EACTS Daily News
European Association For Cardio-Thoracic Surgery
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Tuesday 14 October

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The versatile beauty of the hand

Mysterious, powerful and ingenious

In his Presidential Address, Professor Paul Van Schil (Antwerp University Hospital, Edegem, Antwerp, Belgium) began by thanking his wife and family for their endless support, the EACTS Secretariat and Council, and Alan Sihoe, who was of great help in the preparation of his address.

Professor Van Schil was born in Antwerp, Belgium, and it's the name of his home city that gave him the inspiration for his presentation. Antwerp literally means 'hand-werpen 'or' throwing the hand' and so his address, "The versatile beauty of the hand: mysterious, powerful and ingenious", focused on human hands that have played such an important role in scientific and cultural advancements throughout human evolution.

"In our surgical specialty, hands are extremely important to perform the highly precise technical acts necessary to complete every operation," he said. "Not only are fine technical skills required, but also a balanced interaction between our brain and the hands executing the complex commands."

He cited one of his former vascular teachers who asked his student a specific question: "What's the difference between your hands and my hands?" His answer was: "My hands are connected to a brain."

"Should we not use our hands for what they have been created for, to further advance our species?" Van Schil asked. "Our hands are ideally suited to reach out and embrace other people to obtain a sense of togetherness, common being and unification. Let's apply this to the three pillars of our academic profession."

He said that patient care is paramount, and one of the main tasks of a leader is to bring everybody at each level of his department together, and define common goals and interests, subsequently shaping the way to reach the predefined endpoints.

Almost every patient is discussed within a multidisciplinary board, demonstrated by the birth of heart and lung teams, and specific clinical pathways for disease management have been designed.

"This remains a difficult point for many surgeons as surgery is a highly individualized profession; in fact, there is only one person who can perform a specific operation and take leadership of a complex procedure with its inherent risks of intraoperative technical difficulties and subsequent complications," he added. "Many traditional disciplines of internal medicine and imaging modalities are developing clearly technically-based procedures which are complimentary or in some cases even replacing our so-called 'aggressive' surgical acts."

Cardiologists are becoming more and more invasive, pulmonary physicians are able to play an important part in staging and restaging of lung cancer, and interventional radiologists introduce catheters and sheaths in every major artery for thrombolytic therapy, inflation of balloons, creation of shunts and repair of aneurysms.

"In this changing environment, cardiothoracic surgeons need to get accustomed to reaching out to other colleagues and working – hand-in-hand – in an increasingly multidisciplinary setting," he explained. "We will witness the birth of new specialties incorporating previous sub-disciplines of internal medicine, radiology and surgery, between which the borders are progressively dissolving."

Paul Van Schil

The second pillar is research and he explained that not only clinical, but also basic research should remain an integral part of cardiothoracic specialty, as surgeons are ideally placed to build bridges between basic science and clinical practice.

He introduced Dr Jan Gielis, a surgical group fellow at Antwerp, and asked him to give his impressions and ideas on surgical research performed by young surgeons in training. Dr Gielis said that he has been able to bring into practice qualities that he learnt from his mentors: to adapt, to improvise, to keep his head cool and – above all – to keep his hands steady.

"My experience from this research fellowship has made me appreciate more than ever our mentors and teachers who generously pass onto us not only their fine surgical skills and great clinical insight, but a profound appetite for scientific research," he concluded.

Education is the third building stone, principles of which have changed over the last decade by profound innovations in the way students are taught, not only when they are students, but also when starting their clinical practice, and even for a lifetime thereafter.

Although there is no uniform training in cardiothoracic surgery, he emphasized that organizations such as EACTS have a vital responsibility to promote and lead training programmes, educational and postgraduate courses, and European professional board examinations.

"To meet these challenges, we also have to reach out to join hands with other societies and work together as we have many common interests and goals. In our discussions with other societies and associations the primary goal is to advance scientific knowledge, education and teaching in order to train and prepare the young generation for their profession and the future challenges they will have to cope with."

He ended his address with a special hand salute that was popularized by Mr Spock in the series Star Trek.

"This Vulcan greeting means 'Live long and prosper' and to my successor Martin Grabenwöger I would say all the best. I wish you a highly successful year as you explore strange new challenges, seek out new opportunities and new directions, and boldly go where no EACTS president has gone before!"

Cardiac – Film session: Films

Transapical myectomy for hypertrophic obstructive cardiomyopathy

Relief of midventricular obstruction and subsets of patients with LVOT obstruction

Eduard Quintana *University of Barcelona, Spain*

Obstructive hypertrophic cardiomyopathy (HOCM) accounts for 70% of patients with hypertrophic cardiomyopathy and confers worse prognosis to the disease[1]. Almost consistently, relief of obstruction in these patients corrects heart failure symptoms and restores life expectancy.

Surgery for hypertrophic cardiomyopathy has continued to evolve significantly since the first description of a transaortic myectomy for LVOT (left ventricular outflow tract) obstruction. From a practical point of view LVOT obstruction (basal obstruction) is usually amenable to resection through the aortic root by means of and extended septal myectomy[2]. In addition to this basal excision it is frequently possible to resect

Continued on page 2

Cardiac – Abstract session: What is the benefit of a radial conduit?

Equipoise between radial artery and right internal thoracic artery as the second arterial conduit in LITA based CABG

A multi institutional study

Thomas A Schwann *University of Toledo, USA*

A large body of high quality evidence has accumulated over the past two decades in support of multiple arterial grafts for surgical revascularization of multivessel CAD. Yet, single arterial CABG based on the left internal thoracic artery (LITA) to the LAD with additional saphenous vein (SV) grafts stubbornly remains predominant in most practices worldwide and particularly in the United States. In 2013, only 9% of multivessel CABG surgery in the US was performed with multiple arterial grafts.

The study presented by Dr. Thomas A. Schwann on behalf of a multi-institutional team of investigators from New Haven (Dr. S. Hashim) Toledo (Drs. M. Bonnell and M. Engoren), and New York (Dr. R. Tranbaugh) in the US and from Beirut, Lebanon (Drs. M. Obeid, S. Badour and R.H. Habib) joined this important debate. Their study aimed to address two pertinent questions: 1) Is multi-arterial CABG truly superior to single-arterial?, and 2) In case of multi-arterial CABG, should the radial artery (RA) or the right ITA (RITA) be preferred as the second arterial conduit choice. To this end, Dr. Schwann presented their sixteen year follow-up study which utilized an analysis based on study cohorts of matched SV, RA and RITA triplets.

The investigators employed propensity score modeling and matching methods to arrive at well matched subcohorts belonging to the three grafting methods (551 SV, RA and RITA triplets). The resulting late or 16-year survival was equivalent in the RA and RITA matched groups (68.2% vs. 66.7%, p=0.127), and both were significantly better

Continued on page 2

Tuesday 14 October

Professional Challenge

08:15 Part I: Catheter based mitral interventions: The mitral going transcutaneous

Gold Room

Moderators: F. Maisano, Zurich; J. Seeburger, Leipzig

08:15	The long and winding road	*Alec Vahanian*
08:40	Transcatheter mitral valve replacement for native mitral valve stenosis using the inverted Sapien 3 prosthesis in six consecutive patients	*Philipp Kiefer*
08:55	Acute safety and efficacy of the Neochord procedure	*Andrea Colli*
09:10	Surgical options after unsuccessful mitral clipping – repair or replace	*Michael Schmoeckel*

Abstract

Basic Science: Genes, cells and drugs

Titian

Moderators: P. Menasche, Paris; G. Steinhoff, Rostock

08:15	Metagenomic analysis of native – and prosthetic-valve infective endocarditis	*Andreas Oberbach*
08:30	Tissue engineered mitral valve: Morphology and biomechanics	*Pavel Yablonski*
09:00	A novel model of murine ascending aortic aneurysm	*Giacomo Bianchi*
09:15	Serotonin signalling and mitral valve prolapse: Ovine and murine models reveal shared molecular mechanisms to human pathological remodelling	*Giovanni Ferrari*
09:30	The effects of losartan in preserving the structural integrity of decellularised small-diameter vascular allograft conduit implants	*Seung Hyun Lee*

Films

Michelangelo

Moderators: A. Ahlsson, Örebro; R. Poffo, São Paulo

08:15	A new anastomotic option for severely calcified aortas: Double-folded adventitial anastomosis	*Hiroshi Kurazumi*
08:27	Transapical approach in redo myectomy for hypertrophic cardiomyopathy	*Eduard Quintana*
08:39	Technique and pitfalls of off-pump waffle procedure for constrictive pericarditis	*Kaoru Matsuura*
09:27	Resect or respect strategy of mitral annular calcification for patients with mitral regurgitation or stenosis	*Fumikazu Nomura*

