Among the other parameters, only PBF and the hematocrit showed a weak correlation, whereas age, SMM, or years of experience did not correlate at all (table 1).

- **Total race time**
  - HR rest
  - BMI
  - LV EF, 3D
  - LVEDVI
  - LVMMI
  - RV area enddiastole
  - PBF
  - SMM
  - Age
  - Training per week
  - Hematocrit
  - Years as IM ATHL

- **LV measures**
  - LVEDVI
  - LV EF (percent)
  - LVMMI
  - RV area enddiastole
  - PBF
  - SMM
  - Age
  - Hematocrit
  - Years as IM ATHL

**Conclusions:** In IM ATHL, performance measured by race time is best predicted by RV size at enddiastole and regional RV function. It also correlates with LVMMI and LV volume. Race time was associated with right ventricular (RV) area, LV enddiastolic volume index (LVEDVI) and regional right ventricular function assessed by tissue Doppler imaging (TDI) of the RV of the basal free wall and of the basal left ventricular septum (base). The best predictor for race time was RV area. Among the other parameters, only PBF and the hematocrit showed a weak correlation, whereas age, SMM, or years of experience did not correlate at all (table 1).

**Determinants of exercise capacity in patients with Ebstein’s anomaly**


**Aim:** This study aims to elucidate the determinants of exercise capacity of patients with Ebstein’s anomaly (EA).

**Methods:** Patients underwent a complete echocardiographic (TTE) and cardiac magnetic resonance imaging study (CMR). The severity of Ebstein’s anomaly and the degree of tricuspid regurgitation (TR) were described as mild, moderate or severe based on the echocardiographic findings. As measures of ventricular systolic function right and left ventricular (RV, LV) 2D longitudinal global strain (2DGS) were obtained. To evaluate diastolic LV function the ratio of the peak early filling of mitral inflow (E) and the early diastolic velocity (E’) were determined. Indexed RV enddiastolic volume (RVEDVI) and aortic cardiac index (aCI) were calculated by CMR. Cardiopulmonary exercise testing was performed to evaluate maximum oxygen uptake (VO2max) and oxygen saturation at peak exercise (SO2peak).

**Results:** 76 (31 men) individuals were included. Mean age was 30 ± 16 years. Multivariate analysis revealed the severity of Ebstein’s anomaly and SO2peak as independent predictors of VO2max (table).
Conclusions: This study shows for the first time that the severity of Ebstein's anomaly and the degree of a right to left shunt on atrial level, reflected by the oxygen saturation under peak exercise, are predictive for the exercise capacity in patients with EA. To our surprise TR was not predictive of exercise capacity.

Progression of ascending aorta dimensions in pediatric patients with bicuspid aortic valve
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Introduction: Bicuspid aortic valve (BAV) is the most common congenital cardiac defect. Apart from obstructive lesions, a significant part of patients develop dilation of the ascending aorta. Natural history and significance of aortic dilatation in pediatric BAV patients is not well defined. Therefore, we studied progression of dimensions in these patients with and without coarctation.

Methods: Patients with BAV or with BAV and coarctation (BAV + coarc) were selected from institutional database. Inclusion criteria were: at least three echocardiograms over last 15 years, each at least one year apart. Aortic diameters were measured at 3 levels (annulus, sinus, ascending), and transformed into age- and gender-specific z-scores. Impact of gender, diagnosis (BAV vs. BAV+coarc) and valve function on changes of z-scores over time was analyzed by linear mixed-effects regression.

Results: 116 measurements were recorded in 28 patients (9 patients BAV, 19 patients BAV+coarc). Mean age at time of measurements was 12.0 years (range, 0.1 to 23.1 years). Eighty-five measurements were performed in male patients. Aortic regurgitation was present in 29, and mild valvular stenosis in 22 patients. Ascending aorta z-scores increased significantly over time in the entire sample (0.07/year; 95%CI, 0.04 to 0.10; p <0.001); in both BAV (0.12/year; 95%CI; 0.05 to 0.18; p <0.001) and BAV + coarc (0.06/year; 95%CI; 0.02 to 0.10; p = 0.002); in boys (0.08/year; 95%CI; 0.04 to 0.11; p <0.001) but not in girls (0.03/year; 95%CI; -0.05 to 0.10; p = 0.49); in patients with 0.10/year (95%CI; 0.03 to 0.17, p = 0.006) and without aortic regurgitation (0.07/year; 95%CI; 0.03 to 0.10; p <0.001); and in patients without aortic stenosis (0.02/year; 95%CI; -0.10 to 0.06; p = 0.65).

Conclusions: Ascending aorta z-scores progressed significantly, particularly in patients with isolated BAV; indicating intrinsic wall abnormalities. Progression was influenced by gender and aortic function. Patients will be further examined for molecular markers, aiming to identify patients at risk for severe progression, with potentially highest benefit from early medical treatment.

Enhanced endocannabinoid anandamide levels improve vasodilation in atherosclerosis-prone mice: evidence for endothelium-dependent mechanism
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Background: Endothelial dysfunction is a key event in atherosclerosis, leading to reduced endothelial nitric oxide release and thus impaired vasodilation. Endocannabinoids exhibit a variety of cardiovascular effects, including vasodilation in isolated blood vessels and hypotension in anesthetized rodents. The underlying mechanisms are less clear and may involve endothelial-dependent or -independent mechanisms. In the present study, we took advantage of genetically modified mice with enhanced endocannabinoid anandamide (AEA) levels due to deficiency of its major degrading enzyme fatty acid amide hydrolase (FAAH). Our aim was to study the effect of elevated AEA levels on endothelial function in the apolipoprotein E knockout (Apoe-/-) mouse model of atherosclerosis.

Methods and results: Apoe-/- and Apoe-/- FAAH-/- mice were maintained during 10 weeks with high cholesterol diet. Aortic rings of 2–3 mm length were isolated, placed in a myograph and stretched to a passive tension of 5 mN. Endothelium-dependent and -independent contractions were measured using phenylephrine (PE) dose-response (from 10e-10 to 10e-6 M). ApoE-/- FAAH-/- mice displayed reduced endothelium-dependent concentration-response compared to ApoE-/- mice (Emax 4.4 vs 7.4 mN, p <0.01). Then, endothelium-dependent and -independent relaxations were assessed by concentration-response curves to acetylcholine (ACH) and sodium nitroprusside (SNP), respectively.
of matched PE-induced precontraction. ApoE-/- FAAH-/- mice showed a significant decrease of Ach EC50 (200 vs 250 nM, p <0.01) suggesting their greater sensitivity to the endothelium-dependent relaxation. Moreover, western blot analysis demonstrated increased aortic endothelial nitric oxide synthase (eNOS) expression in ApoE-/- FAAH-/- mice. Further in vitro studies with human umbilical ven endothelial cells (HUVEC) revealed enhanced phosphorylation of eNOS and Akt, a kinase directly phosphorylating eNOS, as well as an increased nitric oxide (NO) release in response to stimulation with the stable AEA analogue methanandamide.

Conclusion: Our data showed for the first time in a mouse model of atherosclerosis, that the endocannabinoid AEA improves vasodilation through an endothelium-dependent mechanism which seemed to be mediated by the activation of the eNOS pathway and the release of NO.

Evidence for inhibition of eNOS via downregulation of AKT-phosphorylation by Rapamycin in human arteries


Background: Evidence has accumulated that rapamycin causes impaired endothelial function. Recently we observed that rapamycin diminishes acetylcholine-induced endothelium-dependent relaxation of rings from human internal thoracic arteries (ITA) in organ bath experiments. Of the molecular level it is well established that long-term treatment with rapamycin impairs mTOR-rictor complex formation. Our goal was to investigate whether there exists a downstream pathway via the AKT-eNOS signaling axis in human arteries which could play a keyrole in the inhibition of endothelium-dependent relaxation.

Methods: ITA from patients undergoing bypass surgery were incubated for 20 h with 1µM rapamycin in RPMI 1640 (without serum or growth factors). Controls were treated with ethanol used in the highest rapamycin concentration. To investigate whether down-regulation of AKT after 20 h rapamycin-treatment also affects the phosphorylation of eNOS in cultured endothelial cell line Hmec-1. Protein-extracts were prepared and analyzed via Westernblot assays using anti-AKT-, anti-phospho-AKT- and anti-phospho-eNOS antibodies.

Results: In 22 out of 24 ITA samples rapamycin diminished the phosphorylation of AKT on Ser473 (p <0.0001) without changing total AKT levels. In 9 of these ITA levels of phosphorylation dropped to less than 20%. Incubation of Hmec-1 for 20 h with 1 µM rapamycin revealed a 50% down-regulation of phospho-eNOS.

Conclusion: Long-term incubation with rapamycin down-regulates AKT-phosphorylation in arterial tissue of human ITA and decreases eNOS-phosphorylation in cultured endothelial cells. In addition, rapamycin decreases eNOS expression along with increased uncoupling of eNOS, implying endothelial-dependent relaxation via the m-TOR-Rictor-AKT-eNOS pathway.

Critical role for PI3K/p110alpha in arterial thrombosis and vascular smooth muscle cell activation: implications for drug-eluting stent design

E.W. Holy, A. Akhmdevov, T.F. Lüscher, F.C. Tanner (Zürich)

Background: Impaired reendothelialization and stent thrombosis remain safety concerns associated with the use of drug-eluting stents (DES) despite a reduction in restenosis rates. Phosphoinositide-3-kinase p110alpha (PI3K/p110alpha) controls cellular processes such as proliferation and chemotaxis and thus represents an emerging drug target. However, its effect on arterial thrombosis formation and activation of vascular smooth muscle (VSMC) as well as endothelial cells (EC) is not known.

Methods: PI3K/p110alpha was inhibited by treatment with the small molecule inhibitor PIK 75 or, alternatively, a specific siRNA. Arterial thrombosis studies were performed in mice carotid artery photochemical injury model. Proliferation and migration of VSMC and EC were assessed by cell number and Boyden chamber, respectively. Endothelial senescence was evaluated by beta-galactosidase assay, endothelial dysfunction by organ chambers for isometric tension recording as well as Western blots for analysis of eNOS, TF, and PAI-1 expression.

Results: Male C57Bl/6 mice were either treated with PIK 75 (10 mg/kg/d for 7 days) or vehicle. Arterial thrombus formation was delayed in mice treated with PIK 75 as compared to controls (n = 8; p <0.005). PIK 75 impaired arterial expression and activity of TF and PAI-1 as well as NFκB activity (n = 8; p <0.05). In contrast, plasma clotting and tail bleeding times did not differ (n = 8; p = NS). In human vascular smooth muscle and glomus cells, PIK 75 inhibited expression and activity of TF and PAI-1 (n = 4; p <0.01). These effects occurred at the transcriptional level via the Fhox signaling cascade and the transcription factor NFκB. Furthermore, inhibition of PI3K/p110alpha with PIK 75 or a specific siRNA selectively impaired proliferation and migration of VSMC while sparing EC completely. Treatment with PIK75 did not induce endothelial senescence nor inhibit eNOS expression or endothelium-dependent relaxations. In contrast to PIK 75, both rapamycin and paclitaxel inhibited endothelial proliferation and migration; moreover they induced expression of TF and PAI-1.

Conclusion: PI3K/p110alpha inhibition delays arterial thrombus formation via inhibition of TF and PAI-1. In addition, PI3K/p110alpha inhibition impairs proliferation and migration of VSMC, but not EC. Hence, PI3K/p110alpha inhibition represents an interesting profile of action and may offer new options for DES design.
Tissue factor disulfide mutation causes a bleeding phenotype with gender specific organ pathology and lethality


Tissue factor (TF), the key initiator of coagulation, is expressed in sub-endothelial tissue, particularly in heart, lung and brain. The extracellular allosteric disulfide bond Cys186–Cys209 of human TF shows high evolutionary conservation. In vitro experiments suggest that TF pro-coagulant activity depends on the intact Cys186–Cys209 disulfide bond. To investigate the role of this TF mouse by replacing Cys213 of the corresponding disulfide heterozygous breeding pairs was homozygous for C213G TF at birth, while the distribution of genotypes was still normal on embryonic day 9.5. Vascular defects in yolks sacs as described for TF KO mice could be ruled out as a reason for partial lethality bleeding from placenta and uterus around day 14.5 occurred suggesting that bleeding might also account for the partial loss of homozygous embryos in heterozygous females. After birth, homozygous C213G TF mice presented with a bleeding phenotype, affecting predominantly heart, lung, and brain. This resulted in a gender specific lethality with reduced survival especially in homozygous males. In brain and lung, the expression of C213G TF protein was about 10 fold lower, whereas expression was equal to the wildtype protein in heart. Procoagulant activity of C213G TF was reduced by about 100-fold in these organs. Between the genders, however, there was neither a difference in expression nor in activity. Homozygous female mice exhibited bleeding in lung less frequently, while...
endpoint was all-cause mortality. During a median follow-up of 2.6 years, 78 patients died, 61 of cardiac causes, and 9 underwent heart transplantation. Observed cumulative incidence of mortality was 7%, 13%, and 25%, at 1, 2, and 5 years, respectively. The median SHFS was higher for patients who died compared to those who survived (0.66 [IQR 0.04 to 1.06] versus –0.06 [IQR –0.51 to 0.47]; P <0.001). Observed versus predicted 5-year mortality rates were 10.0% vs. 10.1%, 17.7% vs. 17.9%, 23.4% vs. 27.6%, and 47.7% vs. 50.9% for ascending quartiles of risk, respectively. Discrimination was excellent without systematic estimation errors of risk prediction; the c-statistic ranged from 0.78 at 1-year follow-up to 0.70 at 5-year follow-up; the Hosmer-Lemeshow 2 was 0.87 (P = 0.65). Figure 1 shows the cumulative survival according to the tertiles of the SHFM, figure 2 the ROC curves for the prediction of 1 and 5 year mortality.

Conclusions: In heart failure patients implanted with a CRT-D, the SHFM offers adequate discrimination of risk for all-cause mortality, and estimation of risk without substantial or systematic errors.

Safety of access control systems based on radiofrequency identification in patients with implantable cardioverter-defibrillators

I. Fauchere, A. Moini, F. Luechinger, L. Haegeli, F. Dury, T. Wolber (Zürich)

Background: Recently published in vitro tests with radiofrequency identification readers (RFID) revealed clinically significant electromagnetic interference with implantable pacemakers and implantable cardioverter-defibrillators (ICDs). Incidents in patients with pacemakers and ICD’s have not been reported yet. The aim of this clinical study was to evaluate the risk of electromagnetic interference (EMI) during use of RFID-based access control systems used in ski resorts in patients with ICDs and cardiac resynchronization therapy-defibrillators (CRT-Ds). Methods: 34 patients implanted with an ICD or CRT-D were included in the study. Tests were performed using two commercially available RFID access control systems (gates) used at ski resorts operating on different frequencies of 125 kHz and 13 mHz. After initial device interrogation, patients were standing upright within each gate for a minimum of 30 seconds both at a random position as well as with the ICD positioned at the closest possible distance from the RF source, simulating a worst case scenario. Electrocardiographic and telemetric real-time monitoring of devices and patients heart rhythm was performed throughout the study.

Results: ECG monitoring by body surface ECG demonstrated artefacts in all patients. However, real-time telemetry of intracardiac electrograms did not show artefacts or evidence of EMI causing inappropriate pacing, changes in pacing rate, or delivery of antitachycardia pacing. Interrogation of devices after the test revealed no inappropriate tachycardia detection, programming changes, oversensing or ICD malfunction during all tests in all patients.

Conclusions: Although in vitro test demonstrated the ability of RFID systems to interfere with the function of ICDs, this clinical study showed no evidence of EMI during use of RFID-based access-control systems used in ski resorts simulating a real-world setting. Therefore, the use of these access-control systems seems to be safe for patients implanted with an ICD or CRT-D.

Significance of pre-existing right bundle branch block for need of cardiac pacing in patients undergoing transcatheter aortic valve implantation


Introduction: Pre-existing right bundle branch block (RBBB) is considered a risk factor for subsequent permanent pacemaker (PM) implantation in patients (pts) undergoing transcatheter aortic valve implantation (TAVI). The aim of this study is to characterize pts with pre-existing RBBB undergoing TAVI.

Methods: Pts undergoing transfemoral and apical TAVI from 08/2007 to 12/2011 at our hospital were included. Data acquisition was performed by a prospective registry. Pts were divided into group 1 with pre-existing RBBB including bifascicular block, and group 2 without pre-existing RBBB.

Results: A total of 229 pts (age, 82.5 ± 6.4 years; male, 91 (39.7%)) undergoing TAVI (transfemoral, 198 (86.5%); apical 31 (13.5%)) from 08/2007 to 12/2011 constitute the study population. Thirteen (5.7%) pts had RBBB before TAVI (group 1). In group 1, bifascicular block was present in 36 (15.9%) pts. Group 2 consisted of 206 (90.0%) pts; in this group, left bundle branch block was present in 27 (13.1%) pts. Ten (4.4%) pts had paced rhythm at baseline and were excluded from further analysis. Before TAVI, 3 (23.1%) pts in group 1 had a PM already implanted vs. 8 (3.9%) pts in group 2, p = 0.021. After TAVI, a PM was newly implanted in 5 (38.5%) pts in group 1 vs. 35 (17.0%) pts in group 2, p = 0.066; after exclusion of pts with a pre-existing PM, a new PM was implanted in 50.0% in group 1 vs. 17.7% in group 2, p = 0.025. Overall after TAVI, a pre-existing or newly placed PM was present in 8 (61.5%) pts in group 1 vs. 43 (20.9%) pts in group 2, p = 0.003. In pts undergoing PM implantation post TAVI, complete AV block was the indication for PM implantation in 3 (60.0%) pts in group 1 vs. 11 (31.4%) pts in group 2 (p = 0.322).

Conclusions: Pts with pre-existing RBBB undergoing TAVI require more often permanent pacemaker therapy than pts without RBBB. Further analysis is needed to identify those pts with RBBB who will likely develop complete AV block during or after TAVI.

Catheter ablation of ventricular tachycardia and premature ventricular contractions

J. Seiler, M. Stoller, H. Tanner, F. Nott, L. Roten, J. Fuhrer, E. Delaëretaz (Bern)

Introduction: Aim of this study is to characterize the patients (pts) who underwent catheter ablation for ventricular tachycardia (VT) and premature ventricular contractions (PVC) in a single center, and to analyze the procedural and long-term outcome.

Methods: All pts undergoing catheter ablation for VT or PVC from 01/1996 to 12/2009 were included in the study. Data acquisition was performed by review of the medical records.

Results: 154 consecutive pts (118 [77%] males, mean age 57 ± 15 years) underwent 207 ablation procedures for VT or PVC. Forty-two (26.9%) pts had more than one procedure. Mean follow-up was 3.0 ± 3.1 years. Sixty-five (42%) pts had no
structural heart disease, 61 (40%) pts had ischemic heart disease, and 28 (18%) pts had non-ischemic heart disease. Arrhythmia mechanism was scar-related reentry in 53 (34.4%) procedures, bundle-branch reentrant or fascicular reentry in 11 (7.1%) pts, focal VT/PVC in 87 (56.5%) pts and not determined in 3 (1.9%) pts, respectively. All arrhythmias were abolished in 105 (50.7%) procedures, and the procedure failed in 55 (26.6%) cases. Arrhythmias recurred in 68 (44.2%) pts after the first procedure; and in 56 (36.4%) pts after the last procedure. In procedures with arrhythmia recurrence and data from ICD interrogation available (n = 44) within a 6 months’ period before and after intervention, the median number of VTs was reduced from 8 to 6, and the median number of ICD shocks was reduced from 3 to 0, respectively. There was no procedure-related death, and major complications were reported in 8 of 199 (4.0%) procedures. During follow-up, 12 (7.8%) pts died, all of them had structural heart disease.

Conclusions: Ablation for ventricular arrhythmias is safe and efficient. Long-term freedom from recurrent arrhythmias is achieved in almost two third of the patients, and in patients with arrhythmia recurrence, catheter ablation allowed a significant decrease in ICD shocks. On the basis of these data, particularly in regard to the low risk of major complications, VT catheter ablation should be considered as treatment option in larger groups of patients and/or at an earlier stage of the disease.

Dronedarone inhibits platelet-aggregation in vivo

Background: Dronedarone is a benzofuran derivative with an electropharmacologic profile resembling that of amiodarone, but less thyroid-related and pulmonary side-effects. In a subgroup analysis of the ATHENA trial, there was a significant reduction in hospitalisations for acute coronary syndromes in patients under dronedarone-treatment. Whether this is due to its antiarrhythmic effect or possible anti-thrombotic properties is unknown.

Methods and results: Male C57Bl/6 mice were treated with dronedarone (200 mg/kg body weight once daily via oral gavage) or vehicle (0.5% methylcellulose) for two weeks. 24 hours after the last application, platelets were isolated and further processed. Total platelet number (P = NS) and platelet turnover (P = NS) as measured by the glycoprotein index did not differ between the two groups. Thus, alterations of platelet kinetics were not present. In a next step, platelet-rich plasma from the mice was isolated and platelet aggregation was measured by using the Chronolog impedance aggregometer. Aggregation was initiated with thrombin (1 U/ml), ADP (20 umol) or collagen (1 mg/l). Dronedarone significantly reduced maximal aggregation in thrombin-stimulated platelets as compared to the controls (P < 0.05). Even though maximal aggregation was reduced, velocity of thrombin-induced aggregation as well as time to initiation of aggregation were unaltered (P = NS). In contrast to thrombin, aggregation due to ADP and collagen did not differ (P = NS) between the two groups.

Conclusions: Dronedarone impairs thrombin-induced platelet aggregation in vivo. This action thus represents a possible explanation for the reduction in hospitalisations for acute coronary syndromes in patients under dronedarone treatment. Nevertheless, further investigation is necessary to elucidate the mechanisms responsible for this pleiotropic effect.

Long-term cardiac remodeling and arrhythmias in nonelite marathon runners: Focus on the right heart
M. Wilhelm, L. Roten, H. Tanner, J.-P. Schmid, H. Saner (Bern)

Background: Long-term endurance sport is associated with atrial remodeling and atrial arrhythmias. More importantly, high level endurance training may promote complex ventricular arrhythmia originating from a dysfunctional right ventricle (RV). We investigated the long-term consequences of marathon running on cardiac remodeling as potential substrate for arrhythmias with a focus on the right heart.

Methods: We invited runners of the 2010 Grand Prix of Bern, a 10 mile race. 873 marathon and non-marathon runners applied for participation, 138 were randomly selected. Subjects were stratified according to former marathon participations: control group (non-marathon runners, n = 34), group 1 (1 to 5 marathons, mean 2.7, n = 46), and group 2 (≥6 marathons, mean 12.8, n = 42). Transthoracic echocardiography and 24 hours Holter analysis. Mean age was 42 ± 7 years. Right and left atrial size and RV/LV enlargement was present in only 2.4%/4.3% of marathon runners, respectively. Overall, significant correlations were observed between right atrial and RV end-diastolic areas and between left atrial and LV end-diastolic volume indices. Right and left atrial enlargement was present in 53% and 47%, respectively, while RV and LV dimension exceeded normal limits in only 2.5% and 0.8% of cases, respectively (fig. 2). In multiple linear regression analyses, marathon participation was an independent predictor of right and left atrial size, but had no impact on RV and LV dimensions and function (RV lateral wall tissue Doppler, tricuspid annular plane systolic excursion, myocardial performance index, fractional area change of the RV).
Atrial and ventricular ectopy during 24 hours Holter monitoring was low and equally distributed between the groups. No complex ventricular arrhythmias occurred.

Conclusions: In nonelite athletes, marathon running was not associated with RV enlargement, dysfunction or ventricular ectopy. However, marathon running promoted biatrial remodeling as potential substrate for atrial arrhythmias.

Measurement of left atrial volume in patients undergoing ablation for atrial arrhythmias: comparison of different algorithms of real-time 3D echocardiography
S. Reverdin, H. Burri, D. Shah, R. Lerch, H. Müller (Genève)

Background and Purpose: Real-time full-volume 3D echocardiography (3DE) allows rapid and non-invasive measurement of left atrial (LA) volume without making geometric assumptions as volume is reconstructed from endocardial contours of the entire chamber. Different algorithms from different commercial providers are available. Older software requires manual tracing of endocardial contours. Recently software with semiautomatic endocardial contour finding algorithms has become available, which considerably speeds up the procedure. Our aim was to compare, in the same data set, LA volume determined by an algorithm involving manual tracing to values obtained by a software algorithm with semiautomatic contour detection.

Methods: 88 patients in sinus rhythm undergoing radiofrequency ablation for atrial arrhythmias, mainly paroxysmal AF, were studied by real-time 3DE. LA volume was measured using a multiplane interpolation method algorithm (4D Analysis Cardio-View v.1.3, Tomtec Gmbh) with manual planimetry of 8 equidistant slices. These volumes were then compared with LA volume determined by the QLAB 7.1 software (Philips) using a semiautomated border detection method.

Results: Linear regression showed an excellent correlation between LA volume determined by Tomtec and QLAB software (r² = 0.90, p <0.001). Bland-Altman analysis of Tomtec versus QLAB volume determination showed rather narrow 95% limits of agreement (~12 to +16 cc) with a minimal slight bias of +1.9 ± 7 cc by the Tomtec method.

Conclusions: The QLAB 7.1 semiautomated border detection method shows excellent correlation for left atrial volume determination compared to the older more time consuming multiplane interpolation method by the Tomtec software, with only slight underestimation. The results indicate that values of left atrial volume obtained by either algorithm can be compared, for example during follow-up examinations.

Area strain for the assessment of regional left ventricular wall thickening using 3D speckle tracking
S.F. de Marchi, S Urheim, E.W. Remme, R. Massey, S. Aakhus (Oslo, NO)

Background: 3D speckle tracking is a promising new technology for the echocardiographic assessment of left ventricular (LV) function. It allows reconstructing myocardial tissue motion in time and space. Shortening in the longitudinal and circumferential directions can be combined in an area strain measurement which...
in contrast to wall thickening (radial strain) does not require endo- and epicardial border detection. In this study we investigated the relation between area strain and wall thickening by two geometrically independent measurements. 

Methods: In 12 patients, 3D full volume echocardiographic clips of the LV were acquired using a GE Vingmed E9 ultrasound scanner in multislice view. 3D endo- and epicardial border detection was performed to calculate regional wall thickening, whereas 3D speckle tracking was used to assess regional area strain. All geometric measurements were performed frame-by-frame at 336 local sites on refined 3D meshgrid datasets.

Results: A total number of 52'752 wall thickness – area strain data pairs were retrieved. In ROC analysis, an area strain >–15.3% was able to detect a systolic wall thickening <20% with a sensitivity and specificity of 83.2% and 80.2%, respectively. The area under the ROC-curve was 0.88. As expected from deformation theory, there was a nonlinear relation between wall thickening and area strain (Poisson effect). The estimated Poisson’s ratio (v) of myocardium was 0.39, showing that myocardium is not perfectly elastic and incompressible (v = 0.50), but exhibits a volume loss during systole.

Conclusions: Area strain derived from 3D speckle tracking reflects local wall thickening during the cardiac cycle and has the potential to detect clinically relevant regional contraction abnormalities. In principle, area strain can be converted directly into radial strain using basic elastic deformation formulas (Poisson effect), but the compressible nature of myocardial tissue should be considered by applying a Poisson's ratio below 0.50.

Specific longitudinal strain patterns in left ventricular hypertrophy
P. Monney, X. Jeanrenaud (Lausanne)

Background: In patients with left ventricular hypertrophy (LVH), standard echocardiography cannot easily distinguish between true LVH due to hypertension (HT) or hypertrophic cardiomyopathy (HCM), and infiltration (amyloidosis). We investigated whether 2D longitudinal strain (LS) analysis could help to define these different aetiologies.

Methods: Consecutive patients with LVH (wall thickness >13 mm or indexed LV mass >95 g/m² (F) or >115 g/m² (M)) and having a biopsy-proven diagnosis of amyloidosis, a familial HCM or severe HT were included. Standard 2D and Doppler echocardiography detection was performed to calculate regional wall thickening, whereas 3D speckle tracking was used to assess regional area strain. All geometric measurements were performed frame-by-frame at 336 local sites on refined 3D meshgrid datasets.

Results: A total number of 52'752 wall thickness – area strain data pairs were retrieved. In ROC analysis, an area strain >–15.3% was able to detect a systolic wall thickening <20% with a sensitivity and specificity of 83.2% and 80.2%, respectively. The area under the ROC-curve was 0.88. As expected from deformation theory, there was a nonlinear relation between wall thickening and area strain (Poisson effect). The estimated Poisson’s ratio (v) of myocardium was 0.39, showing that myocardium is not perfectly elastic and incompressible (v = 0.50), but exhibits a volume loss during systole.

Conclusions: Area strain derived from 3D speckle tracking reflects local wall thickening during the cardiac cycle and has the potential to detect clinically relevant regional contraction abnormalities. In principle, area strain can be converted directly into radial strain using basic elastic deformation formulas (Poisson effect), but the compressible nature of myocardial tissue should be considered by applying a Poisson's ratio below 0.50.

