SSRCTS

SCANDINAVIAN SOCIETY FOR RESEARCH IN CARDIOTHORACIC SURGERY

27th Annual Meeting

Program & Abstracts

February 9 - 11 2017
Geilo, Norway

www.ssrcts.org

Contents

Welcome!

Dear Colleagues and friends,

The organising committee welcomes you to the 27th Annual Scientific Meeting of The Scandinavian Society for Research in Cardio-Thoracic Surgery (SSRCTS) from February 9 to 11, 2017 at Hotel Bardøla in Geilo, Norway.

This meeting is an excellent opportunity to be introduced to the field, learn from the experts, interact in the Scandinavian scientific network, and train surgical skills in the wet lab.

International capacities from around Europe will lecture and provide a knowledge base from which we will all benefit. The program covers cardiac and thoracic surgery and statistical issues. Entwined with invited lectures, the program offers 25 oral and 11 poster presentations, combining basic science and clinical research. As usual, we have a special focus on nurturing the scientist of tomorrow, by dedicating time and training to the young scientists.

New this year is the Guðbjartsson Award session on Friday. The five best abstracts have been elected based and an award committee will select the presenter who handled the presentation and the following discussion to the highest scientific level. The best presentation will be acknowledged at the presidential dinner together with the announcement of the best oral and the best poster presentation.

In order to encourage and stimulate researchers to participate and interact, we have appointed young scientists to co-chair sessions with more experienced scientists. Furthermore, a young scientist has been appointed to act as a discussant for each of the Award papers posing questions, before the paper is open for discussion by the audience.

On behalf of the organising committee, we welcome you all to SSRCTS 2017!

Vibeke E. Hjortdal
President of SSRCTS

Committee

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Thursday, February 9		Friday, February 10		Saturday, February 11	
14:00	Arrival and registration	**14:00**	Guðbjartsson Award Session 1	**14:00**	Oral Session 3
14:45	Vibeke Hjortdal: Welcome to SSRCTS	**14:45**	Invited lecture: Stuart Head		
15:00	Oral Session 1			**15:00**	Invited lecture: Mari-Liis Kaljusto
		15:30	Coffee Break	**15:30**	Coffee Break
		15:45	Guðbjartsson Award Session 2	**15:45**	Oral Session 4
16:00	Coffee Break				
16:15	Poster Session 1				
		16:30	Invited lecture: Emmanuel Lansac		
16:45	Invited Lecture: Hans Pilegaard				
				17:00	Poster Session 3
17:15	Coffee Break	**17:15**	Coffee Break		
17:30	Oral Session 2	**17:30**	News in NORCAAD Tómas Guðbjartsson	**17:30**	Coffee Break Award-committee meeting
		17:45	Insights on working with the president		
		17:50	Wetlab	**18:00**	Awards
18:30	Poster Session 2			**18:30**	Evaluation Beer & Business
18:50	Coffee Break				
19:00	Invited Lecture: Tobias Wang & Peter Agger			**19:00**	Jeopardy
				19:30	Break Dress to impress!
19:45	Break	**19:45**	Break		
20:00	Dinner	**20:00**	Dinner with hosts	**20:00**	Presidential Dinner with pompous speeches

Scientific Program

Thursday, February 9

14:00 - 14:45	**Arrival and registration**
14:45 - 15:00	**Welcome to SSRCTS** Vibeke Hjortdal, Aarhus, Denmark.
15:00 - 16:00	**Oral Session 1** Chairmen: Hans Pilegaard, Tinna Arnardottir, Marie Maagaard 5+3 minutes for each presentation
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O5 - Page 26	**Evaluation of Respiratory Function in Adults Born with a Ventricular Septal Defect – The VENTI Trial** *F Eckerström, C Rex, M Maagaard, J Heiberg, VE Hjortdal*

O6 - Page 27 **Lobectomy for Non-small Cell Lung Carcinoma: Nationwide Study of Short and Long Term Survival**
GN Oskarsdóttir, H Halldórsson, MI Sigurdsson, BM Friðriksson, K Baldvinsson, AW Orrason, S Jónsson, M Planck, T Guðbjartsson

16:00 - 16:15 Coffee Break

16:15 - 16:45 Poster Session 1
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3+3 minutes for each presentation

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RF Nybo, JE Nielsen-Kudsk, P Johansen

P2 - Page 51 **Concomitant Ablation for Atrial Fibrillation in Patients Undergoing Cardiac Surgery**
M Onat, SL Nielsen, VE Hjortdal, E Moss, H Jensen

P3 - Page 52 **Functional and Biomechanical Effects of an Adjunct Annuloplasty Ring in Extracellular Matrix Posterior Mitral Leaflet Reconstruction**
K Bagger, MJ Tjørnild, S Skov, LL Benhassen, M Sharghbin, DM Røpcke, SL Nielsen

P4 - Page 53 **Impact of Health Care System Delay in Patients with Acute Aortic Dissection**
RA Chemtob, H Møller-Sørensen, L Holmvang, PS Olsen, HB Ravn

16:45 - 17:15 Treatment of Pectus Deformities (Invited Lecture)
Hans Pilegaard, Aarhus University Hospital, Denmark.
Chairman: Vibeke E. Hjortdal

17:15 - 17:30 Coffee Break

17:30 - 18:30	**Oral Session 2** Chairmen: Hans Pilegaard, Jarle Vaage, Sheyanth Mohanakumar 5+3 minutes for each presentation
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O8 - Page 29	**Long-Term Outcome for Surgical Treatment of Primary Spontaneous Pneumothorax** *TH Arnardottir, GF Tomasdottir, A Geirsson, T Guðbjartsson*
O9 - Page 30	**Fracturing Surgical Bioprosthetic Heart Valves by High-pressure Balloon Dilatation in-vitro** *H Engholt, P Rasmussen, M Tang, HR Andersen, JE Nielsen-Kudsk, P Johansen*
O10 - Page 31	**Trifecta has Lower Gradient than Mosaic Ultra in the Aortic Position: A Prospective Randomized Study** *B Braathen, T Huseby, T Tønnessen*
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18:30 - 18:50	**Poster Session 2** Chairmen: Tómas Guðbjartsson, Marcell Tjørnild 3+3 minutes for each presentation
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P6 - Page 55	**The Cardiopulmonary Effect of Bronchodilation on Adult Ventricular Septal Defect Patients – The VENTI Trial** *C Rex, F Eckerström, M Maagaard, J Heiberg, VE Hjortdal*
P7 - Page 56	**Comparison of Valve-sparing Aortic Root Repair Techniques with Single and Double Annuloplasty Rings** *J Hedensted, LL Benhassen, DM Røpcke, T Bechsgaard, P Johansen, SL Nielsen*
18:50 - 19:00	**Coffee Break**
19:00 - 19:45	**The Evolution of the Four-chambered Heart** (Invited Lecture) Tobias Wang, Aarhus University, Denmark. Peter Agger, Aarhus University Hospital, Denmark. Chairman: Peter Johansen
19:45 - 20:00	**Break**
20:00	**Dinner**

Friday, February 10

14:00 - 14:45 **Guðbjartsson Award Session 1**

Chairmen: Anders Jeppsson, Theis Tønnessen

7+5 minutes for each presentation

G1 - Page 15 **Exercise Hemodynamics in Chronic Thromboembolic Pulmonary Hypertension Patients before and after Pulmonary Thromboendarterectomy**

F Waziri, S Mellemkjær, TS Clemmensen, LB Ilkjær, SL Nielsen, SH Poulsen

Discussant: Hanna Dagnegård

G2 - Page 17 **Microvascular Fluid Homeostasis during Deep-hypothermia Circulatory Arrest versus Deep-hypothermia Low-flow Cardiopulmonal Bypass**

B Elvevoll, ØS Svendsen, VL Kvalheim, A Mongstad, LB Stangeland, P Husby

Discussant: Leila Benhassen

14:45 - 15:30 **Multivariate Analysis and the Common Pitfalls**

(Invited Lecture)

Stuart J. Head, Erasmus University Medical Center

Rotterdam, The Netherlands.

Chairman: Tómas Guðbjartsson

15:30 - 15:45 **Coffee Break**

15:45 - 16:30	**Guðbjartsson Award Session 2** Chairmen: Mari-Liis Kaljusto, Tómas Guðbjartsson 7+5 minutes for each presentation
G3 - Page 18	**Novel Remodeling Mitral Annuloplasty Ring that Preserves Axial Dynamics of the Native Mitral Annulus** *S Skov, DM Røpcke, MJ Tjørnild, C Ilkjær, J Rasmussen, H Nygaard, JM Hasenkam, MO Jensen, SL Nielsen* *Discussant: Victoria Fröjd*
G4 - Page 20	**Phenotype Differences of Valve Interstitial Cells in Healthy and Calcified Aortic Valves** *M Bogdanova, A Rutkovskiy, KŽ Enayati, A Malashicheva, A Zabirnyk, KO Stensløkken, A Fiane, J Vaage* *Discussant: Peter Agger*
G5 - Page 21	**Prediction of Severe Bleeding in Ticagrelor-treated Cardiac Surgery Patients: Platelet Function Assessment Before or After Cardiopulmonary Bypass?** *E Björklund, A Jeppsson, CJ Malm* *Discussant: Björn Friðriksson*
16:30 - 17:15	**Aortic Valve Repair - A Step-by-step Approach** (Invited Lecture) Emmanuel Lansac, Institut Mutualiste Montsouris, Paris, France Chairman: Mari-Liis Kaljusto
17:15 - 17:30	**Coffee Break**
17:30 - 17:45	**News in NORCAAD** Tómas Guðbjartsson, Reykjavik, Iceland.
17:45 - 17:50	**Insights on Working with the President**
17:50 - 19:45	**Wetlab**
19:45 - 20:00	**Break**
20:00	**Dinner with Hosts**

Saturday, February 11

14:00 - 15:00 **Oral Session 3**

Chairmen: Stuart Head, Søren Skov, Erik Björklund

5+3 minutes for each presentation

15:00 - 15:30 **CABG and Arterial Grafts: Should We Care?**

(Invited Lecture)

Mari-Liis Kaljusto, Ullevål University Hospital, Oslo, Norway.