Congenital aortic valve disease and Ross procedure

Raphael

Moderators: D. Anderson, London; D. Barron, Birmingham; D. Shore, London

08:15	A multicentre evaluation of the autograft procedure for young patients undergoing aortic valve replacement: Results from the German Ross Registry	*Hans-Hinrich Sievers*
08:30	The Ross procedure in young adults: Over 20 years' experience in a single centre	*Stefano Mastrobuoni*
08:45	Seventeen-year single-centre experience with the Ross procedure: Fulfilling the promise of a long-lasting option without anticoagulation?	*Aleksandra Miskovic*
09:00	Bicuspid aortic valve disease and ascending aortic aneurysm: Should the aortic root replacement be mandatory?	*Igor Vendramin*
09:15	Red blood cell distribution width predicts morbidity and mortality after aortic valve replacement	*Calogera Pisano*

Hot strategies in complex cardiac surgery

Amber 5

Moderators: M. Borger, Leipzig; F. Eckstein, Basel

08:15	Aortic wall thickness as a parameter in pathogenesis of acute aortic dissection	*Jaroslav Benedik*
08:30	A multiple patch technique for the treatment of ischaemic ventricular septal defects or contained ventricular rupture	*Gloria Faerber*
08:45	Cardiomyopathy in Marfan Syndrome	*Eva Maria Delmo Walter*
09:15	Redo after acute type A aortic dissection: Early results from a multicentre real-world experience	*Angelo Maria Dell'Aquila*
09:30	Novel method of assessment for ascending aortic dilatation with the bicuspid aortic valve	*Kaoru Hattori*

Valve Repair

Amber 1&2

Moderators: B. Asfour, Sankt Augustin; R. Greco, Madrid

Continued on page 2

Transapical myectomy

Continued from page 1

additional muscle at the midventricuar level through this approach.

It is important to identify the particular individual in whom the surgeon will find difficulties in exposing the hypertrophic septum responsible for obstruction. There are certain clinical scenarios that can complicate or preclude successful relief of obstruction at both subaortic and midventricular levels. Thus, alternative approaches to relief obstruction become necessary and are reproducible.

Factors such as a small ascending aorta, small aortic annulus, obese patients or patients with an increased antero-posterior chest distance pose patients at increased risk of incomplete myectomy. Although redo septal myectomy can be performed with excellent results in experienced hands this situation is usually preventable[3]. Understanding the anatomy through which the surgeon will access the point of obstruction by careful examination of preoperative and intraoperative imaging is the first step to success. In general when LVOT obstruction is present myectomy should be attempted first through the aortic root. This should be carried avoiding heart block, iatrogenic aortic regurgitation, ventricular septal defect or injury to the mitral valve chordae.

Transapical septal myectomy is safe and provides excellent exposure for midventricular obstruction relief. In cases where the basal septum cannot be reached though an aortotomy a myectomy usually can be performed reaching the LVOT through a 3cm left ventricular apical incision. This approach offers important advantages and one can gain extensive control of the LV cavity and assess pathologic findings inherent to the disease. Usually a midventricular myectomy can be performed if concomitantly present in cases of extensive septal hypertrophy with additional shaving of papillary muscles. This approach may offer control of basal obstruction and its especially useful in cases with concomitant LVOT and midventricular obstruction when an extended transaortic septal myectomy has been attempted. This technique should be in the armamentarium of surgeons dealing with HOCM and particularly in patients with a previously unsuccessful myectomy.

References

1. Ommen SR, Maron BJ, Olivotto I, et al. Long-term effects of surgical septal myectomy on survival in patients with obstructive hypertrophic cardiomyopathy. Journal of the American College of Cardiology 2005;46:470-6.

2. Schaff HV, Said SM. Transaortic Extended Septal Myectomy for Hypertrophic Cardiomyopathy. Operative Techniques in Thoracic and Cardiovascular Surgery 2012;17:238-250.

3. Cho YH, Quintana E, Schaff HV, et al. Residual and recurrent gradients after septal myectomy for hypertrophic cardiomyopathy-mechanisms of obstruction and outcomes of reoperation. J Thorac Cardiovasc Surg. 2014;148:909-16.

A multi institutional study

Continued from page 1

than the survival observed in single arterial SV patients (61.1%).

Dr. Schwann and colleagues interpreted their findings as being yet another piece of compelling evidence supporting use of multiple arterial conduits in CABG surgery as a documented technique to improve long-term survival compared to the traditional single arterial LITA based configuration. This late advantage is apparently obtained without any increased risk of early adverse outcomes, complications or resource utilization. The authors further suggested that the identified equipoise between the RITA and the RA graft in combination with the cornerstone LITA to LAD graft as a strategy for improved survival should translate into their more frequent use, and that the choice of RA versus RITA is of secondary importance and should mostly reflect surgeon preference and experience. The one notable extra consideration is that the choice of bilateral ITA use should carefully consider risk factors associated with increased risk of sternal wound infections such as the growing CABG segment of diabetic and obese patients. In such patients, the RA may in fact be a safer choice as a second arterial conduit.

Dr. Schwann concluded his presentation by suggesting that the time for a "palpable shift" towards multi-arterial CABG has come. Perhaps our professional societies can facilitate such pragmatic change by instituting multiple arterial grafts as a quality metric. The LITA graft is now an established cornerstone of CABG, but its wide adoption in practice only came after its establishment as a quality metric. The data presented suggest that we are now in need for similar leadership from our cardiac surgery community to facilitate this small yet rational "leap of faith" in favor of multi-arterial CABG.

Cardiac – Abstract session: Congenital aortic valve disease and Ross procedure

Update on the German Ross Registry

A multicentre evaluation of the autograft procedure for young patients undergoing aortic valve replacement

Hans-Hinrich Sievers *University of Lübeck, Germany*

Despite advances in prosthetic heart valves, in young patients with aortic valve disease conventional aortic valve replacement represents a suboptimal solution. Mechanical aortic valves still require lifelong anticoagulation, bring lifestyle restrictions and a potential for bleeding or thrombotic complications, whereas biological prostheses in young patients have disappointing durability. Repair of stenotic aortic valves with significant leaflet degeneration and calcification is questionable. Young adult patients with aortic valve disease represent only a small minority of all patients requiring aortic valve replacement, however these patients have different needs, expectations and wishes so that outcomes and expectations from the 60- and 70- year old patient populations cannot be extrapolated to the young.

In the Ross procedure the autologous living pulmonary valve is used for aortic valve replacement, thus potentially offering an extended durability and near normal valve function. Continuous follow-up with high patient numbers is necessary to evaluate this technique. Additionally, dealing with young patients mandates follow-up durations much longer than in the older populations in order to judge the efficiency and efficacy of treatment. With this in mind we started the Ross Registry in 2001. The Registry now includes more than 1800 patients with a 14.133 patient years cumulative follow-up and maximum follow-up of up to 24 years. The Registry is not industry financed or driven and relies completely on the cooperation and financing from the participating centers adhering to the Registries policies. Although registry results have their own shortcomings they do provide a more general and real world view on a specific operation.

Early mortality in the Registry was 1.1% (n=19). Thus the argument or objection against the Ross operation concerning a high early mortality cannot be supported by this Registry's results.

Late survival of the adult population (Figure 1) was comparable to the age and gender matched general population. Although this might deviate in the years to come, even 15 years after the Ross procedure the survival of the Ross patients follows closely that of the general German population.

Freedom from autograft reoperation at 5, 10, and 15 years was 96.8%, 94.7% and 86.7% (Figure 2) respectively whereas freedom from homograft reoperation was 97.6%, 95.5% and 92.3% respectively (Figure 3). Overall freedom from reoperation was 94.9%, 91.1% and 82.7% respectively.

Homograft function concerning the development of pulmonary insufficiency and stenosis remained relatively constant, the probability of pulmonary insufficiency grade I increased slightly over the years and also slightly the pressure gradient over the right ventricular outflow tract without hemodynamic significance (Figure 4). Also autograft valve function was stable in the second decade, with a slight increase in aortic insufficiency grade I (Figure 5).

In conclusion, the autograft principle for the young active patient results in postoperative long-term survival comparable to that of the age and gender matched general population with reoperation rates in the 1% per patient*year range. The functional homograft and autograft results are encouraging. Altogether the autograft principle for the treatment of aortic valve disease in young, active patients, who wish to avoid the shortcoming of conventional prostheses, should be strongly considered.

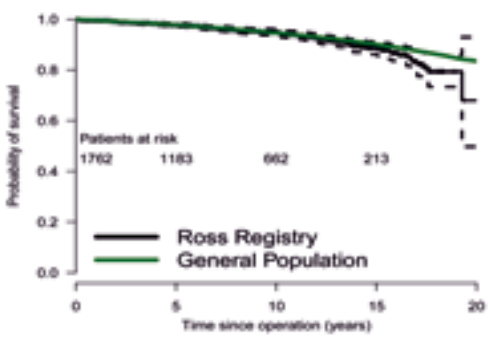

Figure 1. Probability of survival of the Ross patients compared with general German population.