Specific longitudinal strain patterns in left ventricular hypertrophy
P. Monney, X. Jeanrenaud (Lausanne)

Table: Patients' characteristics

<table>
<thead>
<tr>
<th></th>
<th>Amyloidosis</th>
<th>Hypertension</th>
<th>HCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>67.4 ± 9.9</td>
<td>65.9 ± 14.6</td>
<td>55.3 ± 7.0</td>
</tr>
<tr>
<td>Male Gender (%)</td>
<td>48</td>
<td>48</td>
<td>75</td>
</tr>
<tr>
<td>Heart rate (bpm)</td>
<td>84.7 ± 5.4</td>
<td>74.7 ± 8.1</td>
<td>68.5 ± 8.0</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>170.7 ± 7.1</td>
<td>170.0 ± 9.9</td>
<td>169.8 ± 7.2</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>96.7 ± 17.1</td>
<td>78.4 ± 7.6</td>
<td>73.8 ± 9.5</td>
</tr>
<tr>
<td>Septal wall thickness (mm)</td>
<td>16.5 ± 3.0</td>
<td>14.4 ± 1.5</td>
<td>22.9 ± 4.5</td>
</tr>
<tr>
<td>Posterior wall thickness (mm)</td>
<td>15.1 ± 2.5</td>
<td>12.9 ± 2.2</td>
<td>9.6 ± 1.6</td>
</tr>
<tr>
<td>End-diastolic LV diameter (mm)</td>
<td>45.4 ± 7.0</td>
<td>43.0 ± 6.1</td>
<td>41.5 ± 5.3</td>
</tr>
<tr>
<td>End-systolic LV diameter (mm)</td>
<td>34.3 ± 9.1</td>
<td>25.7 ± 5.5</td>
<td>25.4 ± 5.0</td>
</tr>
<tr>
<td>Indexed LV mass (g/m²)</td>
<td>132.6 ± 59.5</td>
<td>115.4 ± 28.7</td>
<td>143.4 ± 52.4</td>
</tr>
<tr>
<td>Relative wall thickness (RWT)</td>
<td>0.68 ± 0.12</td>
<td>0.61 ± 0.14</td>
<td>0.45 ± 0.07</td>
</tr>
<tr>
<td>Modified RWT</td>
<td>0.72 ± 0.14</td>
<td>0.64 ± 0.13</td>
<td>0.75 ± 0.11</td>
</tr>
<tr>
<td>Fractional shortening</td>
<td>0.26 ± 0.03</td>
<td>0.40 ± 0.19</td>
<td>0.41 ± 0.11</td>
</tr>
<tr>
<td>Asymmetrical hypertrophy index</td>
<td>1.11 ± 0.15</td>
<td>1.14 ± 0.18</td>
<td>2.41 ± 0.19</td>
</tr>
<tr>
<td>End-diastolic LV volume (ml)</td>
<td>79.9 ± 35.2</td>
<td>67.9 ± 25.2</td>
<td>75.9 ± 30.7</td>
</tr>
<tr>
<td>End-systolic LV volume (ml)</td>
<td>26.7 ± 27.5</td>
<td>13.9 ± 8.9</td>
<td>27.0 ± 16.9</td>
</tr>
<tr>
<td>LV ejection fraction</td>
<td>0.52 ± 0.09</td>
<td>0.71 ± 0.08</td>
<td>0.66 ± 0.07</td>
</tr>
<tr>
<td>Mitral annular S5 velocity (cm/s)</td>
<td>3.8 ± 0.7</td>
<td>5.7 ± 1.5</td>
<td>5.7 ± 1.7</td>
</tr>
<tr>
<td>Indexed LA volume (ml/m²)</td>
<td>41.5 ± 8.4</td>
<td>38.3 ± 9.6</td>
<td>58.6 ± 18.0</td>
</tr>
<tr>
<td>Mitral E-wave velocity (cm/s)</td>
<td>80.9 ± 25.4</td>
<td>76.0 ± 23.8</td>
<td>79.8 ± 24.2</td>
</tr>
<tr>
<td>Mitral A-wave velocity (cm/s)</td>
<td>41.3 ± 24.0</td>
<td>96.29 ± 39.6</td>
<td>55.8 ± 24.9</td>
</tr>
<tr>
<td>E/A ratio</td>
<td>3.03 ± 2.01</td>
<td>0.36 ± 0.60</td>
<td>1.57 ± 0.71</td>
</tr>
<tr>
<td>E-wave deceleration time (ms)</td>
<td>153.3 ± 21.9</td>
<td>291.7 ± 121.1</td>
<td>135.0 ± 73.7</td>
</tr>
<tr>
<td>Mitral annulus Emax velocity (cm/s)</td>
<td>4.79 ± 0.85</td>
<td>5.47 ± 2.19</td>
<td>8.05 ± 2.90</td>
</tr>
<tr>
<td>E/Em ratio</td>
<td>19.46 ± 7.55</td>
<td>12.53 ± 7.71</td>
<td>10.86 ± 2.48</td>
</tr>
</tbody>
</table>

* p < 0.05 amyloidosis vs hypertension; *p < 0.05 amyloidosis vs HCM; *p < 0.05 hypertension vs HCM.
*p < 0.01 amyloidosis vs hypertension, *p < 0.01 amyloidosis vs HCM. *p < 0.001 hypertension vs HCM.
was performed. LS was derived from 3 apical 2D acquisitions at a frame rate set between 40 and 100/\text{s}.

**Results:** 22 patients were included (amyloidosis N = 7, HT N = 7, HCM N = 8). Regarding patients' characteristics (table), diastolic LV diameter and LV volumes were not significantly different between all 3 groups but indexed LV mass tended to be lower in HT. Amyloidosis patients had a higher heart rate and a lower systolic function as assessed by ejection fraction, fractional shortening and mitral annulus Sm velocity. HCM patients had more severe septal hypertrophy with a more asymmetric pattern and larger atrial volume. With LS analysis, three different patterns were observed (figure). Amyloidosis showed markedly decreased global LS with an increased basal to apical gradient, LS being preserved apically and very severely reduced basally. Severely reduced mean basal LS was associated with a high diagnostic accuracy for amyloidosis. In HCM, global LS was moderately decreased with little basal to apical difference. A strong regional heterogeneity was observed with reduced LS in the hypertrophied septal wall and preserved LS in the lateral wall. High interoseptal to antero-lateral LS difference and lack of significant basal to apical LS gradient were associated with a high diagnostic accuracy for HCM. HT had mildly reduced global LS with a normal basal to apical gradient and no significant regional heterogeneity. Preserved LS in the septal wall was able to separate HT from HCM or amyloidosis.

**Conclusion:** This study included a small population of patients with LVH of proven aetiology; it suggests that LS analysis could become a useful screening tool for the detection of cardiac amyloidosis and may help to separate HT from HCM. Larger series are needed to establish diagnostic cut-offs and to prospectively test their accuracy.

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**Dual-source computer tomography and magnetic resonance perfusion imaging may optimize coronary revascularisation**


**Objective:** Coronary artery bypass grafting (CABG) is routinely based on invasive coronary angiography (ICA) without information on myocardial perfusion. This study evaluates the outcome of CABG as well as patency rate of bypass anastomoses in relation to pre- and postoperative myocardial perfusion.

**Methods:** CABG was performed in 19 patients (18M/1F; age 65 ± 8 y) based on ICA data with a total of 62 bypass anastomoses (mean 3.1 bypass anastomoses / patient). Perfusion MRI assessed the myocardium for ischemia and scars preoperatively in a 16-segment heart model. These data were compared to postoperative values in follow-up exam (mean follow-up 13 ± 3 months). Coronaries were preoperatively evaluated in Dual-Source CT (DSCT) for significant stenosis and postoperatively for bypass anastomoses patency.

**Results:** Of 304 assessed heart segments 39% (88/304) showed ischemic myocardium under stress/rest preoperatively. CABG was successful in treating 94% (83/88) of all ischemic segments with no signs of residual ischemia postoperatively. In 6% (5/88) of segments persistent ischemia was present postoperatively in 3 patients (one patient with 5 patent bypass anastomoses, 2 patient with each one occluded bypass anastomosis). 79% of all bypass anastomoses (49/62) were optimally placed to supply ischemic regions. 21% (13/62) of all bypass anastomoses were placed either into non-ischemic myocardium (9) or into scar tissue (4). 10% (6/62) of all bypass anastomoses were occluded: 3 anastomoses to non-ischemic regions (potential competitive flow), 1 anastomosis was placed into scar-tissue, 2 anastomoses to ischemic regions that therefore remained ischemic postoperatively.

**Conclusions:** Even if 94% of ischemic segments were successfully revascularized, the outcome of CABG may be improved by myocardial perfusion imaging allowing for better preoperative planning with regards to the number and location of bypass graft anastomoses.
First in man clinical application of quantitative edema assessment using Free-Breathing 3T T2-mapping in patient with subacute ST elevation myocardial infarction (STEMI)


Background: Early primary percutaneous coronary intervention (PPCI) helps preserve cardiac function and save lives in STEMI. Late myocardial reperfusion may lead to complications related to reperfusion injury. Extravascular blood is a strong trigger for inflammation, associated with edema and (expanding) necrosis. As a consequence, microvascular obstruction reflects severe microvascular injury with progressive myocardial damage. A novel quantitative 3T T2-mapping protocol was therefore developed and tested in STEMI patients for edema quantification.

Methods: 8 STEMI patients who underwent a primary angioplasty (PPCI) had a cardiac magnetic resonance scan (CMR) at our institution within 2–4 days. An adiabatic T2prep with 3 incremental TE values were combined for free-breathing T2-mapping at 3T with a spatial resolution of 1.25 mm. This protocol was used to acquire 1 short-axis slice (centered on the akinetic infarction zone) in the 8 patients after PPCI of STEMI. The continuous limits of the edema zones and their starting and ending angles were identified, the difference between the angles was calculated as the edema angle spread and expressed in degrees (°).

Results: In all patients the size of the edema zone correlated significantly with the total creatinine kinase (CK) peak (r = 0.75, p = 0.03) (fig. 1). The edema angle spread significantly correlated with the size of the edema zone (r = 0.75, p = 0.03) and with both total CK (fig. 2), and CK-MB peaks (r = 0.87, p = 0.005; r = 0.75 p = 0.03, respectively).

Conclusions: The methodology presented in this study enables free breathold cardiac T2-mapping at 3T and these preliminary clinical data in a population of STEMI patient showed a correlation between CK, edema angle spread, and edema zone. However, as the edema tissue is not representing necrosis, a correlation with CK as a necrosis marker is not easy to explain, in fact, if a considerable amount of tissue has been saved by the PCI, we would not expect such a correlation. A correlation between edema mass and necrosis mass would prove this explanation and further necrosis quantification analysis is needed. This technical innovation may help to better quantify edema i.e microvascular damage and may guide and support therapy in patient post STEMI even if this preliminary T2-mapping data are correlated with necrosis markers.
absolute signal intensity (delayed enhancement) and on the signal increase (perfusion) of the anterior/posterior left ventricular wall after gadolinium injection. These criteria were applied in 30 patients (15 males and 15 females) scanned at 1.5 Tesla and 15 patients scanned at 3.0 Tesla (8 males and 7 females) by 3 CMR experts (SCMR level 3) and 1 extensively trained study nurse. In these 45 patients the correlation between the results of the quality assessment obtained by the different readers was calculated.

Results: On the 1.5 Tesla scanner, the mean quality score was 3.5. The mean difference between each pair of observers was 0.2 (5.7%) with a mean standard deviation of 1.4. On the 3.0 Tesla scanner, the mean quality score was 4.4. The mean difference between each pair of observers was 0.3 (6.4%) with a mean standard deviation of 1.6. The quantitative quality assessments between observers were well correlated for the 1.5 Tesla scanner: R was between 0.78 and 0.99 (p <0.05) for delayed enhancement and between 0.71 and 0.95 (p <0.05) for perfusion. The correlations were lower for the 3.0 Tesla scanner: R was between 0.46 and 0.93 (p <0.05) for delayed enhancement and between 0.69 and 0.93 (p <0.05) for perfusion.

Conclusion: The described criteria for the assessment of CMR image quality are robust and have a low inter-observer variability. Further research is needed to define the impact of the image quality on the diagnostic accuracy of CMR studies.
Mortality risk prediction of Seattle heart failure model in CRT patients

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Introduction: The present study aims to validate Seattle Heart Failure Model (SHFM) mortality prediction in patients treated with cardiac resynchronization therapy (CRT) from the "real-life" clinical setting.

Methods: SHFM 14 variables' data of 1139 consecutively implanted CRT patients (from 5 Centers) were collected retrospectively. Kaplan Meier and model discrimination analyses were performed.

Results: Three-hundred and seven deaths occurred over 40.1 months (IQR 25.2–60.0 months; mean yearly event rate 9.7% and survival was 89%, 81%, and 64% at 1, 2, and 5 years, respectively). Kaplan Meier event-free survival analysis stratified according to SHFM score was significant (Log Rank test p <.001) (figure). Survival of T1 group was 82%, 67% and 46% at 1, 2, and 5 years, respectively. Observed compared to SHFM-predicted survival was 0.11 vs. 0.08, 0.19 vs. 0.16, and 0.36 vs. 0.36 at 1, 2, and 5 years. Model discrimination by c-statistic was 0.64; logistic models' AUC-ROC of risk tertiles was 0.66, 0.68, and 0.67 at 1, 2, and 5 years.

Conclusion: SHFM discrimination was modest, tending to overestimate survival of heart failure patients treated with CRT. Nevertheless, SHFM may be clinically adapted to identify patients at higher risk who require close follow-up or additional therapeutic measures.

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Mid-regional pro-adrenomedullin as a novel predictor of mortality in patients with acute chest pain


Background: The purpose of this study was to investigate the utility of mid-regional pro-adrenomedullin (MR-proADM) in the early diagnosis and risk stratification of patients with acute chest pain in comparison with high-sensitive cardiac troponin-T (hs-cTnT) and B-type natriuretic peptide (BNP). Adrenomedullin is a potent vasodilator with inotropic and natriuretic properties. Its secretion is probably stimulated by both cardiac pressure and volume overload.

Methods: In this prospective, international, multi-center trial, MR-proADM was determined in 1179 unselected patients presenting with acute chest pain. The final diagnosis was adjudicated by two independent cardiologists according to the universal definition of acute myocardial infarction. Patients were followed for 24 months.

Results: Acute myocardial infarction was the final diagnosis in 16%. MR-proADM levels at presentation were higher in patients with AMI (median: 0.78 nmol/l, IQR 0.60–1.13) than in patients with other final diagnoses (0.64 nmol/l, IQR 0.49–0.86 nmol/l; p <0.001). Adding MR-proADM to hsc-TnT resulted in a numerically small, albeit statistically significant increase in diagnostic accuracy as quantified by the area under the receiver operating characteristic curve (AUC; 0.951 vs. 0.947; p = 0.002). There were 79 deaths (7%). Seventy-six percent of all deaths occurred in the fourth quartile of MR-proADM (>0.90 nmol/l).
The optimal cut-off of MR-proADM at presentation for the prediction of death amounted to 0.94 nmol/l with a sensitivity of 79% and specificity of 89%. Adding MR-proADM (AUC 0.93) to the TIMI-score predicted all-cause mortality more accurately than the TIMI-score alone (AUC 0.80 vs. combination with an AUC 0.85; p < 0.001). Net reclassification improvement (TIMI vs. additionally MR-proADM) amounted to 0.137 (p = 0.012), relative integrated discrimination improvement was 55% (p <0.001). MR-proADM had higher prognostic accuracy as compared to hs-cTnT in patients with AMI (AUC 0.80 vs. 0.60; p = 0.002) and in those with acute chest pain particularly by providing added value for prognosis.

**Conclusions:** MR-proADM levels may improve the management of patients with acute chest pain particularly by providing added value for prognosis.

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**Patent foramen ovale percutaneous closure after paradoxical embolism – long-term – Comparison of the two most common devices**

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**Background:** Percutaneous PFO closure was launched in 1994 in Switzerland to prevent cerebrovascular events after TIA or stroke presumably due to paradoxical embolism. Since then, 18 different PFO occluders have been used clinically. Growing evidence suggests that PFO closure is more effective than medical treatment but differences may exist between devices. We have therefore compared the two most frequently implanted devices in Switzerland.

**Method and results:** A total of 960 consecutive patients with cerebrovascular events presumably related to PFO underwent percutaneous PFO closure with either the Amplatz PFO Occluder (APFO, 712 patients) or the CARDIA Intrapect Occluder (CPF0, 244 patients). Contrast echocardiography was performed 6 months after device implantation to assess for residual shunts in CPF0 group than APFO group (32% vs. 10%, respectively, p <0.01). The RF changed significantly (pre: 22 ml and 84 ± 14 ml, respectively (p = .01). The intervention reduced the mean MR Vol (pre: 58 ± 14 ml to post: 19 ± 13 ml, p <.001) and increased the SV LVOT (pre: 48 ± 14ml to post: 70 ± 13 ml, p <.001, Fig 2A). The RF changed significantly (pre: 54 ± 8%, post: 21 ± 11%, p <.001, fig. 2B), while there was no

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**Prevalence and characteristics of early repolarization in young female athletes**

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**Introduction:** early repolarisation in infero-lateral leads (ER) is traditionally considered a normal ECG variant more prevalent in young individuals, males and athletes. However, recent reports have linked ER with an increased risk of sudden cardiac death raising concern about potential risk of this ECG feature. There are limited data about ER specifically in females. The aim of this study was to analyse the prevalence and the characteristics of ER in a cohort of young female athletes. This should add more information about the features of this common ECG pattern in female athletes.

**Methods:** ECG of female athletes was analysed as part of a prospective ongoing study about the impact of cardiovascular screening with ECG in young (14–35 years) competitive athletes. ER was defined as J point elevation => 1 mm in 2 or more contiguous leads (except V1-V3). Following features were noted: localisation of ER (inferior, lateral or infero-lateral), amplitude of J point, morphology of J wave (notch, slurred or indeterminate), ST segment pattern (ascending, horizontal or descending).

**Results:** ECG of 209 female athletes (age 20.0 ± 6.4 years) was analysed. An ER pattern was present in 39 athletes (19%). In 6% of athletes it was localised in lateral leads, in 8% in inferior leads, in 5% in infero-lateral leads. Maximal amplitude of J point was => 2 mm in 13%. The morphology of J wave was notch in 49%, slurred in 37% and indeterminate in 14%. The ST segment was ascending in 16%, horizontal in 49% and descending in 35%. ER with a descending ST pattern in inferior leads was present in 5% of female athletes, with J wave amplitude => 2 mm in 1%. No athlete with ER suffered from syncope of undetermined origin or had family history of premature sudden death.

**Conclusions:** ER is a common ECG pattern even in female athletes. The most frequent phenotype is a notch J wave with horizontal ST pattern in inferior leads. Even the phenotype that seems to be more often associated with adverse outcome (inferior leads with descending ST pattern) is frequent in young female athletes. This should be taken into account before drawing premature conclusion about risk stratification in this young healthy population.
significant change of LVEF (pre: 45 ± 16%, post: 47 ± 16%, p = 0.17).

Conclusion: In this population undergoing MitraClip implantation, the quantification of change in periprocedural MR is feasible by 3D TTE using RT-VDFD software. Future studies are required to determine the diagnostic performance in comparison to invasively measured hemodynamic data.

Effect of age on left ventricular ejection fraction assessed by echocardiography
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Introduction: Various age-related changes of the cardiovascular system are well known. Yet, age-related changes of left ventricular ejection fraction (LVEF), left ventricular fractional shortening (LVFS), left ventricular volume (LVEDVI), and left ventricular muscle mass (LVMMI) have not conclusively been elucidated in a large population of healthy adult individuals.

Methods: Transthoracic two-dimensional echocardiography was performed in 6280 normal subjects (3032 (49%) males) for different reasons obtained retrospectively from case notes and patient interviews. Mean age at presentation was 44.6 ± 02 years (range 7 to 80 years).

Results: With advancing age, a significant increase in LVEF was observed (females: p <0.0001; males: p <0.0001), which was more pronounced in females (62.7 ± 0.4% for age <20 years vs. 65.0 ± 0.3% for age 60–80 years) than in males (62.0 ± 0.42% for age <20 years vs. 63.4 ± 0.3% for age 60-80 years). Similarly, LVFS increased in females from 37.9 ± 0.5% (age <20 years) to 41.9 ± 0.4% (age 60–80 years) and in males from 37.3 ± 0.5% (age <20 years) to 39.5 ± 0.4% (age 60–80 years) (p <0.0001). LVEDVI decreased from 49.9 ± 0.9 ml/m² (age 7–20 years) to 43.4 ± 0.5 ml/m² (age 60–80 years) in females and from 56.5 ± 0.8 ml/m² (7–20 years) to 48.9 ± 0.5 ml/m² (age 60–80 years) in males (p <0.0001). LVMMI increased significantly in elderly subjects compared to younger ones (74.5 ± 1.2 g/m² for age <20 years vs. 88.0 ± 0.7 g/m² for age 60–80 years; p <0.0001).

Conclusion: LVEF, LVFS, and LVMMI increase with advancing age in healthy individuals, in particular in females. These findings may have implications for the echocardiographic assessment of left ventricular function and size in the elderly and suggest that age-adjusted standard values for these parameters are needed.

Giant bi-atrial enlargement of totally unusual proportions with bilateral lung compression and severe restrictive respiratory syndrome
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Case: A 78 year-old patient consulted for progressive dyspnoea of NYHA class II. He was in permanent atrial fibrillation (AF) and on anticoagulation therapy. On physical examination, the patient was comfortable, eupnoeic at rest with no need for oxygen support, non cyanotic and afebrile. Heart rate was irregular at around 70 beats per minute. Chest palpation was unremarkable and auscultation revealed a soft holosystolic murmur with no diastolic component. The EKG showed AF with a heart rate of 62 bpm with normal voltage and no signs of ischemia. Chest X-ray revealed a severe cardiomegaly (fig. 1). On echocardiography, left ventricular ejection fraction (EF) and right ventricular function were found to be normal but both atria were severely dilated. There was a moderate excentric mitral regurgitation, most probably related to the significant mitral annular dilation. The valve leaflets were thickened but mobile with no apparent rheumatic valve disease and no component of mitral stenosis. Right ventricular systolic pressure was estimated to be 60 mm Hg. On cardiac MRI, left and right atria were severely dilated (fig. 2). Maximum left and right atrial volumes were 2259 ml and 1135 ml, respectively. Left and right ventricular EF were calculated at 59% and 44%, respectively, with end-diastolic volumes of 175 ml and
151 ml (normal values < 200 and <238). The ratio of total atrial to ventricular volumes was 3364 ml/326 ml, i.e. 10.3. Despite potential inaccuracies related to AF, mitral regurgitant fraction was calculated at 48%, corresponding to moderate to severe (grade III/IV) mitral regurgitation. The kinetics of early gadolinium enhancement suggested there was no cardiac amyloidosis. There was no evidence of diffuse fibrosis by late gadolinium enhancement. Lung function tests revealed a severe restrictive syndrome (FVC 2.38 L, 60%; FEV₁ 1.32L, 44%) most likely attributed to the severely augmented cardiac dimensions.

**Discussion:** Previous reports of such severely dilated left atrium have been published in patients with either a current rheumatic mitral valve disease or a history of rheumatic valve disease and past mitral valve replacement with a Starr–Edwards caged ball, or non-detailed chronic mitral regurgitation. Much less important but nevertheless severe biatrial enlargement has been described in patients with cardiac amyloidosis and systemic lupus erythematosus. We have however found no description of such severe biatrial enlargement in the literature.

**CONCLUSIONS:**

Previous reports of such severely dilated left atrium have been published in patients with either a current rheumatic mitral valve disease or a history of rheumatic valve disease and past mitral valve replacement with a Starr–Edwards caged ball, or non-detailed chronic mitral regurgitation. Much less important but nevertheless severe biatrial enlargement has been described in patients with cardiac amyloidosis and systemic lupus erythematosus. We have however found no description of such severe biatrial enlargement in the literature.
Fatty acid amide hydrolase deficiency is associated with a vulnerable plaque phenotype in atherosclerotic mice


(Geneva; La Jolla, US)

Background: Elevated endocannabinoid levels are linked with the development of atherosclerotic vascular disease and coronary circulatory dysfunction in obese individuals, a precursor of coronary artery disease. However, it remains unclear whether endocannabinoid levels might represent a risk factor or diagnostic biomarker for acute atherosclerotic vascular events. In fact, a causal role of increased endocannabinoid levels in atherosclerotic plaque vulnerability and occurrence of acute clinical events has not been investigated. Here, we studied the involvement of fatty acid amide hydrolase (FAAH) deficiency, the major enzyme responsible for endocannabinoid anandamide degradation, in atherosclerotic plaque vulnerability.

Methods: We generated apolipoprotein E-deficient (ApoE-/-) FAAH-/- mice and measured serum levels of anandamide and related FAAH metabolites palmitoylethanolamide and oleoylethanolamide. We assessed atherosclerosis in ApoE-/- and ApoE-/-FAAH-/- mice after 5, 10 and 15 weeks on high cholesterol diet (HCD; 1.25% cholesterol) and analyzed weight, serum cholesterol and atherosclerotic plaque composition.

Results: Levels of FAAH metabolites anandamide, palmitoylethanolamide and oleoylethanolamide were 1.4 to 2-fold higher in FAAH-/- mice, FAAH deficiency attenuated atherosclerotic plaque size increase (by ~50% in thoraco-abdominal aortas after 15 weeks HCD; n = 7–10; P = 0.007), but plaques had significantly lower content of smooth muscle cells (reduced by 36% at 10 weeks HCD in aortic sinuses; n = 10–15; P = 0.01) and increased matrix metalloproteinase MMP-9 expression (by 73%; P = 0.049). There was no difference in macrophage content, but a 65% increase in neutrophil infiltrates (P = 0.0007) in aortic sinus plaques from ApoE-/-FAAH-/- mice compared to ApoE-/- controls. This was accompanied by 1.9-fold increased chemokine CXCL1 mRNA levels (P = 0.004) in mouse aortas. CXCL1 expression within plaques was confirmed by immunostaining. MMP-9 mainly colocalized with neutrophils rather than macrophages (correlation coefficient: r = 0.6529; P = 0.006).

Conclusions: Enhanced levels of endocannabinoid anandamide and related FAAH metabolites trigger the development of an unstable plaque phenotype and increased risk of plaque rupture.

High aldehyde dehydrogenase activity (ALDH) identifies human adult cardiac progenitor cells with cardiomyogenic potential: Roles of ALDH isoforms and retinoic acid in cardiac progenitor function


Objective: We have isolated human adult cardiac progenitor cells (CPCs) based on high aldehyde dehydrogenase activity (ALDH-hi), a property shared by many stem cells across tissues and organs. However, the role of ALDH in stem cell function is poorly known. In humans, there are 19 ALDH isoforms with different biological activities. The isoforms responsible for the ALDH-hi phenotype of stem cells are not well known but they may include ALDH1A1 and ALDH1A3 isoforms, which function in cell signaling. ALDH activity has been shown to regulate hematopoietic stem cell function via RA. We aimed to analyze ALDH isoform expression and the role of RA in human CPC function.

Methods: Human adult CPCs were isolated from atrial appendage samples from patients who underwent heart surgery for coronary artery or valve disease. Atrial samples were either cultured as primary explants or enzymatically digested and sorted for ALDH activity by FACS (Figure; panel A). ALDH isoforms were determined by qRT-PCR. Cells were cultured with or without RA. Induction of cardiac-specific genes in cells cultured in differentiation medium was measured by qRT-PCR.

Results: While ALDH-hi CPCs grew in culture and could be expanded, ALDH-low cells grew poorly. CPC isolated as primary explants or enzymatically digested and sorted for ALDH activity by FACS (Figure; panel A). ALDH isoforms were determined by qRT-PCR. Cells were cultured with or without RA. Induction of cardiac-specific genes in cells cultured in differentiation medium was measured by qRT-PCR.

Conclusions: These data demonstrate that ALDH induces endothelial dysfunction by causing eNOS uncoupling and increasing endothelial superoxide production via LOX-1. This indicates a new important mechanism in the pathogenesis of atherosclerotic disease.
presence of DEAB. In differentiation medium, ALDH-hi CPCs expressed approximately 300-fold higher levels of cardiac troponin T compared with their ALDH-low counterparts (figure; panel B).

Conclusions: High ALDH activity identifies human adult cardiac cells with high growth and cardiomyogenic potential. ALDH1A3 and, possibly, ALDH1A1 isoforms account for high ALDH activity and RA-mediated regulation of CPC growth.

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Very late coronary stent thrombosis of newer generation everolimus-eluting stents compared with early generation drug-eluting stents: a prospective cohort study

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Background: Early generation drug-eluting stents (DES) releasing sirolimus (SES) or paclitaxel (PES) are associated with an increased risk of very late stent thrombosis (VLST). It is unknown whether the risk of VLST persists with newer generation DES releasing everolimus (EES).

Methods: We assessed the risk of ST in a cohort of 12,339 patients treated with the unrestricted use of DES (3,819 SES, 4,308 PES, 4,212 EES). Results are reported as cumulative incidence per 100 person-years (CIR) with hazards weighted using inverse probability of treatment weight to adjust for group differences.

Results: During follow-up to 4 years, the overall CIR of definite ST was lower with EES (1.4%) compared with SES (2.9%; HR 0.41, 95% CI 0.27–0.62, p <0.0001) and PES (4.4%; HR 0.33, 95% CI 0.23–0.48, p <0.0001). The CIR of early, late, and VLST amounted to 0.6%, 1.1%, and 0.6% among EES, 1.0%, 0.3%, and 1.6% among SES, and 1.3%, 0.7%, and 2.4% among PES treated patients, respectively. Differences in favor of EES were most pronounced during the very late period with a 67% (EES vs SES p = 0.006) and 76% (EES vs PES p <0.0001) risk reduction, respectively. There was a lower risk of cardiac death or MI with EES compared with SES (HR 0.67, 95% CI 0.58–0.77, p <0.0001), which was directly related to the lower risk of ST associated events (EES vs PES; HR 0.36, 95% CI 0.23–0.57).

Conclusions: Newer generation EES reduce the risk of VLST compared with early generation DES and thereby overcome the principal limitation of early generation DES.

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Effects of doxorubicin cancer therapy on apoptosis, autophagy and the ubiquitin-proteasome system in long-term cultured adult cardiomyocytes

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Introduction: The clinical use of doxorubicin (Doxo) in cancer therapy is limited by cardiotoxicity, which involves cardiomyocyte injury and cell death. We tested the hypothesis, that anthracycline cancer therapy modulates several protein degradation pathways in adult cardiomyocytes. Methods: Chronic effects of Doxo were studied in isolated adult rat cardiomyocytes cultured for a total of 12 days in medium containing 20% FCS and exposed to the cancer therapy for 48 hours. Data were obtained for viability by MTT-assay, for necrosis by LDH-assay and for apoptosis by TUNEL-assay. Proteasome activity was measured using a fluorescent substrate. Gene expression by real-time PCR. Autophagic activity was monitored by Western blotting for the autophagosome marker LC-3 and by measuring the accumulation of poly-ubiquitinated proteins and Cathepsin-D by immunofluorescence microscopy.