Chairman: Vibeke E. Hjortdal

15:30 - 15:45 **Coffee Break**

15:45 - 17:00 **Oral Session 4**

Chairmen: Robert S. Stephenson, Peter Agger, Farhad Waziri

5+3 minutes for each presentation

17:00 - 17:30	**Poster Session 3** Chairmen: Ari Mennander, Bergrós Jóhannesdóttir 3+3 minutes for each presentation
P8 - Page 57	**Observations of the Cavitation Produced by a Mechanical Heart Valve using High Speed Ultrasonic Imaging** *K Stentz-Olesen, J Arendt, P Johansen*
P9 - Page 58	**Mitral Valve Posterior Leaflet Extension using Porcine Extracellular Matrix- Six and Nine Months Histological and Biomechanical Characterization** *LC Hanse, MJ Tjørnild, S Skov, DM Røpcke, SL Nielsen*
P10 - Page 59	**The Effect of Congenital Heart Disease on Cerebral Function and Comorbidity in Adulthood** *B Asschenfeldt, J Heiberg, L Østergaard, S Ringgaard, VE Hjortdal*
P11 - Page 60	**Myocardial Metabolism in Heart Failure induced by Right Ventricular Volume Overload** *N Boegh, MF Petersen, C Omann, VE Hjortdal, ES Hansen, C Laustsen, P Agger*
17:30 - 18:00	**Coffee Break** Award-committee meeting
18:00 - 18:30	**Awards**
18:30 - 19:00	**Evaluation** Beer & Business
19:00 - 19:30	**Jeopardy**
19:30 - 20:00	**Break** Dress to Impress!
20:00	**Presidential Dinner with Pompous Speeches**

Abstracts - Gudbjartsson Award

Exercise Hemodynamics in Chronic Thromboembolic Pulmonary Hypertension Patients before and after Pulmonary Thromboendarterectomy

G1

F Waziri[1,2,3], S Mellemkjær[2,3], TS Clemmensen[2,3], LB Ilkjær[1,3], SL Nielsen[1,3], SH Poulsen[2,3]
Discussant: Hanna Dagnegård

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[1]Department of Cardiothoracic and Vascular Surgery, Aarhus University Hospital, Denmark. - [2]Department of Cardiology, Aarhus University Hospital, Denmark. - [3]Department of Clinical Medicine, Aarhus University, Denmark.

Background
Chronic thromboembolic pulmonary hypertension (CTEPH) can cause severe right ventricular dysfunction, which can lead to death. Correctly diagnosing CTEPH is of major importance, as CTEPH is potentially curable by surgery (pulmonary thromboendarterectomy, PTE). The traditional work-up for operation includes invasive measurements of the pulmonary hemodynamics with Swan-Ganz catheter at rest. However, pulmonary pressure rises during activity, which loads the right ventricle even more.

Material and Methods
Twenty CTEPH patients were examined before PTE and three months after. Invasive hemodynamics were measured at rest and during exercise test using a Swan-Ganz catheter.

Results
Three months after PTE the max workload at exercise was significantly increased from 35,71 $\pm$ 16,60 W to 66,43,71 $\pm$ 38,55 W, and pulmonary artery mean pressure at max workload was significantly reduced from 74,43 $\pm$ 14,30 mmHg to 50,14 $\pm$ 12,05 mmHg. There was also significantly increase in cardiac output from 6,78 $\pm$ 2,62 L/min to 11,01 $\pm$ 3,87 L/min after the operation. This resulted in significant decrease in the total pulmonary vascular resistance from 10,29 $\pm$ 4,43 Wood units to 3,62 $\pm$ 1,78 Wood units.

Conclusion
PTE is an effective treatment for chronic thromboembolic pulmonary hypertension. However, exercise hemodynamics after PTE is very important, since it reveals in some patients abnormal elevated pulmonary artery mean pressure, which is not always the case

when measured at rest. These patients could potentially benefit from further medical treatment ex. antidiuretic or vasodilator medicine.

Microvascular Fluid Homeostasis during Deep-hypothermia Circulatory Arrest versus Deep-hypothermia Low-flow Cardiopulmonal Bypass

G2

B Elvevoll[1,3], ØS Svendsen[1], VL Kvalheim[2,3], A Mongstad[2], LB Stangeland[3], P Husby[1,4]
Discussant: Leila Benhassen

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[1]Department of Clinical Medicine, Aarhus University, Denmark. - [2]Department of Cardiothoracic and Vascular Surgery, Aarhus University Hospital, Denmark.

Background
Studies in newborns have indicated less edema formation during deep hypothermia circulatory arrest (DHCA) compared to deep-hypothermia low-flow (DHLF) cardiopulmonal bypass. DHCA is favorable related to surgical conditions, but is hampered with uncertainty concerning safe circulatory-arrest time. We compared DHCA versus DHLF in respect to fluid extravasation, edema generation and brain metabolism.

Methods
12 anesthetized pigs underwent 30 min stabilization before initiation of CPB. During the first 30 mins CPB, animals were cooled to 20°C. Thereafter, low-flow CPB with 30 ml/kg/min, or cardiac arrest, was instituted for 30 min in the respective groups. Both groups were then rewarmed during 90 minutes of full CPB flow. Hemodynamic parameters, serum-electrolytes, serum-albumin, serum-protein, colloid osmotic pressures in plasma- and interstitial fluid, hematocrit levels, plasma volume and net fluid balance were recorded. Fluid extravasation rate was calculated. Regional blood flow and total tissue water content were measured in various tissues, and markers of cerebral metabolism were measured by using brain microdialysis.

Results
No significant group differences could be demonstrated for fluid extravasation rate or total tissue water content in different organs. Significant higher lactate/pyruvate ratio ($p = 0.007$) and glycerol levels ($p = 0.010$) were observed in the DHCA-group compared to the DHLF-group. Increase in lactate/pyruvate ratio was observed immediately after start of full reperfusion and rewarming, while the glycerol concentration steadily increased in the DHCA group.

Conclusions
There was no between group difference regarding microvascular fluid extravasation and edema formation. Cerebral microdialysis indicated ischemia during 30 min DHCA, and thus favors DHLF in our experimental setup.

Novel Remodeling Mitral Annuloplasty Ring that Preserves Axial Dynamics of the Native Mitral Annulus

G3

S Skov[1,2], DM Røpcke[1,2], MJ Tjørnild[1,2], C Ilkjær[1,2], J Rasmussen[1,2], H Nygaard[1,2], JM Hasenkam[1,2], MO Jensen[1,3], SL Nielsen[1,2]
Discussant: Victoria Fröjd

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Introduction

The configuration of the native mitral valve annulus changes from being nearly flat in the diastolic phase to a saddle shaped configuration in the systolic phase. We have developed a new remodeling annuloplasty ring with septal-lateral fixation and commissural axial flexibility to maintain the annular saddle shape (Figure). The aim was to compare the biomechanical performance of the new remodeling annuloplasty ring compared to two conventional remodeling annuloplasty rings.

Methods

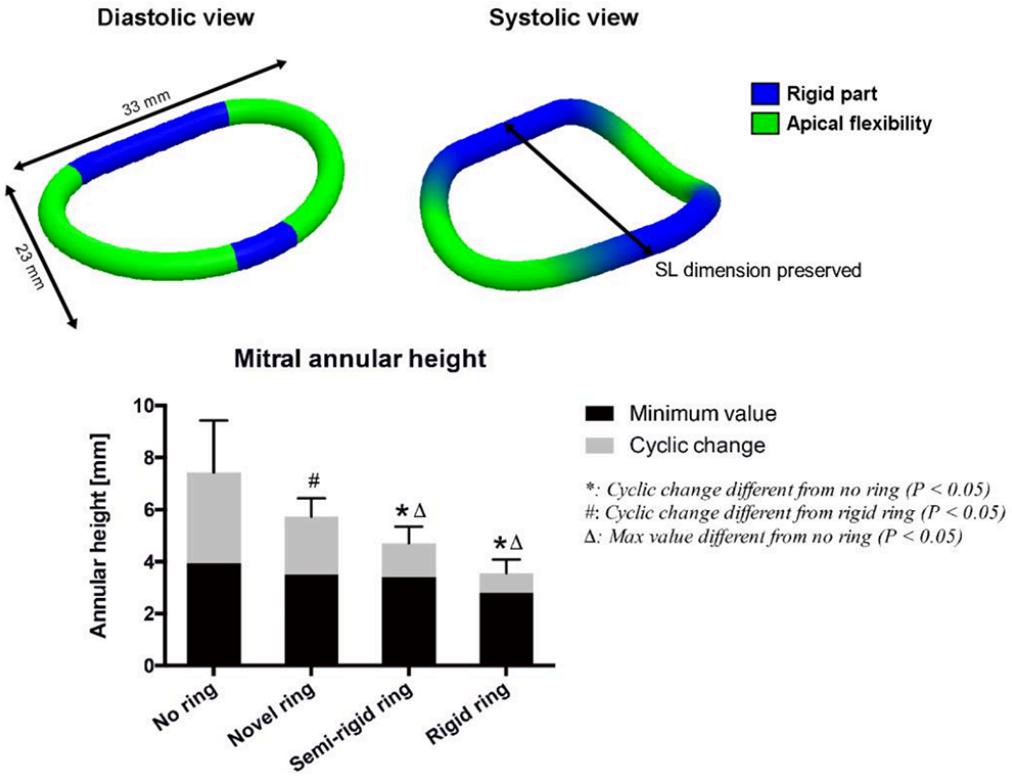
The measurements were performed in-vivo using an 80 kg porcine model. 28 animals were randomized into four groups: A No ring, a novel remodeling ring, a semi-rigid ring (CE Physio ITM Ring) and a rigid ring group (CE ClassicTM Annuloplasty Ring). Geometry parameters were measured with sonomicrometry crystals implanted along the mitral annulus.

Results

The novel remodeling, rigid and semi-rigid mitral annuloplasty rings significantly restricted dynamics of the mitral annular area, septal-lateral distance and segmental contraction and dilatation compared to the no ring group. The dynamics of the annular height was maintained for the novel ring but significantly decreased for the conventional rings compared to the no ring group (Figure).

Conclusion

There were no differences in annular height between the novel remodeling ring and no ring group, indicating that the intended function of the new device was obtained. Geometry measurements confirmed a significant remodeling capacity especially due to the fixation of the septal-lateral direction. The annular systolic saddle shape is believed to protect the mitral valve function and decrease leaflet stresses and could improve the outcome of the repair.


Diastolic view
Systolic view
33 mm
23 mm
Rigid part
Apical flexibility
SL dimension preserved
Mitral annular height
Annular height [mm]
10
8
6
4
2
0
#
*Δ
*Δ
No ring
Novel ring
Semi-rigid ring
Rigid ring
Minimum value
Cyclic change
*: Cyclic change different from no ring (P < 0.05)
#: Cyclic change different from rigid ring (P < 0.05)
Δ: Max value different from no ring (P < 0.05)

Phenotype Differences of Valve Interstitial Cells in Healthy and Calcified Aortic Valves

G4

M Bogdanova[1,2], A Rutkovskiy[3], KŽ Enayati[1], A Malashicheva[2], A Zabirnyk[1], KO Stensløkken[1], A Fiane[4,5], J Vaage[3,5]
Discussant: Peter Agger

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Background
Aortic valve calcification is caused by differentiation of valve interstitial cells (VICs) into osteoblasts and myofibroblasts. We hypothesize that VICs from calcified aortic valves have changed their phenotype into a pro-calcification state.