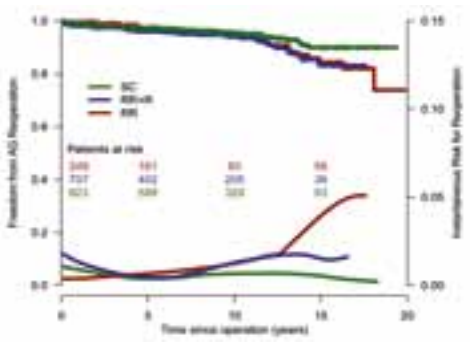

Figure 2. Freedom from autograft reoperation stratified by technique. SC, subcoronary; RR+R, root replacement with additional root reinforcement; RR root replacement without additional root reinforcement.

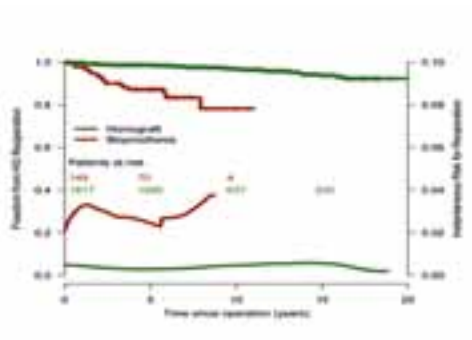

Figure 3. Freedom from homograft reoperation stratified by type of prosthesis.

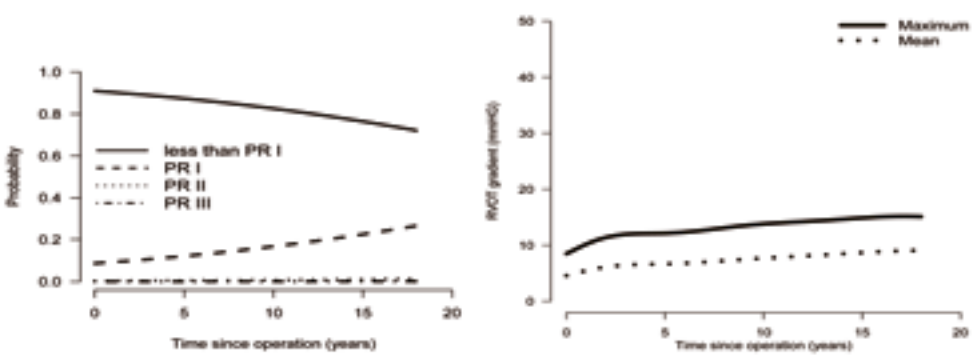

Figure 4. (Left) The time course of transvalvular mean and maximum homograft gradients. (Right) Longitudinal probability of being in each pulmonary regurgitation grade with time. PR, pulmonary regurgitation.

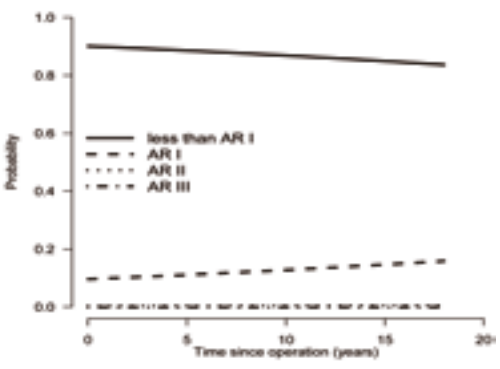

Figure 5. Longitudinal probability of being in each autograft regurgitation grade with time. AR, aortic regurgitation.

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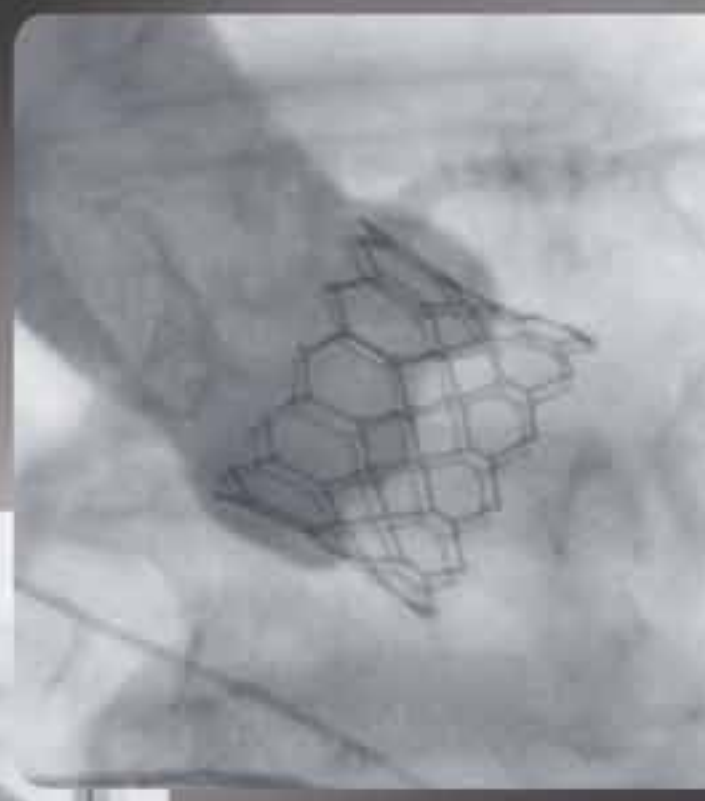

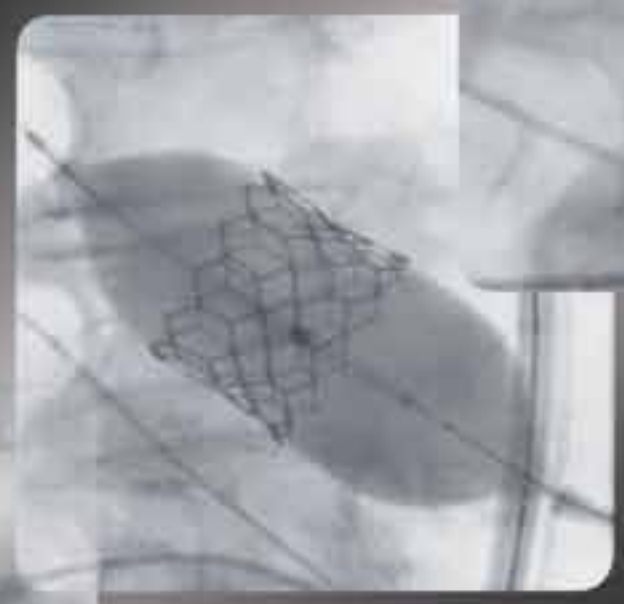

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08:15 **Aortic valve repair for insufficiency in older children offers unpredictable durability that may not be advantageous over primary Ross operation** *Travis Wilder*

08:30 **Contemporary long-term outcomes of an aggressive approach to mitral valve repair in children: Is it effective and durable for both congenital and acquired mitral valve lesions?** *Paneer Selvam Krishna Moorthy*

08:45 **Atrioventricular valve regurgitation in univentricular hearts: Outcomes after repair** *Daniela Laux*

09:15 **Durability of tricuspid valve plasty in paediatric patients** *Yuki Nakamura*

09:30 **Surgical treatment of infective endocarditis in paediatric patients: A 25-year review** *Eun Seok Choi*

The Fontan-Total cavopulmonary connection circulation

Amber 3

Moderators: J. Fragata, Lisbon; A.-R. Hosseinpour, Seville

08:30 **Results of extracardiac conduit total cavopulmonary connection in 500 patients** *Toshihide Nakano*

08:45 **Results of Fontan operation in patients with atrioventricular valve regurgitation** *Sergey Zaets*

09:00 **Ten-year outcomes of Fontan conversion in Australia and New Zealand demonstrate the superiority of a strategy of early conversion** *Chin Poh*

09:15 **Comprehensive rhythm evaluation in a large contemporary Fontan population** *Sjoerd Bossers*

09:30 **Initial management of pulmonary blood flow is associated with late outcomes in tricuspid atresia** *Travis Wilder*

Thoracic oncology III

Brown 2

Moderators: M. Lucchi, Pisa; A. Nakas, Leicester

08:30 **Surgical management of malignant pleural mesothelioma by pleurectomy-decortication with curative intent: A single-institution experience** *Maurizio Infante*

08:45 **The influence of visceral pleural invasion on the survival in completely resected non-small-cell lung cancer: Is the definition of 7th Edition of the TNM staging system for lung cancer suitable?** *Hiroyuki Adachi*