Results: Accumulation of poly-ubiquitinated proteins, increase of cathepsin-D, positive lysosomes and autophagosome degradation was commonly observed in Doxo-treated cardiomyocytes. Chymotrypsin-like activity of the proteasome was initially increased, then inhibited by Doxo over a time-course of 48 hours. Proteasome 20S proteins were down-regulated by higher doses of Doxo. The mRNA of MURF-1 - an ubiquitin-ligase specifically targeting myofibrillar proteins- GATA-4 and Bcl-2 was suppressed by Doxo at all concentrations measured. LC3-positive puncta observed by fluorescence microscopy and both LC3-I and -II proteins detected by western blot were induced by Doxo in a dose-dependent manner. The lysosomotropic drug chloroquine led to autophagosome titration with increased with concomitant Doxo treatment suggesting enhanced autophagic flux.

Conclusions: We conclude, that Doxo causes a downregulation of the protein degradation machinery of cardiomyocytes with resulting accumulation of poly-ubiquitinated proteins and autophagosomes. While autophagy is initially stimulated in Doxo-treated cells as a compensatory response to cytokinetics, it is followed by apoptosis and necrosis at higher doses and longer exposure times. This mechanism may contribute to the late cardiotoxicity of anthracyclines by accelerated aging of the postmitotic adult cardiomyocytes and to the susceptibility of the aging heart to anthracycline cancer therapy.

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Changes in microcirculatory function during revascularisation and stenting for acute myocardial infarction

F. Cuculi, A. De Caterina, B. Prendergast, C. Forfar, K. Channon, R. Kharbanda, A. Banning (Luzern; Oxford, UK)

Introduction: Mechanical opening of the obstructed epicardial artery in patients with ST-elevation myocardial infarction (STEMI) undergoing primary percutaneous coronary intervention (PPCI) does not guarantee restoration of normal myocardial perfusion as some impairment of the coronary microcirculation (CM) is probably ubiquitous. Further understanding of the mechanisms responsible for CM dysfunction in STEMI could ultimately give an insight into improving patient outcomes.

Methods: We used the Pressure Wire (Ceritus, SJM) to make physiological assessment of the coronary circulation and measured temporal changes during PPCI treatment. Fractional flow reserve (FFR), coronary flow reserve (CFR) and index of microcirculatory resistance (IMR) were measured after re-canulization/pre-dilatation (pre) and after stent-implantation/post-dilatation (post). Hyperaemia was induced with adenosine via the femoral vein at 140 ug/kg/min. The relationship between IMR and CFR and evidence of angiographic reflow and complete ST-resolution was tested using receiver operating characteristic (ROC) curves.

Results: A total of 55 patients with a mean age of 62.4 ± 11.6 years were included. FFR and CFR significantly increased (FFRpre 0.84 (IQR 0.71–0.90) vs. FFRpost 0.94 (0.89–0.98), p <0.0001; CFRpre 1.25 (0.99–1.71) vs. CFRpost 1.47 (1.05–2.09), p = 0.009) and IMR decreased after stent implantation (IMRpre 48.0 (25.9–74.4), IMRpost 31.3 (19.2–56.2), p = 0.01). There was a strong linear correlation between IMRpre and CFRpost (R2 = 0.69 for prediction of complete ST-Resolution (>70%) was 0.68 for CFRpost and 0.69 for IMRpost.

Conclusion: Fractional flow reserve (FFR) increased after stenting and CFR increased after stenting and complete ST-resolution was tested using receiver operating characteristic (ROC) curves. The area under the ROC curve for prediction of angiographic reflow was 0.82 for CFRpost and 0.72 for IMRpost. The area under the ROC curve for prediction of complete ST-Resolution (>70%) was 0.68 for CFRpost and 0.69 for IMRpost.
Conclusion: Measurement of final CFR and IMR demonstrate good correlation with existing parameters of successful reperfusion during PPCI. In most patients stent implantation has a favourable effect on indices of coronary macro- and microcirculation leading to increased FFR/CFR and decreased IMR. However in patients failing to achieve normal perfusion abnormalities of microcirculatory function are already evident when the coronary occlusion is removed and fail to improve despite stent implantation.

Characterization of the early changes in coronary flow reserve in acute ST-elevation myocardial infarction and relationship to infarct size
F. Cuculi, A. De Caterina, B. Prendergast, K. Channon, C. Forfar, A. Banning, R. Kharbanda (Luzern; Oxford, UK)

Background: The coronary microcirculation is a key determinant of the effectiveness of reperfusion in acute ST-elevation myocardial infarction (STEMI). The recently introduced combined pressure and thermomultiplication wire (Curtus, SJM) can be used to assess the coronary microcirculation after primary percutaneous coronary intervention (PPCI). The aim of this study was to describe early serial changes of coronary flow reserve (CFR) after STEMI and to define relationship of these changes to infarct size.

Methods and Results: 71 patients with STEMI underwent assessment of CFR on completion of primary angioplasty (PPCI) using the pressure wire (Curtus, SJM). 50 patients underwent repeat assessment, the next day. Infarct size was measured using serial Troponin I [cTnI] up to 48 hours post PPCI. CFR increased (median 1.5 [1.1-2.2] to 2.2 [1.7-2.6], p = 0.001) between PPCI and day 1. Day 1 CFR correlated well with log auc cTnI (r = -0.51, p = 0.0002) and independently related to infarct size (p <0.0001). 20% of patients showed no improvement in CFR at Day 1 and 20% deteriorated. Failure to improve or deterioration in CFR was associated with larger infarction.

Conclusions: This study demonstrates that early dynamics of CFR in acute STEMI relate to infarct size. Although there is an increase of CFR within the first day after PPCI in the population as a whole, a failure to improve CFR or reduction in CFR is associated with larger infarction. These data increase understanding of the role of coronary microcirculation in determining outcomes in patients undergoing PPCI.

Quantitative assessment of the peripheral artery collateral circulation in patients with coronary artery disease
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Background: Despite the fact that numerous studies pursued the strategy of improving collateral function in patients with peripheral artery disease (PAD), there is currently no method available to quantify collateral arterial function of the lower limb and, thus, to determine potential therapeutic effects. The objective of this study was therefore to evaluate a new invasive method to quantify arterial collateral flow in the lower extremity.

Methods: Pressure-derived collateral flow index (CFI) of the left superficial femoral artery (SFA) was obtained in patients with chronic stable coronary artery disease (n = 26, 81% men) undergoing elective coronary angiography using a 0.014 inch pressure sensor-tipped angioplasty guidewire (CFI) over 5 min under resting conditions, followed by an exercise protocol (repetitive plantar-flexion movements in supine position, n = 24) for another 5 min maximum or until pain occurred. Results: In all patients, balloon occlusion of the SFA over 5 min was painless under resting conditions; while CFI decreased at rest determined in the SFA amounts to more than half the normal antegrade flow and is sufficient to prevent ischemic symptoms during a total occlusion of 5 minutes. To a lesser extent, CFI, is sufficient also with exercise, although its strong decline indicates a steal phenomenon.

Dual effect of the heart-targeting cytokine Cardiotrophin-1 on glucose transport in cardiac myocytes
M. Asrih, I. Papageorgiou, C. Montessuit (Genève)

Background: Cardiotrophin-1 (CT-1) is a heart-targeting cytokine that is increased in the metabolic syndrome due to overexpression in the adipocytes. CT-1 has been shown to promote cardiac myocytes hypertrophy and resistance to apoptosis. Chronic exposure of adipocytes to CT-1 results in insulin resistance. In contrast a recent study showed that CT-1 treatment was able to correct insulin resistance in vivo. The circulating concentration of CT-1 in humans is 5-6 nM, but none knows the actual interstitial concentrations in the vicinity of the cardiac myocytes. The effects of CT-1 on cardiac myocytes substrate metabolism remain unknown. We therefore determined the effects of CT-1 on basal and stimulated glucose transport in cardiac myocytes exposed to a low dose (1 nM) or a high dose (10 nM).

Results: Dose-response curves for insulin showed that 1 nM CT-1 reduced insulin responsiveness, while 10 nM CT-1 increased insulin responsiveness. In either condition insulin sensitiveness was unaffected. Similarly 1 nM CT-1 reduced the stimulation of glucose transport in response to metabolic stress, induced by the mitochondrial poison oligomycin, while 10 nM CT-1 increased this response. In cardiomyocytes exposed to 1 nM CT-1 there was reduced phosphorylation of the insulin receptor (IR) and Akt in response to insulin, and of AMPK in response to oligomycin. Reduction of stimulated glucose transport by 1 nM CT-1 was also associated with overexpression of SOCS-3, a protein known to hinder proximal insulin signaling, and increased phosphorylation of STATs. On the other hand in cardiac myocytes exposed to 10 nM CT-1 there was increased phosphorylation of the IR and Akt in response to insulin. Most importantly, basal and oligomycin-stimulated phosphorylation of AMPK was markedly increased in cardiac myocytes exposed to 10 nM CT-1. The enhancement of basal and stimulated-glucose transport was abolished in patients, 3 (13%) remained symptom-free for an occlusion time of 10 min. Fifteen patients (63%) experienced pain after 478 ± 74 seconds (sec) and 9 (38%) suffered from cramps or tired muscles after 502 ± 66 sec. Mean total occlusion time was 528 ± 104 sec. CFI values positively correlated with the time duration that patients remained pain free (e.g., for minimal CFI under exercise: r = 0.717, P = 0.003) and with SaO₂ (e.g., after 4 min: r = 0.460, P = 0.041).
cardiomyocytes treated with the calmodulin-dependent kinase (CaMK) inhibitor KN93, and so was AMPK phosphorylation. This suggests that activation of one or several CaMK, perhaps driven by increased intracellular calcium, mediates activation of AMPK by a high dose of CT-1 independently of metabolic stress.

**Conclusions:** Our results point to a role for CT-1 in the regulation of myocardial glucose metabolism and implicate entirely separate mechanisms in the glucose transport inhibiting or stimulatory effects of CT-1 at low or high concentrations respectively.

**P205**

**Low dose of cocaine infusion increases cardiac vasodilatory properties**

S. Gardier, E. Belin de Chantemèle, J.P. Giliberto, D. Morel (Geneva; Augusta, US)

**Background:** Recreational use of cocaine significantly increased recently and more and more emergency department visits could be due to cocaine consumption. To properly take care of cocaine-induced cardiovascular complications a better understanding of the underlying mechanisms of cocaine toxicity is required. We investigated the cardiovascular effects induced by a short term cocaine administration in rats.

**Methods:** In Wistar rats hemodynamic parameters were measured with an intraventricular conductance catheter after injections of cocaine hydrochloride (75 mg/kg, twice a day, for 7 days IP; CC group, n = 7) or NaCl (Ctrl group, n = 7). Measurement were done in baseline conditions and during a volume loading challenge (12 mL of vascular-loading solution, IV). To decipher the potential involvement of nitric oxide (NO) in cocaine-induced cardiovascular defects, similar measurements were performed in rats under L-NAME perfusion (n = 7).

**Cardiovascular function was also assessed in 5 CC and 5 Ctrl rats by magnetic resonance imaging (MRI, tagged images acquired on clinical scanner 1.5 Tesla).**

**Results:** As determined by MRI, no functional difference was observed between CC and Ctrl groups. Furthermore, whereas baseline hemodynamic function was similar in CC and Ctrl rats, CC animals displayed a greater response to volume-loading compared to untreated rats, with notably lower systemic vascular resistance (SVR) and a higher end-diastolic volume (EDV).

**Conclusion:** These data showed that 7 days of a low dose of cocaine infusion are enough to increase cardiac vasodilatory properties likely through an increased NO production.

**P206**

**Quantitative free-breathing 3T T2-mapping of the heart designed for longitudinal studies**

R.B. van Heeswijk, H. Feliciano, G. Bonanno, S. Coppo, N. Lauriers, D. Loca, J. Schwitter, M. Stuber (Lausanne)

**Background:** Recently, T2-weighted MRI for the characterization of edema after myocardial infarction has attracted considerable attention. Furthermore, the recently proposed combination of bSSFP imaging and T2Prep for T2-mapping at 1.5T has enabled a rapid quantitative cardiac T2 estimation (Huang et al., MRM2007). However, the accuracy of this method may still be limited in the complex T2/T1 signal weighting. Especially for longitudinal studies designed for monitoring and/or guiding therapy, accurate and reproducible T2 measurements will be critical. A novel quantitative 3T T2-mapping protocol was therefore developed and tested in both healthy volunteers and patients.

**Methods:** An adiabatic T2prep with 3 incremental TE values, affine coregistration, a navigator and 2D radial gradient echo imaging were combined for free-breathing T2-mapping at 3T with a spatial resolution of 1.25 mm. Simulations were used to optimize scan parameters. The novel T2-mapping sequence was then validated in a series of 15 phantoms in which the true T2 was determined with a spin-echo sequence. Next, the myocardial short axis T2 of 8 healthy volunteers was mapped in two different scan sessions while a reference phantom was placed next to the thorax. The average myocardial T2 for both sessions was computed with and without correction with the “true” reference phantom T2. Finally, this validated protocol was used in 5 patients.

**Figure 1.** Short-axis T1map together with conventional T1-weighted turbo spin-echo and X-ray coronary angiogram in a patient with a myocardial infarct. A) A clearly demarcated zone with elevated T1 can be seen in the region of the black arrow, which might indicate myocardial edema. The non-infacted tissue has a homogeneous T2, while the reference phantom adjacent to the thorax appears homogeneous with T2 values similar to those in healthy tissue. B) The conventional T1-weighted TSE image confirms the elevated T1 in the region of the infarct (arrow). C) Consistent with these findings, the x-ray coronary angiogram shows a severe stenosis in an obtuse marginal artery (arrow).
in the subacute phase after revascularization of acute STEMI patients and compared to T2-weighted TSE imaging.

**Results:** As a result of both the simulations and phantom scans, optimized sequence parameters included: TET2prep = 60/300 ms, TRR = 3 heartbeats, TR/TE = 5.3/2.4 ms. The myocardial T2 in the volunteers was homogeneous (42 ± 5 ms over all volunteers) and on average showed a 5 ± 2% difference between the two scan sessions. When compensated with the T2 from the reference phantom, this difference decreased to 2 ± 1% (p = 0.02). In all patients, T2maps could successfully be obtained and a clear demarcation of zones with elevated T2 values was consistent with the findings on T2-weighted MRI and X-ray coronary angiography as shown in the example in fig. 1.

**Conclusions:** The methodology presented in this study enables robust and accurate cardiac T2-mapping at 3T, while the addition of a reference phantom improves reproducibility. Therefore, it may be well-suited for longitudinal studies in patients with ischemic heart disease.

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**Iatrogenic ventricular fibrillation followed by Tako-Tsubo syndrome**

F. Rigamonti, H. Müller, H. Sunthorn (Genève)

**Case description:** A 30-years-old woman with a history of Fallot tetralogy completely corrected in childhood was reoperated for severe pulmonary regurgitation. A pulmonary homograft and a tricuspid annuloplasty were performed. The post pump intraoperative transesophageal echocardiogram showed a normal left ventricular ejection fraction (LVEF) without amines. Postoperatively the patient presented a sudden ventricular fibrillation (VF) of 3 minutes duration before defibrillation was successful.

**Discussion:** TTS is a reversible disorder occurring mainly in post-menopausal women. It usually follows an intense stress and the typical apical ballooning image is best appreciated on TTE or MRI and is often difficult to visualize on X-ray cardiac angiography. Our report suggests that it may be secondary to catecholamine excess plays a central role, by affecting either the small coronary vessels or the myocardium directly. The VF was triggered by an inappropriate electrical stimulus of the P-M in the window of 10 to 20 msec on the upstroke of the T wave, just before its peak, an electrically vulnerable period, when inhomogeneous dispersion of repolarization is greatest, creating a susceptible myocardial substrate for malignant arrhythmias. This case suggest a new, electrical trigger as possible etiological cause of TTS and shows the importance of correct placement and rigorous control of the sensitivity of epicardial P-M to avoid life-threatening arrhythmias.

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**Kinetics of intravenous liquemin during ablation of atrial fibrillation**


**Background:** Catheter ablation of atrial fibrillation (CA-AF) is associated with peri- and early post-procedural thromboembolic events regardless of the post-procedure rhythm and risk factors for stroke. CA-AF is complicated by symptomatic ischemic stroke (IS) in 0.5–0.9% and by asymptomatic IS in up to 14% of patients. The two major recognized risk factors for IS during CA-AF are electrical cardioversion and poor iv anticoagulation (activated coagulation time, ACT <250 sec).

**Aims:** The Aim of our study is to analyze the temporal kinetics of iv Liquemin as measured by the ACT in patients referred for CA-AF.

**Methods:** 17 consecutive patients (62 ± 8, men 88%), suffering from drug-refractory AF (paroxysmal 47%, persistent 53%) underwent CA-AF. After transseptal puncture of the fossa ovalis, 100 U/kg of Liquemin was injected into the left atrial appendage by a flush of saline was infused using a forearm venous access. ACT values were measured before (T0), and at 10 (T10) and 20 (T20) min following the infusion. An ACT value >300 sec was targeted based on recent ESC guidelines.

**Results:** The figure shows the temporal kinetics of ACT values for the 17 patients. A significant increase was noticed from an average value of 85 ± 21 sec at T0 to 344 ± 97 sec at T10 and to 369 ± 94 sec at T20 (p <0.05, T0 vs T10/T20). The difference, however, remained non significant between T10 and T20 (p = 0.14). Importantly, at T10 and T20, ACT values were <300 sec in 24% (4/17) of the patients.

**Conclusion:** Liquemin infusion during CA-AF remains subtherapeutic (i.e. <300 sec) after 20 min in 24% of the patients in spite of the use of a standardized protocol. An additional Liquemin infusion must be considered at 10 min in patients with low ACT values as no further increase can be expected. Whether the slow kinetics of iv Liquemin contributes to IS during CA-AF needs further investigation.

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**Value of P wave signal averaging to predict fibrillation recurrences after electrical cardioversion**

C. Blanche, D. Carballal, N. Tran, F. Rigamonti, H. Burri, M. Zimmermann (Meyrin, Genève)

**Background:** Atrial fibrillation (AF) is the most frequent sustained arrhythmia in clinical practice but accurate markers of recurrences are still lacking. The aim of this study was to assess the usefulness of the signal-averaged P wave (SAPW) ECG for predicting AF recurrences after electrical cardioversion (ECV).

**Methods:** Eighty-nine patients (68 ± 8 years, 73 males, 16 females; structural heart disease in 41/89; hypertension in 42/89;
antiarrhythmic drug therapy in 77/89) underwent one hundred and fifteen ECV for persistent AF (mean duration 10 ± 25 months). Mean ejection fraction (EF) was 59 ± 11%, and mean diameter of left atrium was 45 ± 8 mm. A SAPW ECG (Phi-Res analysis, Marquette Medical System; measurement of total filtered P wave duration (FPD), P wave integral, RMS voltage of the terminal 20, 30 40 ms) was obtained immediately after the ECV and the SAPW parameters was statistically different between the group of patients with recurrences and the group of patients without recurrences, including the FPD (164 ± 24 ms vs 160 ± 23 ms, p = 0.44). In a univariate analysis, none of the clinical variables such as age, sex, hypertension and left atrial size was significantly associated with AF recurrences.

Conclusion: None of SAPW parameters, including the FPD and the RMS-20 can predict AF recurrences after electrical cardioversion.

Late cavo-tricuspid isthmus conduction recovery after bidirectional conduction block

C.-I. Park, G. Ehret, H. Sunthorn, H. Buri, M. Zimmermann, P. Gentil-Baron, D. Shan (Bad Krozingen, DE; Genève)

Introduction: Cavo-tricuspid isthmus (CTI) ablation with bidirectional block is considered to be highly effective for the elimination of typical atrial flutter (AFL). However, about 5% of patients experience clinical recurrence and therefore require a repeat ablation. The precise incidence and parameters predictive of late CTI conduction recovery remain unclear.

Methods: We retrospectively reviewed the records of patients undergoing an AF ablation at our institution who had previously undergone CTI ablation for typical AFL. CTI conduction was evaluated during the AF ablation procedure. Atrial dimensions (LA-R/A) and radiofrequency parameters were correlated with CTI conduction.

Results: Forty patients (90% male, mean age 56.6 ± 8.8 yrs) with previous CTI ablation 17.5 ± 17.5 months ago underwent evaluation of CTI conduction during ablation of AF at our institution. CTI block was obtained in 95% (38/40) of patients during the first procedure (performed with an irrigated ablation catheter at maximum 50 W). Two patients in whom CTI block could not be obtained were excluded. 60.5% (23/38) had persisting CTI conduction (group 1) compared to 39.4% (15/38) in whom the CTI remained blocked (group 2) from the first procedure. Only 34.7% (8/23) patients in group 1 had clinical recurrence of typical AFL. In all patients with CTI recovery (23/23), complete CTI block could be obtained during the second procedure. The two groups were similar in terms of echocardiographic parameters (group 1 LA 21.8 ± 5.7cm² / RA 178 ± 3.7 cm² vs. group 2 LA 22.0 ± 5.4 cm² / RA 18.4 ± 5.2 cm², p = 0.73). The number of RF applications and the total RF time for CTI ablation during the original procedure was higher for group 1 (RF number 15.1 ± 10.1 / RF time 13.5 ± 8.7 min vs. group 2 RF number 12.9 ± 6.7 / RF time 11.7 ± 6.0, p = 0.69/0.35).

Conclusions: Late CTI conduction recovery is surprisingly frequent and only uncommonly associated with clinical recurrence of typical AFL. Achievement of CTI block during the index procedure tended to require more RF applications in patients with late recurrence indicating greater procedural difficulty. Variations of CTI anatomy and suboptimal contact may be important underlaying parameters determining the late stability of CTI conduction block.

Termination of atrial fibrillation by catheter ablation can be successfully predicted from baseline ECG


Purpose: multiple organization indices (OIs) have been used to predict the outcome of stepwise catheter ablation (step-CA) in long-standing persistent AF (pers-AF), however with limited success. Our study aims at developing innovative OIs from baseline (BL, before ablation) ECG in order to predict the outcome of step-CA.

Methods: fourteen consecutive patients (pts) (60 ± 5 yrs, AF duration 21 ± 9 m) underwent a step-CA consisting in pulmonary veins isolation, left atrial (LA) defragmentation and linear ablations, and right atrial (RA) ablations if non terminated. Chest lead V6 was placed in the back (V6b). After QRST cancellation from chest leads V1 to V6b, two OIs were computed to quantify the harmonic components of ECG atrial activity: 1) phase difference variance (PD) between the AF harmonic components as a measure of AF regularity, and 2) adaptive OI (AOI) evaluating the time evolution of the AF harmonic components. Both indices were compared to classical ones: a spectrum-based OI (SOI) and ECG AF cycle length (AFCL).

Results: Pers-AF was terminated into sinus rhythm or atrial tachycardia in 10/14 pts during step-CA, 8 during LA (LT), 2 during RA (RT) ablation, and 4 were non terminated (NT). The figure shows that LT was best separated from RT/NT before ablation by AOI computed on lead V1 (A) and PD from lead V6b (B) as compared to SOI and AFCL respectively.

Conclusion: Our results suggest that adaptive OIs computed before ablation perform better than classical OIs for separating LT from RT/NT pts. These findings are indicative of a higher baseline organization in LT pts that could be used to select candidates for the restoration of sinus rhythm by step-CA.

Lead extraction in CRT: Do lead issues engender lead issues?

M. Regoli, M. Acena, M. Giacchi, T. Moccetti, A. Auricchio (Lugano)

Introduction: To evaluate whether lead extraction procedure involves further lead issues in the same patient during follow-up.

Methods: From January 2009 to January 2012, 127 leads (86 pts, mean age 70 ± 12 yrs, 69 male, LVEF 37 ± 13%, mean NYHA class II) were extracted. Extraction techniques combined mechanical approach amended by laser technique if needed, and were performed in general anesthesia under continuous hemodynamic and transesophageal echocardiographic monitoring.

Results: Complete extraction was achieved in 126/127 leads (1 non-clinically relevant embolization of silicon rubber tines' tip of a dual chamber pacemaker) without any complications. Among CRT patients, repeat extraction procedures were common (4/19) (table), while none were observed for non-CRT devices (0/87). In spite of the markedly reduced implantation time of CRT system extracted leads (n = 27, 21%) (CRT: 376 ± 28.9 vs non-CRT: 69.0 ± 52.7 months, p = .01), multiple binding sites and use of laser technique for extraction were observed with similar frequency as for lead extraction procedure involving non-CRT devices. Conclusion: The higher lead burden of CRT device systems (especially CRT-D devices) involve mechanical stress and tissue injury during extraction procedure, which may expose these systems to further lead issues during follow-up.
**P213**

The impact of gender and training volume on autonomic modulations in nonelite endurance athletes


Background: Athletes have an increased risk of sudden cardiac death with a striking male predominance. More than 90% of sports-related sudden deaths occur in nonelite athletes. Sympathetic activation may precipitate or enhance ventricular arrhythmias, whereas vagal tone suppresses their occurrence. We studied the impact of gender and training volume on autonomic modulation in nonelite endurance athletes.

Methods: Amateur runners scheduled to participate in the 2010 Grand Prix of Bern, a 10 Mile race, were invited. 873 athletes applied for participation, of whom 68 female and 70 male athletes were randomly selected. Athletes with cardiovascular diseases were excluded. Athletes were stratified according to their average weekly training hours of the last three months in a low volume (≤4 hours) and a high volume (>4 hours) training group. Echocardiography, spiroergometry, and 24-hour Holter monitoring with frequency domain analysis of heart rate variability was performed. The low frequency (LF)/high frequency (HF) power ratio reflects the sympatho-vagal balance and was calculated for hourly 5-minute segments and averaged for daytime and nighttime. Values were adjusted for baseline heart rate.

Results: 114 athletes were included in the final analysis. Mean age was 42 ± 7 years. There were no gender differences for age, average weekly training hours, former 10 Mile race or marathon participations, and 10 Mile race time. Peak \( V_O^2 \) was higher in male athletes (53.6 vs. 49.8 ml/min/kg; \( P = 0.002 \)). Left ventricular systolic and diastolic function were normal in all athletes. The LF/HF ratio showed a circadian pattern (figure) and was significantly lower in female athletes during daytime (4.2 ± 2.3 vs. 6.1 ± 2.9; \( P <0.001 \)) and nighttime (2.4 ± 1.3 vs. 4.4 ± 7.6; \( P = 0.009 \)). In female athletes, a higher training volume was associated with a significantly lower LF/HF power ratio at nighttime (3.8 ± 1.8 vs. 2.1 ± 1.9; \( P = 0.008 \)), while in male athletes, the same was true at daytime (7.1 ± 3.1 vs. 5.4 ± 2.5; \( P = 0.021 \)).

Conclusions: For a comparable amount of training and performance, female athletes showed a higher vagal tone, possibly protecting against ventricular arrhythmias. Female and male athletes showed a different circadian pattern of the training-related increase in vagal tone.

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**P214**

Phrenic nerve palsy during ablation of atrial fibrillation using a 28 mm cryoballoon catheter: predictors and prevention


Introduction: Phrenic nerve palsy (PNP) is a complication of cryoballoon (CB) ablation. The purpose of this study was to determine whether predictors of PNP exist and to test whether a standardized ablation protocol may prevent PNP.

Methods: 3D geometry of the pulmonary veins (PV) and the superior vena cava (SVC) was analyzed. Ablation was performed using a 28-mm CB. Phrenic nerve (PN) stimulation was performed during ablation of the right-sided PVs. The freezing cycle was immediately terminated in case of loss of PN capture or decrease in diaphragmatic contraction. The low frequency (LF)/high frequency (HF) power ratio reflects the sympatho-vagal balance and was calculated for hourly 5-minute segments and averaged for daytime and nighttime. Values were adjusted for baseline heart rate.

Results: 65 patients (age 58 ± 11 years, ejection fraction 0.59 ± 0.06, left atrial size 40 ± 5 mm) with paroxysmal atrial fibrillation were included. No persistent PNP was observed. Persistent PNP resulting in immediate termination of the freezing cycle occurred in 4 of 65 patients (6%). PN function normalized within 24 hours in all 4 patients. A short distance between the right superior PV and the SVC was significantly associated with PNP, but left atrial and 3D PV anatomy were not. Low temperature early during the freezing cycle (< –41 °C at 30 seconds) predicted PNP with a sensitivity and a specificity of 100% and 98%, respectively.

Conclusion: Prevention of persistent PNP during CB ablation using a standardized protocol is feasible. The anatomical relationship between the right superior PV and the SVC was a...
A novel spiral mapping catheter for real-time recordings from the pulmonary veins used in conjunction with an electroanatomic mapping system during cryoballoon ablation of atrial fibrillation


Background: A novel spiral mapping catheter (Medtronic AchieveTM) allows real-time recordings from the pulmonary veins (PV) during cryoballoon (CB) ablation of atrial fibrillation (AF) and may be visualized with a 3D electroanatomic mapping (EAM) system. The purpose of this study was to assess the value of real-time recordings from the PVs during CB ablation and to determine the impact of the additional use of a 3D EAM system on the procedure.

Methods: Patients with paroxysmal AF undergoing CB ablation were studied. Real-time recordings from the PVs were analyzed during CB ablation and validated using a conventional circumferential mapping catheter. The procedure was performed without (non-EAM group) and with (EAM group) the use of a 3D EAM system (NAVX) in 13 and 7 patients, respectively. Procedural data were compared between the two groups.

Results: 20 patients (age 58 ± 11 years, ejection fraction 0.61 ± 0.08, left atrial size 38 ± 5 mm) with paroxysmal AF were included. Real-time recordings from the PVs could be obtained in 21 of the 81 targeted PVs (26%). Real-time recordings could be used more often during CB ablation of the left-sided PVs (16/39 = 41%) compared to the right-sided PVs (5/42 = 10%; p = 0.002). Procedure time was 162 ± 21 min. in the non-EAM group compared to 160 ± 20 min. in the EAM group (p = 0.85). Fluoroscopy time was 35 ± 9 minutes in the non-EAM group compared to 26 ± 6 minutes in the EAM group (p = 0.03).

Conclusion: Real-time recordings using the AchieveTM spiral mapping catheter could be obtained only in a minority of PVs and were not sufficient to accurately confirm PV isolation. The additional use of a 3D EAM significantly reduced fluoroscopy time, but not procedure duration.