Methods
VICs were isolated from human aortic valves with or without calcification harvested during surgery. VICs were cultured in osteogenic medium for 21 days to induce osteoblast differentiation and calcification. Calcification was quantified using Alizarin Red staining. To differentiate VICs into myofibroblasts we stimulated them with TGFβ1. The expression of myofibroblastic marker alpha smooth muscle actin (aSMA) was evaluated by immunostaining and rqPCR. Cells were also cultured in collagen gel for seven days with TGFβ1. Gel contraction is a measurement of the presence of myofibroblasts.

Results
VICs from calcified valves, but not VICs from healthy valves, accumulate calcium deposits during culture for 21 days even without osteogenic medium. .After exposure to osteogenic medium cells from both types of donors accumulated calcium, but significantly more with VICs from calcified valves ($P<0.0001$). Upon stimulation with TGFβ1 VICs from both calcified and normal valves differentiate into myofibroblasts, but expression of aSMA was highest in VICs from the healthy ones ($P<0.0001$). VICs from healthy valves also had the strongest gel contraction.

Conclusions
VICs from healthy and calcified aortic valves have significant differences in phenotype. The VICs from calcified valves have a stronger ability to differentiate into osteoblasts and myofibroblasts, they have a more pro-calcification state. By elucidating the cellular and molecular mechanisms of calcification, new therapeutic options may be developed.

Prediction of Severe Bleeding in Ticagrelor-treated Cardiac Surgery Patients: Platelet Function Assessment Before or After Cardiopulmonary Bypass? G5

E Björklund[1], A Jeppsson[1], CJ Malm
Discussant: Björn Friðriksson

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[1]Dept. of Cardiothoracic Surgery, Sahlgrenska University Hospital, Gothenburg, Sweden.

Background
Dual antiplatelet therapy with acetylsalicylic acid and ticagrelor increases the risk of perioperative bleeding. Preoperative platelet function testing predicts the bleeding risk but the predictive value of testing after cardiopulmonary bypass (CPB) has not been evaluated. The aims of this study were to compare the ability of pre- and postoperative testing to predict severe bleeding and to assess the effect of cardiac surgery on platelet aggregability.

Material and Methods
Seventy-four patients treated with acetylsalicylic acid and ticagrelor within five days before on-pump cardiac surgery were included in this prospective observational study. Adenosine diphosphate (ADP) induced platelet aggregation was assessed with impedance aggregometry before and two hours after CPB and postoperative bleeding complications were registered. Receiver operating characteristic (ROC) curves were used to assess the ability to predict severe bleeding. Additionally, pre- and postoperative aggregability was compared.

Results
Severe bleeding occurred in 25/74 patients (34%). The ability of pre- and postoperative platelet aggregability to predict postoperative bleeding was comparable (area under ROC curve 0.75 versus 0.77). There was no significant difference between pre- and postoperative ADP-induced aggregability [median 37 U (range 0-117 U) versus 29 U (0-145 U), $p=0.24$]. A significant correlation between the measurements was observed (Spearman Rho=0.88, $p<0.001$), however there was an individual variation where 31% of the patients decreased and 22% of the patients increased their aggregability with >10 U.

Conclusion
Postoperative aggregability predicts severe bleeding with comparable ability to preoperative measurements. Postoperative aggregability correlates to the preoperative but its predictability in an individual patient is low.

Abstracts - Oral Presentations

Three-dimensional Optical Strain Measurements on Mitral Valve Anterior Leaflet

O1

M Noor[1], S Skov[2], P Johansen[1,2]

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[1]Dept. of Engineering, Aarhus University. Denmark. - [2]Dept. of Cardiothoracic and Vascular Surgery T, Aarhus University Hospital. Denmark.

Background
Limited data exist on mitral valve leaflet deformation. When a full field strain profile is required the digital image correlation technique may provide a solution. The objective of this study is to investigate and understand how an optical measurement system can be applied to achieve high resolution field strain measurements of the mitral valve anterior leaflet.

Materials and Methods
In vitro measurement of fresh porcine hearts with and without a rigid mitral annuloplasty ring and optically exposed mitral valves were deployed. A stochastic pattern was applied onto the surface of the mitral valve undergoing deformation in order to determine the strain under pressure loading with time, using a dual camera systems with digital image correlation software (4M Aramis system).

Results
The results indicate that there is a statistically significant difference between the mean strain value for mitral valve anterior leaflets with and without a ring ($p<0.02$).

Conclusions
High resolution field strain measurements of the mitral valve anterior leaflet was achieved. The result indicate that the leaflets without ring implantation exposed larger elasticity than those where an annuloplasty ring was implantated. This tool can be used to differentiate the impact on leaflet strain using different annuloplasty rings.

Minimally Invasive Plication of The Diaphragm

O2

MN Nardini[1], S Jayakumar[2], M Migliore[3], MS Elsaegh[1], IM Mydin[1], JD Dunning[1]

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[1]James Cook University Hospital, Middlesbrough. UK. - [2]King's College Hospital, London. UK. - [3]University of Catania, Italy.

Background
Diaphragm plication is an operative option for patients with phrenic nerve paralysis, but the open approach has a significant morbidity and therefore is less commonly performed. We have found Endoscopic Plication using CO2 to be technically easier to perform than the open approach. We report our results using minimally invasive techniques. The aim of this analysis is to measure the outcome of patients who underwent minimally invasive plication of the diaphragm for paralysis of different aetiology.

Methods
Indications for surgery included limiting dyspnoea for daily activities and positivity for paradoxical movement at fluoroscopy or ultrasound. In the last 3 years 16 patients, of whom 6 women, received 3 ports VATS (13) or Robotic (Da Vinci Si) plication (4, one patient had 2 procedures for bilateral condition). At follow up we reassessed their quality of life, short and long term post-operative pain score (VAS), paresthetic discomfort, MRC breathlessness scale and repeated pulmonary function test.

Results
None of the patients died. Two high risk patients had prolonged intensive care stay due to ventilatory dependency. There were no wound infections. The mean length of stay was 7 days (range 2-35) with 11 (68.7%) patients discharged within 4 days. There were 2 pleural effusions drained after discharge. All patients reported a significant improvement in symptoms with a dramatic improvement of quality of life. In only one person was this effect not maintained. 83% of patients MRC scores improved by 2 points or more. FVC and FEV1 improved of 25% (range15-40%) and 23% (range 8-32%) respectively. None of the patients have chronic pain or paraesthesia.

Conclusions
Patients with diaphragm paralysis represent an under-treated group of patients who may expect excellent results with minimally invasive diaphragm repair.

Hospital Re-admissions Following Surgical Resection for Lung Cancer

O3

BM Friðriksson[1], GN Oskarsdóttir[2], H Halldórsson[1,3], H Harðardóttir[2], A Geirsson[1], S Jónsson[1,3], T Guðbjartsson[1,2]

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Objectives

We aimed to investigate hospital readmissions following lung cancer surgery, focusing on causes, clinical predictors and short term mortality.

Materials and methods

A retrospective study on consecutive patients that underwent pulmonary resection with curative intent for non-small cell lung cancer in Iceland 1991- 2014. Acute readmission within 30 and 90 days were registered, but only for patients that survived to discharge. Predictors of readmission together with mortality at 90 days and 6 months were evaluated with multifactorial logistic regression.

Results

A total of 641 NSCLC-patients underwent 670 pulmonary operations and were discharged from hospital. Readmission rate at 30 and 90 days was 9.7% and 16.4%, respectively; 63% being related to the procedure. Predictors of readmission within 30 days were chronic obstructive pulmonary disease (COPD) (OR 1.98, 95%-CI: 1.09-3.55) and minor peri- and postoperative complications diagnosed before discharge (OR 3.3, 95%-CI: 1.9-6.1). Independent predictors of 6-month mortality were advanced tumor stage (OR 1.43, 95%-CI 1.22-1.70), major complications detected before discharge (OR 5.40, 95%-CI:2.11- 13.26),readmission within 30 days (OR 3.66, 95%-CI 1.71-7.53) and a high ASA score (OR 1.66, 95%-CI: 1.03-2.70).

Conclusions

Readmissions after pulmonary resection for NSCLC are common and most frequently are related to the operation.Patients with advanced disease and COPD that sustain complications are at higher risk for readmission and their survival is negatively affected 6 months from surgery.

The Architecture of the Right Ventricular Myocardium Changes through the Cardiac Cycle

O4

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Background
Right ventricular heart failure constitutes a significant clinical challenge in several patients with congenital heart disease. Changes in the myocardial structure has recently been suggested as a contributing factor to heart failure. However, no studies have investigated the normal three-dimensional rearrangement of the cardiomyocytes through the cardiac cycle in the healthy right ventricle. In the present study we have investigated these dynamic changes using diffusion tensor imaging.

Methods
14 healthy female domestic 20 kg pigs were included. The hearts were excised and randomized to fixation in either diastole or systole. The orientation of the cardiomyocytes was quantified using diffusion tensor imaging and compared between systole and diastole.

Results
From diastole to systole no significant change in the helical angle of was found in cardiomyocytes located in the right ventricle. In the left ventricle a significant increase of this angulation was found. The transmural angulation showed significant change in both ventricles. In both right and left ventricular myocardium the angulation of aggregated units of cardiomyocytes changed towards zero from diastole to systole.

Conclusion
The architecture of the entire myocardium changes through the cardiac cycle provided by continuous changes in the orientation of cardiomyocytes. This movement of cardiomyocytes is, however, different in the right ventricle and left ventricle indicating that the normal physiological remodelling of the myocardium differs between the ventricles. These results must be taken into account when assessing remodelling in the diseased myocardium.

Evaluation of Respiratory Function in Adults Born with a Ventricular Septal Defect – The VENTI Trial

O5

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Background

Ventricular septal defect (VSD) is the commonest congenital cardiac defect, where large defects are surgically closed early, and small VSDs are left untreated. Both are generally considered to have great prognoses, and consequently; the majority receive little or no follow-up in their adult life. Nevertheless, studies recently demonstrated decreased oxygen uptake during exercise in both VSD-operated adults and adults with small, open defects when compared with healthy controls. Whether a link to a possible physiological alteration can be found in the pulmonary vascular bed needs to be established. Therefore, we aim at evaluating long-term pulmonary function in adults with surgically closed VSDs or small, open VSDs.

Methods

Adults with small, open or surgically closed VSDs and healthy controls are included. Participants undergo five different pulmonary tests at rest, enabling investigation of predefined sections of the respiratory tract. Tests include: Multiple Breath Washout, Impulse Oscillometry, static and dynamic pulmonary function test, and diffusion lung capacity.

Results

Pending. We aim at including 30 participants in each group. Preliminary data on 30 participants in total will be presented at the conference.