09:00 **Clinical impact of radical loco-regional surgery in synchronous oligometastatic non-small-cell lung cancer** *Andrea Viti*

09:15 **The relative contribution of imaging, invasive staging and thoracotomy in detecting pathologic N2 disease in the era of PET/CT** *Massimo Castiglioni*

09:30 **The number of lymph nodes removed and postoperative outcome for patients with clinical T1aN0M0 non-small-cell lung cancer** *Taketsugu Yamamoto*

Thoracic non oncology II

Amber 8

Moderators: F.M. Melfi, Pisa; A. Sihoe, Hong Kong; C. Zirafa, Pisa

08:15 **Congenital bronchiectasis** *Muhtar Sundetov*

08:30 **The management of bronchial stumps in anatomical lung segmentectomy** *Hiroyuki Oizumi*

09:00 **Successful treatment of complicated post-pneumonectomy bronchopleural fistula with autogenous corticocancellous bone graft** *Voravit Chittithavorn*

09:15 **The use of video-assisted thoracoscopic surgery in the treatment of lung hydatid cysts** *Levent Alpay*

09:30 **Results of laryngotracheal resection and anastomosis with posterior cricoidotomy in thirty-one patients** *Farahnaz Sadegh Beigee*

Focus Session

Thoraco-abdominal aortic repair reloaded

Brown 1

Moderators: R. Di Bartolomeo, Bologna; F.-W. Mohr, Leipzig; G. Weiss, Vienna

08:15 **Current practice in thoracoabdominal aortic surgery** *Roberto Chiesa*

08:35 **Hypothermic circulatory arrest** *Joseph Bavaria*

08:55 **Left heart bypass technique** *Marc A.a.m. Schepens*

09:05 **Total endovascular thoracoabdominal aortic repair** *Timothy Resch*

09:15 **The EACTS position paper on neuroprotection** *Christian D. Etz*

09:25 **Contemporary approach of thoraco-abdominal aortic repair using moderate to deep hypothermia combined with target reconstruction of the Adamkiewicz artery** *Hiroshi Tanaka*

Continued on page 6

Cardiac – Film session: Films

Resect or Respect strategy of mitral annular calcification for the patients with mitral regurgitation or stenosis

Fumikazu Nomura, M. Suzuki, N. Sakagami, A, Adachi, Y. Ohkawa, K. Sugiki, T. Kazui, T. Ohno, *Cardiovascular Center Hokkaido Ohno Hospital, Sapporo Japan.*

Mitral annular calcification (MAC) has become often seen combined with mitral valve disease, ischemic heart disease (IHD), and aortic valve disease, especially with hemodialysis patients. Operation treating MAC is challenging one, however, there are grades and managements of MAC differ in cases.

Strategy of how-to-treat MAC (Table 1) differs in cases according to the grade of severity of MAC, whose spectrum involves from partial posterior mitral annulus to entire posterior mitral annulus with subvalvular calcification and even further involves anterior mitral annulus. In case with MR, mainly annular calcification is not extending into subvalvular tissue, thus "respect" strategy of MAC is feasible and reasonable. However, in case with MS, where especially MVR is needed, in order to ensure adequate valve size at least over 25mm, "resect" strategy is reasonable and safe. "Resect" strategy consists of aggressive annular decalcification, which usually needs CUSA, and reconstruction of posterior mitral annulus with or without pericardial patch (autologous or bovine).

Neither MR nor MS were seen and more over there were no re-do nor death in the midterm period. This indicates that our strategy of "respect" or "resect" for MAC is safe and reasonable for severe MAC patients.

Table 1

Main Dx	Ope	Resect	Respect	Annular reconstruction with Patch	No Patch	HD	Re-do	Death
MS	MVR 5	5	0	2	3	2	0	0
MR	MVP 4	1	3	0	1	2	0	0

Combined surgery includes AVR (4), CABG (2), TAP (3), Maze (2) MVR: mitral valve replacement, MVP: mitral valve plasty, HD: hemodialysis

Cardiac – Abstract session: Hot strategies in complex cardiac surgery

A multiple-layer patch technique for the treatment of ischemic ventricular septum defects or contained ventricular rupture

Gloria Fäerber, Alexandros Moschovas, Mahmoud Diab, Kubanychbeck Abdyvasiev, Torsten Doenst *Hospital, Friedrich Schiller University, Jena, Germany*

Ischemic ventricular septal defects (VSD) or contained ventricular ruptures (CVR) are rare but life-threatening complications that usually occur with some delay after acute myocardial infarction. The gold standard of treatment remains surgical repair mostly for a lack of reasonable alternatives. However, perioperative mortality rates of more than 50% have been reported, often due to reoccurrence of VSD/CVR. From a technical standpoint, one likes to wait with the repair because the freshly infarcted tissue is fragile. However, due to the hemodynamic challenge of the VSD, waiting is often not an option and the surgeon is faced with freshly ischemic myocardium with very low resistance for suture anchoring.

Faerber et al describe a novel surgical technique consisting of multiple-layered patches reducing the risk of reoccurrence of VSD/CVR and allowing to operate early, negating the need to wait for surgery. The rationale consists of placing multiple overlaying patches to stepwise reduce forces on the outer patch, providing hemostasis and avoiding residual shunts.

Out of 14 patients, 13 received the multi-layer approach. Four of these high risk patients (mean logEuroSCORE 61%) died in the hospital, but none of them due to recurrence of VSD/CVR. The time from the diagnosis of VSD/CVR to surgery was on average 12 days. Kaplan-Meyer survival rates were 71% (n=10) at 30 days and 64% (n=9) at 4 years. Quality of life in the survivors showed unexpectedly high values. This novel technique provides a safe tool to surgeons faced with the need to treat patients with ischemic VSD/CVR.

Gloria Fäerber

Edwards

Tricuspid valve annuloplasty concomitant with mitral valve surgery: Effects on right ventricular remodelling

Herbert Gutermann, MD *Dep. Of Cardiac Surgery, Ziekenhuis Oost-Limburg, Genk, Belgium*

Tricuspid regurgitation (TR) usually does not regress after successful mitral valve surgery and its persistence or worsening has an adverse impact on exercise capacity, reoperation rate and outcome[1,2]. In 2005, Dreyfus et al. showed that remodelling annuloplasty of the tricuspid valve should be based on the presence of tricuspid annular dilatation (TAD), rather than the grade of TR3. Accordingly, ESC guidelines recommended tricuspid valve annuloplasty (TVA) in case of significant TAD (defined as an annular diameter >40mm or 21mm/m^2), irrespective of TR severity[4].

We strictly implemented these guidelines as from 2007, using a ring annuloplasty (Edwards MC3 Tricuspid or Carpentier-Edwards Physio Tricuspid ring) in all patients. In the presence of severe thetering (tenting distance>8mm), an augmentation of the anterior tricuspid leaflet using autologous pericardium, was added.

Our group recently published the results of this strategy on right ventricular (RV) remodelling[5]. We compared pre- and post-operative echocardiographic data from 45 consecutive TVA procedures performed in mitral valve surgery (Carpentier-Edwards Physio Ring), with a propensity-matched control group of 33 procedures without concomitant TVA. Performing TVA at the time of mitral valve surgery clearly leads to favourable changes in RV geometry, with the RV becoming more elliptical and less spherical.

As expected, a decrease in RV size was only significant in the subgroup with more than moderate TR, and not in the group with TAD without TR. However, performing an annuloplasty in the latter group did prevent further annular dilatation and the occurrence of TR. In the propensity-matched control group without concomitant TVA, there was a significant increase in RV size and sphericity, along with progressive TAD and TR (see Figure).

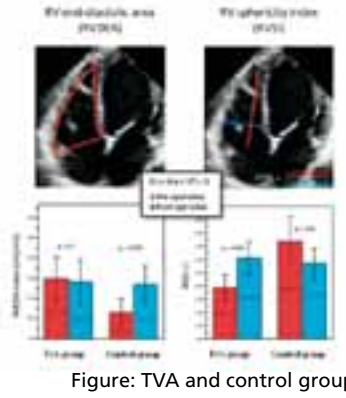

Figure: TVA and control group echocardiographic indices

These results are in accordance with other recently published data, demonstrating that TVA performed concomitantly with mitral valve surgery effectively inhibits ongoing RV dilatation and associated postoperative TR6. This beneficial effect on RV geometry avoids diastolic distortion of the interventricular septal geometry by RV overload, and may be an important factor to maintain or improve LV preload and ejection fraction[7]. Indeed, once the left-sided lesion has been addressed, a subsequent improvement in cardiac output increases RV preload and also leads to higher end-diastolic RV volumes, particularly in patients with lesser degrees of TR preoperatively. This subsequent rise in RV preload is an important cause of recurrent or progressive TR, observed late after mitral valve surgery and constitutes the rationale to consider TVA in patients scheduled for left-sided heart surgery when TAD is present, despite absence of significant TR. This is especially true in women, in rheumatic valve disease, and in the presence of atrial fibrillation or diabetes, since these are independent predictors for increased TR with time[8].