The response of the QT interval and the T-wave morphology to sudden tachycardia provoked by standing in young athletes

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Introduction: It has been suggested that the response of the QT interval to the sudden tachycardia provoked by standing can aid in the diagnosis of the long QT syndrome (LQTS) in problematic cases with borderline QT interval prolongation. It is therefore important to know what is the normal response to this maneuver. The aim of this study was to characterise the response of the QT interval and the T-wave morphology following an abrupt heart rate acceleration provoked by standing in young healthy athletes.

Methods: ECG was analysed as part of a prospective ongoing study about the impact of cardiovascular screening with ECG in young (14-35 years) competitive athletes. 12-lead ECG was performed after 5 minute of supine resting. Athletes with normal physical examination, negative personal and family history, not taking drugs and with normal ECG (QTc for men <450 msec, for women <460 msec) were asked to stand up quickly with continuous 12-lead ECG monitoring for 30s. Following parameters were analysed at baseline and at maximal tachycardia: heart rate, QT, T-wave morphology (normal, biphasic, notched T2–T1 (G1), notched T2>>T1 (G2)).

Results: ECG of 132 athletes was analysed (72 % men, mean age 19, 1 ± 5,9 years). Baseline parameters were following: heart rate 68 ± 9/min, QT 373 ± 25 msec, QTc 397 ± 20 msec. After standing, the maximal heart rate was 101 ± 12/min achieved in 9,5 ± 2,0 sec. QT was 356 ± 26 msec (shortening by 17 ± 11 msec). In 59 % of athletes QT shortened by ≥ 20 msec, in 37% by 0-20 msec and in 4 % increased by 10 msec. QTc was 460 ± 28 msec (lengthening of 63 ± 21 msec). In 7 % of athletes QTc was ≥ 500 msec. T-wave morphology during tachycardia were following: 71 % normal, 17 % G1, 4 % G2, 8 % biphasic. During tachycardia, 10 % of athletes displayed a QTc ≥ 500 msec or QT shortening or G2 morphology of T waves.

Conclusions: During sudden tachycardia, a significant minority of healthy young athletes demonstrated QTc interval and changes of T-wave morphology in the magnitude observed in patients with the LQTS. At present, the significance of the QTc shortening is indeterminate. Caution should be applied in interpreting these parameters in ECG tracing and Holter monitoring displaying sudden oscillations of heart rate in this population.
GROUPE DE POSTERS 2 – POSTERGRUPPE 2 RHYTHMOLOGY AND PACEMAKERS

**P218**

First validation of esophageal long-term electrocardiography as an alternative technique for long-term heart rhythm monitoring

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**Introduction:** Diagnosing arrhythmias by conventional Holter-ECG can be cumbersome because of small p-waves, which impair visual ECG interpretation. Moreover, computer-based arrhythmia detection in continuous ECG recordings only relies on R-R-interval detection as a surrogate marker for true atrial activity. Prolonged periods of long-term rhythm monitoring have been suggested, in particular for the detection of paroxysmal atrial fibrillation. However, longer monitoring intervals without reliable detection of true atrial activity are a limitation of techniques such as implantable loop recorders. Esophageal long-term electrocardiography (eECG) offers a way out due to the anatomic vicinity of the esophagus to the atria and its favorable bioelectric properties.

**Methods:** We recorded long-term eECGs from 30 subjects with a novel miniaturized ECG recorder optimized for esophageal use. The device can be worn discretely behind the ear and continuously records two bipolar eECG channels (inter electrode spacings 60 and 15 mm) during 3 days with 500 Hz sampling frequency and high 24-bit resolution (fig. 1). A bag made of soft waterproof tissue protects the device, removal of the device during showering is unnecessary. Simultaneously, a conventional surface Holter-ECG was registered. We evaluated feasibility, signal quality and tolerance of this new method.

**Results:** Mean ± SD recording time was 21.9 ± 13.3 hours (max. 60 hours). Test persons were not limited in their daily activities (e.g., eating, speaking, exercising) and only complained of mild discomfort during probe insertion, which subsided later on. No complications occurred. We recorded better signals (higher signal amplitudes) in the esophageal ECG compared to surface lead II (table). There was no difference in ventricular signal amplitudes, however we observed a tendency towards higher amplitudes in the esophageal lead.

**Conclusion:** Esophageal long-term electrocardiography has the potential to overcome current limitations of conventional Holter-ECGs. In particular, excellent atrial signal quality will improve automatic wave detection and therefore will facilitate accurate analysis of true atrial activity.

<table>
<thead>
<tr>
<th>Atrial signal amplitude [mV]</th>
<th>esophageal lead</th>
<th>surface lead II</th>
<th>p-value</th>
</tr>
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<tr>
<td></td>
<td>0.71±0.31</td>
<td>0.13±0.05</td>
<td>&lt;0.0001</td>
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**P219**

Giant left and right atrium: incidence and etiology in 1945 consecutive patients in the current era


**Background:** In the past, giant left atrium (GLA) has been described to occur predominantly in rheumatic mitral valve disease, but has also been associated with heart failure, chronic atrial fibrillation (afib) and left-to-right shunts. There are no data on the etiology of GLA and giant right atrium (GRA) in the current era.

**Methods:** We analyzed consecutive transthoracic echocardiographic examinations from July 1, 2010 to Sep 30, 2011 in whom biplane left (n = 1950 patients) and monoplane right atrial (n = 1738) volume indices (LAVI; RAVI) were measured (Simpson). Presence of cardiovascular risk factors, the CHA2DS2VASc score, the underlying heart rhythm and valvar heart disease were analyzed and correlated to atrial size. Definitions: Dilatation of LA or RA = atrial size >28 ml/m² body surface area (BSA); GA defined as atrial size >60 ml/m² BSA.

**Results:** There were 1950 different patient (pts); 58% males; mean age 63 ± 16 years; CHADS2VASc score of 3.0 ± 2.3. Any history of afib (or atrial flutter) was present in 298 pts (15%), in 149 pts (8%) it was chronic. Any dilatation of the LA was found in 1067 pts (54%); of the RA in 363 pts (21%), GLA was found in 92 pts (5%), and GRA in 30 pts (1%). LA size correlated with age (R² = 0.14); LAVI of >60 ml/m² was rarely observed in pts <55 years. Age-dependency was not observed for RA size (R² = 0.04). None of the pts with GLA or GRA had amyloid heart disease, there was no association with diabetes, alcohol abuse, or atrial septal defect (p >0.05). Other results are shown in the table. BMI = body mass index; HTN = hypertension; CMP = cardiomyopathy; CAD = coronary artery disease; LV EF = LV ejection fraction; PASP = estimated pulmonary artery systolic pressure. Size of LA and RA correlated significantly with age (for
LA see figure), CHA2DS2VASc score, chronic afib and valvular heart disease. The most frequent association of GLA and GRA were chronic afib, arterial HTN and CAD. 41% of pts with GLA were in sinus rhythm.

**Conclusions:** In these consecutive pts seen at an echo lab, dilatation of the LA of any degree is much more common than that of RA. Atrial size correlates with CHA2DS2Vasc Score. Most often atrial dilatation is not severe. Giant atria in pts <55 years is rare reflecting that chronic disease is needed. Currently, giant atria occur most commonly in the setting of hypertensive and coronary artery disease with or without chronic afib – reflecting chronic atrial pressure overload; nowadays, rheumatic heart disease with associated GLA is rare.

**Methods:** We studied 31 of the 35 patients receiving a CRT-D at our hospital between January and November 2010 for drug refractory heart failure. 4 were lost to follow-up. Consulting electronic patient files and conducting phone interviews with the patients and/or their primary care physicians, we determined the DAOH and percent DAOH (i.e., percentage of time spent alive and out of hospital) in the year before and during the whole follow-up period after CRT implantation. In case of a non-elective CRT implantation, the days before implantation were counted to the before- days from implantation to discharge to the after-CRT period.

**Results:** The mean follow-up was 563 ± 103 days. The population consisted of 30 men (97%), the mean EF was 27 ± 7%, the underlying pathology was ischemic cardiomyopathy (ICMP) in 18 (58%) and dilated cardiomyopathy (DCM) in 13 patients (42%). 24 patients (77%) received their device for primary prevention.

**Conclusion:** Compared to the patients in CHARM, CRT patients showed a better clinical course with 98% of the time out of hospital during the first 1.5 years. Patients with DCM were significantly longer out of hospital than those with ICMP.

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**Progressive Shrinkage of the left atrium – A rare complication of pulmonary vein ablation**

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**Introduction:** Pulmonary vein (PV) radiofrequency ablation (RFA) is an excellent treatment modality for atrial fibrillation (Afib). Rarely, severe acute and/or long-term complications can occur such as pericardial tamponade, esophageal perforation and PV stenosis. We present a rare long-term complication of an ostial ablation of pulmonary veins.

**Methods:** Progressive Shrinkage of the Left Atrium – A Rare Complication of Pulmonary Vein Ablation
right PV with significant improvement of symptoms and normalization of right ventricular pressure. However, the follow-up echocardiograms have demonstrated progressive shrinkage of the LA (fig. 1) whereas RA size even slightly increased. Atrial contractility has decreased in parallel.

**Conclusion:** Ostial PV RFA can not only produce severe PV stenosis but also abnormal left atrial remodeling with iatrogenic reduction of the atrium size compromising the LA function and volume capacity. Correlation between changes in the size of PV ostium and LA after ablation after RFA has been published. An important decrease in LA size after PV ablation might be a sign of concurrent PV stenosis. Since not all patients develop this complication despite similar ablation time and procedure, an abnormal cicatrization process can not be excluded.

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**Appropriate and inappropriate shocks among primary prevention implantable cardioverter defibrillator patients**

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**Introduction:** Shock delivery in patients with prophylactic implantable cardioverter-defibrillator therapy (ICDs) and its clinical implications are highly debated.

The objectives of our study were: to analyse 1) the incidence of shock delivery in our patients (pts) using the data registry of implantation and follow-up 2) the effect of shock delivery on mortality, 3) the incidence of appropriateness 4) risk parameters associated with shock delivery.

**Method:** We retrospectively studied patients who received an ICD at our centre (CHUV, in Lausanne) for primary prevention of sudden cardiac death, between January 2000 and October 2010.

**Results:** 138 pts were included, mean age at implantation 55+/−15 years, 75% male. 100% had a structural heart disease (HD), 44% of them had ischaemic HD (IHD). The mean left ventricular ejection fraction (LVEF) for the pts with IHD was 33+/−9%. 52% of all pts a single chamber ICD was implanted. During a mean follow-up period (f-up) of 55+/−30.7 months (mths), 71% of the pts with HD never received a shock (DC). 20% of all pts received at least 1 appropriate DC. 8% of HD pts received only an inappropriate DC. A total of 237 DCs were given, 40.5% were appropriate, 59.5% were inappropriate. 81% of inappropriate DCs were prompted by supraventricular tachyarrhythmias (SVT), 4.1% were caused by a specific sensing electrode malfunction. Effect on mortality: The annual mortality rate for the whole group was 3.2%. During a f-up period of almost 5 years the probability of survival was not affected whether the pt received an appropriate or inappropriate DC. Mortality was significantly higher in pts who had diuretic drug treatment, age over 65 years and dual chamber ICDs.

**Conclusions:** In our pts DC shocks had no effect on mortality. Appropriate shocks are delivered in 20% of our pts during the observed f-up. These pts were characterised by less betablocker therapy. Prophylaxis of inappropriate DC consists in betablocker therapy and reliable electrode material.
questionnaire; all events (CHF, HL, complications) were verified by case record review.

**Results:** Pt mean age was 64.9 ± 11, 51.7% (n = 29) were male, mean logistic EuroSCORE was 18.75 ± 14%. Mean number of previous surgery was 2.44 (range from 1 to 7) and mean time between last surgery and PPL reduction was 2785.5 ± 2449.8 days. Indications included CHF (91%, n = 51), HL (39%, n = 22), or both (9%, n = 5), for mitral mechanical (n = 5), mitral bioprosthetic (n = 5), aortic mechanical (n = 11) and aortic bioprosthesis (n = 1) PPL. Device implantation was successful in 46 procedures (75.4%, 46/61) involving 42 pts (75%) and technical success was achieved in 43 of the 61 procedures (70.5%). Two pts had prosthetic valve obstruction corrected by immediate percutaneous device retrieval. Three major complications happened during the 30-day follow-up in the 42 pts who received a device (PDA occluder embolization at day 2 leading to death, haemolytic syndrome requiring surgical retrieval of the device at day 5 and a non cardiac death at day 12). Mean follow-up was 539.2 ± 662 days. Overall 6/42 pts (14%) required a surgical redo after successful initial device deployment.

**Conclusion:** Percutaneous reduction is a promising alternative to redo surgery and should be considered for the challenging clinical problem of PPL in high risk patients.

**P225 Early experience with the St Jude Trifecta aortic bioprosthesis**

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**Introduction:** The St Jude Trifecta is a newly developed aortic perivalvular prosthesis. It was designed to offer superior hemodynamics and longevity through extensive in-vitro testing.

We report our early experience using this device.

**Method:** Between september 2010 and november 2011, 74 patients (62 men) with a mean age of 77±7 years (range 53 to 91) had an aortic valve replacement using a Trifecta bioprosthesis. Indication for operation included aortic stenosis in 54, regurgitation in 7, mixed pathology in 6, endocarditis in 2, failed TAVI in 2, and prosthesis dysfonction in 1. 6 Patients had had previous cardiac surgery.

**Results:** 21, 23, 25, 27 and 29 mm prosthesis were implanted in 21,23,25,27 and 29 patients respectively. Additional procedures included CABG in 20 patients, reductive aortoplasty in 8, mitral annuloplasty in 2, ascending aorta replacement in 2, Bentall operation in 1, annulus enlargement in 1. Mean aortic cross-clamp time and CPB time were 65 ± 22 and 80 ± 26 minutes respectively. 3 patients died perioperatively. Postoperative complications included revision for bleeding in 3 patients, late tamponnade in 4, need for a permanent pacemaker in 2 and embolic cerebrovascular accident in one. 7 days echo controls showed good prosthesis function in all patients, without regurgitation. Mean transvalvular gradients were 8.1 ± 3.0, 7.5 ± 4.1, 5.9 ± 2.8, 5.3 ± 1.6 and 6.0 mm Hg for 21, 23, 25, 27 and 29 prosthesis respectively.

**Conclusions:** In our experience the Trifecta prosthesis was easy to handle and implant. It was successfully used in different scenarios. Early postoperative gradients were satisfyingly low. This cohort of patients will have be followed to determine intermediate and late evolution of the prosthes.

**P226 Utility of peripheral biomarkers of myocardial extracellular matrix metabolism in heart failure with preserved and reduced ejection fraction**

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**Background:** Myocardial remodelling is an integral feature of heart failure (HF). Interstitial fibrosis contributes significantly by virtue of its effect on myocardial stiffness and arrhythmogenesis. In this context, many studies have assumed that elevated peripheral levels of matrix biomarkers correlate with the presence of active myocardial collagen synthesis. The aim of the present study was to determine the relationship between peripheral biomarkers of extracellular matrix metabolism and myocardial matrix turnover in HF.

**Methods:** We performed simultaneous arterial and coronary sinus blood sampling in healthy controls (n = 9), patients with HF and reduced ejection fraction (HFREF, n = 18), and patients with HF and preserved ejection fraction (HFPEF, n = 14).

Concentrations of N-terminal-pro-collegen I propeptide (PINP), N-terminal-pro-collegen III propeptide (PIIINP), matrix metalloproteinase 9 (MMP9), and tissue inhibitor of the matrix metalloproteinases 1 (TIMP1) were measured, and transcardiac gradients were calculated.

**Results:** Patients with HFREF had significantly higher arterial PIIINP plasma concentrations compared to controls (mean ± standard error of the mean, 7.0 ± 0.7 vs 4.0 ± 0.2 mcg/L, p <0.001) and HFPEF patients (4.1 ± 0.3, p < 0.05). The PIIINP concentration was closely correlated with the pulmonary capillary wedge pressure (r = 0.65, p <0.001, fig. 1). In contrast, arterial plasma concentrations of PINP, MMP9 and TIMP1 did not differ between groups. There was no net gradient for either PINP or PIIINP or TIMP1 in any group. By contrast, transcardiac release of MMP9 was detected in healthy controls and this was significantly reduced in HFREF patients (p <0.05, fig. 2). The transcardiac MMP9 gradient correlated negatively with the pulmonary capillary wedge pressure (r = –0.45, p < 0.01) and end-systolic (r = 0.41, p = 0.01) and end-diastolic wall stress (r = –0.40, p = 0.02).

**Conclusions:** The concentration of extracellular matrix derived molecules does not accurately reflect cardiac turnover. Despite elevated PIIINP concentrations in peripheral blood in patients with HFREF, there was no evidence of a net release from the myocardium. The increased peripheral PIIINP plasma concentrations may be explained by pulmonary congestion. By contrast, our study demonstrates the release of MMP9 in the non-failing human heart and this appears to be diminished progressively in the context of HF. As such, conceptually a reduction in myocardial MMP biosynthesis could favour a pro-fibrotic state.
**P227**

**Evaluation of multidimensional geriatric assessment as predictor of mortality and adverse events after transcatheter aortic valve implantation**


**Background:** Currently used risk scores do not reliably estimate mortality and MACCE in elderly patients undergoing transcatheter aortic valve implantation (TAVI). This study evaluated multidimensional geriatric assessment (MGA) as predictor of mortality and major adverse cardiovascular and cerebral events (MACCE) after TAVI.

**Methods:** This prospective cohort comprised 100 consecutive patients >= 70 years undergoing TAVI. Global risk scores (STS-score, EuroSCORE, and MGA-based scores (cognition, nutrition, mobility, activities of daily living (ADL) and frailty index) were evaluated as predictors of all cause mortality and MACCE at 30 days and 1 year after TAVI in regression models.

**Results:** All predictors were significantly associated with mortality and MACCE at 30 days and 1 year, except for the EuroSCORE at 30 days and instrumental ADL at 30 days and 1 year. Associations of cognitive impairment (OR 3.63, 95%CI 1.29–10.23) and frailty index (OR 3.68, 95%CI 1.21–11.19) with 1-year mortality were similar compared to STS-score (OR 5.47, 95%CI 1.48–20.22) and EuroSCORE (OR 4.02, 95%CI 0.86–18.70). Similar results were found for 30-day mortality and MACCE. Bivariable analyses including STS-score or EuroSCORE suggested independent associations of MGA-based scores (e.g. OR of frailty index 3.29, 95%CI 1.06–10.15, for 1-year mortality in a model including EuroSCORE).

**Conclusion:** This study provides evidence that risk prediction can be improved by adding MGA-based information to global risk scores and suggests the development and validation of improved risk prediction models.

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**P228**

**Small hemodynamically non-compromising pericardial effusion is associated with increased mortality in patients with heart failure**


**Introduction:** The prognostic relevance of a small, hemodynamically non-compromising pericardial effusion in patients with reduced ejection fraction has not been investigated. However, in patients with pulmonary hypertension, the presence of a minor pericardial effusion has a negative effect on prognosis. Therefore, this study assessed the impact of a small pericardial effusion on mortality in a heart failure population.

**Methods:** All patients who were diagnosed with a decreased ejection fraction (<50%) by echocardiography and had follow-up examinations in our heart failure clinic from years 1990 until 2010 were eligible for inclusion. Patients with a hemodynamically relevant pericardial effusion were excluded, as well as patients with myo-/pericarditis, after heart transplantation, after heart surgery within the last 6 months and with malignant neoplasms in the last 3 years. Patients are either included in the “pericardial effusion” group or the control group without pericardial effusion.

**Results:** In total, 901 patients (control: 826 patients; pericardial effusion: 75 patients) were included. The groups were comparable with regard to age (median 56 years [IR 46–65] vs. 54 years [IR 38–63]; p = 0.07), male gender (82% vs. 73%; p = 0.09), LV-EDD (median 6.1 cm [IR 5.3–7.0] vs. 6.4 cm [IR 5.4–7.4]; p = 0.15), as well as the severity of mitral regurgitation (p = 0.67). A significant difference between the groups was noted with regard to LV-EF (median 34% [IR 25–47] vs. 29% [IR 18–45]; p = 0.03), RV-fac (median 39% [IR 33–49] vs. 33% [IR 19–42]; p = 0.002), TAM (median 18 mm [IR 15–22] vs. 15 mm [IR 12–20]; p = 0.002), tricuspid regurgitation (grade 1 [IR 1–2]; p <0.0001), heart rate (median 76/min [IR 65–89] vs. 87/min [IR 76–98], beta-blocker therapy (58% vs. 45%; p = 0.04), and spironolactone therapy (12% vs. 23%; p = 0.01). Cox regression model corrected for age, LV-EF, beta-blocker, spironolactone, heart rate, heart rhythm, and underlying heart disease revealed as independent risk factors for death: a) the presence of a pericardial effusion (p = 0.02, HR 1.98), b) advanced age (p = 0.03, HR 1.02), c) reduced LV-EF (p = 0.005, HR 0.98).

**Conclusion:** A minor pericardial effusion is associated with an accentuated hazard for death in a population with reduced ejection fraction.

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**P229**

**Rehabilitation outcome after TAVI compared to conventional aortic valve replacement**

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Transcatheter aortic valve implantation (TAVI) is an established method for the treatment of patients with a very high surgical risk. Until now, mainly the morbidity and mortality results have been analysed. We investigated whether there are differences in the course of rehabilitation between patients treated with TAVI and patients operated by the conventional method (control group).

**Methods:** We included 34 TAVI patients between January 2008 and December 2010 who were hospitalized in our rehabilitation center. We compared them to 78 sex-matched patients, who were conventionally operated (control group) in the same period with regard to baseline data (including EURO score and STS score), 6-minute walking test (6MWT) on admission and discharge, FIM scores on admission and discharge, HADS score at admission and discharge and length of stay.

**Results:** We found significant differences in age between TAVI patients and control group (81.9 ± 4.59 vs. 78.1 ± 5.85; p <0.001), EURO score (26.2 ± 13.94 vs. 11.6 ± 8.88; p <0.001), STS Mortality score (26.2 ± 13.94 vs. 11.6 ± 8.88; p = 0.007) and STS Stroke Score (7.52 ± 5.38 vs. 1.75; p <0.001). In addition, the presence of coronary heart disease, pulmonary hypertension, renal insufficiency, previous stroke, previous PCI was higher in TAVI patients. Both patient groups showed comparable improvements concerning the 6MWT (91.52 ± 68.38 vs. 88.65 ± 62.09; p = 0.852), total FIM score (9.54 ± 6.338 vs. 12.235 ± 10.896; p = 0.265), length of stay (19.24 ± 6.396 vs. 19.60 ± 5.084; p = 0.750) the HADS score (–0.08 ± 1.44 vs. –0.68 ± 2.77; p = 0.465), HADS D score (–0.08 ± 2.06 vs. –1.32 ± 2.44; p = 0.114). Even after adjusting for the significant differences in the baseline groups, there were no significant differences in the endpoints.

**Conclusion:** Although patients treated with TAVI were a much sicker and older, there were no significant differences in the outcome during rehabilitation regarding the improvement of the 6-minute walking test, the FIM and HADS scores and length of stay.

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**P230**

**Rifabutin instead of Rifampicin in immunosuppressed cardiac transplant patients**

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**Rationale:** Infections associated with foreign bodies like sternotomy cerclage or osteosynthesis material, show relevant morbidity and mortality in immunosuppressed patients. Rifampicin (RFM) is a potent staphylococcal antibiotic and is the only curative substance active against foreign body infections. Unfortunately, RFM is also a potent inducer of the cytochrome P-450 (CYP) enzyme-, as well as the P-glycoprotein transport-system, leading to major drug-drug interactions. After RFM introduction, calcineurin inhibitors (CNI), such as tacrolimus or cyclosporine, their respective dose need to be massively increased. Rifabutin (RFB) is as active as RFM and seems to be a less potent inducer of CYP 450 than RFM, but no data is available in transplanted patients (pts), yet.

**Methods:** We report of our experience with foreign body infections treated with RFM or RFB and their concomitant infections treated with RFM or RFB (age 57.6 ± 7.5), all males, HTx between 12/2008 and 07/2011, because of dilated cardiomyopathy and following specifications: see table 1.

**Results:** We found significant differences between RFM and RFB (p = 0.004), serum levels (RFM 0.3 ± 0.3 μg/mL vs. RFB 0.1 ± 0.1 μg/mL; p = 0.001), treatment duration (months 6.0 ± 4.7 vs. 2.0 ± 1.0; p = 0.001), recurrences (9/5 vs. 2/3; p = 0.007), reinfections (1/2 vs. 2/3; p = 0.003). Of the patients treated with RFM, 2/3 (3/5) responded to the therapy, while all patients treated with RFB showed a successful therapy. Even after adjusting for the significant differences in the baseline groups, there were no significant differences in the endpoints.

**Conclusion:** Although the outcome of patients treated with RFM was not as good as patients treated with RFB, the infection rate was significantly lower in the RFB group. Therefore, RFB seems to be the method of choice for the treatment of patients with a very high surgical risk due to their foreign body infections.
Conclusions: Compared with RFM, RFB revealed clinically a smaller CYP enzyme induction, which leads to less harm of over- or underimmunosuppression, better compliance and probably to a cost reduction, being aware of the pricing of immunosuppressants.

Clinical outcome of patients at low or intermediate risk undergoing transcatheter aortic valve implantation


Background: TAVI is an established treatment alternative to surgical aortic valve replacement among high-risk patients with symptomatic severe aortic stenosis. Clinical outcome of patients undergoing TAVI at low or intermediate risk, as calculated by established risk scores, remains to be determined. We therefore compared the outcomes of low and intermediate risk patients with the standard high risk TAVI patient population.

Methods and results: 400 patients (aged 82.5 ± 6 years) with symptomatic aortic stenosis (mean NYHA functional class 2.7 ± 0.8) were included into a prospective single-center registry. Patients were divided into three groups according to the estimated risk: low-risk (STS <3 (65.5%), mean 5.1 ± 1.4) and high-risk (STS >8 (24.0%), mean 10.5%), mean 2.1 ± 0.5), intermediate-risk (STS >= 3 and <= 8 (13.3 ± 7.1). There were significant between group differences with respect to diabetes (12.2% vs. 25.6% vs. 35.5%, p = 0.016), peripheral vascular disease (4.9% vs. 20.1% vs. 34.4%, p <0.001), chronic pulmonary disease (7.5% vs. 17.1% vs. 26.0%, p = 0.012) and coronary artery disease (46.3% vs. 61.0% vs. 67.7%, p = 0.064). Low-risk patients were younger (78 ± 7 vs. 83 ± 6 vs. 84 ± 5, p <0.001), had a higher BMI (28 ± 6 vs. 27 ± 5 vs. 24 ± 4, p <0.001), higher left ventricular ejection fraction (59 ± 11 vs. 55 ± 15 vs. 48 ± 15, p <0.001) and were less symptomatic compared to patients at intermediate or high surgical risk. There were no differences regarding vascular access between the three risk groups (transfemoral 80.5% (low) vs. 78.7% (intermediate) vs. 80.6% (high-risk), p = 0.912).

Conclusion: Short-term clinical outcome of well-selected TAVI patients at low or intermediate risk is favorable with 30 day mortality below 5% and appears adequately predicted by the STS-score.

Chronobiological pattern of takotsubo cardiomyopathy: data from a large international, multicenter registry


Background and aim: Takotsubo cardiomyopathy is a syndrome that is most frequently observed in postmenopausal women and is usually triggered by a stressful event. This syndrome is classified as a cardiomyopathy, however the acute presentation is indistinguishable from acute myocardial infarction. While the occurrence of myocardial infarction is correlated to cold whether with a seasonal preference to winter, there are conflicting reports about the preferential occurrence of takotsubo regarding seasonal, monthly and day of weekly distribution. Therefore, we sought to examine the chronobiological pattern of takotsubo cardiomyopathy from a large international, multicenter patient population.

Methods: We enrolled 585 patients with takotsubo cardiomyopathy classified according to the Mayo Clinic Diagnostic criteria from 15 different international centers across Europe and analyzed their occurrence by month, season, and day off the week in order to identify a potential critical period with a susceptibility for takotsubo.

Results: Our results demonstrated a pronounced incidence of takotsubo cardiomyopathy in June and October. The lowest incidence was found in December and January, reflecting the coldest months in the year. However, analysis of the seasonal distribution revealed that the onset of takotsubo was increased in autumn compared to winter, summer and spring. Interestingly, the circaseptan pattern of employed patients revealed a critical occurrence for takotsubo on Monday, while a gradually increase in takotsubo was found from Tuesday to Friday.

Conclusions: While ACS most often occurs in the coldest month of the year, as previously reported, takotsubo does not show any preference for the coldest months. One possible explanation for the peak occurrence on Monday might be the potential risk of major stress at the beginning of the week associated with the job triggering a takotsubo event.
Associations of reactive hyperemia index and intravascular ultrasound-assessed coronary plaque morphology
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Background: Though reactive hyperemia index (RHI) predicts future coronary events, associations with intravascular ultrasound (IVUS)-assessed coronary plaque morphology have not been reported. This study therefore investigates associations between RHI and IVUS-assessed coronary plaque morphology.

Methods: In 362 patients RHI was measured by non-invasive peripheral arterial tonometry (PAT) and coronary plaque components (fibrous, fibro-fatty, necrotic core, and dense calcium) were identified by IVUS in 594 vessel segments of left anterior descending, circumflex and/or right coronary artery. RHI values <1.57 were considered abnormal. Analysis of variance was used to detect independent associations of RHI and plaque composition.

Results: Patients with an abnormal RHI had higher plaque burden (41% vs. 39% in patients with normal RHI, P = 0.047). As compared to patients with normal RHI, the plaque of patients with abnormal RHI had more necrotic core (21% vs. 17%, P <0.001) and dense core calcification. In addition, RHI was associated with a lower fibrous area (F-ratio 14.79, P <0.001), fibro-fatty (F-ratio 5.66, P = 0.018), necrotic core (F-ratio 14.47, P <0.001), and dense calcium volumes (F-ratio 10.80, P = 0.001).

Conclusions: Coronary artery plaques of patients with an abnormal RHI had a higher proportion of necrotic core and dense calcium. The association of an abnormal RHI with a plaque morphology that is more prone to rupture may explain why these patients exhibit a greater risk of coronary events.