Perspectives

We hypothesize that adults with repaired VSD demonstrate increases in airway resistance, inferior diffusion capacity, and impaired dynamic spirometry when compared with open VSD-patients and healthy controls. With this study we hope to provide further knowledge of the potentially overlooked long-term consequences of living with a VSD. Furthermore, we hope to clarify whether a possible pulmonary dysfunction is responsible for reduced oxygen uptake observed in adults born with a VSD.

Lobectomy for Non-small Cell Lung Carcinoma: Nationwide Study of Short and Long Term Survival

O6

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Introduction

Lobectomy is the standard curative treatment for non-small cell carcinoma (NSCLC) of the lung. Most studies on lobectomy focus on short-term outcome and 30 day mortality. The aim of this study was to evaluate both short and long-term surgical outcomes in all patients who underwent lobectomy for NSCLC in a whole nation during a 24-year period.

Materials and methods

This is a study of 489 consecutive patients with NSCLC who underwent lobectomy with curative intent in Iceland between 1991 and 2014. Patient demographics, pTNM stage, rate of perioperative complications and 30-day mortality was registered and overall survival analyzed by the Kaplan Meier method. Cox proportional hazard model was used to evaluate prognostic factors of overall mortality. To evaluate trends in survival, the study period was divided into six 4-year periods. Median follow up time was 40 months and no patient was lost to follow-up.

Results

The average age was 67 yrs and 53.8% were female. The pTNM disease stage was IA in 148 patients (30.0%), IB in 125 patients (25.6%), IIA in 96 patients (19.5%), IIB in 50 patients (10.1)%, but 74 (15.0%) were found to be stage IIIA, most often diagnosed perioperatively. The total rate of major complications was 4.7%; with a 30-day mortality of 0.6% (3 patients). One and 5-year overall survival was 85.0% and 49.2%, respectively; with 3-year survival improving from 48.3% to 76.6% between the periods 1991-1994 and 2011-2014 ($p=0.0004$). Advanced TNM-stage and age were independent negative prognostic factors of all cause mortality and advanced calendar year and free surgical margins independently predicted improved survival.

Discussion

The short-term outcome of lobectomy for NSCLC in this population based study was excellent; reflected in the low 30-day mortality and rate of major complications. Long-term survival was acceptable but, importantly, has improved significantly during the study period.

A Novel Technique of Video Assisted Lung Surgery: Microlobectomy

O7

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Background

Despite the dramatic development of Video Assisted Thoracic Surgery (VATS) we observed high degree of pain in patients who underwent anterior VATS lobectomy. We tried to improve the patients outcome changing the incisions site and size.

Methods

he concepts that guided us are summarized in six key points: no incision in the intercostal space larger than five millimetres, use of carbon dioxide, one additional subxiphoid port, adoption of five millimetres diameter cameras and stapling devices, and finally, delivery of the specimen through the subxiphoid port. We called this Microlobectomy referring to the size of the wounds. The indications for surgery where the same as for traditional VATS lobectomy with obesity as a relative contraindication.

Results

n the last 2 years 81 microlobectomies (29 right upper lobes, 6 middle, 15 right lower, 20 left upper, 7 lower, 4 mixed) and 2 micropneumonectomies (one left) were performed in our institution for different pathologies. 7(8.4%) patients experienced air leak and 4 were discharged home with the drain in situ. 11(13.2%) patients needed intravenous antibiotics for pneumonia and 2(2.4%) were admitted to intensive care for respiratory failure. Most of the patients were discharged within 3 days from surgery.

Conclusion

We experienced a significant reduction of postoperative pain with a potential reduction in complications. After these promising results we will continue to perform this approach and able to provide data on a more extensive cohort of patients.

Long-Term Outcome for Surgical Treatment of Primary Spontaneous Pneumothorax

O8

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Background
The incidence of pneumothorax varies geographically and known risk factors are changing. Surgical techniques have furthermore shifted from thoracotomies to video-assisted thoracoscopic surgery (VATS), despite reoperations being more common after VATS. However, recent research suggests decreasing difference in incidence. We aim to determine the long-term incidence and outcome of surgery for spontaneous pneumothorax.

Material and methods
A retrospective nation-wide study, spanning 25 years on 333 patients (average age 27.5 years, 78% male) who underwent 400 surgeries for primary spontaneous pneumothorax (PSP). Information was gathered from medical records, including patient profile, type of surgery and complications, with emphasis on recurrent pneumothorax requiring reoperation. The mean follow-up time was 12.8 years.

Results
The incidence of PSP requiring surgery per 100,000 decreased from 12.4 to 8.5 for males and from 3.8 to 2.3 for females from the first to last 5 years. Change in surgical indication, age and gender was not significant. Daily smokers decreased from 30% to 15%. Reoperation for recurrent pneumothorax was needed in 21 cases (5.3%) and was more common after VATS (6.5% vs. 3.4%, $p<0.01$, HR 2.94). VATS increased from 63% to 92% but surprisingly, reoperations decreased overall from 9.0% to 3.0%. The mean time from surgery to recurrence was 4 months (range: 0-47).

Conclusion
The incidence of PSP requiring surgery is decreasing which could be linked to decreased smoking and rising BMI. Reoperations were overall more common after VATS, but are however decreasing dramatically which could be linked to the increased application of partial pleurectomy and pleurodesis.

Fracturing Surgical Bioprosthetic Heart Valves by High-pressure Balloon Dilatation in-vitro

O9

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Objectives

Transcatheter aortic valve implantation (TAVI) is an alternative to surgically implanted heart valve prostheses. In addition to replacing diseased native valves, the TAVI valves can be used for valve-in-valve therapy, where the TAVI valve is inserted into a degraded bioprosthesis, thus reestablishing proper valve function. However, this procedure will reduce the valve orifice area. To circumvent this, the geometrical restrictive stent structure can prior to the TAVI procedure be fractured through high pressure balloon predilatation. To minimize the risk involved, the aim of this study is to provide guidance for various types, sizes and pressure ranges of stented bioprosthetic valves.

Materials and Methods

The fracture mechanics of stented bioprosthetic valves will be evaluated in vitro. Balloon dilatation catheters are used to fracture a various selection of stented bioproshetic valves. The valve prosthesis will be placed onto the high-pressure balloon, mounted on a custom made holder, positioned within a 3D bi-planar CT scanner, and gradually inflated until fracture. During inflation a high speed camera will detect the instant of fracture and corresponding balloon pressure, and audio recording will be used to assess and characterize the click associated with the fracture.

Results

Preliminary results show the Trifecta bioprosthetic valve (21 mm) were fractured with a balloon dilatation catheter (22 mm) at 26 bar (2.6 MPa). The Trifecta bioprosthetic valve (19 mm) were also attempted fractured with a balloon dilatation catheter (20 mm). However the balloon ruptured at roughly 30 bar (3 MPa) with no valve fracture. Further results are still pending.

Trifecta has Lower Gradient than Mosaic Ultra in the Aortic Position: A Prospective Randomized Study

O10

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Background

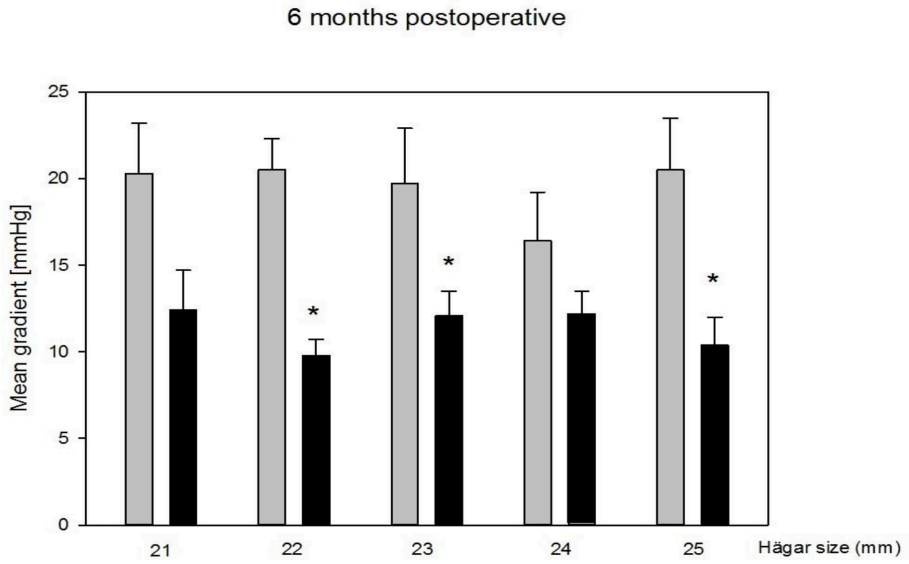
In patients over 65 years a biological valve is usually implanted in the aortic position when the guidelines criteria are met for aortic stenosis and regurgitation. A large opening area of the valve is important to avoid patient-prosthesis mismatch and facilitate reverse myocardial remodeling. Trifecta is a biological prosthesis claimed to reduce transvalvular gradient compared to various other prostheses. Several retrospective studies compare transvalvular gradients of implanted valves based on the respective manufacturers sizers and not to the actual annulus size measured by a metric sizer. This makes comparison of different valve sizes difficult. In this study we compared the transvalvular gradients of the Trifecta valve to our standard Mosaic Ultra valve in a prospective randomized study.

Material and Methods

75 elective patients with small to medium annulus diameter undergoing implantation of a biological valve were included in the study and prospectively randomized to either a Trifecta or Mosaic Ultra. After removal of the native valve and decalcification, the annulus was measured with a Hegar-sizer to obtain an objective measure of annulus size. Then the largest possible valve of either brand was implanted. Patients obtaining a larger valve than 23mm were excluded from the study. Transvalvular gradient was measured by the same cardiologist 6 months postoperatively.

Results

Basline parameters of the two cohorts were comparable. As seen in the figure below, there were significantly lower gradients in the Trifecta valves compared to Mosaic Ultra for a given annulus size.



Gray: Mosaic ultra, Black: Trifecta

Conclusion

Biological Trifecta valves show significantly lower transvalvular gradients compared to Mosaic Ultra for a given annulus size.

Penetrating Stabbing Injuries in Iceland; a Retrospective, Population Based Study

O11

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Background
Vehicle accidents are the most common cause of death in young people in developed countries, but stab injuries are also an important factor. European studies on penetrating injuries are few and often represent single institutions. The aim of this nationwide study was to describe incidence and demographic features of penetrating injuries in a well-defined population.

Material and methods
Retrospective study on consecutive patients hospitalized in Iceland following a stab injury 2000-2014. International scales (AIS, ISS) were used to assess injury severity.