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Meet the experts

Amber 6

Moderators: L. Careddu, Bologna; I. Ilonen, Helsinki

08:15 **Aortic and Mitral valve reconstruction** *Volkmar Falk*
09:15 **Indications for Fontan Operation** *Gaetano Gargiulo*

Aortic valve repair – Repair is for everyone

Botticelli

Moderators: A. Oo, Liverpool; J. Pepper, London; H.-J. Schäfers, Homburg

08:15 **Technique of aortic valve repair** *Emmanuel Lansac*
08:30 **Video: Aortic valve sparing operation (David)** *Ulrich Rosendahl*
08:45 **All valves are equal – repair in bicuspid** *Laurent de Kerchove*
09:00 **Repair for aortic stenosis** *Paul Urbanski*
09:15 **Long-term results of leaflet repair** *Gebrine El Khoury*
09:30 **A word of caution** *Thomas Modine*
09:45 **Wrap up** *John Pepper*

Professional Challenge

Part II: Catheter based mitral interventions: The mitral going transcutaneous

Gold Room

Moderator: J. Seeburger, Leipzig

10:30 **Clinical and anatomical predictors of MitraClip therapy failure for functional mitral regurgitation** *Maurizio Taramasso*
10:45 **Mid-term outcomes (over three years) of percutaneous mitral repair in the real world: A single-centre experience** *Nicola Buzzatti*
11:00 **Video: Valve in ring** *David Holzhey*

Abstract

Coronary Surgery: Quality matters

Titian

Moderators: B. Buxton, Victoria; T. Modine, Lille

10:15 **Ensuring graft patency a must** *Teresa Kieser*
10:25 **Video: Intraoperative angiography in hybrid** *Stephan Jacobs*
10:40 **Video: Skeletonize and T-it!** *Piroze Davierwala*
10:55 **Carotid artery screening at the time of coronary artery bypass: Does it influence neurological outcomes?** *Pradeep Narayan*
11:10 **The impact of a modified 'Safe Surgery Saves Lives' checklist developed specifically for the cardiac surgical patient** *Helen Loeblein*
11:25 **Cost-benefit of endoscopic vein harvesting in high-risk patients undergoing CABG** *Prabhjeet Kaur*
11:40 **Wrap up** *Matthias Siepe*

The tricuspid: A continuing problem

Michelangelo

Moderators: F. Casselman, Aalst; R. Klautz, Leiden

10:15 **Untreated mild to moderate tricuspid regurgitation in dilated cardiomyopathy patients submitted to mitral repair: What happens at long-term?** *Michele De Bonis*
10:30 **Redo tricuspid valve surgery after tricuspid valve repair: Re-repair versus replacement** *Ho Young Hwang*
10:45 **Effect of pulmonary hypertension on ovine tricuspid annular dynamics** *Marcin Malinowski*
11:00 **Functional and biomechanical performance of stentless extracellular matrix tricuspid tubegraft in pigs** *Diana Ropcke*
11:15 **Prophylactic tricuspid annuloplasty in patients with mild tricuspid regurgitation undergoing double valve replacement** *Pyo Won Park*
11:30 **Prognostic impact and late evolution of untreated moderate functional tricuspid regurgitation in patients undergoing aortic valve replacement** *Maurizio Taramasso*

Transcatheter aortic valve implantation: the treatment of choice

Raphael

Moderators: V.N. Bapat, London; T. Walther, Bad Nauheim

10:15 **Propensity matched comparison of two different transapical transcatheter aortic valve implantation systems** *Alexander Meyer*
10:30 **Transcatheter valve-in-valve (VIV) implantation: Experience with four different catheter valves in three different bioprostheses** *Daniele Camboni*
10:45 **What is the best surgical strategy for aortic disease in redo scenarios? A comparison between traditional aortic valve replacement and transapical transcatheter aortic valve implantation from two real-world multicentre surgical registries** *Francesco Onorati*

Continued on page 8

Cardiac – Abstract session: Hot strategies in complex cardiac surgery

Redo after acute type A aortic dissection

Early results from a multicenter real-world experience

Angelo Maria Dell'Aquila
Universitätsklinikum Münster, Münster, Germany

Despite improved health care including more expeditious referral to surgery and better ICU treatment, surgery for acute type A dissection (AAD) continues to remain a challenging operation. During emergency surgery for acute type A aortic dissection (AAD), the major operative concerns regard the extent of aortic resection to be performed and the use of an appropriate surgical procedure when the dissection proximally involves the aortic root and or more distally the aortic arch and the descending aorta. Those concerns rise from the potential risk of reoperations, since un-removed tissue might predispose the patient to aneurysms, anastomotic pseudoaneurysm, redissection and aortic valve incompetence as a consequence of root dilatation. The aim of this study is to report outcomes and risk factors for mortality in redo after prior operation for AAD in a multicenter European real-world experience including a reasonable number of patients and procedures.

Between May 1998 and January 2014, 117 aortic reoperations after initial operation for AAD (mean time from the first procedure was 3.98 years, range, 0.1-20.87) were performed in 110 patients (mean age 59.8 ± 12.6 years) at seven sites in Europe (Italy five centers and Germany two centers). Proximal causes for reoperation were aortic root aneurysm in 20, root re-dissection in 17, aortic valve insufficiency in 27 and proximal anastomotic pseudoaneurysm in 26 patients. Distal causes were arch re-dissection in 18, arch dilatation in 15, anastomotic pseudoanerysm in 25 patients. A total of 71 isolated proximal, of 31 isolated distal and of 15 combined procedures were performed.

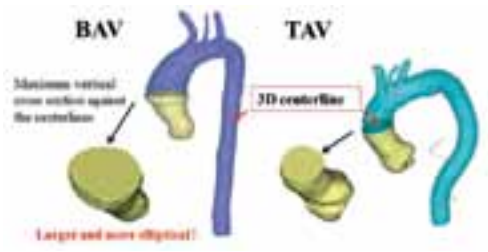
There were 23 (19.66%) in-hospital deaths (elective/urgent 11.11%, emergency 66.67%). Mortality rates for isolated proximal, distal and combined operations regardless of emergency setting were 14.08% (10 pts.), 25.81% (8 pts.) and 33.33% (5pts.) respectively. Causes of death were cardiac in eight, neurological in three, MOF in five, sepsis in two, bleeding in three and lung failure in two cases. Regarding mortality for proximal operations seven out of 10 deaths were after emergency operation. Mortality rate for isolated proximal procedures in elective or urgent setting was of 6% (3 pts. out 60). Mortality rate for isolated distal procedures in elective or urgent setting was of 14.80%. Regarding distal procedures four out of the eight operative deaths were operated in emergency setting.

Multivariate logistic regression analyses revealed that risk factors for mortality were emergency operation ($p< 0.0001$), previous distal procedure ($p = 0.04$) and new distal procedure ($p = 0.018$). New proximal procedures were not found to be risk factors for early mortality ($p= 0.15$). This multicenter experience shows that redo surgery after AAD operations remains a challenging procedure especially in emergency settings and after surgery of the distal aorta. Proximal reoperation does not affect mortality; therefore initial aortic root preservation for AAD should not be considered a concern for late reoperations.

Cardiac – Abstract session: Hot strategies in complex cardiac surgery

Novel method of assessment for ascending aortic dilatation with the bicuspid aortic valve

K.Hattori, I.Fukuda, K.Daitoku, W.Fukuda, M.Minakawa, Y.Suzuki *Hirosaki University, Japan*



Bicuspid aortic valve (BAV) is the most common congenital heart malformation that occurs in 0.5%–2% of the population. Patients with BAV are at increased risk of aortic complication, including aortic dilation, dissection, and rupture after reaching adulthood. Dilation of the ascending aorta associated with BAV has a typical asymmetrical configuration at the convexity of the aorta. Valve-related hemodynamic abnormalities might lead the asymmetric distribution of wall shear stress, resulting in asymmetric aneurysmal formation. We hypothesize the asymmetry of the aorta is a risk factor for aortic complication associated with BAV. However, there are only a few reports on quantitative assessment for 3-Dimensional deformation of the aorta. The aim of our study is to evaluate the 3D configuration of the aorta in patients with bicuspid aortic valve, using an innovative way, Mimics software.