Temporal trends in treatment of ST-elevation myocardial infarction among men and women in Switzerland from 1997 through 2010

Introduction: Few data describe temporal trends in presentation, treatment and outcome in men and women with acute ST-segment elevation myocardial infarction (STEMI).

Methods: Swiss STEMI patients enrolled in the AMIS Plus registry from 1997–2010 were analyzed using multivariate logistic regression.

Results: From 20,363 STEMI patients, 5458 were women and 14,891 were men. Women were 8.6 years older, had more comorbidities (Charlson Index > 2 16.9% vs 12.8%; P <0.001), diabetes mellitus (22.6% vs 17.3%; P <0.001) and hypertension (64.9% vs 58.5%; P <0.001). They presented 50 minutes later with less pain, more dyspnea, more frequently Killip class >2 (10.6% vs 7.2%; P <0.001) and atrial fibrillation (5.6% vs 3.9%; P <0.001). More patients underwent primary percutaneous intervention (21.7% vs 19.2%; P <0.001), resuscitation prior admission (6.3% vs 5.2%; P = 0.003) and were more often current smokers (46.3% vs 29.9%; P <0.001). Women were less likely to undergo primary reperfusion (61.6% vs 75.4%; OR 0.52; 95%CI 0.49–0.58; P <0.001) even after adjusting for baseline characteristics and admission year (OR 0.80; 95%CI 0.71–0.89; P <0.001), or to receive early and discharge drugs such as thienopyridines, ACE inhibitors, AT antagonist, clopidogrel 75 mg/d and statins. In-stent restenosis was performed in 51% of male and 39% of female patients. Now, thrombolysis is negligible. Use of primary PCI increased from below 10% in both genders in 1997 to over 70% in females and over 80% in males. Early thienopyridine therapy steadily increased to 90% of all patients in 2010. Statin use rapidly increased until 2002, peaking at 72% in women and 82% in men in 2005/6. Early statin use even decreased but thienopyridine and statin therapies at discharge increased and were prescribed to over 90% of patients in 2010. From 1997–2010, annual in-hospital mortality decreased by 6% in men (OR 0.95; 95%CI 0.94–0.97; P <0.001) and 6% in women (OR 0.94; 95%CI 0.92–0.96; P <0.001). Despite higher crude in-hospital mortality, female gender was not an independent predictor of in-hospital mortality (OR 1.10; 95%CI 0.90–1.35; P = 0.37).

Conclusion: Therapy of STEMI patients has changed greatly during the past 14 years in Switzerland, largely in accordance with guideline recommendations.

Effect of low dose eplerenone on endothelial function in patients with stable coronary artery disease

Background: clinical study showed as eplerenone significantly reduced all cause and cardiovascular mortality in patients with left ventricular dysfunction after a recent myocardial infarction. The aim of the present study was to investigate whether endothelial dysfunction associated with stable coronary heart disease (CHD) is altered by selective aldosterone antagonism with eplerenone, as potential anti-inflammatory drug, versus placebo.

Methods and Results: 42 patients with history of CHD (age 63.5 ± 9.1, 37 males) and stable cardiovascular medication for at least 4 months were included in the study. The patients were randomized, in a double blind fashion, to receive eplerenone 25 mg or placebo for 1 month. Endothelial function, non invasive assessed as flow mediated dilation, 24-hour blood pressure (BP), endothelial progenitor cells, platelet adhesion as well as laboratory parameter for safety and evaluation of oxidative stress and inflammation were evaluated in baseline condition and after 2 and 4 weeks of treatment. In this prospective study adding eplerenone 25 mg on top of standard therapy did not induce significant modification in endothelial function (eplerenone 25 mg: from 4.63 ± 2.35 to 4.65 ± 2.04; placebo: from 5.06 ± 2.18 to 4.86 ± 2.06) as well as in oxidative stress and inflammation parameters and in endothelial progenitor cells or platelet adhesion. Moreover, in this study population both eplerenone 25 mg and placebo induces a slight and not significant reduction in 24-hour BP (eplerenone 25 mg: systolic BP from 129.1 ± 13.97 to 126.9 ± 17.3 mm Hg, and diastolic BP from 75.3 ± 9.64 to 73.3 ± 12.9 mm Hg; placebo: systolic BP from 124.1 ± 11.5 to 122.3 ± 9.7 mm Hg, and diastolic BP from 72.1 ± 7.6 to 71.7 ± 7.3 mm Hg; all p = ns) when added on top of standard therapy.

Conclusion: 4-week therapy with eplerenone 25 mg on top of a standard therapy did not induce any significant changes in endothelial function and 24-hour blood pressure in patients with coronary artery disease.

Transcatheter left atrial appendage occlusion in atrial fibrillation: a 100 cases single center experience
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Aims: In patients with atrial fibrillation (AF), >90% of embolic strokes originate from the left atrial appendage (LAA). Transcatheter occlusion of the LAA has been proven as an alternative to oral anticoagulation (OAC) in patients with CHADS Score ≥2.

Methods: The Amplatzer Cardiac Plug (ACP) is a modification of Amplatzer shunt occluders. It consists of a lobe with tiny hooks for anchorage in the LAA, a flexible thin wire, and in comparison to other devices, of a disc for sealing the orifice of the LAA (pacifier principle). We report on 100 consecutive ACP patients (age 72 ± 10 years) with non-valvular AF (mean CHADS2 Score 2.6 ± 1.3, CHA2DS2-VASc Score 3.7 ± 1.7, HASBLED 2.5 ± 1.3). The LAA was entered via femoral venous and transseptal access under local anesthesia only. Diameters of the LAA orifice were measured by transesophageal echocardiography (TEE) assistance. The procedure was often combined with other cardiac interventions. After ACP Implantation, OAC was stopped. Acetylsalicylic acid 100 mg/d and clopidogrel 75 mg/d were prescribed for >3 and 1 months respectively. Follow-up with TEE and neurological examination were performed after 1 months.

Conclusion: Transcatheter left atrial appendage occlusion in atrial fibrillation is a safe and well tolerated procedure. Success rate was 100%. Adverse events occurred in 7.0% of patients. The procedure was safe and to date no embolic events were observed.
Results: Device sizes ranged from 16 to 30 mm (mean 22.8 ± 3.9 mm). The LAA was successfully occluded in 98%. Procedural complications occurred as follows: Two cardiac tamponades, one with need for pericardiocentesis (1%) and one with conservative management (1%), device embolization (2%, one needing semi-elective surgery), one air embolization with transient symptoms (1%), one stroke (1%). The procedure was combined with coronary angiography in 65%, coronary stenting in 25%, closure of atrial shunts in 34% and transcatheter aortic valve implantation in 10%. At follow-up TEE, potential thrombi on the device were described as follows: Mobile 1%, non-mobile 4% and questionable 11%. In 6%, a small residual shunt remained and in 1% a pericardial effusion was seen and treated conservatively. No clinical events occurred.

Conclusion: Transcatheter occlusion of the LAA with the Amplatzer Cardiac Plug can be performed as an alternative to OAC with high procedural success rates, acceptable rates of complications, and good results during early follow-up.

Comparison of Watchman and AGA device for LAA occlusion and the problem of late pericardial tamponade
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Background: Two systems are commercially available for catheter based internal occlusion of the left atrial appendage (LAA), the Watchman (W, BSc) and the AGA Amplatzer (A, SJM) devices. However, their performance has not been compared head to head.

Methods: Implantation data at a single center were prospectively collected.

Results: Between 2010 and 2011, a total of 71 patients (pts) underwent LAA occluder implantation (table 1). Two implants failed because of multiple lobes of the LAA (W) and subacute dislocation (A). There were 4 (5.7%) late pericardial tamponades occurring at 36 hours (n = 2), 4 days and 2 months post procedure leading to death in one pt (W) with missed diagnosis outside the hospital despite hypotension and tachycardia. Another pt died of cerebral bleeding (A). Two late unexplained deaths (after 2–3 months) occurred.

Conclusion: Both devices perform similarly with respect to implant success and sealing. Choosing the device type according to LAA morphology is preferable to avoid crossover. The late tamponade rate of 3% (W) and 9% (AGA) raises concern about safety of the fixation with metal barbs. The relation to two late tamponades at 36 hours (n = 2) and BES (n = 2) (p-value = 1.0).

Effects of coronary sinus occlusion on myocardial ischemia
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Background: Coronary sinus occlusion (CSO) is thought to salvage ischemic myocardium at risk for necrosis. In animal models, efficacy of CSO to reduce infarct size has been very rarely documented. The present study tested the hypotheses that CSO reduces myocardial ischemia and that the amount of ischemia reduction is related to the function of coronary collaterals.

Methods: Fifteen patients with chronic stable coronary artery disease (CAD) electively referred for coronary angiography underwent two 2-minute coronary balloon occlusions. One of them was performed without, the other with application of CSO. For the assessment of collateral function, aortic pressure (Pao) and central venous pressure (CVP) was registered. Collateral flow index (CFI), i.e., the collateral function parameter, was calculated at 2 minutes of coronary occlusion: CFI = (Pao-CVP)/(Pao+CVP) [mm Hg/mm Hg]. An intracoronary ECG obtained from the guidewire distal to the balloon occlusion was registered during coronary occlusion with CSO and during coronary occlusion without CSO. The ST segment shift from the intracoronary ECG was measured at
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2 minutes of coronary occlusion. Measurements were randomized for the sequence "CSO first" or "CSO second". Absolute intra-coronary ECG ST segment shift was significantly higher at the end of the procedure vs with CSO: 1.73 ± 1.25 mV vs 1.39 ± 1.22 mV, p = 0.048 (fig. 1). Regression analysis showed that the degree of ST segment shift reduction during CSO first and in 8 procedures "CSO second" was performed.

Overall, coronary sinus occlusion reduces myocardial ischemia in patients with chronic CAD. The amount of ischemia reduction of CSO is dependent on coronary collateral function. A minimal degree of collateral function appears necessary to render CSO effective. Obviously, CSO cannot manifest an effect when collateral function prevents ischemia in the first place.

Gender-based analysis of outcomes among patients with acute coronary syndromes undergoing percutaneous coronary revascularization with drug-eluting stents


Aims: To investigate gender differences in clinical outcomes among patients with acute coronary syndromes (ACS) undergoing percutaneous coronary revascularization with drug-eluting stents (DES) during long-term follow-up to 2 years.

Methods: Individual patient data were pooled from 3 “all-comer” trials with the exclusive use of DES (SIRTAX – N = 1,012, LEADERS – N = 1,707, RESOLUTE AC – N = 2,292). Out of 2,683 (54%) presented with ACS (including non-ST-elevation myocardial infarction (NSTEMI)), 2,607 (97%) completed 2 years follow-up (624 women and 1,983 men) and were included in the present analysis. Following stratification by gender, clinical outcomes were compared between women and men. Mixed effects regression models were used to derive differences between groups. The pre-specified primary endpoint of the study was the composite of cardiac death and myocardial infarction (MI).

Results: At baseline women compared to men were older, had more frequently diabetes, obesity, and hypertension, and less frequently smoking habits and prior bypass surgery. Moreover, women presented more frequently with non-ST-elevation ACS than ST-elevation ACS, while there were no differences with respect to the Syntax score. At 2 years, women had a similar risk of the primary endpoint (7% vs 6.8%, OR = 1.05, 95% CI 0.74–1.50, p = 0.77) as well as its components cardiac death (3.0% vs 3.1%, OR = 0.94, 95% CI 0.56–1.59, p = 0.80) and MI (4.5% vs 4.4%, OR = 1.01, 95% CI 0.65–1.57, p = 0.96) compared with men. The risk of clinically- indicated repeat revascularization did not differ between women and men in terms of both target-lesion (6.6% vs 5.7%, OR = 1.16, 95% CI 0.80–1.68, p = 0.44) and target-vessel revascularization (6.8% vs 7.1%, OR = 0.93, 95% CI 0.65–1.33, p = 0.69). Similarly, the risks of definite (2.2% vs 1.9%, OR = 1.13, 95% CI 0.80–2.10, p = 0.71) and definite or probable stent thrombosis (2.9% vs 2.5%, OR = 1.14, 95% CI 0.66–1.98, p = 0.63) showed no differences between women and men. After adjustment for differences in baseline characteristics, the risks of the primary and secondary endpoints remained comparable between women and men.

Conclusions: Despite more advanced age and a greater prevalence of diabetes, obesity, and hypertension, women with ACS undergoing coronary revascularization with DES show a similar long-term clinical outcome as men with ACS.

Impact of aspirin and statin on the presentation of ACS type in patients without prior myocardial infarction: data from the Zurich-ACS Registry (Z-ACS Registry)


Introduction: The beneficial effects of aspirin (ASA) and statin treatment after myocardial infarction, as secondary prevention is well known. Conflicting results exist about prior ASA therapy in primary prevention. It has been well documented that statin treatment is protective in cardiovascular disease due to its pleiotropic effects.

Objective: The aim of the present study was to investigate whether pre-treatment with ASA, statin or their combination has an influence on the presentation of ACS type.

Methods: Between 2007–2010, 1818 patients with ACS at the University Hospital of Zurich were included in our Zurich-ACS Registry (ZACS Registry). Patients’ data were collected including baseline characteristics and medication on admission. Patients with prior myocardial infarction were excluded from the final analysis. All patients were assigned to 3 groups: ST-segment elevation myocardial infarction (STEMI), Non-ST-segment myocardial infarction (NSTEMI) and unstable angina pectoris (UAP). All three groups (STEMI, NSTEMI and UAP) were followed up for adverse cardiac events (MACE) and hard events at 30 days after the index event by using the Kaplan Meier method. Pretreatment medication was assessed between the three groups for ASA, statins, the combination of ASA and statin.

Results: Of 1818 patients, 1609 were included in the final analysis. 57% (n = 911) revealed STEMI, 35% (n = 557) revealed NSTEMI and 9% (n = 141) UAP. The mean age of the study population was 63 ± 13 years and 75% (n = 1209) were male. Kaplan Meier survival analysis for MACE demonstrated no significant difference between all three ACS groups at 30-days of follow-up (p = n.s., log-rank test). However, analysis of hard events between the three groups demonstrated a significant difference (p < 0.01, log-rank test) with the most unfavorable outcome for patients with STEMI. Pre-treatment with aspirin in STEMI, NSTEMI and UAP demonstrated the most favorable outcome for hard events at 30 days follow-up suggesting a beneficial effect for ASA, statins or the combination of both.

Role of inflammation markers in outcome prediction of patients with acute coronary syndrome: data from the Zurich-ACS Registry (Z-ACS Registry)


Aim: Evaluation of the added combinatorial value of C-reactive protein (CRP) and white blood cells (WBC) in patients with acute coronary syndrome (ACS) as predictors for major adverse cardiovascular events (MACE).
Background: Inflammation is a key factor in the process of ACS. However, data on the combinatorial predictive value of CRP and WBC in patients with ACS are still lacking.

Methods: This retrospective study included 1,164 consecutive patients with ACS who were referred to a tertiary care center. CRP and WBC values were determined twice on admission and after 24 hours and patient follow-up was obtained from a period of 30 days with assessment of hard events (cardiac death and events (MACE) including hard events, hospitalization for cardiac reasons, late revascularization, and stroke. Cut-off values of CRP and WBC for prediction of MACE were identified by analysis of receiver operator characteristic (ROC) curve and the Kaplan-Meier method was used to assess the predictive value of CRP and WBC.

Results: ROC analysis of CRP and WBC to predict MACE or hard events revealed cut-offs of 44.5 ng/ml and 14.2 x 10^3/µl for hard events, respectively. The cumulative MACE rate was significantly higher in patients with abnormal CRP (≥44.5 ng/ml) 17% vs. 3%, P <0.001) or WBC (≥14.2 x 10^3/µl) 16% vs. 4%, P <0.001. Levels of CRP and WBC were further identified as independent predictors of MACE and hard events (P <0.001) and highest MACE rate when using the combination of both inflammatory markers (27% vs. 4%, P <0.001). Levels of CRP and WBC were further identified as independent predictors of MACE and hard events (P <0.001) and highest MACE rate when using the combination of both inflammatory markers (27% vs. 4%, P <0.001).

Conclusions: The inflammatory markers CRP and WBC are strong predictors for outcome in patients with ACS. In particular, their combination may allow improved risk stratifications of patients with ACS.

Clinical features of myocardial infarction and myocarditis in young patients
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Background: Chest pain (CP) represents about 5% of admissions to emergency departments (ED), even in young people. Acute coronary syndrome (ACS) and myocarditis are among the most important diagnoses to rule out. Clinical and ECG findings are not specific for either condition and separating both diagnoses is a challenge.

Methods: Retrospective study of all consecutive patients <40 years old admitted to our ED from January 2009 to June 2011 for CP with elevated serum troponin concentration. All clinical, angiographic and cardiac magnetic resonance (CMR) data from the local database was reviewed. Clinical follow-up was obtained to assess mortality and re-hospitalisation for CP and ACS.

Results: 1588 patients <40 years old were admitted to the ED with chest pain. 49 (3.1%) of patients presenting with an elevated troponin I (>0.09 µg/l) were included in the study. The study population was characterized by a young age (34.1 ± 3.8 vs 26.9 ± 6.4, P = 0.0002) and significantly more cardiovascular risk factors (mean 2.06 vs 0.65, p = 0.000). Diabetes (18.8% vs 0%, p = 0.0039), dyslipidemia (56.2% vs 3.4%, p <0.0001) and family history of coronary artery disease (CAD) (37.5% vs 10.3%, p = 0.000) were significantly associated with ACS. No significant association was found for smoking, hypertension and obesity. Fever (>38 °C) or flu-like syndrome were present in 75.8% (22/29) of patients with confirmed or suspected myocarditis, and in 0% of ACS patients (p <0.0001). During follow-up, only 2 patients with myocarditis were re-admitted for chest pain.

Conclusions: In this study, 32.7% of patients <40 year old admitted to an ED with CP and elevated troponin had an ACS. Key clinical factors include diabetes, dyslipidemia, family history of CAD, fever or recent flu-like symptoms, and may help to differentiate ACS from myocarditis.

Prediction of myocardial infarction size using the SYNTAX score in patients treated with primary coronary intervention for acute ST-elevation myocardial infarction
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Objectives: The aim of this study was to evaluate the impact of the SYNTAX score for the prediction of the myocardial infarction size, estimated by the CK peak value, using the SYNTAX score in patients treated with primary coronary intervention for acute ST-elevation myocardial infarction.

Background: Prior studies evaluating the relevance of the SYNTAX score for the particular case of patients with acute ST-elevation myocardial infarction are based on large prospective randomized trials like STRATEGY (Single High-Dose Bolus Tirofiban and Sirolimus-Eluting Stent Versus Abciximab and Bare-Metal Stent in Acute Myocardial Infarction) and MULTISTRATEGY (Multicenter Evaluation of Single High-Dose Bolus Tirofiban Versus Abciximab With Sirolimus-Eluting Stent in Acute Myocardial Infarction). A "real-life" population approach has never been explored before.

Methods: The primary endpoint of the study was myocardial infarction size as measured by the CK peak value. The SYNTAX score was calculated retrospectively in 253 patients with acute STEMI undergoing PCI at our center in Lausanne, Switzerland, between January 2009 and June 2010. Linear regression analysis was performed to compare myocardial infarction size with the SYNTAX score. This same endpoint was then stratified according to SYNTAX score tertiles: low (<22, n = 178), intermediate [22–32] (n = 60), and high ≥33 (n = 15).

Results: A moderate Pearson product-moment correlation coefficient (r = 0.4074) was found. The coefficient of determination (R^2 = 0.1650) shows that approximately 17% of the variation of CK peak value (myocardial infarction size) can be explained by the SYNTAX score, i.e. by the coronary disease complexity. When stratified according to the SYNTAX score tertiles average CK peak values of 1985 (low <22), 3336 (intermediate [22–32]) and 3684 (high≥33) were obtained with a p-value <0.0001. Bartlett’s test for equal variances between the three groups was 9.999 (p-value <0.05).

Conclusion: In an all-comers population, the SYNTAX score is accurate in predicting myocardial infarction size in patients treated with PCI. The stratification of patients in different risk groups according to SYNTAX enables to identify a high risk population.

In vivo intermittent hypoxia as a tool for cardioprotection
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Aim: The purpose of this study is to test the hypothesis that intermittent hypoxia (IH) is cardioprotective and identify the underlying mechanisms through investigation of biochemical and molecular changes occurring in the myocardium after exposure to IH.

Materials and Methods: For exposure to IH or normoxia (N), animals (C57Bl/6, 8–10 weeks old, n = 8/group) were housed in custom-made identical cylindrical Plexiglas chambers with tightly fitted lids. IH was repeated every 6 hours for 14 day. During IH, the level of hypoxia was set to 7% O2, with a rapid reoxygenation to 21% O2. This event was repeated for 5 times. Animals exposed to N (Control group) received room air. To evaluate the susceptibility to myocardial infarction, in vivo regional ischemia was induced by occlusion of the left anterior descending coronary artery (LAD) for 30 min followed by 120-min of reperfusion. Areas of infarcted tissue were measured by triphenyltetrazolium staining using a computerized planimetric technique and expressed as a percentage of total ventricular area minus cavities. Addition hearts were excised and washed in saline solution. The ventricles were cut into two parts, and the percentage of total ventricular area minus cavities was determined (R^2 = 0.66). Areas of infarcted tissue were measured by triphenyltetrazolium staining using a computerized planimetric technique and expressed as a percentage of total ventricular area minus cavities.
The degree of protein carbonylation, an index of oxidative stress, was evaluated by means of Oxyblot.

**Results:** Intact zone was markedly decreased in IH (p < 0.01), strongly indicating IH-induced cardioprotection. Exposure to IH increased peak systolic pressure, dP/dt\text{max} and left ventricle LAD heart, compared to the non-ischemic one, reflecting the developed pressure. Normalized densitometric values (Oxy/RP) difference was observed between non-ischemic and LAD IH ventricles. Furthermore, before LAD occlusion, IH significantly increases the phosphorylation levels of Akt and eNOS compared to normoxic group. Such trend was maintained after LAD occlusion.

**Conclusion:** Our data demonstrate that IH confers cardioprotection against ischemia-reperfusion injury by enhancing the production of Akt and eNOS, known be involved in the cardioprotection induced by ischemic preconditioning and postconditioning.

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**Lack of association between connexin40 polymorphisms and coronary artery disease**

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**Objective:** Cx40 is a gap junction protein important for cell-cell communication in the endothelium. Polymorphisms in both promoter regions of the human Cx40 gene, -44G>A and +71A>G for promoter A and -26G>A for promoter B, were shown to reduce Cx40 transcription by half. As mice with an endothelial-specific deletion of Cx40 are more susceptible to atherosclerosis, this study was designed to discover a correlation between these polymorphisms and atherosclerosis in European populations.

**Methods and results:** Cx40 expression in human endothelial cells (ECs) was confirmed by immunofluorescence and/or Western Blot. To determine relative contribution of promoters A and B to Cx40 transcription in human ECs, HUVECs, human saphenous veins and human aortic ECs were used for relative qPCR of Cx40 transcripts under both promoters. Transcripts under promoter A were overrepresented by approximately 50-fold. We thus investigated Cx40 promoter A polymorphisms in relation with atherosclerosis. A total of 803 patients referred to the Geneva University Hospitals for elective coronary angiography were divided according to the number of significantly stenosed vessels (from 0 to 3) and were genotyped for the Cx40 promoter A polymorphisms. Genotype distribution in the control group was -44G>-17AA = 59.8%, -44AG+71AA = 35.1% and -44AA+71GG = 5.2%. Surprisingly, this distribution was similar in the CAD group, with -44AG+71AA = 58.5%, -44AG+71AA = 37.6% and -44AA+71GG = 3.8% (p = 0.67). Moreover, this polymorphism was not associated with hypertension. Finally, no significant association between histological carotid plaque composition of culprit lesions and Cx40 polymorphisms could be detected in 583 Dutch patients of the Athero-Express study.

**Conclusions:** Despite a clear anti-atherogenic role of Cx40 in mice, our study could not detect an association of Cx40 promoter polymorphisms and CAD in human. Moreover, a correlation with atherosclerotic plaque stability or hypertension could not be demonstrated either. Previous studies demonstrated a clear association of CAD in the Swiss population with a polymorphism in the Cx37 gene, leading to a predicted change in the C-terminus of the other endothelial connexin. Therefore, connexin polymorphisms affecting channel function may be of greater importance for cardiovascular disease than polymorphisms affecting the expression level of the protein.
The impact of physical activity intensity on microvascular function, autonomic tone and exercise capacity in healthy adolescents


Introduction: Physical activity (PA) is inversely associated with clustering of cardiovascular disease (CVD) risk factors in children and adolescents. We examined the impact of PA on surrogate markers of cardiovascular health in healthy adolescents.

Methods: In a prospective, cross-sectional study, 52 adolescents (28 females, mean age 14.5 ± 0.7 years, BMI 20.1 ± 2.5 kg/m²) were investigated. Microvascular function was assessed by peripheral arterial tonometry to determine the reactive hyperemic index (RHI). Autonomic tone was assessed by time-domain analysis of heart rate variability and vagal activity was measured using the root mean square of successive normal-to-normal intervals (RMSSD). Cardiopulmonary exercise testing was performed to determine peak oxygen uptake (VO₂peak) and maximum power output. PA was assessed by accelerometry for 8 consecutive days. We applied two different models and dichotomized the cohort into two activity groups (low vs. high) based on a daily time spent in moderate-to-vigorous PA (MPA, 3000–5200 counts.min⁻¹, model 1) and vigorous PA (VPA, >5200 counts.min⁻¹, model 2). Data were adjusted for age, sex, skinfold, and pubertal status.

Results: In a multivariate regression analysis MVPa was an independent predictor for RMSSD (β = 0.416, P = 0.022), and VPA was independently associated with maximum power output (β = 0.10, P = 0.009). In model 1, the high MPA group exhibited a higher vagal tone (RMSSD 49.9 ± 12.9 vs. 38.4 ± 12.4 ms, P = 0.006) and a lower systolic blood pressure (106.7 ± 9.8 vs. 113.2 ± 7.0 mm Hg, P = 0.031). In comparison, in model 2, the high VPA group had higher maximum power output values (3.8 ± 0.6 vs. 3.5 ± 0.6 watt kg⁻¹, P = 0.010). In both models, no significant differences were observed for RHI and VO₂peak.

Conclusions: Healthy normalweight adolescents, PA intensity reveals different beneficial effects on cardiovascular health-related parameters. In particular, MVPa had favorable effects on vagal tone and systolic blood pressure, whereas VPA contributes to an improvement in exercise capacity.

Acute hemodynamic response to finnish sauna and cold water immersion in patients with heart failure


Introduction: Finnish sauna is popular in heart patients, however the hemodynamic response to this type of heat exposure and subsequent cold-water immersion (CWI) in patients with heart failure is unknown.

Methods: Hemodynamic response to two consecutive Finnish sauna (80 °C) exposures for 10 minutes each, followed by a final head-out CWI (12 °C) was measured in 37 male participants: 12 with chronic heart failure (CHF) (61.8 ± 9.2 yrs, EF 30.6 ± 7.3%, NYHA class II–III), 13 with coronary artery disease and preserved EF (CAD, 61.2 ± 10.6 yrs, EF 57.7 ± 7.7%) and 12 control subjects (60.9 ± 8.9 yrs, EF 64.2 ± 3.6%). Cardiac output (CO), inert gas rebreathing system, Innocor® and heart rate were measured prior to and immediately after the first sauna exposure as well as after CWI, respectively. Blood pressure was measured before, twice during (3 and 6 min) and after sauna.

Results: Sauna and CWI were well tolerated by all subjects. CO and heart rate significantly increased in all groups after sauna exposure and CWI (p < 0.05), except for CAD patients after sauna exposure. Systolic blood pressure during sauna decreased significantly in all groups with a minimal value after 6 minutes (133.5 ± 16.5 mm Hg to 119.8 ± 13.5 mm Hg in controls, 113.4 ± 11.0 mm Hg to 99.1 ± 15.5 mm Hg in CAD and 101.2 ± 11.3 to 93.6 ± 13.6 mm Hg in CHF patients, all p < 0.05). CWI significantly increased systolic blood pressure in all groups (117.4 ± 13.1 mm Hg to 133.7 ± 12.6 mm Hg in controls, 97.0 ± 14.3 to 116.3 ± 13.6 mm Hg in CAD and 94.0 ± 15.7 to 110.1 ± 20.8 mm Hg in CHF patients, all p < 0.05).

Conclusions: Acute exposure to Finnish sauna and subsequent CWI increases CO and HR in CHF patients similarly to control subjects. Blood pressure decreases modestly during heat exposure without eliciting symptoms. No significant arrhythmias were registered during sauna and CWI.

The metabolic syndrome significantly affects the association between resting heart rate and all cause as well as cardiovascular mortality


Epidemiological studies suggest that the resting heart rate (RHR) is an independent predictor of cardiovascular and all cause mortality. However, the power of the RHR to predict cardiovascular events in patients with the metabolic syndrome (MetS) is not known. We prospectively investigated the relationship between RHR and cardiovascular events in 756 consecutive patients undergoing coronary angiography for the evaluation of coronary artery disease (CAD) over a follow-up period of 7.1 ± 0.1 years. The MetS was defined according to NCEP-ATPIII criteria. In this study population, both all cause and cardiovascular mortality were increased with an increasing RHR (standardised adjusted HRs 1.03 [1.01–1.04]; p = 0.001 and 1.15 [1.03–1.47]; p = 0.001, respectively). From our patients, 357 (47.2%) had the MetS and 399 did not have the MetS. Among patients without the MetS, a higher baseline RHR indicated a significantly higher risk of total mortality (HR = 1.14 [1.11–1.16]; p = 0.001) and cardiovascular mortality (HR = 1.13 [1.12–1.16]; p = 0.001) after multivariate adjustment. However, the RHR did not significantly affect total mortality (p = 0.120) or cardiovascular mortality (p = 0.244) in patients with the MetS. Interaction terms RHRxMetS were significant for both total and cardiovascular mortality (p = 0.027 and p = 0.037, respectively), indicating that the respective risks conferred by a high RHR were significantly higher in patients without the MetS than in patients with MetS. We conclude that among angiographically characterized coronary patients, the metabolic syndrome status significantly affects the association of the RHR with total and cardiovascular mortality.