Results
Altogether 75 patients (mean age 31 years, 89.3% males) were admitted; with an increase from 26 to 28 during the first to the last 5 year-period, respectively. Most were assaults (95.6%) occurring at home or at public streets, and involved the chest (n=32), abdomen (n=30), upper limbs (n=29), head/neck/face (n=22), lower limbs (n=11) and the back (n=9). Average ISS was 9.6 with 13 patients (17.3%) suffering severe injuries (ISS>15). The average length of stay was 4.6 days (range 0-53). A total of 38 patients (50.7%) needed surgery and 28 (37.3%) required admission to ICU. Three patients did not survive days (4%) but all had severe injuries (ISS 18, 25 and 75).

Conclusion
Stab injuries that require hospital admission are rare in Iceland and the incidence is relatively stable. One out of six patients sustain severe injuries, half need surgery and just over a third required ICU care. A 30-day mortality, however, is very low and comparative to other studies.

Previous Cardio-thoracic Procedure is not a Contraindication for Re-intervention by Thoracoscopy: 4 Cases

O12

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Background

Although there is still very little in the literature upon this subject, having previous surgery on the thorax does not exclude a re-do lung surgery by a minimally invasive approach. The literature on this topic is in the form of case report and small case series. D'Amico et al. does not list re-do surgery within the contraindications for VATS. Our experience confirm that re-do lung surgery is feasible by VATS and we report, in this video-presentation, four cases of lung resection. Each case is a different procedures, and different techniques are showed for the treatment of different pathologies. The first case is very interesting because there is no mention in the literature of a re-do major lung resection by VATS after a previous lobectomy (patient underwent VATS right upper lobectomy 2 years after a posterior VATS right middle lobectomy). Decaluwe et al described a lung lobectomy after double lung transplant and this was the closest case report we found. We also show a case of re-do wedge resection after previous thoracotomy. At the end of the video we conclude that, not only previous cardiothoracic procedure is not a contraindication for lung resection by VATS, but also we suggest that the magnification and the angle of the optic can show better the adhesions, especially at the apex and in the costophrenic recess, resulting in a safer dissection technique. A thoracotomy can instead be harmful when the lung is tightly adherent to the parietal pleura.

Characterization of Valve-sparing Aortic Root Repair with Different Subvalvular Annuloplasties: A Clinical Experimental Study

O13

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Background
Valve sparing aortic root repair has become an advantageous alternative to avoid the adverse effects of prosthetic valve replacement. New evidence suggests that adding a subvalvular annuloplasty provides a better repair, but no standardization or comparison have yet been made for the different types of annuloplasty approaches. The aim is to compare different types of annuloplasties in a porcine experimental in vivo model after performing: a) Suture annuloplasty, b) Conventional Dacron-ring and c) Native control valve.

Material and Methods
An 80 kg acute porcine model was used. A force transducer was inserted in the aortic annulus to assess stress distribution. Piezoelectric crystals were implanted in the aortic root to assess the geometrical changes.

Results
We observed greater accumulated forces in the control group compared to the two interventions, although not statistically significant (native 5.01 N vs. Dacron 4.32 N vs. suture 4.53 N). For each segment of the transducer, we observed a smaller force after annuloplasty, most pronounced for the right-non segment of the aortic root. There was a tendency towards increased force accumulation in the non-left commissure after suture annuloplasty compared to the two other groups.

Conclusion
As expected, the force measurements were smaller after both types of annuloplasties compared to the control group, which suggests an overall remodeling effect after annuloplasty. The increased force accumulation in the non-left segment for the suture annuloplasty is interesting in a clinical context, since this is close to a potential vulnerable site for dilatation, i.e. the non-coronary sinus.

The Medtronic Freestyle Stentless Bioprosthesis® as a Full Aortic Root Indications and Outcomes

O14

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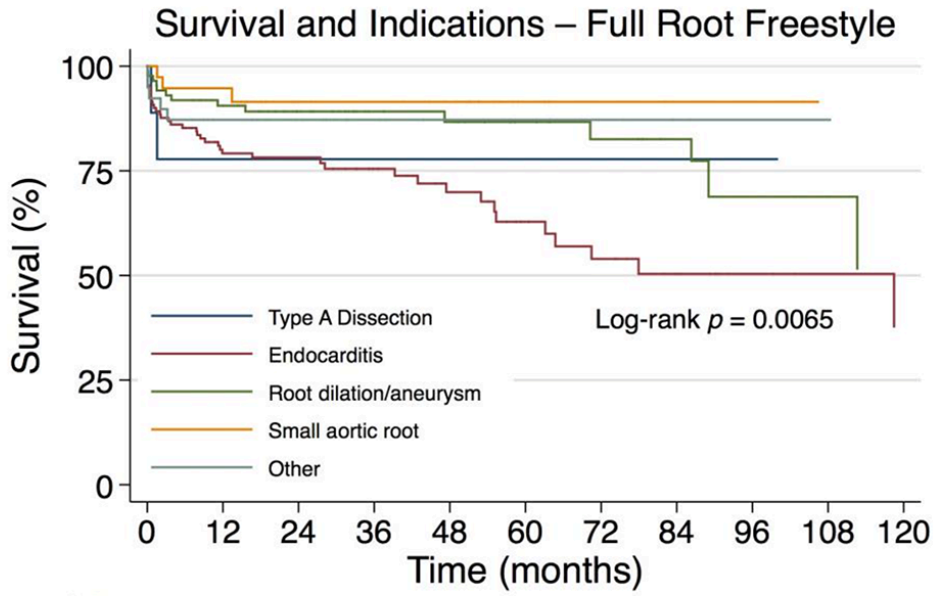
Objective
Few studies have investigated the Medtronic Freestyle Stentless bioprosthesis® (Medtronic Inc., Minneapolis, MN, USA) as a full root replacement. The aim of this study is to describe current indications and associated outcomes for the Freestyle as a full aortic root replacement at our institution.

Methods
This was a prospective, observational cohort study. All full root Freestyle implantations at Rigshospitalet from 1999 to June 2016 were included. Data was extracted from the local surgery registry. The patients were stratified according to indication: 1. Type A dissection, 2. Endocarditis, 3. Root aneurysm, 4. Small root and 5. Miscellaneous.

Results
335 Freestyle bioprostheses were implanted in 324 patients. The mean age was 63.8 years, 69.3% were male. The preoperative characteristics were: mean LVEF 48%; 41.8% NYHA class II; 42.2% NYHA III/IV. 45% was elective surgery. The most common indication was endocarditis at 42.6%. 27.2% of the cohort was operated due to aneurysm, 12.4% due to small aortic roots and 3.7% due to type A dissection. 12.7% was miscellaneous. Follow-up was at mean 2.9 years (range 0 to 14.4 years). 30day mortality was 9.9%. Overall survival was 73% at 5 years. See Figure. for Kaplan Meier survival analysis, stratified for indications.

Conclusions
In the present study the most common indication for full root Freestyle implantation was endocarditis. The survival curves of the indications endocarditis and aneurysm are continuously falling, whereas patients operated for type A dissection and small aortic root are stable in survival after the early postoperative period.



Number at risk

Type A Dissection	9	6	1	1	1	1	1	1	1	0	0
Endocarditis	130	88	64	47	34	23	18	12	6	4	3
Root dilation/aneurysm	86	69	53	38	35	25	20	16	8	5	3
Small aortic root	38	31	19	18	15	6	3	2	2	0	0
Other	39	30	22	14	10	8	5	2	1	1	0

The 9 Stressless Stiches Technique: Feasibility and Outcomes of a New Method for Aortic Valve Replacement

O15

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Objective

Aortic stenosis (AS) is the most frequent heart valve disease in Western societies and its prevalence increases with age. The aim of this study is to evaluate the feasibility and short-term outcomes of the new method "the 9 stressless stiches technique" for the aortic valve replacement (AVR) in patients with a critical Aortic valve stenosis. This technique uses the design of the prosthesis for a natural sealing and adequate positioning of the bioprosthesis on the ring.

Methods

From May 2013 to October 2015, 63 consecutive patients underwent aortic Valve replacement by the same surgeon with the 9 stressless stitches technique, using the Magna Ease prosthesis (Edwards Lifesciences, Irvine, CA, USA). 30 patients had a full median sternotomy (redo and combined procedure) and 33 patients had a minimally invasive approach (single procedure). Pre-operative patients characteristics are summarized in table I.

Results

Mean transaortic valve gradient was 12.6 $\pm$ 4 mmHg and 14.4 $\pm$ 3.4 mmHg in the isolated AVR group and in the redo and combined procedure group, respectively. There was one moderate paravalvular leak. 2 patients suffered from atrioventricular block, requiring permanent pacemaker implantation. Hospital mortality was 6.3% all in redo or combined procedure patients. One-year mortality was 6.7%, non-related to AVR

Conclusion

This preliminary series demonstrates that the 9 stressless stitches technique is a safe and acceptable technic for aortic valve replacement.

Aortic Valve Calcification: The Role of Interaction Between Valve Endothelial and Interstitial Cells

O16

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Background

Aortic valve calcification is caused by differentiation of valve interstitial cells (VIC) into osteoblasts and myofibroblasts. Endothelial cells produce an abundance of bioactive substances. We hypothesize that the valve endothelial cells (VEC) may influence the phenotype and the calcification process of the VIC.

Methods

VIC and VEC were isolated from human aortic valves with or without calcification harvested during surgery. VEC were seeded over a 3D culture of VIC embedded in collagen gel and cultured for 21 days in osteogenic differentiation medium. All four possible combinations of VIC and VEC from calcified and noncalcified valves were investigated. The expression of osteogenic markers BMP2, BCAT and RUNX2 was evaluated by RQ-PCR. To achieve myofibroblast differentiation co-cultures were stimulated by TGF1. Their ability to contract the gel size was used as a quantitative measurement of myofibroblast differentiation.

Results

The expression of mRNA of BMP2, BCAT and RUNX2 was most prominent in co- cultures of VEC from calcified valves together with VIC from non-calcified valves compared to all other groups. Compared to co-culture of VIC and VEC from calcified valves, BMP2 increased 5.6 fold ($p=0.02$), BCAT increased 4.8 fold ($p=0.03$), and RUNX2 increased 3.9 fold ($p=0.02$). Gel co-cultures of the same cell combination also contracted more strongly compared to all other groups (1.8 fold, $p<0.0001$) suggesting stronger myofibroblast differentiation.

Conclusion

VEC are able to influence osteogenic and myofibroblast differentiation of VIC. This suggests that cross-talk between VEC and VIC may have a regulatory function in the development of valve calcification.

High Mortality from Major Vascular Trauma in Traffic Accidents O17

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Objective
The most common mechanism of major vascular injury is road traffic accidents. The aim was to establish, in an entire population, mortality rate and risk factors of patients with major vascular trauma (MVT) following traffic accidents.