We retrospectively reviewed data derived from 52 patients with aortic stenosis who presented with ascending aortic dilation defined as an aortic diameter >35mm. The DICOM data of CT scans were imported into Mimics software to reconstruct patient-specific 3D models of the thoracic aorta. The following parameters were measured on the 3D models in Mimics: 3D centerlines and size, symmetry and ellipticity of the aorta. Three-dimensional centerlines, equivalent to the central axis of the aorta, were automatically calculated. Aortic size was determined by calculating the cross-sectional area (mm2) of the maximum vertical section against the centerlines. The symmetry of the dilated aorta was evaluated as the ellipticity of the maximum vertical section of the aorta. We compared data from 24 patients with BAV and 28 with tricuspid aortic valve (TAV).

The ascending aorta was significantly larger and more elliptical in the group with BAV. The maximum cross-sectional area of proximal transverse arch was also significantly larger in this group. These findings showed that patients with BAV had a more asymmetrically dilated ascending aorta, and that such expansion frequently progressed to the proximal aortic arch.

The 3D configuration of the aorta is difficult to conventionally quantify, mostly because of the 3D complexity of the aortic configuration. Since the aortic cross sections visualized in conventional axial CT images is not vertical to the central axis of the aorta, the measured values included in the axial CT data do not always accurately represent aortic status. In addition, results include errors due to analogue data manipulations. We evaluated the aortic configuration using Mimics 3D reconstruction software, which allows automated calculation of the 3D centerline of the aorta. We could determine aortic size by calculating the cross-sectional area of the vertical section against the centerlines and evaluate symmetry by calculating the ellipticity of the maximum vertical section. We believe that this technique allows 3D quantitation of aortic configrations. In addition, the novel method of quantifying aortic symmetry described herein might reveal associations between aortic dilation rates and degree of asymmetry.

Congenital – Abstract session: The Fontan-Total cavopulmonary connection circulation

Fontan operation in patients with atrioventricular valve regurgitation

Sergey Zaets *Bakoulev Center for Cardiovascular Surgery, Moscow, Russia*

Historically, atrioventricular valve regurgitation was considered a contraindication for Fontan operation. Over the years, the repair of concomitant atrioventricular valve regurgitation has become a frequent intervention performed in up to 26-42% of the total number of Fontan procedures. However, it remains disputable if the repair of concomitant atrioventricular valve regurgitation is a risk factor for Fontan operation. Another topic for discussion is a degree of atrioventricular valve regurgitation that serves as mandatory indication for the repair made simultaneously with Fontan operation.

During the years 1983-2013, four hundred and fifty two patients underwent Fontan operation at the Bakoulev Center for Cardiovascular Surgery, Moscow, Russia. Seventy nine of them (17%) had atrioventricular valve regurgitation. Our approach to the repair of atrioventricular valve regurgitation in patients undergoing Fontan operation has been changing over the years. This gave the opportunity to retrospectively analyze the outcomes of Fontan operation in patients with different severity of atrioventricular valve regurgitation and different surgical strategies chosen. The goal of the study presented at the 28th EACTS Annual Meeting was to compare early and late results of Fontan procedure performed in patients with mild or moderate-to-severe atrioventricular valve regurgitation. For this purpose, patients were retrospectively divided into 3 groups: Group 1: mild regurgitation that was not repaired simultaneously with Fontan operation (n=33); Group 2: moderate-to-severe regurgitation of 3-4+ that was not repaired simultaneously with Fontan operation (n=11); Group 3: moderate-to-severe regurgitation that was repaired simultaneously with Fontan operation (n=35). Our data show that patients with unrepaired moderate-to-severe atrioventricular valve regurgitation have higher hospital mortality, demonstrate lower left ventricular ejection fraction, larger pleural effusions, required more intensive inotropic support, longer mechanical ventilation as well as the intensive care unit stay when compared to patients from other groups. Patients with unrepaired moderate-to-severe atrioventricular valve regurgitation also show lower late survival as well as higher frequency of late complications.

Our study has several limitations. First of all, this is a nonrandomized, retrospective study. Fontan operations combined with atrioventricular valve regurgitation repair were performed throughout a 30-year period. During these years, significant improvements in surgical technique, anesthesiological, and postoperative care were achieved. The selection criteria for Fontan operation have also gradually changed. Thus, no standard algorithm of care has been applied to the patient population. Furthermore, different methods of Fontan operation as well as various techniques of atrioventricular valve regurgitation repair have been used. Besides, the number of patients in the group with moderate-to-severe atrioventricular valve regurgitation not repaired simultaneously with Fontan procedure was three times smaller than in other two groups. Lastly, other risk factors for Fontan operation have not been taken into consideration during the analysis.

We believe that despite of aforementioned limitat ions, the analysis of our findings allow concluding that unrepaired concomitant moderate-to-severe atrioventricular valve regurgitation significantly worsens immediate and late results of Fontan procedure. Longer observation is needed to define strategy in patients with mild atrioventricular valve regurgitation that remained unrepaired during Fontan operation. They need constant follow-up after surgery because of possible progress of atrioventricular valve regurgitation.

Vascular – Focus session: Thoraco-abdominal aortic repair reloaded

Contemporary approach of thoraco-abdominal aortic repair using moderate to deep hypothermia combined with target reconstruction of the Adamkiewicz artery

Hiroshi Tanaka *National Cerebral and Cardiovascular Center, Osaka, Japan*

Thoracoabdominal aortic repair continues to be associated with high mortality and morbidity rates. Intraoperative organ protection is the major issue, particularly in the spinal cord. Even the advent of endovascular repair has not resulted in better operative and long-term outcomes, particularly when the pathology is aortic dissection. The most common adjuncts for organ protection during thoracoabdominal aortic repair include mild hypothermia, distal aortic perfusion, visceral perfusion, and spinal fluid drainage. Excellent outcomes have been reported using these adjuncts with mortality rates of 3%–5% and spinal cord injury (SCI) rates of 5%–8% for those with considerable experience. However, standardized methods are still required.

Although the causes of SCI are considered to be multi-factorial, a better understanding of the spinal cord circulation can provide a basis for preventing SCI. In these situations, the anatomical details of the spinal cord vasculature described by Adamkiewicz have been the focus in aortic surgery, and the development of imaging modalities have provided for preoperatively locating the arteria radicularis anterior magna (Adamkiewicz artery, ARM). The anatomical and physiological importance of ARM for the spinal cord circulation is paramount, although few reports have supported the importance of indentifying the ARM for aortic surgery.

Deep hypothermia provides intraoperative spinal cord protection when the spinal cord circulation is disrupted and prevents against reperfusion injury. Even for extensive repairs with extent I or II aortic pathologies, with the identification and reconstruction of ARM, deep

Hiroshi Tanaka

hypothermia may provide better results by providing intraoperative ischemic tolerance and optimal postoperative spinal cord circulation. Since 2006, we have used moderate to deep hypothermia combined with the identification of ARM for 100 thoracoabdominal aortic repairs. For this report, we retrospectively reviewed the outcomes of these patients. Two patients had spinal cord injuries and four had a stroke. For those for whom the ARM was identified (90%), all had target artery reconstruction. The mean pairs of reconstructed intercostal arteries was 1.5 ± 0.7. There were five in-hospital deaths for which the causes were lung bleeding, infection, and iliac aneurysm rupture. Temporary dialysis for new-onset renal failure was required for nine. The mean postoperative mechanical ventilation period was 1.7 ± 1.9 days. Six required a tracheostomy due to respiratory failure. Four surgeons have performed the procedure, and there were no differences of the outcome among them. In conclusion, moderate to deep hypothermia combined with target reconstruction of ARM provided satisfactory outcomes with thoracoabdominal aortic repair, particularly for spinal cord protection.

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Continued from page 6

11:00	CT-based calculation of the 'line of perpendicularity' and 'implanter's views' in patients prior to transcatheter aortic valve implantation	*Andreas Holzamer*
11:30	Conventional versus transapical aortic valve replacement: Is it time for indication shift?	*Samir Ahad*

Surgical remodelling of the left ventricle

Amber 5

Moderators: J.S. Coselli, Houston; L. Menicanti, Milan

10:15	Left ventricular reconstruction	*Gilles Dreyfus*
10:45	Improved results twelve years after surgical ventricular restoration: Significance of the evolving concept of reshaping compared to the volume reduction approach	*Guglielmo Stefanelli*
11:00	Posterior restoration procedures and long-term results in indicated patients with dilated cardiomyopathy	*Tadashi Isomura*
11:15	Preoperative transaortic forward flow, a predictor of surgical outcome for mitral surgery in patients with dilated cardiomyopathy and mitral regurgitation	*Tadashi Isomura*
11:30	Structures and forces involved in ventricular remodelling	*Paul Lunkenheimer*

Focus Session

Chronic heart failure – Welcome to the machine

Botticelli

Moderators: G. Gerosa, Padua; A.R. Simon, Harefield

10:15	Chronic left ventricular assist device support	*Thomas Krabatsch*
10:35	Video: Less invasive sternotomy sparing (LIS) left ventricular assist device implantation	*Faiz Ramjankhan*
10:50	Will the right ventricular make it?	*J Lahpor*
11:35	Wrap up	*Gino Gerosa*