Serum omentin is neither associated with the metabolic syndrome nor with angiographically determined coronary artery disease

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Some recent small studies have described associations of the new adipocytokine omentin with the metabolic syndrome (MetS) and with cardiovascular disease. However, data still are very scarce. We therefore measured serum omentin in 395 patients undergoing coronary angiography for the evaluation of established or suspected stable CAD. The MetS was defined according to NCEP-ATPIII criteria; significant CAD was diagnosed when coronary stenoses >50% were present. Omentin was positively correlated with age (r = 0.170; p < 0.001) but did not show significant correlations with waist circumference, fasting glucose, HDL cholesterol, triglycerides, systolic blood pressure, or diastolic blood pressure; it was similar in MetS patients (n = 118) as in subjects without the MetS (15 ± 21 vs. 14 ± 15 ng/ml; p = 0.460). Omentin also did not differ significantly between patients with significant CAD (n = 190) and those without significant CAD (14 ± 19 vs. 15 ± 15 ng/ml; p = 0.253). When both, MetS and CAD status were considered, omentin similar in MetS patients as in subjects without the MetS both among those who had significant CAD (15 ± 13 vs. 15 ± 13 ng/ml; p = 0.482) and among those who did not have significant CAD (16 ± 30 vs. 14 ± 15 ng/ml; p = 0.876); it further did not differ significantly between patients with significant CAD and subjects without significant CAD among MetS patients (0.351) nor among subjects without MetS (p = 0.452). We conclude that omentin is neither associated with the MetS nor with angiographically determined CAD. Omentin therefore does not appear to be a useful marker of cardiometabolic disease.
Birth weight per se is not a determinant of systemic vascular function in humans

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Background: Epidemiological studies suggest that low birth weight (BW) is associated with systemic vascular dysfunction and premature cardiovascular morbidity and mortality later in life. However, this association could be due to other confounding factors such as genetic factors, pathological events during intrauterine life, and maternal and early-life environmental events. Studies of monzygotic twins provide an unique opportunity to control for these factors, allowing to directly study the effect of low BW per se on systemic vascular function.

Methods: We, therefore, measured flow-mediated dilation (FMD) of the brachial artery, carotid-femoral pulse wave velocity (PWV) and carotid intima-media thickness (IMT) in 13 monzygotic, monochorionic healthy twins pairs (mean age 13.5 ± 3.4y) with significantly different birth weight (defined as >20% within pairs, ± 360 g). None of the participants had suffered from intrauterine or perinatal complications.

Results: The major new finding was that systemic vascular function between the low and the high BW twins was comparable (FMD: 9.0 ± 1.8 vs 8.7 ± 2.0%, P = 0.30; PWV: 6.5 ± 1.3 vs 6.6 ± 0.9 m/s, P = 0.62; IMT: 390 ± 30 vs 390 ± 20 µm, P = 0.23) and even more importantly, systemic vascular function in twins was similar to the one in controls (FMD: 8.8 ± 1.3 vs 8.9 ± 1.8%, P = 0.96; PWV: 6.5 ± 1.1 vs 6.6 ± 1.2 m/s, P = 0.80; IMT: 390 ± 25 vs 385 ± 20 µm, P = 0.33). Finally, there existed no significant relationship between birth weight and vascular function in the whole study population (FMD: r = 0.001, P = 0.99).

Conclusions: This study provides the first direct evidence that BW per se is not a determinant of systemic vascular function (and cardiovascular risk later in life) in humans. We suggest that the associations between BW and cardiovascular risk reported in earlier epidemiological studies was related to other confounding factors.

Impact of prenatal diagnosis of congenital heart disease on neonatal outcome in a regional case controlled study (Canton of Vaud, Switzerland)

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Introduction: This study reports on the outcome of a fetal cardiac screening program in the Swiss canton of Vaud from 1.5.2003 to 31.12.2008. Methods: 40’567 births were registered in Eurocat registry, 572 cases of congenital cardiac pathology (CCP) were reported. Cardiac abnormalities were sorted in four separate categories based on the severity of the CCP.

Results: 126 of the 572 CCP were referred to the 4 defined groups considered major cardiac congenital malformations. Prenatally diagnosed in this population were 83/126 detection rate 67%.Group I (32 cases), all CCP for which only palliative care is available, 28 were detected antenatally (28/32, 87.5%), resulting in TOP in 24 (85.7%), 3 were diagnosed at birth. Of the 7 live birth 4 died (comfort care), 3 went on to be operated. Group 2 (6 cases) severe heart disease requiring immediate postnatal. Of the 4 detected prenatally, 2 had associated chromosomal anomaly and underwent TOP. The 2 other prenatally diagnosed and 1 non-diagnosed underwent an arterial switch. Another non-diagnosed TGA died within 2 hours after birth during transport. Group 3 requiring immediate postnatal care but deferred surgical or interventional correction like conotruncal anomalies: AVSD) 52 cases were included in the Eurocat register, of these 36/52 were detected prenatally (69.2%). 34/52 had a chromosomal anomaly. There were 22 TOP (21 chromosomal abnormal), 28 born alive, 2 stillbirths. Of the 28 born alive, 26 had a surgical correction, 1 died shortly after birth (pulmonary atresia type of Fallot) and 1 (with VACTERL) received palliative care and died subsequently. Group 4: The group consisted of 38 cases of pathologies needing a follow-up such as Ebstein’s disease, large perimembranous VSDs, coarctation, aortic stenosis. Prenatal diagnosis 15/38, TOP in 10 cases (associated with chromosomal/ syndromal anomalies or other malformation) 28 were born alive.

Conclusion: This study shows that the percentage of prenatal diagnosed cases of congenital heart disease increases over the years, probably as a result of increasing experience, improving technology and intensive teaching. The study shows that in the most severe group of congenital heart disease the percentage of interruption of pregnancy reaches 86% in the prenatal diagnosed group. TOP were associated with severe heart diseases or heart disease combined with chromosomal/syndromal/other anomalies.

Effects of a multifaceted cardiac rehabilitation programme in the real life and clinical implications

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Background: Various studies show that multidisciplinary rehabilitation programmes including physical training, nutritional counselling and risk factor management for patients with cardiac disease result in behavioural change and improve both quality of life and physical performance. To what extent these results can be translated into clinical practice is less well understood.

Purpose: To measure changes in nutrition habits, smoking habits, wellbeing, self-perceived physical fitness and physical performance of patients with various cardiac diseases attending a multidisciplinary cardiac rehabilitation programme in a regional outpatient cardiological rehabilitation centre in Switzerland. To study variability of effects in female and elderly patients.

Methods: 485 consenting patients (mean age: 61.6 years [±10.5], 397 [81.9%] male) attending a cardiac rehabilitation programme were asked to complete a questionnaire before and after a 3-month outpatient cardiac rehabilitation programme of 36 sessions. We also assessed physical performance before and after rehabilitation. We tested changes from baseline statistically and investigated whether the patients’ age and gender had an influence in the rehabilitation effects.

Results: Patients reduced the intake of unhealthy food by –2.41 score points (95%CI –2.74 to –2.08; p <0.001) and increased their intake of healthy food by 2.47 score points (95%CI 2.16 to 2.78, p <0.001). WeHDL increased by 1.49 score points (95% CI 1.33 to 1.65, p <0.001) and self-perceived physical fitness increased by 2.52 score points (95% CI 2.22 to 2.82, p <0.001). The 6-minute walking test increased by 107.57 metres (95% CI 99.55 to 116.09, p <0.001) and exercise capacity increased by 0.32 watt/bodyweight (kg) (95% CI 0.29 to 0.35, p <0.001). Elderly patients tended to be less willing to change nutritional behaviour. Gender had no influence on changes in the five domains investigated.

Conclusions: Our multidisciplinary rehabilitation programme can be successfully implemented in clinical practice and has similar beneficial effects to those reported in clinical trials. Our results encourage broad implementation of such programmes in clinical practice.

Secular trends in women with acute coronary syndrome referred to coronary artery angiography: a 15-year observation of the university hospital Berne

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Introduction: It is suggested that the rate of young women suffering from Acute Coronary Syndrome (ACS) is increasing. We therefore investigated our invasive cardiology database to assess secular trends in the incidence of first ACS and CV risk factors in women classified into different age-groups over the last 15 years (1995 to 2010).

Methods: We extracted data of all women with coronary angiography between 1995 and 2010 for a first ACS event on age, cardiovascular risk factors, hypertension, diabetes mellitus, dyslipidemia, family history, and obesity. In the age groups 20–49 years, 50–59 years, 60–69 years, 70–79 years, and 80–89 years, we calculated numbers of first ACS per year and proportion of first ACS per year with regard to the female population (according to data from the Swiss Federal Institute of Statistics) of the referring area (Cantons of BE, SO, FR, and NE). We also calculated the proportion of women with first ACS with CV risk factors. To assess
temporal trends within age groups, we performed linear regressions of absolute and relative numbers of first ACS versus time, as well as risk factors versus time.

**Results:** Absolute and relative time trends showed significant linear increases for all age groups for absolute as well as relative numbers of first ACS events (all p < 0.01, figures 1a and 1b). While the increase in the group of the 20–49 year old women was small in absolute and relative numbers, from 1995 to 2010 it was almost 5-fold, compared to a 3- and 2-fold increase in the 50–59 yrs and 60–69 yrs age groups, respectively. The increase between 1995 and 2000 in the older age-groups was most probably influenced by a change in indication with the advent of PCI. Temporal trends with regard to risk factors showed a significant increase in smoking and obesity in the 60–69 yrs age group.

**Conclusions:** Our results confirm that there was a small but significant increase of ACS in 20–49 year-old women which, relative to the incidence in 1995, was considerably greater than the increase in the 50–59 yrs and 60–69 yrs age groups. Increases in first ACS in the 60–69 year old women may have been linked to increased prevalence of smoking and obesity.

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Cardiovascular risk assessment and effects on behaviour in a population of Swiss volunteers – results from a "HerzCheck" campaign population
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**Introduction:** Risk factor assessment and preventive strategies for cardiovascular events are a major goal in health care. The "Arbeitsgruppe Lipide und Atherosklerose" (AGLA) from the "Schweizerische Gesellschaft für Kardiologie" (SGK) published the AGLA-Risk-Score (ARS) that has been used for cardiovascular risk assessment of volunteers in Swiss pharmacies ("HerzCheck"). The aim of this study was to evaluate if this test risk stratified the participants and if it had impact on their behaviour.

**Methods:** In the "HerzCheck" campaign of the SGK trained pharmacy personnel of 174 pharmacies all over Switzerland tested a large series of volunteers. Participants underwent blood pressure measurements, body waist circumference, random venous blood samples and were asked about their recent medical history preceding the acute event. Preliminary data

**Results:** A total of 748 volunteers (male 59.9%) with a mean age of 62.7 (±12.8) years participated in the follow-up. The cardiovascular risk throughout the study-population turned out to be low: 4.4% had a high ARS >20%, 21.7% an intermediate ARS 10–20% and 73.9% had a low ARS <10%. Significantly more participants with ARS >20% consulted their family doctor because of the test results (46.2%) or informed him during a routine visit (64.0%) in comparison to the lower risk groups with ARS 10–20% (25.2%/29.1%) and ARS <10% (10.4%/18.8%), respectively (p < 0.01 for all comparisons). The number of smokers at baseline was higher than at follow-up, 10.3% and 7.3%, respectively (p <0.001). 36.2% mentioned to have changed their dietary habits. The event rates increased as a function of ARS (fig. 1).

**Discussion:** "HerzCheck" provides risk stratification with respect to future cardio-vascular events. The event rate increased as a function of ARS. "HerzCheck" seems to have impact on individual behaviour and life style modification.

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Triggers for Acute Myocardial Infarction two months before the acute event. Preliminary data

**Introduction:** Most cases of acute myocardial infarction (AMI) are caused by disruption of an atherosclerotic plaque with subsequent formation of an occluding thrombus. The trigger that may lead to the disruption of the plaque is often an external activity associated with increased sympathetic stimulation. A recent paper has highlighted the association of a recent mourning in the next of kins as a significant event anticipating AMI. Our running prospective/retrospective study aims to investigate, through a dedicated questionnaire in patients undergoing outpatient cardiac rehabilitation (OCR) in two swiss rehabilitation centers (Ticino end Basel Stadt), the possible physical and psychological triggers for AMI within the two months preceding the acute event.

**Methods:** Multicenter, retrospective study. Between 01.05.2011 and 31.12.2013, 500 patients with documented new onset of AMI who undergo OCR are invited to complete a questionnaire on their recent medical history preceding the acute event: infective disease, emotional stress (new job, problem with job, car accidents, familiar problem), dentist visit, surgery therapy.
and mourning among others. Patients with Tako-Tsubo cardiomyopathy are excluded from the study.

**Results:** Between 01.09.2011 and 15.01.2012, questionnaire of 42 patients (31 male, age 62.8 ± 10 years) were evaluated. Of 42 patients, 52% were smokers. A total of 28 patients presented serum level, and 40% did not know the value of their arterial pressure before the event. Ten patients (23.8%) have visited a dentist and ten patients have suffered a psychologic stress in the two months preceding the AMI: among them, one medical doctor patient has suffered of an AMI four hours after the death of his wife.

**Conclusion:** Our very preliminary results indicate that the study design may probably help in identifying possible triggers of AMI. To our knowledge this is the first study addressing the issue of triggers of AMI using an ad hoc questionnaire concerning the two months before the acute event.

**P258**

**Association between Parity and Blood Pressure – Results of the Swiss Cohort Study on Air Pollution and Chronic Disease in Adults (SAPALDIA)**


**Introduction:** Pregnancy is considered a "stress test" for cardiovascular diseases (CVD). While gestational diabetes or eclampsia is clearly associated with increased risk of CVD, studies on impact of uncomplicated pregnancies are rare and inconsistent. We aimed to investigate the association between parity and blood pressure in women participating in the SAPALDIA cohort, making use of a women’s health questionnaire collecting information on parity and on pregnancy complications in the third follow-up in 2010/11.

**Results:** Of the study sample, 26% of the women were nulliparous and 29% were hypertensive. Parous women had given birth to a mean of 2.3 children (range 1–7). In hypertensive women, parity (reference: nulliparity) was associated with an increase of SBP (2.9 mm Hg, 95% CI: 0.2; 6.1) and PP (2.5 mm Hg, 95% CI: 0.16; 4.8), and in non-hypertensive women with a decrease in SBP (–1.5 mm Hg, 95% CI: –2.7; –0.25) and PP (–0.96, 95% CI: –1.8; –0.11). No significant effects were found for DBP. The increase in SBP and PP was particularly high in women with ≥6 children both in the full sample (SBP 16.8 mm Hg, 95% CI: 8.1; 25.4; PP 14 mm Hg, 95% CI: 8.3; 19.7) and in hypertensive women (SBP 37 mm Hg; 95% CI: 14;60; PP 28.1 mm Hg, 95% CI: 12.3; 43.8). Age stratification yielded weaker associations in younger women. We found a significant positive interaction between parity and use of anti-hypertensives. Women with higher parity were slightly less likely to report medication use.

**Conclusion:** Our results support prior findings on adverse effects of parity, particularly higher parity, on blood pressure. A new finding is the opposite effect in non-hypertensive women, parity being associated with a decrease in blood pressure. Additional data on gestational complications, which we plan to present, will improve our understanding of our findings and the association of parity and blood pressure.

**P259**

**Comparative cost-effectiveness analyses of magnetic resonance imaging and coronary angiography combined with fractional flow reserve test**

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**Introduction:** Patients with coronary artery disease (CAD) should undergo revascularization if myocardial ischemia is present. While coronary angiography (CXA) allows the morphological assessment of CAD, the fractional flow reserve (FFR) has proved to be a complementary invasive test to assess the functional significance of CAD, i.e. to detect ischemia. Perfusion Cardiac Magnetic Resonance (perfusion-CMR) has turned out to be a robust non-invasive technique to assess myocardial ischemia.

The objective is to compare the cost-effectiveness ratio – defined as the costs per patient correctly diagnosed – of two algorithms to diagnose CAD depends on the prevalence of the disease. The aim of the present analysis is to compare the cost-effectiveness ratio for both algorithms for hypothetical patient cohorts with different pretest likelihood of CAD.

**Methods:** We ran linear regression analyses in 2837 women (age 28–72) with standardized blood pressure measurements and reported data on parity, adjusting for main confounders and including main determinants of hypertension. Main outcomes were systolic (SBP) and diastolic blood pressure (DBP) and pulse pressure (PP). We performed stratified analyses by hypertension status and age (<50/>50 yrs.) and tested interaction between medication use and parity. Hypertension was defined on the basis of reported physician diagnosis, SBP >140 mm Hg, diastolic >90 mm Hg in clinical exam or anti-hypertensive use.

**Results:** In the study sample, 26% of the women were nulliparous and 29% were hypertensive. Parous women had given birth to a mean of 2.3 children (range 1–7). In hypertensive women, parity (reference: nulliparity) was associated with an increase of SBP (2.9 mm Hg, 95% CI: 0.2; 6.1) and PP (2.5 mm Hg, 95% CI: 0.16; 4.8), and in non-hypertensive women with a decrease in SBP (–1.5 mm Hg, 95% CI: –2.7; –0.25) and PP (–0.96, 95% CI: –1.8; –0.11). No significant effects were found for DBP. The increase in SBP and PP was particularly high in women with ≥6 children both in the full sample (SBP 16.8 mm Hg, 95% CI: 8.1; 25.4; PP 14 mm Hg, 95% CI: 8.3; 19.7) and in hypertensive women (SBP 37 mm Hg; 95% CI: 14;60; PP 28.1 mm Hg, 95% CI: 12.3; 43.8). Age stratification yielded weaker associations in younger women. We found a significant positive interaction between parity and use of anti-hypertensives. Women with higher parity were slightly less likely to report medication use.

**Conclusion:** Our results support prior findings on adverse effects of parity, particularly higher parity, on blood pressure. A new finding is the opposite effect in non-hypertensive women, parity being associated with a decrease in blood pressure. Additional data on gestational complications, which we plan to present, will improve our understanding of our findings and the association of parity and blood pressure.

**P260**

**Age-related variations of diastolic parameters assessed by Doppler echocardiography and phase-contrast cardiac magnetic resonance in healthy volunteers**


**Background:** Recent data suggest that velocity and flow-related diastolic parameters obtained by phase-contrast cardiac magnetic resonance (PC-CMR) show a good correlation with Doppler echocardiography (DE). Furthermore, DE diastolic parameters are known to vary with aging. The aim of the present analysis is to assess whether the age-related variation of diastolic parameters is comparable when assessed by DE and PC-CMR.
Methods: Forty-six healthy volunteers (22 males [48%], mean age 43 ± 17, range 19–77 years old) underwent left ventricular diastolic function assessment by DE and PC-CMR on the same day. Transmitral E(DE) and A(DE) and lateral mitral annulus E›(DE) peak velocities were assessed by DE. PC-CMR data were analysed using a custom software designed for a semi-automated extraction of mitral flow-rate curves and the myocardial velocity curves. Then, PC-CMR diastolic parameters such as transmitral E(CMR) and A(CMR) peak flow rates and early E›(CMR) peak myocardial diastolic longitudinal velocity were extracted. E›(DE)/A›(DE) peak velocities were assessed by DE. PC-CMR data were analysed using a custom software designed for a semi-automated extraction of mitral flow-rate curves and the myocardial velocity curves. Then, PC-CMR diastolic parameters such as transmitral E(CMR) and A(CMR) peak flow rates and early E›(CMR) peak myocardial diastolic longitudinal velocity were extracted.

Results: Mean values of diastolic parameters by DE were: E(DE) 76 ± 21.9 cm/s; A(DE) 60.5 ± 38.9 cm/s; E›(DE)/A›(DE) 1.7 ± 1.5. Mean values of PC-CMR diastolic parameters were: E(CMR) 288.4 ± 104.4 ml/s; A(CMR) 232.7 ± 82.6 ml/s; E›(CMR) 9.9 ± 4.4 cm/s; E›(CMR)/A›(CMR) 1.3 ± 0.6. There was a good correlation between E›(DE)/A›(DE) and E›(CMR)/A›(CMR) ratios (r = 0.77, p < 0.001) as well as between E›(DE) and E›(CMR) velocities (r = 0.68, p < 0.001). Furthermore, correlations between age and diastolic parameters were similar for both techniques (fig. 1).

Conclusion: Our results suggest a very good correlation of diastolic parameters in healthy volunteers as assessed by DE and PC-CMR. Furthermore, age-related variations of diastolic parameters appear to be comparable for both techniques.

Relationship of tricuspid annulus dimensions and right ventricular volumes assessed by cardiac magnetic resonance

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Purpose: Cardiac magnetic resonance (CMR) is considered as the method of reference for assessment of right ventricular (RV) volumes. However, delineation of the RV boundary remains difficult and cumbersome. The tricuspid annulus (TA) is a component of the RV which can be promptly measured, and is independent from anatomic variants of RV morphology. Thus, TA measurements could serve as potential surrogates for assessment of RV volume.

The aim of the present analysis is to describe the relationship between RV volumes and TA diameters as assessed by CMR.

Methods: Eighty-five healthy volunteers (42 ± 16 years, 68% male) underwent a CMR exam at 1.5T with ECG-gated steady-state free precession (SSFP) cine sequences. Cine images were acquired in short-axis, 4-chamber (4C) and 2-chamber (2C) views with complete coverage of both ventricles. QMass (MEDIS) software was used to assess end-diastolic and end-systolic RV volumes and to measure the maximum diastolic and the minimum systolic diameters of the TA in both 4C and 2C views. Mean maximum and minimum TA diameters were calculated. Relationships between TA diameters and RV volumes were studied using linear regression analysis.

Results: RV end-diastolic and end-systolic volumes were respectively 140 ± 39 ml [range 56–272] and 56 ± 19 ml [range 17–128]. Maximum diastolic 4C, 2C and mean maximum diameters of TA were respectively 35.8 ± 5.4 mm [range 25–49], 45.8 ± 6.3 mm [range 21–68] and 40.8 ± 4.3 mm [range 31–50]. Minimum systolic 4C, 2C and mean minimum diameters of TA were respectively 28.7 ± 4.3 mm [range 20–39], 40.1 ± 6.2 mm [range 16–54] and 34.4 ± 3.9 mm [range 26–43]. Univariate and multivariate analyses showed that maximum diastolic 4C, 2C and mean maximum diameters of TA were associated with end-diastolic RV volume (respectively r = 0.50, p < 0.0001; r = 0.52, p < 0.0001; r = 0.69, p < 0.0001, fig. 1), while minimum systolic 4C, 2C and mean minimum diameters of TA were associated to end-systolic RV volume (respectively r = 0.50, p < 0.0001; r = 0.50, p < 0.0001; r = 0.67, p < 0.0001, fig. 2), independently of age, gender, weight, height and systolic blood pressure. Overall, mean TA diameters showed stronger correlations with RV volumes than 2C and 4C TA diameters.

Conclusions: In healthy volunteers, CMR measurements of TA are strongly associated with RV volumes, independently from age, gender, body size and blood pressure. These parameters, which are simple and readily available, may serve as potential surrogates for assessment of RV volumes.

Success and complications of 1005 consecutive cardiac catheterization for congenital heart disease

S. Di Bernardo, T. Boulos-Ksontini, Y. Mivelaz, M. Bernath, N. Sekarski (Lausanne)

Introduction: Cardiac catheterization has become a cornerstone of the treatment and care of patient with congenital heart disease (CHD). Over the years, cardiac catheterization had swept from a diagnosis tool to a hemodynamic and therapeutic tool. Objective of this study was to describe the patient who had a cardiac catheterization in our center, to identify complications and to identify risk factors for complications.

Methods: Retrospective review of the registry of cardiac catheterization in children of our center. All patients that had a cardiac catheterization in the pediatric age between 2004 and 2011 were included. In order to identify risk factors for complications (major and minor); types of cardiac catheterization, duration of intervention, age at intervention, have been recorded.
and then categorized. Correlation and odds ratio have been calculated, first in a univariable model and then in a multivariable model with backward increment.

Results: 1005 patients were included, median age 3.4 (IQR: 0.6–8), median weight 13 kg (IQR: 6–22). 561 patients (55%) had a hemodynamic evaluation and 444 patients (45%) had an interventional procedure, of whom 54 patients with a hybrid intervention (12%). Median time of intervention was 65 min (IQR 47–90), median irradiation dose was 9.5 cGycm² (IQR 5–19) and median contrast dose was 3.5 ml/kg (IQR 2.5–4.8). Complications were registered in 85 patients (8.5%). Major complications, where a medical treatment has to be continued after the end of the intervention or where a surgical or new catheterization was necessary, occurred only in 20 patients (2.0%), death occurred in 3 patients (0.3%). Regarding the type of cardiac catheterization major complications occurred in 7 patients (35%) during a hemodynamic evaluation and in 13 patients (65%) during an interventional catheterization. Risk factors for any complication were an interventional catheterization (OR 1.7, 95%IC 1.2–2.7) and prolonged duration of procedure >60 min (OR 4.595%IC 2.8–8.4).

Conclusion: Although the complexity of patients with CHD is increasing, cardiac catheterization is a safe procedure in children. Rate of complications is comparable to the ones published in the literature and major complications that will need a medical intervention are rare. Risk factors for a complication are not surprisingly related to interventional catheterization and duration of the procedure.

Effect of long-distance running on left atrial mechanical function
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Introduction: The intensity of endurance training and the number of long-distance races (LDR) have emerged as risk factors for left atrial (LA) dilation, which is related to the occurrence of atrial fibrillation (AF). The link between the substrate of AF (LA dilation) and LA mechanical function is not known.

Methods: Forty-seven healthy amateur endurance runners were divided in 3 groups according to their number of LDR (marathon, ultra marathon, triathlon, mountain marathon): none (n = 15), 1-9 (n = 17) and >9 (n = 15). A complete transthoracic echocardiography was performed. High frame rate 2D loops of the LA in 3 apical views were acquired and analyzed off line using speckle tracking imaging. LA global strain was calculated as the spatial average of the 3 views. Two temporal LA mechanical functions were distinguished using strain (fig. 1): LA contraction (pump) and LA conduit function during left ventricular (LV) peak systole.

Results: There was a trend to higher LV mass and larger LA size from group 1 to 3: 98 ± 4.1, 105 ± 5.8 vs. 115 ± 5 g/m² (p = .071), and 24 ± 1.6, 28 ± 2.1 vs. 28 ± 1.6 ml/m² (p = .072). Between the groups, there were no differences in age (42 ± 2.2, 42 ± 1.9 vs. 44 ± 2.3 Years, p = .689) and LV diastolic function (Peak E’ septal: 10 ± .3, 10 ± .5 vs. 10 ± .6 cm/s, p = .526). Heart rate (HR) declined between group 1 and 3 (58 ± 1.7, 53 ± 1.9 vs. 49 ± 1.8 / min, p = .006), and the amount of training in the last 3 months increased (3 ± .5, 5 ± .4 vs. 7 ± .9 hours per week, p = .002). More vs. less intensely trained runners had a weaker LA pump function (–16 ± .8, –15 ± .6 vs. –14 ± .8%, p = .041) without a difference in LA conduit function (22 ± 1, 22 ± 1.1 vs. 22 ± 1.9%, p = .978). No correlation was present between LA functions and size (Beta = .203, p = .172) or the number of LDR (Beta = .232, p = .117). Using multivariate regression analysis, the predictors of LA pump function were HR and diastolic function (Beta = −.44, p = .001; Beta = .30, p = .021; RF = .33); LA conduit function was determined by age and HR (Beta = −.61, p = .001; Beta = −.35, p = .021; RF = .32) (fig. 2).

Conclusions: More as compared to less intensely trained endurance runners need less LA contraction for LV filling: their lower HR leads to augmented passive LV filling as shown by the inverse relation of pump and conduit function according to HR. The link between the substrate of AF (LA dilation) and LA function could not be uncovered due to the difference in HR between the groups with its strong impact on LA pump and conduit function.

Assessment of diastolic function from velocity-encoded cardiac magnetic resonance data in patients with hypertrophic cardiomyopathy

Background: Recent data suggest that velocity and flow rate-related diastolic parameters obtained by phase-contrast cardiac magnetic resonance (PC-CMR) are accurate for the evaluation of left ventricular (LV) diastolic function. The aim of the present study is to assess the value of these parameters in patients with hypertrophic cardiomyopathy (HCM).

Methods: CMR was performed in 26 patients with HCM and 24 healthy volunteers matched for age, gender, body surface area and blood pressure. Diastolic parameters were obtained using a
Aortic distensibility independently predicts exercise capacity in adults with repaired conotruncal defect


Introduction: Histologically detectable structural abnormalities of the media aorta are commonly seen in the ascending aortic wall of patients with conotruncal defects, i.e. tetralogy of Fallot (TOF) and complete transposition of the great arteries (d-TGA).

Using cardiac magnetic resonance imaging (MRI), we recently documented a decreased distensibility of the ascending aorta and increased aortic diameters in these adult patients compared to healthy controls. We hypothesize that impaired aortic distensibility increases the afterload burden for the subaortic ventricle and compromises its ability to generate adequate cardiac output, particularly during exercise.

Methods: Exercise capacity was assessed by cardiopulmonary exercise testing in 26 adults with d-TGA and an atrial switch procedure, and 35 adults with repaired TOF, and analyzed in relation to the patients’ characteristics, the ejection fraction of the subaortic ventricle at rest, and the ascending aortic distensibility. Cardiac MRI for measurement of ejection fraction and aortic diameters was performed in adults with d-TGA at baseline and at follow-up. Aortic diameters were measured by phase-velocity magnetic resonance in congenital heart disease

Benchmarking the accuracy of pulmonary perfusion measurements by phase-velocity magnetic resonance in congenital heart disease


Background: Phase-velocity magnetic resonance (PV-MR) is more accurate for the evaluation of pulmonary perfusion ratios than lung perfusion scintigraphy in patients with congenital heart diseases. However, detailed information about the accuracy and long-term reproducibility of this method is still missing. The aim of this study was to determine the accuracy and long-term reproducibility of consecutive pulmonary blood flow measurements using PV-MR.