Material and methods
This was a retrospective analysis of all patients who sustained MVT in traffic accidents in Iceland from 2000-2011. Patient demographics, mechanism, and location of vascular injury were registered, together with signs of life and treatment. Injury scores (ISS, NISS, RTS and Ps) were calculated. Patients that died before reaching hospital were compared to those admitted alive.

Results
There were 62 individuals (mean age 44 yrs., 79% males); of whom 21 (34%) reached hospital alive, but 33 patients died on-scene and 8 during transport. Two thirds sustained their injuries in the rural areas of Iceland compared to 31% injured in the capital area ($p<0.01$). Mean ISS and NISS for those admitted was 36 and 44, and mean hospital stay of discharged patients was 34 days. Eighteen patients were operated on; 14 with open vascular repair and 3 with endovascular stent insertion. Altogether 15 of the 62 patients survived (24%) to discharge from hospital.

Conclusion
Every other patient with MVT following traffic accidents dies on-scene (53%) or during transport (13%) to hospital. The most serious vascular injuries involve the thoracic aorta (68%). Patients that survive to admission are often severely injured and need emergent surgery with high demands on hospital resources.

The Morphology and Function of the Lymphatic Circulation in Fontan Operated Patients

O18

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Background

The lymphatics regulate the interstitial fluid by removing excessive fluid. It represents an extremely important step in the prevention of edema. The Fontan procedure has revolutionized the treatment of univentricular hearts. However, it is associated with severe complications such as protein-losing enteropathy (PLE) and peripheral edema that may involve the lymphatic circulation. We hypothesis that patients with a univentricular circulation have a reduced functionality of the lymphatic vasculature, which predisposes them to developing complications such as edema and PLE

Material and Methods

The functional state of lymphatics is investigated using near infrared fluorescence imaging, NIRF. The anatomy is described using non-contrast MRI and the capillary filtration rate is measured using plethysmography. The study population is 10 patients with Fontan circulation operated at Aarhus University hospital. Exclusion criteria is BMI$>$30 and age (years) $<$ 18. The Fontan group will be compared with an age, gender and weight matched control group (n=10) of healthy volunteers.

Results

Preliminary data (Fontan n=7, Control n=7) show that Fontan patients with clinical edema have a vast abnormal network of lymphatic collaterization. We also find a dilated thoracic duct with an abnormal course compared to normal. Lymphatic function in the Fontan group using NIRF, shows a contraction frequency: 0.8(0.2) min^{-1}, propulsion velocity: 2.4(0.4) cm/s and a pumping pressure: 53(4.4) mmHg. No significant difference is seen for these parameters between Fontan patients and controls.

Conclusion

The results indicate that lymphatics in some Fontan patients are abnormal with respect to morphology while function seems not to be altered.

Renal Recovery and Long-Term Survival Following Acute Kidney Injury After Coronary Artery Surgery

O19

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Background
Early recovery of renal function following acute kidney injury (AKI) after coronary artery bypass surgery (CABG) may positively affect patient outcome. We studied nationwide incidence and risk factors of AKI following CABG together with renal recovery and long-term survival.

Methods
Incidence of AKI, as defined by the KDIGO criteria, was studied among 1,754 consecutive patients undergoing CABG in 2001-2013. Renal recovery was defined as decrease of serum creatinine (SCr) to $\leq$1.25 baseline SCr. Predictors of AKI and long-term survival were evaluated with logistic regression-analysis.

Results
Postoperatively 184 (10.8%) patients developed AKI; 121 (7%), 27 (2%) and 36 (2%) at stage 1, 2 and 3, respectively. At postoperative day 10 renal recovery rates were 96 (95% CI 91- 99%), 78 (95% CI 53-90%) and 94% (95% CI 77-98%) for AKI stages 1, 2 and 3, respectively. BMI, diabetes, preoperative glomerular filtration rate, EuroSCORE, reoperation and units of red blood cells transfused were independent risk factors of AKI. Long-term survival was predicted by AKI with 10-year survival with normal kidney function and those with AKI stages 1, 2 and 3 being 76, 63, 56 and 49%, respectively ($p<0.001$).

Conclusion
The majority of patients that experienced postoperative AKI recovered their kidney function. Nonetheless, long-term survival remained markedly affected by the severity of the initial kidney injury.

Ventricular Morphology in Adults Born with a Ventricular Septal Defect

O20

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Background
Ventricular septal defects (VSD) whether they are large and surgically closed or small and untreated are considered to have great outcomes in adulthood. However, we have previously demonstrated lower functional capacity in both patient groups compared with healthy, matched controls. The mechanisms behind these findings remain unclear and therefore, we performed cardiac magnetic resonance imaging (MRI) on adult patients in order to evaluate biventricular morphology.

Methods
Adults with surgically closed or small, untreated VSDs and healthy controls underwent cine MRI for the evaluation of the biventricular volumes, and phase contrast scans for the measurement of cardiac index. MRI measurements were analysed post hoc in a blinded fashion by one main investigator.

Results
Twenty operated patients (22.4±2years) and 20 matched controls (23.1±2years) were included, along with 32 small, open VSDs (26.3±6years) and 28 matched controls (26.8±5years). Operated VSDs were found with larger right ventricular end-diastolic volume index (RVEDVi) (102.7±20ml/m^2) compared with their controls (87.7±16), p=0.01. Heart rate and right ventricular stroke index (RVSi) were comparable between operated VSDs and controls. Open VSDs also revealed larger RVEDVi (105±17ml/m^2) compared with their matched controls (88.2±13ml/m^2), p<0.01. Furthermore, RVSi was higher in patients with open VSDs (53.1±12 ml/min/m^2) compared with controls (46.4±8 ml/min/m^2), p=0.02, but heart rates were similar. Left ventricular measurements displayed no differences between patient groups and their matched control groups.

Conclusion
An altered RV morphology was demonstrated in adults with small, untreated VSDs and in adults 20 years following surgical VSD-repair. These findings may explain some of the mechanisms behind the exercise limitations previously found in adulthood in this patient group.

What are the Biomechanical Properties of the Papillary Muscle Approximation used for Repair in Ischemic Mitral Regurgitation

O21

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Background
Papillary muscle approximation (PMA) has emerged as an enticing option in mitral repair of severe ischemic mitral regurgitation (IMR). The aim of this study was to perform a biomechanical assessment of the PMA in order to address the impact on valvular-subvalvular geometry and force in the approximation.

Methods
Measurements were conducted in an acute in-vivo setting using a healthy 80 kg porcine model. Thirteen pigs were included in the PMA intervention group and six pigs were added to the control group. Interpapillary forces were measured with a dedicated force transducer. LV geometry was measured with sonomicrometry. Functional valve parameters were measured with echocardiography.

Results
Hemodynamics were overall comparable for the PMA group and the control group, however significant differences were found for systolic pressure, total ECC period. Between groups mitral annulus parameters such as 3D Area, septal-lateral distance and commissure-commissure distance did not change with PMA. However, AHWCR did change significantly between groups, suggesting an increased saddle shape height. The anterior PM was moved central in a horizontal plane, whereas the posterior PM was moved slightly apically based on 3D sonomicrometric data. Mean force in the PMA suture between the PMs peaked at 8.2 ± 2.2 N.

Conclusion
We have demonstrated that PMA does not interfere with natural annular dimension, but may increase saddle-shape of the annulus. The peak force measured in this study could indicate a disposure to suture detachment and consequently warrant external PM stabilization devices such as a PM sling to prevent early repair failure.

Mortality and Predictors of Mortality after Tricuspid Valve Procedures - A 27-years Single Center Experience

O22

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Background
Tricuspid regurgitation (TR) is associated with increased mortality whereby surgical management of severe TR improves survival. More data to improve patient selection and timing of procedure is needed.

Method
Data from 393 tricuspid valve (TV) procedures in 388 adult patients were compiled. Groups were made according to type of concomitant procedure: CABG (n=87), other valve surgery (n=241), or isolated TV procedure possibly with other minor procedure (n=65), and decade of operation: 1989 - 2005 (n=174) or 2006 - 2015 (n=219).

Results
Overall 30-day mortality decreased from 16 to 7% between the decades, and one- and five- year survival improved from 76±3% to 90±2% respectively 61±4% to 79±3% (all p¡0.001). Annual number of TV procedures increased 2.1-fold and preoperative grade of TR was significantly lower during the last decade (p¡0.001). Concomitant CABG resulted in significantly higher mortality than all other concomitant procedures during both decades, whilst isolated TV procedure had the highest survival rates with no deaths within the first year during the latest decade. Grade of TR (HR 1.6 per grade, 95% CI 1.04-2.5, p=0.035) and NYHA class (HR 1.9 per step, 95% CI 1.2-2.9, p=0.004) were independently associated with overall mortality.

Conclusions
Survival significantly improved during the last decade, in which more TV procedures and at lower preoperative TR-grades were performed. Higher grade of TR and NYHA class were independently associated with increased mortality throughout the last decade. The results suggest that early surgery is beneficial if a TV procedure is considered.

Early Impact of Factor-Xa-inhibition after Experimental Acute Cardiac Volume-overload

O23

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Background
Anticoagulant treatment is mandatory after acute volume-overload (AVO) to prevent thrombosis. Anticoagulation including inhibition of factor-Xa may include molecular cascades reducing detrimental fibrosis. We experimentally investigated whether apixaban, a factor-Xa inhibitor, impacts on myocardial recovery after AVO.

Material and Methods
Fifty syngeneic Fisher 344 rats underwent surgery for abdominal arterial- venous fistula to induce AVO. Seventeen rats were treated with subcutaneous apixaban 10 mg/kg/day (AVO+A), while 32 untreated AVO served as Controls. Myocardial recovery was studied using histology and quantitative reverse-transcription polymerase chain reaction for hypoxia inducible factor 1 (HIF1), inducible nitric oxide synthase (iNOS), E-selectin, atrial natriuretic peptide (ANP), brain natriuretic peptide (BNP), vascular endothelial growth factor (VEGFα), matrix metalloprotease 9 (MMP9), chitinase-3-like protein (YKL-40) and tumor growth factor β (TGFβ).

Results
One rat without treatment was lost due to acute cardiac failure. After 3 days, the relative number of vacuolated myocardial arterial nuclei of the right and left ventricles increased in AVO+A as compared with Controls (0.06$\pm$0.01 vs. 0.013$\pm$0.01, point score units [PSUs], P=0.018 and 0.05$\pm$0.02 vs. 0.008$\pm$0.01, PSUs, P=0.021, respectively). At day 1, TGFβ (2.2 vs. 4.1, fold changes [FCs], P=0.051) decreased, and at day 3, ANP (5.0 vs. 2.1, FCs, P=0.012) and MMP9 (12.0 vs. 5.9, FCs, P=0.053), increased in AVO+A as compared with Controls, respectively.