Quick Fire

Adult cardiac rapid response 2

Brown 3

Moderator: H. Najm, Riyadh

10:15	Endoaortic balloon clamping and transthoracic aortic clamping are both safe and effective in minimally invasive mitral valve surgery	*Mauro Rinaldi*
10:51	Levosimendan does not improve outcome in patients after adult cardiac surgery	*Ju Yong Lim*
11:00	Cardiac surgery and repair of pectus deformities: When and how?	*Ilir Hysi*
11:09	A new pressure mapping system towards optimising cardiac prosthetic attachment	*Angelo Martellaro*
11:18	Feasibility and reliability of nurse-performed pocket-size ultrasound imaging of the pleura and pericardium in patients in early phase after cardiac surgery	*Anne Hammer*
11:27	Immediate and mid-term outcomes of cardiac surgical patients after postoperative cardiopulmonary resuscitation	*Manuel Wilbring*
11:36	New computing technology for real time surgical outcome monitoring: A new tool for quality control and clinical research	*Alexander Meyer*

Focus Session

The problem of low birth weight and premature babies

Amber 1&2

Moderators: M. Carminati, Milan; T. Jones, Birmingham

10:15	Whole body management	*Luca Ragni*
10:35	Should we/can we delay surgical interventions	*Edward Hickey*
10:55	Neurodevelopmental outcome of premature neonates	*Bea Latal*
11:15	Surgical challenges	*Thomas Spray*

Abstract

Oesophagus

Brown 2

Moderators: D.J. Mathisen, Boston; S. Rathinam, Leicester; D.E. Wood, Seattle

10:30	Five-year survival of upper third oesophageal cancer patients was significantly superior in comparison with middle and lower third oesophageal cancer patients after radical surgery and strongly depended on phase transition early-invasive cancer, lymph no	*Oleg Kshivets*
10:45	External validation of the Ferguson pulmonary risk score for predicting major pulmonary	

Continued on page 10

Thoracic – Abstract session: Thoracic oncology III

Clinical impact of radical loco regional surgery in synchronous oligometastatic non-small-cell lung cancer

Andrea Viti *Santa Croce e Carle, Cuneo, Italy*

Stage IV NSCLC presents an ominous prognosis. On the other hand, growing experiences demonstrate that oligometastatic (OMT) patients (cT1-3N1-2 plus 1-3 metastases) may benefit a prolonged survival, when a radical treatment of all neoplastic foci (locoregional and distant disease) is provided. We analysed the role of curative-intent surgery (CIS) of the loco-regional disease in the multimodal treatment of OMT-NSCLC. A retrospective analysis of stage IV NSCLC patients treated between January 2008 and May 2013 was performed. For the aim of our evaluation, OMT-NSCLC was defined as follows: radically treatable local disease (cT1-3N1-2) plus 1-3 synchronous metastases. Given the retrospective nature of the study, a propensity-score-matched analysis was performed to compare the outcomes of treatments (surgery vs chemo-radiation) to reduce selection bias between the treatment schedules. Complication rate, prognostic factors, loco-regional progression free (LRPFS) and overall survival (OS) were calculated (months, mean ± SD). Survival was calculated by Kaplan-Meier method and compared by log–rank/Breslow-tests. Univariate and multivariate analysis identified independent prognostic factors for the surgical group. 92 radically-treated, OMT patients were selected. Surgical group (n=29) had a lower incidence of major complications compared to chemo-radiation group (n=63) (p=0.001). With a median follow up of 60 months (range 18-67 months), mean LRPFS was 22±6.3 months in the CIS group and 10±1.6 months in the CT-RT group (p=0.016). CIS group presented a mean OS of 22±5.1 months (vs. 12±4.0 months in the CT-RT group; p=0.033). In CIS group, pN2 involvement and not-radical/suboptimal metastasis treatment were associated with worse prognosis (p=0.017 and p<0.001). Surgery was associated with lower rate of major complications and better local disease free and overall survival, when compared to chemo-radiation. In the surgical group, pN-status and completeness of metastases control were significant prognostic factors.

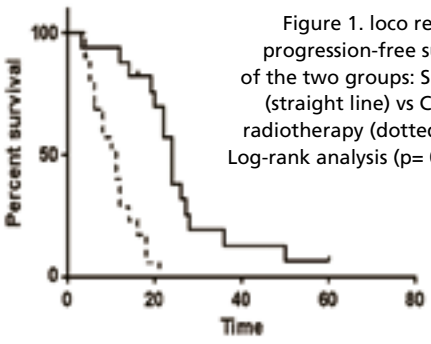

Figure 1. loco regional progression-free survival of the two groups: Surgery (straight line) vs Chemo-radiotherapy (dotted line); Log-rank analysis (p= 0.016).

Thoracic – Abstract session: Thoracic oncology III

The relative contribution of imaging, invasive staging and thoracotomy in detecting pathologic N2 disease in the era of PET/CT

Massimo Castiglioni
University of Insubria, Como, Italy

Left to right: Jed Gorden, Eric Vallières, Massimo Castiglioni, Ralph Aye, Brian Louie and Alexander Farivar

Stage IIIA (N2) non-small-cell lung cancer (NSCLC) remains the most challenging domain in thoracic oncology. It represents a very heterogeneous group of patients ranging from single station microscopic disease to bulky multi-station lymph node involvement. Mediastinal staging plays a central role in this oncologic scenario, guiding the choice of treatment and determining prognosis. For these reasons accurate evaluation of the mediastinum is required. Imaging raises suspicion for N2 disease whereas invasive staging techniques can confirm pathologic diagnosis. However, the optimal sequence of techniques for mediastinal staging is still controversial. The purpose of this study was to investigate the association between PET avidity within N2 nodes and the modality of pathologic confirmation in our clinical practice.

We performed a retrospective chart review of patients with pathologically confirmed N2 stage IIIA NSCLC during the period 2000 to 2012. We identified 198 patients. They were grouped based on PET avidity of N2 nodes. Group one included 85 patients with PET negative nodes (SUV ≤ 2.5) while group two included 113 patients with positive nodes (SUV > 2.5). Pathologic mediastinal node evaluation is standard practice in our group, but the choice of staging modalities was at the discretion of the four individual surgeons. EBUS has been used a directed diagnostic procedure to confirm N2 disease prior to induction therapy, reserving mediastinoscopy for negative EBUS or for staging following induction.

The primary finding of this study was that PET avidity of mediastinal lymph nodes significantly guided the modality of N2 disease pathologic confirmation in our clinical practice by helping to direct the sequence of techniques for staging the mediastinum (e.g. EBUS, mediastinoscopy, VATS, definitive surgery). Specifically, the contribution of EBUS technique was relevant when PET scan showed mediastinal fluorodeoxyglucose (FDG) uptake. In contrast, almost all patients with occult N2 disease obtained pathologic confirmation by the use of cervical mediastinoscopy or at the time of definitive surgery. We also observed that primary tumors in group one were more frequently adenocarcinoma (74%), showing high maximum SUV (8.5, IQR 4-12.5) and the prevalence of associated clinical N1 disease was 34%.

Also, despite preoperative invasive staging, occult N2 disease was identified only at definitive surgery in 20% of patients in the entire cohort of study. This finding is relevant considering that, in the PET/CT era, the probability of clinically understaging the mediastinum is still surprisingly high. In this scenario, intraoperative mediastinal lymphadenectomy plays a prime role in detecting occult N2 disease.

Thoracic – Abstract session: Thoracic oncology III

Number of lymph nodes removed and postoperative outcomes in patients with clinical T1aN0M0 non-small-cell lung cancer

Taketsugu Yamamoto
Yokohama Rosai Hospital, Japan

Lung cancer is the leading cause of cancer-related mortality in Japan, as well as worldwide. Recently, the proportion of patients with small tumors has increased. In Japan, 36.9% of patients with surgically resected non-small-cell lung cancer (NSCLC) have tumors 2cm or smaller in diameter. The seventh edition of the TNM classification of Malignant Tumours defines tumors 2cm or less in diameter as T1a. The 5-year overall survival rate of patients with clinical T1aN0M0 disease was reported to be 77.5%. Recently, lesser resection than standard lobectomy has been considered an alternative procedure for such small NSCLCs. In Japan (JCOG0802/WJOG4607L) and the United States (CALGB-140503), prospective clinical trials are ongoing to evaluate the effectiveness of sublobar resection for cT1aN0M0 NSCLC. In terms of lymph node assessment, it has been reported that about 10% of patients with cT1aN0M0 NSCLC have lymph node metastases. Despite several prospective randomized studies comparing mediastinal lymph node dissection with mediastinal lymph node sampling in patient with stage I NSCLC, it remains unclear whether lymphadenectomy improves survival.