Methods: We studied two different patient groups with two consecutive PV-MR measurements of the right and left pulmonary artery. We used the right pulmonary to total pulmonary blood flow (RPA-ratio) as representative value for the pulmonary blood flow ratio. The negative group consisted of 99 cases without intervention in the RVOT between the two consecutive measurements. The positive group consisted of 11 cases with an explicit unilateral morphological change in the right ventricular outflow tract (RVOT), due to e.g. a dilatation of one pulmonary artery.

Results: In the negative group flow measurements provided highly repeatable and accurate results for the RPA-ratio: 95% of the measurements were within 10% variance to each other (mean time between measurements 13 months). The positive group presented clear changes in the RPA-ratio: 82% of the measurements detected more than 10% variance to each other (mean time between measurements: 9 months). The positive group consisted of 11 cases with an explicit unilateral morphological change in the RVOT between the two consecutive measurements.

Conclusions: A measured change of pulmonary perfusion ratios of about 10% is synonymous with a clinically relevant unilateral change in pulmonary perfusion. These established values can be used to detect and assess changes in pulmonary perfusion ratios.
Cardiac MR in acute dilated cardiomyopathy in children: a support for therapy guidance?
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Introduction: Acute dilated cardiomyopathy (DCM) is a rare disease in children. Most of cases are secondary to myocarditis, even if in few patients the etiology could be genetic or secondary to a drug side effect like anthracycline. Unfortunately the diagnosis is often made when the systolic function is already impaired and a substantial increase of symptoms, heart failure, or sudden death. Cardiac Magnetic Resonance (CMR) normally adds information with a precise volumetric measurement of the systolic function and with the technique of late gadolinium enhancement (LGE), inflammation and necrosis can be visualized. The scope of the study was to depict if CMR in children allows discriminating myocarditis from other causes of dilated cardiomyopathy.

Methods: All pediatric cases presenting a new diagnosis of dilated cardiomyopathy that underwent a CMR study for suspected myocarditis were reviewed. CMR reports and charts of the patients were reviewed including: initial complaint, CMR, echocardiogram findings and final diagnosis.

Results: From 2009 to 2011, 11 children were referred with a history and clinical signs of acute or progressive heart failure. Mean age was 9.7 years-old (range: 30 days-18 years). In all patients echocardiography showed left ventricular dilatation, with decreased (N = 7) or low normal systolic function (N = 4, 36%) (mean EF 44%, range: 15–59%), pericardial effusion was present in 3 (17%). CMR showed left ventricular dilatation in 10 patients (91%), decreased systolic function in 8 (73%) and low normal or normal left ventricular function in 3 (17%). LGE was present in 5 patients (45%) located in the subepicardium confirming the clinical suspicion of myocarditis. LGE was present in 1 patient (9%) in the subendocardium, highlighting ischemia as an origin of DCM. In the remaining 5 patients (45%) no LGE was seen and further investigation was performed. Two patients had a confirmed genetic origin, two a toxic cause and one a possible pulmonary syndrome.

Conclusion: LGE CMR is a new imaging tool allowing tissue characterization in a pediatric population of newly diagnosed DCM. CMR is a safe, reproducible technique without any X-ray exposure. These preliminary results are of clinical interest as they allow discriminating myocarditis from ischemia and from other causes of DCM. CMR examinations that detect inflammatory lesions can guide the clinician for appropriate support therapy.

Left ventricular non compaction: prevalence in various types of congenital heart disease

Introduction: Left ventricular non-compaction cardiomyopathy (LVNC) is a rare cardiomyopathy, originally described as an isolated disease without other structural cardiac abnormalities. The aim of this study was to explore the prevalence of left ventricular non-compaction among adults with different types of congenital heart disease.

Methods: From our clinic databases we identified all patients with congenital heart disease who fulfilled diagnostic criteria for LVNC. We report frequencies of associated congenital cardiac defects and the prevalence of LVNC among patients with specific congenital heart disease entities.

Results: From a total of 202 patients with LVNC, 24 patients (12%) had additional congenital cardiac defects. The most common associated congenital cardiac anomalies were defects of left ventricular outflow tract obstruction (11/24, 46%), including 7 uni- or bicuspid aortic valves; 2 aortic coarctation; 1 diffuse aortic hypoplasia; and 1 subaortic stenosis, Ebstein anomaly of the tricuspid valve (6/24, 25%), and tetralogy of Fallot or double outlet right ventricle of Fallot-type (3/24, 13%). In our cohort, the prevalence of LVNC was highest among patients with Ebstein anomaly (6/40, 15%), followed by aortic anomalies (5/40, 12%), and tetralogy of Fallot (2/60, 3%), tetralogy of Fallot (3/129, 2%), and uni- or bicuspid aortic valves (7/963, 1%).

Conclusion: Various forms of congenital heart disease may be associated with LVNC, particularly stenotic lesions of the left ventricular outflow tract, Ebstein anomaly, and tetralogy of Fallot. In the future, studying these patients in more depth may provide a better understanding of the interplay between genetic and hemodynamic factors that lead to the phenotype of LVNC.

Left ventricular apical hypertrabeculation: pitfall in the diagnosis of non-compaction cardiomyopathy

Introduction: Left ventricular non compaction (LVNC) is characterized by a two-layered myocardium consisting of a non-compactated inner and a compacted outer layer. Prominent trabeculation of the left ventricular apex is a well-recognized feature without pathological significance that may be confounded with LVNC.

Methods: Transthoracic echocardiography was performed in 31 LVNC patients, 31 age-matched individuals with apical hypertrabeculation and 31 age-matched controls. Maximal systolic thickness of ‘non-compacta’ and ‘compacta’ was measured in standard short axis views (2-D) at the apical or midventricular level in the segment with most prominent recesses (patients) or most prominent trabeculations (hypertrabeculations and controls). The thickness of the basal septum was measured in parasternal long axis view (M-mode).

Results: Maximal systolic thickness of ‘non-compacta’ was 1.8 ± 0.10 cm (range: 1.2-2.5) in LVNC compared to 1.5 ± 0.07 cm (range: 0.7–2.4) in hypertrabeculations (p <0.01) and 0.2 ± 0.01 cm (range: 0.1–0.3) in controls (p <0.0001). The ratio of ‘non-compacta’ to ‘compacta’ thickness was 3.5 ± 0.16 (range: 2.2–5.7) in LVNC compared to 1.6 ± 0.1 (range: 1.0–2.7) in hypertrabeculations (p <0.01) and 0.2 ± 0.01 (range: 0.1–0.3) in controls (p <0.0001). Maximal systolic thickness of ‘compacta’ was lower in LVNC (0.5 ± 0.03 cm, range: 0.4–0.8) compared to hypertrabeculations (0.9 ± 0.03 cm, range: 0.6–1.4, p<0.01) and to controls (1.1 ± 0.03 cm, range: 0.8–1.5; p <0.0001). Ratio of systolic thickness of the indexed basal septum to that of the ‘compacta’ was 1.0 ± 0.05/m (range: 0.6–1.8) in LVNC versus 0.6 ± 0.04/m (range: 0.3–1.0) in hypertrabeculations and 0.4 ± 0.11/m (range: 0.3–0.5) in controls.

Conclusion: It is difficult to distinguish apical hypertrabeculation from LVNC by the classic criteria for LVNC. Additional criteria such as ‘compacta’ layer thickness and the ratio of basal septum to ‘compacta’ layer thickness are easily applicable and may better discriminate LVNC from hypertrabeculation than the...
classic criteria. Apart from such criteria, differential diagnosis should consider the morphology of recesses as opposed to hypertrabeculation, which, however, requires clinical experience.

**Introduction:** Left ventricular non compaction (LVNC) is characterized by a two-layered myocardium consisting of a non-compact inner and a compacted outer layer. Since left ventricular non-compaction is associated with a two-layered myocardium consisting of a non-compact inner and a compacted outer layer. Since left ventricular non-compaction is associated with systolic function, LVNC can be misinterpreted as dilated cardiomyopathy (DCM). This study assesses whether novel echocardiographic criteria may facilitate differential diagnosis between DCM and LVNC.

**Methods:** Transthoracic echocardiography was performed in 30 LVNC patients (mean age 36.3 ± 17 years), 40 age-matched patients with DCM, and 42 age-matched controls. Maximal systolic thickness of ‘non-compacta’ and ‘compacta’ was measured in standard short axis views (M-mode). Midventricular level in the segment with most prominent recesses (LVNC) or most prominent trabeculations (DCM) and controls. The thickness of the basal septum was measured in parasagittal long axis view (M-mode).

**Results:** LV ejection fraction was 37% (range: 10–59) in LVNC, 29% (16–51) in DCM, and 63% (range: 55–74) in controls. Maximal systolic thickness of ‘non-compacta’ was 1.8 ± 0.01 cm in LVNC compared to 0.4 ± 0.02 cm in DCM (p < 0.0001), and 0.2 ± 0.01 cm in controls (p < 0.0001). Maximal systolic thickness of ‘compacta’ was lower in LVNC (0.5 ± 0.02 cm) compared to DCM (1.0 ± 0.02 cm; p < 0.0001) and controls (1.1 ± 0.03 cm; p < 0.0001). Maximal systolic thickness of ‘compacta’ was ≤ 8.2 mm (range: 3.5–8.2) in LVNC versus ≤ 8.5 mm (range 8.5–14.0; p < 0.0001) in DCM and ≥ 8.6 mm (range 8.6–15.0; p < 0.0001) in controls. The ratio of maximal systolic thickness of the indexed basal septum to that of the ‘compacta’ was > 0.64/m² (range 0.64–1.90) in LVNC versus < 0.61/m² (range 0.29–0.61) in DCM and < 0.57/m² (range 0.28–0.57) in controls.

**Conclusion:** Maximal systolic ‘compacta’ thickness ≤ 8.2 mm and a ratio of indexed septal wall thickness to ‘compacta’ thickness > 0.64/m² is specific for LVNC. This observation may be particularly useful in patients with dilated ventricles and facilitate the differential diagnosis between LVNC and DCM.
families we have set up a multidisciplinary consultation, "Cardiogene," consisting of a pediatric and an adult cardiologist and a clinical geneticist. All families are seen at a common consult in order to take the family history, genetic background and to explain the disease to patients and their families. Appropriate cardiac investigations and genetic testing are then performed and the families seen again in a multidisciplinary fashion for the results. We have reviewed all our cases over the past 5 years.

Methods: retrospective review of all cases seen at Cardiogene Clinic for suspicion of arrhythmic syndromes since 2007.

Results: 23 families were seen at the Cardiogene Clinic with a total of 41 children. The suspected arrhythmic syndrome was LQTS in 14 families (26 children), BrS in 7 families (14 children), SQTS in 1 family (2 children) and CPVT in 1 family (3 children).

Of the 41 children 17 were genetically positive for an arrhythmic syndrome: 14 were for LQTS, 3 for BrS. 24 children were genetically negative however 4 of those were phenotypically positive: 2 LQTS, 1 BrS and 1 CPVT. In 3 families the diagnosis was initially made in a child and then found in the parent. In 2 families the diagnosis was made after a sudden death of one of their children, 1 LQTS (3 week old child), 1 BrS (20 year old).

Discussion: Genetic testing is an essential part of diagnosis and permits an improved targeting of patients needing follow-up and treatment. In our series, a mutation has been found in most families with LQTS. In all other genetic arrhythmias, the yield of genetic testing is less but nevertheless helpful for medical care of these pts.

Conclusion: A multidisciplinary approach to genetic arrhythmias permits a better and more efficient screening and therapy in affected families. It helps families to better understand their disease and improves follow-up in the affected individuals.

Kawasaki disease in adolescents: a diagnostic challenge
T. Boulos Ksontini, S. Di Bernardo, Y. Mivelaz, N. Sekarski (Lausanne)

Introduction: Kawasaki disease (KD) is a systemic vasculitis affecting predominantly young children, younger than 8 years. It can be responsible for coronary artery abnormalities such as dilatation and/or aneurysms. It is thus the leading cause of acquired heart disease in childhood. Older children and adolescents have a higher risk of developing coronary artery abnormalities. Diagnosis in older children or adolescents can be difficult because clinical presentation may be incomplete leading to delay in diagnosis and treatment.

Methods: Retrospective review of all cases of Kawasaki disease referred to our pediatric cardiology outpatient clinic over a one-year period. Patients over 8 years old were identified. Patient charts, ECG and echocardiography studies were reviewed.

Results: From January 1st to December 31st 2011, 16 patients presented with Kawasaki disease. Median age at presentation was 2 years old (range 0.5–15). Three patients (18%) were older than 8 years old, (12, 13 and 15 years old respectively). All three patients presented with 5 or more days of fever, had bilateral conjunctival injection and oral mucosal changes. One patient presented with a rash, one with extremity changes and one with cervical lymphadenopathy. Therefore, all patients presented with an incomplete form of KD. However, additional symptoms were frequent (arthralgia, respiratory and gastrointestinal symptoms) which lead to additional investigations. The mean time to diagnosis and treatment was 7 days (range 5–11). All three patients presented with coronary involvement, of which one patient presented with giant aneurysms affecting all coronary arteries. They received high dose immunoglobulins and aspirin, with rapid resolution of fever. Follow up after 6 months confirmed complete regression of coronary artery abnormalities in all but one patient in whom a giant aneurysm persists on the left anterior descending artery.

Conclusion: Kawasaki disease is rare in the older child or adolescent. However, these patients are at higher risk of developing CAA. Diagnosis is often delayed due to incomplete presentation and prominent symptoms that are less frequently encountered in KD which can be misleading. KD should be excluded in any older child or adolescent presenting with persistent fever for more than 5 days.

Transseptal implantation of a cardiac resynchronization lead using femoral and subclavian access

Background: Cardiac resynchronization therapy (CRT) is indicated in patients with symptomatic heart failure and intraventricular conduction delay. The major technical challenge in CRT implantation is the placement of the left ventricular (LV) lead into a lateral vein by retrograde cannulation of the coronary sinus (CS). In up to 15% of attempts, the implantation is unsuccessful due to inaccessible CS, lack of CS vein or phrenic nerve capture. An alternative technique consists of placing the LV lead using a combined subclavian and transseptal approach.

Method: We report the case of a 64-y old patient with a history of dilated cardiomyopathy and aortic valve replacement, suffering from left bundle branch block (QRS interval 160 ms) and NYHA III heart failure. In 2001, a defibrillator was implanted for sustained ventricular tachycardia. In 2011, the patient underwent three unsuccessful CS lead placements because of CS tortuosity and left brachiocephalic vein occlusion. A transseptal approach was chosen over an epicardial access because of high operative risk.

Results: Before the procedure a percutaneous dilation of the left brachiocephalic vein was successfully carried out. A transseptal puncture of the fossa ovalis was performed using a femoral
access, followed by full iv anticoagulation. Panel 1 of the figure shows (arrows) the transseptal guide wire introduced into the left superior pulmonary vein. The site of the transseptal puncture was marked with contrast injection as shown in panel 2 (arrows). By the subclavian access, multiple attempts failed to reach the transseptal puncture site using conventional LV guiding sheaths combined with steerable 7 Fr ablation (Webster, B and F curves) and 8 Fr decapolar catheters because of oversized curvature. Finally, the site of the puncture was successfully cannulated using a 5 Fr ablation catheter (St Jude, Therapy S) with a steerable sheath (Medtronic, C 304-L69). A 4 Fr bipolar lead (Medtronic, Select Secure) was then screwed into the high lateral wall of the basal LV (panel 3, arrow). Panel 4 of the figure shows the final position of the LV lead after removal of the guiding sheath.

Conclusion: The site of a transseptal puncture performed via the femoral route can be reached using a subclavian access provided that a steerable guiding sheath with small curvature is used. An ablation catheter might be of help to guide the sheath toward the target site.

Giant right atrial appendage aneurysm
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Introduction: About 100 cases of right atrium anomalies have been reported in the literature; among them right atrial appendage aneurysm (RAAA) is a very rare cardiac condition. Case: A 66-year-old man was referred for echocardiogram before knee arthroplasty because of a 6.5 x 10.2 cm “right atrial pseudoaneurysm” described in 2005 on a cardiac magnetic resonance (CMR). This anomaly was also visualized in 1999 on a CT scan (5.5 x 12 cm), performed to investigate a bladder carcinoma. The patient never had any thoracic trauma. No familial cardiac history. His only complaint was NYHA class II dyspnea, without cardiac palpitations. Cardiorespiratory examination was unremarkable. ECG showed a sinus rhythm with normal P-wave morphology, incomplete right bundle branch block and left anterior hemiblock. Chest-X-ray demonstrated a cardiothoracic ratio at the upper limit of normal, with right hemidiaphragmatic elevation. Transthoracic echocardiography showed a biventricular systolic function, without significant valvular disease, but the echocardiographic windows were poor. Because a bulky 5 x 10 cm structure communicating with the right atrium could not be accurately visualized, the patient was referred for CMR. A giant 5 x 8 x 9.5 cm RAAA was diagnosed, without any thrombus, but with spontaneous contrast at its apex. Its wall appeared thin and fibrotic, and contrast-enhancing after gadolinium. No abnormal venous return was found to the right atrium. No right ventricular compression. Right ventricle and tricuspid valve were normal. Left ventricular ejection fraction was 43%, with diffuse hypokinesia.

Discussion: Most right atrial aneurysms have a congenital origin although posttraumatic cases have been reported. RAAA have rarely been reported, with the largest one measuring 15 x 8.5 cm. About half of them cause symptomatic arrhythmias. Recurrent pulmonary embolisms have also been described. Treatment depends on clinical presentation and includes anticoagulation, catheter ablation and surgery. A conservative approach with anticoagulation is preferred in the absence of symptoms, leaving surgical treatment to cases with arrhythmias and/or compression of adjacent structures.

Conclusion: RAAA is a very rare heart anomaly, which may evolve with high morbidity. Its optimal treatment is controversial and should be individually tailored. In our case, we would suggest to initiate long term oral anticoagulation and to repeat CMR every two years or in case of arrhythmia.

Platypnea-orthodeoxia syndrome associated to a patent foramen ovale: a rare coincidence
A.P. Porretta, M. Di Valentina, A. Menafoglio, U. Guggiari, S. Györik, A. Gallino, F. Quadri (Bellinzona)

Background: Platypnea-orthodeoxia syndrome is an uncommon condition characterized by the development of dyspnea and hypoxia in the upright posture, relieved by recumbency. First described by Altman and Robin in 1969, it may result from a number of cardiopulmonary processes, but is classically described as being the result of shunting of deoxygenated blood from the right to the left atrium through an opening in the interatrial septum. In this case, concomitant conditions leading to an increase of right atrial pressures above the left atrial ones may be required to precipitate this rare syndrome, in previously asymptomatic people, such as kyphoscoliosis or aortic dilatation and elongation.

Objective: To report a case of platypnea-orthodeoxia syndrome with patent foramen ovale.

Case summary: A 95-year-old woman presented to the hospital with paroxysmal dyspnea and severe cyanosis, gradually worsening over the preceding eight months, after a surgical procedure of gastric fundoplication for hiatal hernia. The woman's medical history included bronchiectasis, ischemic-hypertensive cardiopathy and osteoporosis, with multiple vertebral collapse of the thoracic spine. The physical examination was notable for fluctuating and highly positional oxygen saturation, worsened by upright posture and strongly relieved by recumbency. Chest x-ray showed kyphoscoliosis, ectasia and elongation of the thoracic aorta, with no evidence for heart failure or lung infection. The angio-CT performed ruled out the suspicion of pulmonary embolism and of foreign bodies in the respiratory tract. A post-surgical origin was also excluded. A transthoracic echocardiogram was then performed, showing an interatrial septal aneurysm and a copious right-to-left shunting of air bubbles, after the administration of agitated saline contrast.

Conclusions: Transthoracic echocardiography elegantly demonstrated the existence of a right-to-left shunting through a patent foramen ovale causing the unusual platypnea-orthodeoxia syndrome. The gradual natural history of both kyphoscoliosis and aortic elongation, leading to increase in right heart pressures, may explain the syndrome's insidious development over years in the present case.
Multimodal imaging of anomalous pulmonary venous return in a patient with Scimitar syndrome
L.P. Jörg, O.C. Kim, M.T. Maeder (St. Gallen)
We illustrate the case of a 40-year-old asymptomatic female who was referred for investigation of a systolic murmur. Transthoracic echocardiography revealed dilated right-sided cardiac chambers (A). Transoesophageal echocardiography ruled out an atrial septal defect but demonstrated pulmonary venous flow into the right atrium (B, arrow). Cardiac magnetic resonance imaging (MRI) confirmed the diagnosis (C, D, E, arrows). Cardiac MRI (E) and invasive angio-graphics (F, arrow) showed a large single right-sided pulmonary vein draining into the inferior vena cava. Given a large left-to-right shunt with a pulmonary to systemic blood flow ratio of 2.4:1.0 the patient underwent surgical correction with redirection of the pulmonary venous return into the left atrium as illustrated by computed tomography (F, arrow). Three months after surgery, dimensions of the right-sided cardiac chamber had normalized (G). In this case, multimodal imaging established the diagnosis and allowed for an exact description of anatomy, function, and hemodynamics, which was essential for preoperative planning.

Left ventricular apical thrombus months after pericardial biopsy
N.F. Ehl, F. Rohner, H. Rickli, M.T. Maeder (St. Gallen)
A 39-year-old woman presented with recurrent episodes of acute pericarditis over a four years period. Repeated echocardiograms showed normal left ventricular dimensions and wall motion (fig. 1, panel A). During the last episode open pericardial biopsy was performed but did not reveal evidence of a specific aetiology. Fifteen months later, the patient was again referred because of chest pain. The ECG showed negative T waves in leads V1 to V4 and Q waves up to lead V4. Transthoracic echocardiography now revealed a left ventricular apical aneurysm (fig. 1, panel B), with a thrombus evident after contrast administration (13x7 mm; fig. 1, panel C, arrow; LV: left ventricle). Coronary angiography showed smooth coronary arteries with the exception of a totally occluded mid-to-distal left anterior descending artery (LAD; fig. 1, arrow). Review of the operation report on the patient’s open pericardial biopsy procedure revealed the annotation of “accidental perforation of the right ventricle resulting in heavy bleeding”, which was treated by surgical suture. Retrospectively, the LAD rather than the right ventricle had been injured, and attempts to achieve haemostasis had obviously finally resulted in occlusion of the mid-to-distal LAD with subsequent apical infarction with aneurysm and thrombus formation. As evident from the angio-graphics (fig. 2, 90° left lateral view) the patient’s heart has a somewhat unusual, more anteriorly rotated left ventricle; in addition, the LAD may have been adherent to the inflamed pericardium thereby exposing it to this complication. This case highlights the need for a thorough review of a patient’s history in odd cases of myocardial infarction.

A case of primary cardiac Lymphoma presenting with conduction abnormalities
F. Moretti, G.B. Pedrazzini, L. Pons, M. Capolferi, F. Faetra, L. Mazzucchelli, O. Mora, T. Moccetti (Lugano, Mendrisio, Locarno)
A 71 years old caucasian man was referred to our cardiothoracic center for the evaluation of chest burning symptoms. The patient is known for hypertensive cardiomyopathy and hypercholesterolemia. At the admission the patient presented on the first ECG an AV block of III degree with heart rate of 40 beats/minute. On history taking we noted a fever until 39 °C with nocturnal transpiration, shivering and left retro auricular pain since three weeks. This AV block of third degree brought to the insertion of a temporary endocavity pace-maker by right internal jugular access. The haematological laboratory showed a CRP at 150 mg/L and hepatic cytolisis. Serologies: HIV- HCV- HBV-. A trans-thoracic echocardiography revealed the presence of a myocardial mass infiltrating the free wall of the right atrium and right ventricle with further extension into the right atrium. A moderate pericardial effusion of 27 mm. of maximal anterior telediastolic diameter was detected without signs of hemodynamic compromission. The global systolic function was preserved (EF >60). Normal dimensions and kinetics of the right ventricle. A cardiac MRI showed a mass of 11 cm. SI x 5 cm. AP x 9 cm. LL in contact with the following structures: ascending aorta,

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right ventricular outflow tract, free wall of the right ventricle, right atrium-ventricular septum and right atrium lateral wall. This mass enrol the right coronary artery along her proximal and middle tract, pushing and infiltrating the free wall of right atrium and ventricle. This mass appears with the same intensity compared to the myocardium and with an aspect of homogene perfusion in the first passage Sequences of contrast. The aspect is suggestif for malignant tumoral mass. A biopsy of this myocardial lead to the diagnosis of a primary myocardial large B-cells lymphoma non GCB, I EB, IPI 2 (low-intermediate risk). Combination of chemotherapy and radiation therapy is considered as the treatment of choice. In our case a CHOP has been prescribed with a very good response: a reduction of 50% in the lymphoma dimension and the disappearing of the conduction disturbances (SAV III degree at the ECG).

A rare cause of pulmonary vein stenosis
A. Faeh-Gunz, M.T. De Zulueta, D. Maurer, D. Ramsay (Baar, Zürich)

A 32-year old woman with history of bariatric surgery and combined personality disorder was admitted because of epigastric discomfort and nausea. Upper GI endoscopy because of postoperative gastroesophageal reflux disease one day before admission showed normal findings after Y-Roux bypass. Vital sings were within normal limits: blood pressure 124/81 mm Hg, heart rate 86 bpm, oxygen saturation 98%. Physical examination was suggestive of superior and inferior vena cava syndrome with jugular venous distension and bilateral leg edema. Laboratory evaluation was normal. The electrocardiogram showed negative T-waves in lead V1 to V3. The cardiac silhouette was slightly enlarged on conventional chest X-ray. Transthoracic echocardiography revealed a circular pericardial effusion with diastolic collapse of the free wall of the right atrium and a mass in the roof of the right atrium. Transesophageal echocardiography (TOE) showed a heterogenous mass encroaching the superior vena cava and infiltrating the roof of both atria, the atrial septum and pulmonary veins causing partial ostial obstruction and pulmonary vein stenosis. On CT-scan a large polycyclic mass located in the anterior and medial mediastinum was visible. The patient underwent open biopsy of the tumor mass disclosing a diagnosis of nodular sclerosis classical Hodgkin-Lymphoma (Bennett grade 2) on histologic examination. Chemotherapy with Adriablastine, Bleomycine, Vinblastine and Dacarbazine (AVBD) was started and well tolerated by the patient. Signs of superior and inferior vena cava syndrome subsided rapidly over a few days. Magnetic resonance imaging (MRI) confirmed infiltration of the pericardium and the heart by the tumor. After second chemotherapy-cycle we could demonstrate a complete metabolic remission of the Hodgkin lymphoma with some PET-inactive residual mediastinal lymph nodes. Compression of cardiac structures by bulky mediastinal lymphoma is a relatively common finding. Infiltration into the pericardium and the myocardium is well known in non-hodgkin lymphoma but very rarely seen in Hodgkin lymphoma. In our case TOE clearly demonstrated infiltration of the tumor into the heart.

An exceptional cause of sudden death in infants: histiocytoid cardiomyopathy

Introduction: Most sudden deaths infants don’t have an identifiable cause although some are thought to be related to channelopathies. We report here an exceptional cause of sudden death.

Case report: A 5 months old infant, known for mild hypotonia and developmental delay of unknown origin, became suddenly limp and pale and developed respiratory arrest while sitting in an infant seat and playing with her mother. The mother started mouth – to mouth resuscitation. The emergency physician found the child 3 minutes later in ventricular fibrillation (VF). After 2 defibrillations and 2 doses of adrenaline she regained sinus rhythm. Upon arrival at the hospital lactate was 14. She recovered rapidly without neurological sequelae. ECG showed Wolff-Parkinson-White (WPW) syndrome, echocardiogram was normal. Intravenous amiodarone was introduced for suspected antidromic tachycardia and subsequent VF secondary to her WPW. However she continued to have multiple runs of ventricular tachycardia with hemodynamic compromise necessitating defibrillation, cardiac massage and adrenaline. ECG’s immediately prior to those episodes were variable, some showed a long-short-long coupling making a channelopathy more likely, and some resembled a His’s-Purkinje tachycardia. Intravenous beta blockers were introduced without recurrences of arrhythmias. However 48h later she presented extensive ischemic bowel disorder, sepsis and died. Autopsy revealed histiocytoid cardiomyopathy (HICMP).

Discussion: HICMP is a rare cause of sudden death affecting predominantly girls under 2 years of age consisting of subendocardial or epicardial nodules formed of histiocytoïd cells in both ventricles, particularly in the His-Purkinje system causing incessant severe arrhythmias. Extracardiac manifestations include abnormalities of the central nervous system, hypotonia, Peter’s anomaly, congenital glaucoma. Antiarrhythmic drugs are usually inefficient. Treatment may include resection or thermoablation of the nodules as well as heart transplant. Without these the outcome is usually fatal.

Conclusion: This diagnosis should be considered in all infants with severe uncontrollable arrhythmias and in aborted sudden death in order to insure appropriate treatment rapidly.