Conclusion
Apixaban impacts early on ongoing cardiac remodeling after AVO; decreased fibrinogenesis may reduce formation of myocardial fibrosis. This study suggests that prolonged anticoagulation is warranted after AVO and subsequent cardiac insufficiency.

Mitral Valve Posterior Leaflet Reconstruction using Porcine Extracellular Matrix - An Acute Echocardiography Study

O24

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Objectives

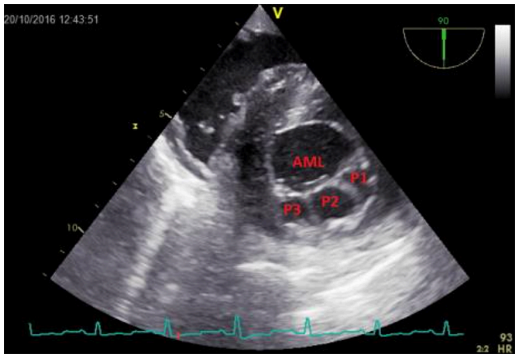
Advanced mitral valve reconstructive surgery may involve tissue replacement with different patch material. CorMatrix® is a novel patch material, which act as a scaffold that is recellularized with the patients own cells, and therefore may be an ideal material for heart valve reconstruction An improved generation of CorMatrix® has been developed, in order to adapt the high-pressure on the left side of the heart. The aim of this study was to design and test a mitral valve posterior leaflet reconstruction using this porcine extracellular matrix.

Materials and Methods

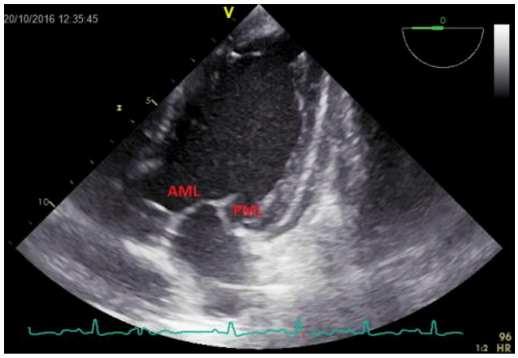
An open chest acute porcine model was used (n=6) together with a piece of 8×4 cm 2-ply CorMatrix® that consisted of P1-P3 scallops with an arc cutout of 1×3 cm for P2. On cardiac bypass, through the left atrium, the native P1-P3 was excised. The new posterior leaflet was attached at two points on each papillary muscle and at the annulus with Prolene 4-0. Magic stitches were performed at the new commissures. An epicardial echocardiography was performed at baseline and after the reconstruction, together with pressure measurements.

Results

Representative echocardiography images are shown in Figure 1 and 2 together with selected data in Table 1.



PSAX view of reconstruction



5 chamber view of reconstruction

Group	Annulus-dia Closed [mm]	Tenting area [mm^2]	Tenting hight [mm]	Coaptation length [mm]	Annulus-dia Opened [mm]
Baseline	23.2 $\pm$ 4.0	160 $\pm$ 25	9.5 $\pm$ 0.8	7.8 $\pm$ 1.3	28.3 $\pm$ 2.3
Reconstruction	18.7 $\pm$ 1.6*	90 $\pm$ 7*	7.2 $\pm$ 1.4*	10.1 $\pm$ 1.2*	21.2 $\pm$ 3.2*

Table 1: Mean $\pm$ standard deviation. MVA: Mitral valve area; AML: Anterior mitral leaflet; PML: Posterior mitral leaflet. *: Statistically different from baseline ($p<0.05$).

Conclusion

The reconstruction of the posterior leaflet showed to be fully functional and comparable to native valve with no gradient or regurgitation. The suture plasty downsized the annulus. Further investigation is needed to evaluate the recellularization potential of the material and to explore if an additional ring annuloplasty would be beneficial to protect the reconstructed tissue.

How can we Secure Continuous Recruitment of Biomedical Engineers in Cardiovascular Research?

O25

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Background

The biomedical engineering (BME) masters program at Aarhus University was launched in 1998. The initial student population for recruitment was among bachelors in electrical and later mechanical engineering. The research based education was anchored in the scientific activities conducted at the Department of Cardiothoracic Surgery at Aarhus University Hospital and in particular the back then renowned Hemodynamic Research Group. Later, the educational specialization broadened to include medical imaging and neuro science. The scope is still being broadened with new fields and specialization. The latest field combining technology with monitoring and diagnosis is telemedicine. As the demographics of the western societies yields more elderly people requiring healthcare and less younger caretakers, technological solutions alleviating this are being developed. This fairly new technological segment has been given many names (telemedicine/e-Health/pervasive healthcare), but is still an interdisciplinary specialization that should be governed under the BME programs. This fast growing area has in particular attracted many students due to the potential regional job opportunities. Consequently, only about 16% chose a classical BME profile.

Aim

Identify means of recruitment into cardiovascular engineering.

Methods

In Aarhus we are redesigning the entire education, by already having reduced the amount of mandatory courses by 50% and updating specialization packages as well as elective courses. We would like to discuss pros and cons in doing this redesign as well as discuss how broad the BME educational programs should be, and how we can ensure recruitment of students into the field of cardiovascular engineering.

Abstracts - Poster Presentations

Mapping of Catheter Tug Forces during Left Arial Appendage Occlusion P1

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Background
Patients with atrial fibrillation have increased risk of thrombus formation in the left atrial appendage (LAA). Although anticoagulant therapy reduces this risk, the increased risk of bleeding episodes in some patients necessitates alternative treatment with LAA occlusion (LAAO), where the source of thrombus formation is closed. LAAO can be performed minimal invasive through a device-delivery catheterbased procedure. Once the device is in place, it will be deployed and secured to the LAA entrance through barbs. After the insertion, some operators will perform a tug test to secure that the device is properly fastened and in place. However, this may potentially lead to endothelial damage or even perforation of the thin walled atrial structure. The purpose of this study is therefore to map the forces being applied to the catheter during a tug test and investigate if those forces can produce the aforementioned damages.

Materials and methods
Catheter forces will be measured through a custom designed force transducer. The transducer has an S shape and is instrumented with strain gauges in a Wheatstone half bridge configuration. The occlusion device will be inserted in fresh porcine hearts. Experienced operators will perform the tug test and forces will be measured. Moreover, damages of the atrial wall will be examined along with registration of damage threshold forces.

Results
Pending.

Perspective
These results will provide initial evidence whether a tug test after LAAO device delivery is to be considered safe. Future in vivo animal studies are also planned.

Concomitant Ablation for Atrial Fibrillation in Patients Undergoing Cardiac Surgery

P2

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Background

Atrial fibrillation causes for 25% of strokes, and concomitant surgical ablation to treat atrial fibrillation is indicated in patients that undergo open heart surgery, using a biatrial ablation (MAZE) procedure, or a less complex pulmonary vein ablation (PVI) procedure. The choice of choosing the MAZE or PVI procedure continues to be a subject of debate. Compared with PVA, the MAZE procedure is more effective in producing sinus rhythm, but also causes more patients to need a permanent pacemaker. Therefore, patient and procedure specific predictors of postoperative rhythm and pacemaker status need to be developed.

Methods

A retrospective single center analysis will be performed, using the study population of 458 patients that underwent open cardiac surgery and concomitant surgical ablation for atrial fibrillation from 2004 to 2015. Multivariate logistic regression analysis will be used to determine predictors of sinus rhythm twelve months postoperatively. The parameters used for regression analysis will be CHA_2DS_2-VASc score, CHADS2 score, gender, age, left ventricle ejection fraction, type of AF (paroxysmal or non- paroxysmal), type of ablation (PVI or MAZE) and concomitant mitral valve surgery. The level of significance will be set to 5%.

Results

Pending results.

Perspectives

This study aims to increase our knowledge about which patients should be treated with PVI and which patients should be treated with the MAZE procedure in order to achieve the highest possible rate of patients obtaining a sinus rhythm and reducing the risk of stroke, while also decreasing the number of patients in need of a permanent pacemaker.

Functional and Biomechanical Effects of an Adjunct Annuloplasty Ring in Extracellular Matrix Posterior Mitral Leaflet Reconstruction P3

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Objectives

Mitral regurgitation pathology often involves degeneration of the posterior mitral leaflet. Promising results are emerging using extracellular matrix (ECM) as a patch material for reconstructive surgery. ECM acts as a degradable bioscaffold that is overgrown and replaced by the recipients cells. The latest generation of ECM (CorMatrix®) contains multiple layers and is specifically adapted to the high pressure of the left side of the heart, making it attractive for patch material in mitral valve reconstructive surgery. However, mitral valve repair frequently involves implantation of a stabilizing annuloplasty ring. The aim of this study is to compare the performance of a CorMatrix® posterior mitral leaflet reconstruction with and without an annuloplasty ring.

Material and Methods

Posterior leaflet reconstruction with a CorMatrix® patch with and without implantation of a flexible ring (n=7) will be tested in an acute in-vivo porcine model (80 kg). The group will be compared to a control group with preserved posterior leaflet (n=7). Leaflet coaptation and valve competence are assessed by echocardiography. 3D geometry and annular dimensions of the mitral valve are evaluated by sonomicrometry. Pressure catheters will measure intracavity pressures.

Results

Pending.

Perspectives

The goal of this study is to clarify whether an annuloplasty ring will improve the physiological configuration and motion of CorMatrix® posterior mitral leaflet reconstruction. Adding an annuloplasty ring to posterior leaflet reconstruction may provide more effective leaflet coaptation and improve long-term results. This study will contribute to the increasing knowledge of ECM material and its use in reconstructive heart valve surgery.

Impact of Health Care System Delay in Patients with Acute Aortic Dissection

P4

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Background

Acute aortic dissection type A (AAD) is associated with a mortality rate of 1% to 2% per hour immediately after symptom onset in untreated patients, why timely diagnosis is essential.[1] However, identifying AAD patients is often challenging and similarities with symptoms presented in acute coronary syndrome, often hampers the establishment of diagnosis.[2] Pre-hospital paths are therefore often complex and patients may have contact with several healthcare providers prior to referral to definitive treatment. The aim of this study is to investigate the clinical and diagnostic factors contributing to system delay in the diagnosis of AAD.

Material and Methods

We performed a retrospective observational study including 132 patients operated for AAD during 2010-2014 at Rigshospitalet, Copenhagen, Denmark. System delay from emergency medical service call to arrival in the operating theatre were obtained from patient records and prehospital databases. Patients were evaluated for factors contributing to system delays.

Results

Data collection is not completed, therefore results are still pending.

Perspectives

System delay in time from diagnosis to surgery is considered to be an important factor in patient outcome, but only limited data are available to elucidate this issue. Initial symptoms at admission vary considerably, and improved physician awareness of atypical presentation may lead to prompt transfer to a tertiary centre, which might benefit AAD patients.