Extensive myocardial infarction (MI) in a 11 year old girl – case report

MI in childhood is a very rare event. It is almost always associated with structural (i.e. Bland-White-Garland, coronary fistulas), hereditary (i.e. hyperlipidemia / hypercholesterolemia, metabolic or other storage disorder) or acquired (i.e. Kawasaki, Kounis, myocardial infarction). A 32-year old girl had a history of bariatric surgery and combined personality disorder. On admission showed normal findings after Y-Roux bypass. Vital signs were within normal limits: blood pressure 124/81 mm Hg, heart rate 86 bpm, oxygen saturation 98%. The patient developed respiratory arrest while sitting in an infant seat and playing with her mother. The mother started mouth – to – mouth resuscitation. The emergency physician found the child 3 minutes later in ventricular fibrillation (VF). After 2 defibrillations and 2 doses of adrenaline she regained sinus rhythm. Upon arrival at the hospital lactate was 14. She recovered rapidly without neurological sequelae. ECG showed Wolff-Parkinson-White (WPW) syndrome, echocardiogram was normal. Intravenous amiodarone was introduced for suspected antidromic tachycardia and subsequent VF secondary to her WPW. However she continued to have multiple runs of ventricular tachycardia with hemodynamic compromise necessitating defibrillation, cardiac massage and adrenaline. ECG’s immediately prior to those episodes were variable, some showed a long-short-long coupling making a channelopathy more likely, and some resembled a His’s-Purkinje tachycardia. Intravenous beta blockers were introduced without recurrences of arrhythmias. However 48h later she presented extensive ischemic bowel disorder, sepsis and died. Autopsy revealed histiocytoid cardiomyopathy (HICMP).
diabetes, tumor) disease. We report on a 11-year-old girl who presented with a near drowning episode to a peripheral hospital. The child was in cardiopulmonary shock and had to be ventilated. Despite volume and start with catecholamins blood pressure remained low. A severely depressed myocardial function was stated in a preliminary echocardiogram. Initial blood work showed white blood cell count of 27’000 with an abnormal I/T ratio, CK 7000 U/l, CK-MB 688 U/l, Troponin 12 U/l. The child’s family was positive for an upper respiratory tract infection. Otherwise the girl’s history was unremarkable. After stabilization the child was transferred to our center. Repeated echocardiogram revealed a severely reduced left ventricular function (ejection fraction (EF) 25–30%) with significant dyskinesia / hypokinesia along the free left ventricular wall. The right ventricular systolic function remained normal. ECG showed sinus tachycardia, deep Q-waves in V3-V5, ST elevation in V1-V2. Based on these findings we primarily diagnosed an acute myocarditis (diagnostic differential acute vasculitis with coronary vasospasm, transient hypoxic ischemia after near drowning). Within the following 2 days her LVEF recovered (EF 50–55%). After a sudden episode of nausea and vomiting on day 3, syncope with severe hypokinesia and subsequent ventricular fibrillation occurred necessitating resuscitation and implantation of extracorporeal membrane oxygenation (ECMO) support. Coronary angiogram revealed an abnormally widely spread thin network of coronary branching along the left coronary artery with a discrete narrowing of the main stem. A subsequent CT scan confirmed the diagnosis of a coronary anomaly with the left coronary artery coming from the acoronary sinus. Corrective surgery with an “unroofing” of the intramural part of the LCA was performed with subsequent ECMO support. The patient was weaned from ECMO on day 5. However, despite regained normal coronary flow the LV-function remained severely depressed (EF 20–25%). The patient is currently listed for heart transplantation.

Conclusion: Presence of segmental myocardial dyskinesia / hypokinesia always implies further diagnostic examination regardless of the patient's age.

Systolic murmur and recurrent syncopes: the cause or the coincidence?

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76-years-old man was admitted to the hospital due to recurrent syncopes on exertion without prodromes. He had a history of cancer of gastro-esophageal junction treated with esophagectomy and tubulization of the stomach seven years before, and known to be on remission until the index event. Physical examination revealed a harsh (5/6) holosystolic murmur predominantly at the left upper sternal border. ECG showed sinus bradycardia with bilisacular block. Echocardiography demonstrated a solid mass protruding in the right ventricular outflow tract (RVOT) resulting in the obstruction of the lumen with maximal gradient of 20 mm Hg (Panel B and C). To differentiate whether the mass is responsible for syncopes, a stress test was performed showing normal haemodynamic response to exercise, and peak gradient rising up to 40 mm Hg in the absence of symptoms. Holter monitoring did not show any arrhythmias, pauses of advanced blocks. Thus, the cause of the syncopes remained uncertain. Thoraco-abdominal CT confirmed the presence of the solid mass compressing the RVOT with the invasion into the lumen (Panel D and E). Neither other masses nor lymphadenopathies were found. Right heart catheterization was performed successfully obtaining the biopsy of the mass. Histological examination revealed gastric carcinoma cells infiltrating the myocardium (Panel F). Thus, the diagnosis of the metastasis of gastric carcinoma was established. The patient refused any rescue or palliative treatment. As to the syncopes intermittent complete AV block was observed while monitoring the patient during right heart catheterization, thus dual chamber pacemaker was implanted. On one month follow-up the patient showed the signs of progressive right-sided heart failure and dyspnea on exertion, but did not experience syncopes although the gradient increased up to 50 mm Hg. He died suddenly two weeks after the follow-up visit. We conclude that the presence of the solid cardiac mass could be an infrequent manifestation the metastatic involvement of the heart. However, the most frequent cause of the syncopes on exertion in elderly patients who present conduction disturbances on resting ECG is complete intermittent AV block.
Lost and found: left atrial appendage occluder
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A 78-year-old patient with history of atrial fibrillation complicated by transient ischemic attack (TIA) and documented thrombus in the left atrial appendage (LAA) on transesophageal echocardiography (TOE) underwent off pump coronary artery bypass graft (OPCAB) surgery. TOE showed an ostial diameter of 20 mm of the multilobular LAA. The patient remained hemodynamically stable and thoracotomy was rejected because of previous bypass surgery and comorbidity. Using the transseptal access with a steerable sheath (Bard Channel 11.5 Fr.) a snare was introduced into the LV and the device located after several attempts. Although the device could not be pulled into the sheath, extraction from the mitral valve apparatus was possible without damage to the mitral valve. Mild mitral regurgitation was unchanged after the intervention. Retraction through the transseptal puncture site resulted in a hemodynamically not significant slitlike atrial septal defect in the fossa ovalis (fig. 2). 6 weeks later, the atrial septal defect could not be demonstrated on transthoracic echocardiography.

Retraction in the groin led to formation of an infected seroma after 1 week, which needed surgical revision. This event demonstrates that patients need careful follow-up in their first hours after implantation of a left atrial appendage device.

Figure 1
TOE showing x-plane of left ventricle with dislocated LAA Occluder (arrow) entrapped in the subvalvular apparatus of the mitral valve, left atrium (LA), left ventricle (LV), aorta (Ao).

Figure 2
TOE showing iatrogenic atrial septal defect (arrow) after extraction of the LAA occluder.

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Outcome of preoperative use of angiotensin-converting enzyme inhibitors/ Angiotensin receptor blockers (ARBs) in off pump coronary artery bypass graft surgery
H. Loeblein, O. Dzemali, D. Odavic, K. Graves, B. Seifert, M. Genoni (Zürich)

Purpose: The outcome of preoperative use of angiotensin converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARBs) in off pump coronary artery bypass graft surgery (CABG) is not well investigated. This study was undertaken to evaluate the postoperative outcome of preoperative use of ACE-inhibitors and ARBs in off-pump CABG.

Methods: The data of patients who underwent off-pump CABG between 1/2009–12/2010 were retrieved from our data bank. An association between use of preoperative ACE-inhibitors/ARBs and postoperative day one troponin and CKMB values, atrial fibrillation, blood transfusion (p = 0.014, p = 0.015, p = 0.028, p = 0.009 respectively).

Results: From 1/2008 to 12/2010, 540 off-pump CABG surgery was performed. 16.7% were female, 41% had NYHA class II and 20% had atrial fibrillation, 8% required postoperative IABP and mortality was 1%. There was no association between preoperative use of ACE-inhibitor/ARBs with postoperative troponin, creatine kinase MB (CK-MB), atrial fibrillation, blood transfusion, intubation time, ICU/hospitalization days, and mortality. A negative correlation was seen between use of ACE inhibitors /ARBs and postoperative day one troponin and CKMB values, atrial fibrillation, blood transfusion (p = 0.014, p = 0.015, p = 0.028, p = 0.009 respectively).

Conclusion: In off pump CABG the use of preoperative ACE inhibitor /ARBs was associated with fewer postoperative myocardial ischemia, atrial fibrillation and blood transfusion. Our study indicates ACE inhibitor /ARBs should not be stopped preoperatively in off pump CABG surgery.

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Prognostic value of preoperative b-type natriuretic peptide in off pump coronary bypass surgery

Background: B-type natriuretic peptide (BNP) a neurohormone secreted in response to volume expansion and pressure overload. Few reports discuss this peptide's prognostic value in patients undergoing open heart surgery predicts survival and patient outcomes. We investigated how the preoperative BNP level related to five postoperative endpoints: troponin, creatine kinase MB (CK-MB), atrial fibrillation, blood transfusion, intubation time, intensive care unit (ICU) and hospital stay.

Methods: The data of all patients who underwent OPCAB between 1/2005–12/2010 was analysed. We investigated how the preoperative BNP level related to five postoperative endpoints: troponin, creatine kinase MB (CK-MB), atrial fibrillation, blood transfusion, intubation time, intensive care unit (ICU) and hospital stay.

Results: 885 patients underwent OPCAB between 1/2005–12/2010. 16.7% were female, 41% had NYHA class II and 20% had NYHA class III.
NYHA class III symptoms. 82% had coronary 3-vessel, 42.4% had left main disease and 9.5% were in a critical preoperative state. The average preoperative values were: creatinine 83 mg/dL, ejection fraction 55%. The average postoperative values were: creatinine 83 mg/dL, C-reactive protein 10 mg/L, intubations time 15 hours, ICU 2.7 days, hospital days 13. 15% had postoperative atrial fibrillation and mortality was 1.3%. ejection fraction (correlation coefficient [CC] = –0.448; p = .0001), age (CC = 0.305; p = .0001), preoperative serum creatinine level (CC = 0.82; p < .0001), haematocrit (CC = –0.390; p < .0001), CRP (CC = 0.358; p < .0001), CKMB (CC = 0.160; p < .0001), pulmonary systolic pressure (CC = 0.387; p < .0001), euroscore (CC = 0.539; p < .0001). Although there was no correlation between preoperative BNP and postoperative atrial fibrillation and mortality, BNP level correlated significantly with postoperative ICU days (CC = 0.303; p < .0001), hospital days (CC = 0.131; p < .0001), intubation time (CC = 0.245; p < .0001) and blood transfusion (CC = 0.220; p < .0001). BNP was found to be an independent risk factor for postoperative troponin (p = 0.006) and ICU days (p <.0001).

Conclusions: Used in conjunction with other clinical information, preoperative measurement of BNP helps predict the postoperative outcomes, especially postoperative ischemia and ICU days for patients undergoing OPCAB.

Endothelial progenitor cells – Gender specific reflection of cardiovascular lifestyle
B. Winkler, T. Grussenmeyer, E. Müller Schweinitzer, F. Rüter, O. Reuthebuch, F. Eckstein, M. Grapow (Basel)

Introduction: Endothelial function depends on the balance between endothelial injury and repair closely linked to vascular aging, risk factors and lifestyle. Endothelial progenitor cells (EPC) considered to be responsible for the renewal of a structurally and functionally intact endothelium. The population of cells represented by the term EPC can be influenced in a positive as well as negative way by various stimuli.

Methods: Between 2010 and 2011 150 healthy volunteers have been examined according to their cardiovascular risk factor profile with focus on stress levels at work, regular exercise, smoking, red wine consumption and body weight. The male to female ratio was 6: 9. Mononuclear cells (MNC) were isolated by Ficoll density grade centrifugation from peripheral blood and EPC populations determined by FACS and triple immunohistochemistry staining for CD 34, KDR and CD 133 as well as functional assay according to the CFU Hill and Ingram assay protocol.

Results: MNC counts correlated with the individual profile and EPC numbers. Occasional smoking (<2 cigarettes a week) was the strongest factor in increasing the EPC count while regular smokers (>10 pack years) showed low numbers and functionally impaired cell count. Female participants seemed to be more prone to be affected by smoking. Surprisingly stressful lifestyle and lack of sleep had a devastating effect on the EPC number. The second strongest negative influence was the BMI.

Conclusion: Additional elements of a healthy lifestyle, such as weight and stress reduction can influence the EPC number and function representing vessel wall integrity and should be considered in the overall concept of therapy and prevention of cardiovascular diseases.
Results: Incomplete pre-operative documentation required for the SING-OUT (patient consent forms, medical checklists, blood group identification) was observed in 54%. Based on the “de-briefing” in the TIME-OUT surgical strategy were changed in 21%, 8% of changes required pre- operative adaptations on the part of all team members. Additions made in the SIGN-OUT procedure (important diversions from routine post-operative protocol) were 3%, instrument/sponge/needle count were inconsistent in 3 cases (2%), two of which were resolved before patient departure. Negligence on the part of a team member to fully participate in the SIGN-OUT procedure was 6%. These results have generated a significant number of critical incident reports (CIRS) and important themes for the departmental Morbidity and Mortality (M&M) conference.

Conclusion: This evaluation indicates that the impact of a SSSL Checklist procedure in a modern surgical theatre is significant and the detection of potentially harmful errors can be made in the pre-operative stage of patient care.

How to deal with pulmonary venous return in acardia

Purpose: In extreme situations, such as hyperacute rejection of heart transplant or major bleeding per-operating complications, an urgent heart explantation might be the only means of survival. The aim of this experimental study was to improve the surgical technique and the hemodynamics of an Extracorporeal Membrane Oxygenation (ECMO) support through a peripheral vascular access in an acardia model.

Methods: An ECMO support was established in 4 bovine experiments (56 ± 8.8 kg) by the transjugular insertion to the caval axis of a self-expanded cannula, with return through a carotid artery. After baseline measurements (A), ventricular fibrillation was induced (B), the great arteries were clamped, the heart was excised and right and left atria remnants, containing the pulmonary veins, were sutured together leaving an atrial septal defect (ASD) over the cannula in the caval axis. Measures were taken with the pulmonary artery (PA) clamped (C) and anastomosed with the caval axis (D). The ANOVA test tor repeated measures was used to test the null hypothesis and a paired t test for assessing the significance in the between groups pairwise comparison of mean pump flow.

Results: Initial pump flow (A) was 4.4 ± 0.8 L/min dropping to 3.3 ± 0.6 L/min (P A-B = 0.003) 10 minutes after induction of ventricular fibrillation (B). After cardiectomy, with the pulmonary artery clamped (C) it augmented not significantly to 3.7 ± 0.7 L/min. Finally, PA anastomosis to the caval axis was followed by an almost to baseline pump flow augmentation (4.3 ± 0.6 L/min, P D-B = 0.003, P D-C = 0.015, P D-A = 0.439), technically permitting a full ECMO support in acardia by a peripheral vascular access.

Conclusions: ECMO support in acardia is feasible, providing new opportunities in situations where heart must urgently be explanted, only if adequate drainage of pulmonary circulation is assured, in order to avoid pulmonary congestion and loss of volume from the normal right to left shunt of bronchial vessels. Furthermore, the PA anastomosis to the caval axis not only improves pump flow but it also permits an ECMO support by a peripheral vascular access making possible the closure of the chest.

A new cable-tie based sternal closure device – First clinical results
L. Melly, O. Reuthebuch, F. Eckstein, M. Grapow (Basel)

Objective: Although many different sternal closing strategies after conventional cardiac surgery have been presented in the last decades, wire closure still remains the preferred technique despite reasonable disadvantages especially in high risk patients. We report the first clinical experience worldwide with a new tool based on the cable-tie principle for sternal closure.

Method: The Sternal ZipFixTM system (Synthes, Oberdorf, Switzerland) consists of biocompatible Poly-Ether-Ether-Ketone. It surrounds the sternum through the intercostal space, avoids bone cut through, supports rapid sternal closure and provides a large implant-to-bone contact for an excellent force distribution (figure). 75 elective patients in our institution were randomly assigned and closed with the ZipFixTM system between March and September 2011.

Results: 30 female and 45 male patients (67 ± 12 years) underwent isolated or combined procedures, mean logistic Euroscore was 15 ± 19%. 66 patients (88%) were considered at high risk for sternal dehiscence by the presence of osteoporosis, metabolic syndrome or pulmonary disease. A total of 4.6 ± 0.7 ZipFixTM were implanted. We observed a gradual reduction in the mean time of implantation from 15 minutes for the first 30 to 7 minutes for the last 40 cases. There was no bleeding due to lesions of intercostal or the remaining internal mammary arteries. One patient died at day 14 due to septic shock of abdominal origin, unrelated to the sternal closure. Clinical and radiographic examination confirmed sternal stability in all patients at discharge from the hospital and in 72/74 at 30 days. Indeed, 2 patients developed mediastinitis that necessitated removal of the ZipFix™ at day 24 and 30 in association with administration of antibiotics. At that time, both sterna were stable and all ZipFix™ were intact. Both patients were suffering from metabolic syndrome with a BMI of 40 and 35 respectively, as well as insulin-dependent diabetes and chronic renal failure under hemodialysis. Postoperatively, 2 other female patients had to be mechanically resuscitated, and even though osteoporotic, their sterna remained stable.
Conclusion: Our initial short-term results proved the safety and efficacy of the Sternal ZipFixTM system in patients at high risk of sternal dehiscence at 30 days. Sternal closure with ZipFixTM is fast, easy to use, reliable and standardized. Therefore and efficacy of the Sternal ZipFixTM system in patients at high risk could be demonstrated in all patients.

Is Syntax Score (SS) a tool for strategy in Off Pump Coronary Artery Bypass grafting? (OPCAB)

G. Siniscalchi, H. Loblein, U. Schurr, O. Dzemali, M. Genoni (Zürich)

Objective: Recently Syntax score has been used to identify the complexity of coronary lesions by incorporating coronary anatomy as it is inclusive intrinsic variables. Troponin subunit T (TT) has been shown to be readily released during myocardial injury. The level of troponin rise has also been shown to predict prolonged ICU stay. We figure out to study a correlation between syntax score and the elevated level of cardiac enzymes after OPCAB

Methods: The data of 192 consecutive patients who underwent OPCAB between 01/09 and 12/09 who underwent coronary artery bypass off pump in our centre were retrospectively recognized. The patients were stratified into two groups: SS 0-33 and SS >33.

Results: On the the valid syntax score was 172: mean was 37.7 median 37 range (12-66) CK-MB-Masse at 24 h (µg) was mean 6.017 median 1.020 range (0–437), ck at 24h mean 451.64 median 336. range (67–5354). There is no significant interdependence of circulating TT, CK, CK Mb in postoperative period and grade of SS

Conclusion: The level of SS has no influence in postoperative myocardial damage in OPCAB. We would suggest using the SS in cardiac surgery only as an additional tool in decision making for revascularization strategy, and not as a predictor of potential postoperative myocardial damage OPCAB.

Effect of transapical aortic valve replacement on cognitive brain function-preliminary results

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Einleitung: There are several studies concerning silent ischemia and embolisation during transapical aortic valve replacement. Controversy exists on its clinical relevance. This study evaluated the acute effect of transapical aortic valve replacement on cognitive brain function with P300 evoked potentials.

Methode: We examined 11 consecutive patients (36% women) with a median age of 80 undergoing transapical aortic valve replacement for severe aortic stenosis. Cognitive brain function was measured through P300 auditory evoked potentials (peak latencies in milliseconds [ms]) before the intervention and 5 days after. Postoperative cognitive dysfunction was defined as a 10% increase in P300 peak latency baseline levels.

Result: Cognitive P300 evoked potentials after transapical aortic valve replacement were comparable to preoperative baseline values (vertex [Cz] 370 ± 18 ms vs. 379 ± 22 ms, p = 0.280; frontal [Fz] 373 ± 18 vs. 372 ± 23 ms, p = 0.366)

Schlussfolgerung: Preliminary results on 11 consecutive patients showed no difference in cognitive function after transapical valve implantation compared to preoperative baseline values.

Preliminary experience and short-term outcome with a second generation selfexpandable transapical TAVI

Q. Reuthebuch, D. Inderbitzin, F. Rüter, R. Jeger, C. Kaiser, P. Buser, F. Eckstein (Basel)

Introduction: We present the first Swiss implant experience and short-term outcome with the JenaValveTM, a second generation transapical TAVI.

Methods: Patients receiving transapical TAVI on beating heart using the JenaValveTM (JenaValve Technology GmbH, Munich, Germany) from 11.2011 to 01.2012 were prospectively analysed. Characteristics, aortic valve disease, implant procedure and postoperative course including echocardiographic evaluation of aortic valve prosthesis were recorded.

Results: Seven patients (2 female, mean age 81.4 (73–89) years, mean EURO Score 10.7 (8-14) were included. Patients presented in NYHA class II (n = 2) and III (n = 5). Preoperative trans-thoracic and trans-oesophageal echocardiography revealed a mean left ventricular ejection-fraction (LVEF) of 47.8 ± 11.6% and a tricuspid calcified aortic valve stenosis (mean dPmean: 47 ± 10.4 mm Hg, mean valve opening area: 0.74 ± 0.19 cm²). Mean operation time was 118 ± 23.2 minutes (90–150 min), 3 paravalvarular leakages were corrected by subsequent balloon dilation. Implanted prosthesis’ sizes ranged from 23 mm (n = 2), 25 mm (n = 4) to 27 mm (n = 1). One patient needed surgical revision due to bleeding at the cardiac apex and was totally given 2 erythrocyte concentrates. Else there were neither intra- nor postoperative device related complications (no conversion to open surgery, no postoperative bundle-block, no valve displacement). Mean duration of stay on the intensive care unit was 1.8 ± 0.6 days and on the general ward until discharge 11.7 ± 3.2 days, with NYHA classes at discharge of I (n = 3) and II (n = 4). Postoperative TTE at discharge (postoperative day 9 ± 3.8) displayed a trivial paravalvular leakage in 3 patients (intraoperatively accepted after balloon dilation) and a dPmean of 15 ± 5.9 mm Hg with a significant reduction of 32 ± 14.6 mm Hg (p = 0.016, Wilcoxon signed rank test, fig. 1) as well as a tendency of improving LVEF compared to preoperative baseline values.

Conclusion: Transapical implantation of the JenaValveTM was safely performed on beating heart with an excellent short-term outcome and postoperative course, steep learning curve, significant reduction of mean pressure gradient and an overall clinical improvement at discharge. Long-term follow-up has to confirm this favorable initial outcome.
Initial experience with a novel low-volume cardioplegic solution in pediatric cardiac surgery


Background: Current concept of cardioprotection consists of application of hypothermia and the repetitive infusion of considerable quantities of a cardioplegic solution. We report on the results of a pilot phase aiming at verifying the efficiency and safety of a novel low-volume, single shot cardioplegic solution (Cardioplexol™) for corrective surgery in children.

Method: 48 consecutive infants (24 Cardioplexol (Cpx) vs. 24 blood cardioplegia (BC)) operated for a ventricular septal defect (VSD) were reviewed for their demographics, per- and postoperative data. Anesthesia, ECC and surgical protocol were standardized.

Results: Both groups are comparable for patient characteristics (age (BC: 8.1 ± 6.9 vs. Cpx: 11.1 ± 12.8 months), weight (6.1 ± 2.0 vs. 6.8 ± 3.0 kg), BSA (0.33 ± 0.07 vs. 0.36 ± 0.11 m²)). Similarly, no significant difference was found for intraoperative data (X-clamp time: BC: 33.5 ± 15.5 min vs. Cpx: 26.4 ± 12.2 min). EEC time: 57.9 ± 16.2 min vs. BC: 64.5 ± 21.1 min; lowest temperature: Cpx: 31.7 ± 0.3°C vs. BC: 31.5 ± 1.3°C). Significantly less volume of cardioplegia was given in Cpx patients (Cpx: 12 ± 5 ml vs. BC: 50 ± 18 ml (p <0.005). No differences were revealed for postoperative data.

Conclusion: Preliminary results suggest that Cardioplexol™ provides at least the same efficiency as standard blood cardioplegia during periods of limited crossclamp time by applying a significantly reduced single shot volume of cardioplegic solution.

Aortic annulus measurement acquired by Trans-Thoracic Echocardiography (TTE), Trans-Esophageal Echocardiography (TEE) and Multi-Slice Computed Tomography (MSCT), correlated with real peroperative measurements.

Methods: In 17 patients, with severe aortic stenosis, 2D-TTE, 2D-TEE and MSCT were performed to determine the size of the aortic annulus. Two modalities were used for the MSCT, using the mean diameter (MSCT-Dm) and the planimetry (MSCT-P).

Results: Annulus diameter was 22.4 mm ± 2.3 by TTE, 23.3 mm ± 3.2 by TEE, 24.1 mm ± 3.3 mm by MSCT-Dm, 23.3 mm ± 3.2 by MSCT-P and 24.4 mm ± 2.4 peroperative. The correlation between both modalities and peroperative measurement was accurate: TTE (r = 0.68, p <0.01), TEE (r = 0.78, p <0.01), MSCT-Dm (r = 0.86, p <0.01) and MSCT-P (r = 0.54, p <0.01).

Conclusion: MSCT measurements based on mean diameter offers the best estimated size of the aortic annulus measured peroperatively, whereas every echocardiography technique must be compared with the same value.

Aortic annulus assessment before transcatheter aortic valve implantation: comparison of imaging and peroperative measurements

A. Roumy, E. Ferrari, S.D. Qanadli, C. Marcuccio, X. Jeannin, L.K. von Segesser (Lausanne)

Aims: The Transcatheter Aortic Valve Implantation allow operating patients currently refused by conventional surgery. However, this technique does not allow the direct measurement of the aortic annulus, which is a crucial information in the choice of the accurate size of the valve prosthesis. In the literature several studies compare different imaging modalities to assess the size of the annulus but there is no currently existant consensus. The present study offers a comparison of the aortic annulus measurement provided by Trans-Thoracic Echocardiography (TTE), Trans-Esophageal Echocardiography (TEE) and Multi-Slice Computed Tomography (MSCT), correlated with real peroperative measurements.

Methods: In 17 patients, with severe aortic stenosis, 2D-TTE, 2D-TEE and MSCT were performed to determine the size of the aortic annulus. Two modalities were used for the MSCT, using the mean diameter (MSCT-Dm) and the planimetry (MSCT-P).

Results: Annulus diameter was 22.4 mm ± 2.3 by TTE, 23.3 mm ± 3.2 by TEE, 24.1 mm ± 3.3 mm by MSCT-Dm, 23.3 mm ± 3.2 by MSCT-P and 24.4 mm ± 2.4 peroperative. The correlation between both modalities and peroperative measurement was accurate: TTE (r = 0.68, p <0.01), TEE (r = 0.78, p <0.01), MSCT-Dm (r = 0.86, p <0.01) and MSCT-P (r = 0.54, p <0.01).

Conclusion: MSCT measurements based on mean diameter offers the best estimated size of the aortic annulus measured peroperatively, whereas every echocardiography technique must be compared with the same value.

Bridging with a biventricular assist device from ECMO to heart transplantation: the Zurich experience


Introduction: Patients with severe low cardiac output which is refractory to medical treatment may run into an emergency situation which makes implantation of an ECMO the only chance for survival. If weaning from ECMO is not possible, a switch to a biventricular assist device as bridge to heart transplantation may constitute the final therapeutic option. However, since the clinical condition of such patients is mostly very critical, the outcome of this costly therapy is uncertain. Here, we present our experience with such treatment.

Methods: We have reviewed our patients who were bridged with an ECMO to a ventricular assist device from 2006 to 2011. In a retrospective analysis of patients who reached heart transplantation from hyperacute rejection (n = 1), coagulation disorder (n = 1), cerebral aspergillosis (n = 1). Complications during assist device implantation were fascial deposits, but there were no thromboembolic events. Four patients (44.4%) died after a mean of 18 ± 25 days (0–61 days) following heart transplantation from hyperacute rejection (n = 1), coagulation disorder (n = 1), cerebral aspergillosis (n = 1). Complications during assist device implantation were fascial deposits, but there were no thromboembolic events. Four patients (44.4%) died after a mean of 18 ± 25 days (0–61 days) following heart transplantation from hyperacute rejection (n = 1), coagulation disorder (n = 1), cerebral aspergillosis (n = 1). Complications during assist device implantation were fascial deposits, but there were no thromboembolic events. Four patients (44.4%) died after a mean of 18 ± 25 days (0–61 days) following heart transplantation from hyperacute rejection (n = 1), coagulation disorder (n = 1), cerebral aspergillosis (n = 1). Complications during assist device implantation were fascial deposits, but there were no thromboembolic events. Four patients (44.4%) died after a mean of 18 ± 25 days (0–61 days) following heart transplantation from hyperacute rejection (n = 1), coagulation disorder (n = 1), cerebral aspergillosis (n = 1). Complications during assist device implantation were fascial deposits, but there were no thromboembolic events. Four patients (44.4%) died after a mean of 18 ± 25 days (0–61 days) following heart transplantation from hyperacute rejection (n = 1), coagulation disorder (n = 1), cerebral aspergillosis (n = 1). Complications during assist device implantation were fascial deposits, but there were no thromboembolic events. Four patients (44.4%) died after a mean of 18 ± 25 days (0–61 days) following heart transplantation from hyperacute rejection (n = 1), coagulation disorder (n = 1), cerebral aspergillosis (n = 1). Complications during assist device implantation were fascial deposits, but there were no thromboembolic events. Four patients (44.4%) died after a mean of 18 ± 25 days (0–61 days) following heart transplantation from hyperacute rejection (n = 1), coagulation disorder (n = 1), cerebral aspergillosis (n = 1). Complications during assist device implantation were fascial deposits, but there were no thromboembolic events. Four patients (44.4%) died after a mean of 18 ± 25 days (0–61 days) following heart transplantation from hyperacute rejection (n = 1), coagulation disorder (n = 1), cerebral aspergillosis (n = 1). Complications during assist device implantation were fascial deposits, but there were no thromboembolic events. Four patients (44.4%) died after a mean of 18 ± 25 days (0–61 days) following heart transplantation from hyperacute rejection (n = 1), coagulation disorder (n = 1), cerebral aspergillosis (n = 1).
Fontan completion in the setting of Kartagener-syndrom


Introduction: The Kartagener-Syndrom, consisting of situs inversus, chronic sinusitis, and bronchiectasis, presents a problematic constellation for Fontan circulation requiring good respiratory function and low pulmonary resistance. We present the unique case of a patient with single ventricle, who underwent successful Fontan-completion in the setting of Kartagener-Syndrom.

Methods/Clinical summary: A 16y/o patient with CAVC and TGA with severe pulmonary stenosis underwent single ventricle palliation by partial cavopulmonary connection at the age of 3. Subsequently severe cyanosis (Sat 70%) developed, however repetitive follow-up evaluation revealed persistent high PA pressures and continuous respiratory dysfunction. Thirteen years later, reassessment revealed reduced PAP (14 mm Hg) with no deterioration of the respiratory function and an extracardiac Fontan was performed after coiling of several MAPCAs.

Results: Three years after TCPC the patient demonstrates significantly increased exercise capacity, weight gain, oxygen saturation of 90%, and improvement of his respiratory situation without intercurrent bronchopulmonary infections.

Conclusion: This case demonstrates that Fontan completion can be accomplished in the setting of Kartagener-Syndrom with excellent mid-term results. Close follow-up and interdisciplinary re-evaluation for feasibility of TCPC correction of those rare patients is mandatory.

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