1. Tsai T, et al. Acute Aortic Syndromes. Circulation; 112:380213, 2005.

2. Harris K, et al: Correlates of delayed recognition and treatment of acute type a aortic dissection: The international registry of acute aortic dissection (IRAD). Circulation; 124:1911-8, 2011

The Effects of the Aortic Root on the Fracturing Pressure of Bioproshetic Heart Valves

P5

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Objectives

In addition to replacing diseased native valves, the transcatheter aortic valve implantation (TAVI) valves can be used for valve-in-valve therapy, where the TAVI valve is inserted into degraded surgical stented bioprosthetic valves, thus reestablishing proper valve function. To circumvent the reduction in valve orifice area, particular in smaller sized aortic valves, the geometrical restrictive stent structure can prior to the TAVI procedure be fractured through high pressure balloon predilatation. The fracture pressure threshold can prior be assessed in vitro. However, the aortic root is often calcified reducing the compliance and introducing a restrictive force acting against the fracturing of the heart valve. To assess these forces, the aim of this study is to simulate the physiological environment in which the bioprosthesis is situated.

Materials and methods

A model of a restrictive acetat ring component of the Mitroflow valve will be developed. A high pressure balloon catheter will be placed inside the acetate ring and gradually inflated until fracture with registration of the fracture pressure. Furthermore, an anatomical 3D printed model representing a severely calcified aortic root will be developed from clinical CT scans. The root model will be cast in silicone and embedded with a restrictive material at the identified sites of calcification. The acetate ring will be inserted and fractured. The fracture pressure will be compared to the fracture mechanics of the free mounted ring. For validation and comparison purposes an experiment will also be made within fresh porcine aortic roots.

Results

Pending results.

The Cardiopulmonary Effect of Bronchodilation on Adult Ventricular Septal Defect Patients – The VENTI Trial

P6

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Background

Ventricular septal defect (VSD) is the most frequent congenital cardiac defect. With the current treatment guidelines VSD-patients are considered as healthy as their peers. Nonetheless, new evidence demonstrates significant long-term abnormalities as adult VSD-patients display lower oxygen uptake and anaerobic threshold during physical performance. The cause of these findings are still unclear and therefore we are investigating whether inhaled-beta-2-agonist improves the impaired VSD-operated patients' cardiopulmonary performance during maximal exercise testing.

Methods

Our study is a double-blinded, randomized, controlled cross-over trial testing beta-2-agonists(Ventoline®) and Placebo. We will include three groups, 18-30 years of age; 30 patients operated for a VSD in early childhood, 30 patients with an unrepaired small VSD, and 30 age- and gender-matched, healthy controls. The participants undergo two incremental bicycle ergometer exercise tests using breath-by-breath analysis at two different visits. Beta-2 agonist and placebo are administered in randomized order, one at each visit. During test sessions respiratory gas exchange, blood pressure and electrocardiogram are measured continuously. The primary endpoint is peak minute ventilation. Secondary endpoints are peak exercise oxygen uptake, peak heart rate, maximal workload and anaerobic threshold.

Status

At abstract submission we have included 13 participants, 6 VSD-operated, 1 open VSD, and 6 controls.

Perspectives

We expect this study to add important knowledge regarding the cardiopulmonary function in VSD-patients during exercise and wish to better enlighten the consequences of surgical VSD repair. We hypothesize that VSD patients experience a small increase in physical performance following beta-2-agonist inhalation that may normalize their peak values as compared to their healthy peers.

Comparison of Valve-sparing Aortic Root Repair Techniques with Single and Double Annuloplasty Rings

P7

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Background

Aortic valve sparing techniques with ring annuloplasty have become an advantageous alter- native to conventional aortic valve replacement for specific patient groups, e.g. patients with isolated aortic insufficiency (AI) due to dilatation of the aortic root. Lansac et al have reported a tendency of reduced recurrent AI with double ring annuloplasty compared to single subvalvular annuloplasty. However, studies regarding ring annuloplasties are lacking, and a systematic characterization of functional and biomechanical aspects of these different techniques have not been carried out. The aim of this project is to investigate and compare the functional and biomechanical properties of single and double ring annuloplasty in a porcine model.

Material and Methods

Evaluation of valve dynamics and stress distribution in the aortic annulus and sinotubular junction will be obtained in an in-vitro model by high-speed imaging, echocardiography and two force transducers. Cardiac-gated aortic 4D-flow MRI is performed to assess leaflet char- acteristics and aortic root dynamics by determination of aortic root distensibility and wall shear stress in different levels of the functional annulus in an acute porcine model. These data can be used for comparison between single and double ring annuplasty. The two groups will also be compared to a native control group.

Results

Pending.

Perspective

We expect that further characterization of the biomechanical and hemodynamic effects of single and double ring annuloplasty will provide essential knowledge leading to optimized surgical treatment in selected patient groups. With further knowledge, a longer-lasting repair and a lower risk of re-operation for each patient are achieved.

Observations of the Cavitation Produced by a Mechanical Heart Valve using High Speed Ultrasonic Imaging

P8

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Background

Cavitation is a phenomenon, where microbubbles are formed in a fluid due to a local drop of pressure below the vapor pressure at a given temperature. At pressure recovery the microbubbles will implode and create large local energies. These local energies can cause damage and erosion of both the nearby fluid elements and surfaces. Cavitation can form at mechanical heart valves (MHV) and been suggested to be co-responsible for the increased risk of thromboembolic complications seen in MHV patients. The energetic cavitation process can potentially activate thrombocytes or cause release of tissue factor as a result of cell damage. Cavitation has been observed in vitro using 2D high speed video cameras. However, with a new high speed ultrasonic imaging technique, 3D visualization of bubble formation may be possible.
The aim of the study is to investigate the transient microbubble formation using high speed ultrasonic imaging.

Materials and Methods

IThe cavitation produced at the closure of a mechanical tilting disc heart valve will be observed in vitro in a custom build single shot model. The setup includes a water filled ventricular chamber, where a 25 mm Björk Shiley monostrut valve is mounted acting as the mitral valve with visual access from the atrial aspect. The valve closure is controlled through applying compressed air into the ventricular chamber. Visualizations of microbubbles will be performed using the experimental ultrasound system SARUS sampling at 70 MHz.

Results

Pending.

Perspectives

This study may provide the first in vivo applicable method for visualizing MHV cavitation.

Mitral Valve Posterior Leaflet Extension using Porcine Extracellular Matrix - Six and Nine Months Histological and Biomechanical Characterization

P9

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Objectives

The aim of this study is to examine weather CorMatrix®, a bio-engineered tissue scaffold, can be used as a patch material in mitral valve repair surgery. CorMatrix® is composed of extra cellular matrix extracted from the submucosal layer in porcine small-intestines.

Material and Methods

The CorMatrix® will be implanted as a posterior leaflet extension in the mitral valve. This study will look at the histological composition and biomechanical properties of CorMatrix® in a chronic porcine model. The pigs will live for six months. A selection of our study population will continue to live for a total of nine months. Thereafter the implants will be explanted and analyzed.

Results

We have pending results.However, our hypothesis is that CorMatrix® after six months will have re-cellularized and contain similar biomechanical properties as valvar tissue. After nine months we expect the collagen in CorMatrix® to be notably deteriorated.

Perspectives

Previous, similar, studies with CorMatrix® on the tricuspid valve, within our research group, has shown excellent results. If the outcome of our study is similar to our results on the tricuspid valve, then this can be beneficial for patients suffering from mitral regurgitation, more specifically functional ischemic mitral regurgitation. A group of patients to which mitral valve repair surgery is a common treatment. If a mitral valve extension on the posterior leaflet is possible using CorMatrix®, reconstructive heart valve surgery in general might benefit from this novel reconstructive method. This study has the potential and perspective to provide a better treatment for many patients suffering from FIMR.

The Effect of Congenital Heart Disease on Cerebral Function and Comorbidity in Adulthood

P10

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Background

Patients with congenital heart disease (CHD) are surviving into adulthood. The substantial advancement in CHD care have improved survival and consequently increased the prevalence of CHD in all age groups. As mortality is shifting away from infants towards adults, so does the burden of comorbidity. Survivors of CHD surgery demonstrate abnormalities in macro- and microstructural brain morphology and hence impaired neurodevelopment and cognitive functions. Brain dysmaturation inflicted in utero because of circulatory pathophysiology is thought to be the origin of the abnormalities. The cerebral alterations are previously demonstrated in minors. As brain development and maintenance occur throughout adulthood, a main concern emerges whether CHD patients are affected into adulthood. Therefore, the aim of our study is to examine the impact of brain dysmaturation on brain morphology and neurocognitive function in adults with simple CHD.

Methods

A prospective long-term follow-up study on CHD patients treated at Aarhus University Hospital between 1975 and 1995. The study population will consist of a group with acyanotic CHD patients, comprised of 20 surgically closed VSD and 20 unclosed ASD patients, and a group of age and gender matched controls. Brain macro- and microstructural morphology will be examined using MRI. Neurodevelopmental outcome will be explored by functional-MRI and a battery of neuropsychological tests.

Results

Pending.

Perspectives

Our study will demonstrate whether congenital cardiovascular anomalies in simple CHD affect the brain into adulthood. This data will help uncover possible cerebral comorbidities and improve information to out-patient clinics who often encounter this population.

Myocardial Metabolism in Heart Failure induced by Right Ventricular Volume Overload

P11

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Background

Every year in Denmark, 500 children are born with a heart disease and many are now surviving into adulthood. Due to constant cardiac overload, some are at risk of heart failure, and heart failure is the most im- portant cause of death and reduced quality of life in patients with congenital heart disease. Thus, monitoring of their cardiac function is of great importance. This is a considerable challenge due to our poor understanding of heart failure pathogenesis and the prolonged course and complex cardiac anatomy and fun- ction seen in congenital heart disease.

Methods

Hyperpolarized [1-^{13}C]-pyruvate magnetic resonance imaging is a novel technique capable of evaluating flux through key metabolic enzymes in the beating heart. Using this technique, we will examine the pyruvate metabo- lism of the heart failing due to right ventricular volume overload. The overload is established by pulmonary valve plication in ten pigs weighing five kilograms. Every four weeks for 16 weeks, the pigs are examined with [1-^{13}C]-pyruvate magnetic resonance imaging as well as conventional magnetic resonance imag- ing, weighing, NT-proBNP measurements and echocardiography. Serial data are analysed using repeated measures ANOVA.

Results

Pending.

Perspectives

We hypothesize that hyperpolarized magnetic resonance imaging enables us to detect the metabolic changes of the failing heart and that these changes precede the changes accessible by conventional diagnostic tools. If this is the case, this study could improve our understanding of heart failure pathology and may prove hyperpolarized magnetic resonance imaging promising for monitoring heart failure in congenital heart disease.

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