Our study was designed to examine the relation between the number of lymph nodes removed during operation and postoperative outcomes in patients with clinical T1aN0M0 NSCLC. We retrospectively studied 241 patients with clinical T1aN0M0 NSCLC who underwent complete resection with curative intent (minimum procedure, segmentectomy) from 2005 through 2007.We divided the patients into two groups according to the number of lymph nodes removed (≥16 vs. <16), and compared the pathological stage, recurrence rate, and survival between the two groups. The pathological node-positive rate was slightly, but not significantly higher in patients with ≥16 removed nodes than in those with <16 removed nodes (9.0% vs. 6.1%, p=0.421). The postoperative recurrence rate was significantly lower in patients with ≥16 removed nodes than in those with <16 removed nodes (10.3% vs. 22.1%, p=0.026). The five-year disease-free survival rate was significantly higher in patients with ≥16 removed nodes than in those with <16 removed nodes (84.5% vs. 73.3%, p=0.017). Multivariate analysis showed that the number of removed lymph nodes was an independent prognostic factor (hazard ratio, 2.028; 95% confidence interval, 1.111-3.702, p=0.021). Even in earliest-stage (T1aN0M0) NSCLC, the number of removed lymph nodes was associated with postoperative recurrence and survival. Because we studied patients with clinical T1aN0M0 disease, this trend is apparently not caused by stage migration, and lymphadenectomy might be a determinant of postoperative outcomes in patients with clinical T1aN0M0 NSCLC.

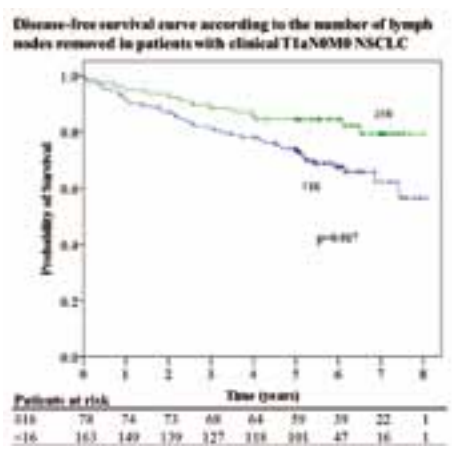

Figure 1

Thoracic – Abstract session: Thoracic non-oncology II

The use of video-assisted thoracoscopic surgery in the treatment of lung hydatid cysts

Levent Alpay
Sureyyapasa Chest Disease and Thoracic Surgery Hospital, Istanbul, Turkey

Pulmonary hydatid cyst (PHC) is a parasitic disease commonly encountered in developing countries. It is especially frequent in areas with intensive animal husbandry in the Mediterranean, the Middle East, South America, Australia, India and the Balkans[1]. In Turkey, PHC is frequent in the East and Southeast of the country; its incidence is approximately 20/1,000,000[2]. The established treatment method for PHC in Turkey, too, is surgery. The surgical interventions have always been performed using large incisions such as thoracotomy and sternotomy[2]. While video thoracoscopy is developing rapidly in its application and minimally invasive surgery is being proposed for even the largest surgical resections, video-assisted thoracoscopic surgery (VATS) only started being used for PHC in small groups of pediatric patients[3]. A surgical technique using a minimally invasive approach in adult chest surgery was described and the first series of patients published by the Süreyyapasa group[4].

In this study, we attempted to compare patients with PHC treated with either minimally invasive surgery or thoracotomy and to describe the relative advantages and disadvantages of both techniques.

Between January 2011 and January 2013, 77 patients (53 male, 24 female) were operated in our clinic for pulmonary hydatid cyst.

Thoracotomy was carried out in 47 (61.0%) patients, while 30 (38.9%) patients had video-assisted thoracoscopic surgery (VATS). In eight patients (21%), operation was started with VATS but converted to thoracotomy for reasons of insufficient single-lung ventilation[2], severe pleural adhesions in infected patients[4] and inability to palpate the cyst[2]. The drainage amount, drain removal time, operation time, the appearance of multiple and/or central cysts, duration of narcotic analgesics used and VAS scores in the thoracotomy group were significantly different than of those of the VATS group. Postoperative mortality was not seen in either of the groups. Postoperative complications occurred in 4.3% of thoracotomy and in 13.3% of VATS patients (P = 201). No recurrence was seen during 3 years of follow-up.

VATS used for surgery of PCH is superior to thoracotomy considering its lighter postoperative pain, better cosmetic result, shorter operative duration, lower drainage volume and shorter time to drain removal. We intended to show that PCH, a parasitic disease, may be treated in appropriate hospitals, giving a priority to VATS over open surgery.

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SORIN GROUP

Sorin Cardiac Surgery Solutions focusing on patient neurological protection

Cardiopulmonary bypass (CPB) is a fundamental part of heart surgery, having an important impact on patient outcome. Nevertheless, patient management during cardiopulmonary bypass is critical as patients might develop morbidity with different organs impacted, mainly brain, lungs, kindeys and splanchnic viscera.

Cerebral injury, in particular, is of primary relevance, because it has been related to high mortality and morbidity, considerable hospital costs and diminished quality of life.1

Although major neurological complications, such as strokes and encephalopathies, occur in only 2–3% of patients following CPB, neurocognitive disfunctions are more common and can persist for months after cardiac surgery, affecting patient's life.2

Despite being multifactorial and depending on numerous patients' pre-existing risk factors, brain injury has been related mainly to cerebral hypoperfusion and embolism. Macro and micro emboli, both solid and gaseous, are common during cardiac surgery, mainly due to the nature of the surgery itself.

The majority of microemboli are gaseous emboli, which may be related to different causes, such as incomplete de-airing, venous cannulation, perfusionist's interventions, and left-sided open cardiac chambers.

Another major source of emboli, lipid and solid, is blood suctioned from the chest, that may contain different kind of particles coming from the operating field.

Diffuse intravascular fat emboli, for example, have been observed in the brains of patients who died for post-operative neurological complications early after cardiopulmonary bypass.

The choice of the ideal perfusion circuit components is crucial to minimize the embolic load transferred to the patient. Many elements may impact: the type of cannulae, the oxygenator system, the arterial filter either separate or integrated in the oxygenator, the use of vacuum or gravity, the presence of a blood-air surface, the segregation and washing of the suction blood.

Sorin Group provides specific solutions for effective handling of gaseous microemboli (GME) entering the perfusion circuit and effective removal of non-emulsified fat microemboli from suction blood.

The new Inspire adult oxygenator family has been designed with a focus on neurological protection and allows superior GME handling capability at a system level.

- Inspire HVR venous reservoir is capable of effective air management, even when operating at its minimum level of 150 ml, and up to the maximum blood flow rates of respectively 6 lpm and 8 lpm;
- Inspire integrated arterial filter embodies all the essential features of stand-alone arterial filters

Isolating and processing suction blood prior to its reinfusion is fundamental to reduce the fat embolic load transferred to the patient. Inspire HVR DUAL and Sorin XTRA make it fast, easy and effective.

- The innovative Inspire HVR Dual Reservoir, allows to easily separate activated suction blood from venous blood, isolating the major source of hemolysis and fat emboli.
- Sorin XTRA new specific fat removal protocol allows to remove more than 99% of fat emboli from processed blood

Sorin Group innovative cardiac surgery solutions aim to minimize the impact of CPB on patients and improve outcome, by redefining perfusion. Focusing on neurological protection is one of our key goals.

Find out more at Sorin booth #112.

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Continued from page 8

complications after oesophagectomy *J Matthew Reinersman*

11:00 **Successful staged surgical treatment for aorto-oesophageal fistula** *Yukitoshi Shirakawa*

11:15 **Repair of post-intubation tracheoesophageal fistulas through the left pre-sternocleidomastoid approach: A recent case series of 13 patients** *Christophoros N. Foroulis*

11:30 **Evolution of treatment of oesophageal surgery** *Douglas Mathisen*

Lung transplantation

Amber 8

Moderators: J. Dark, Newcastle Upon Tyne; W. Klepetko, Vienna

10:30 **A global analysis of contemporary trends in lung re-transplantation: A question of selection** *Jeremiah Hayanga*

11:00 **Early experience with the Organ Care System (OCS) for donor lung preservation in lung transplantation** *Marco Schiavon*

11:15 **The Munich Lung Transplant Group: Use of intraoperative extracorporeal device with low versus high heparinisation in lung transplantation** *Rene Schramm*

11:30 **Blood transfusion after lung transplantation: Impact on early function and survival** *Lay Ping Ong*

Thoracoabdominal aortic pathology – a functional approach in preserving spinal cord integrity

Brown 1

Moderators: S. Geisbusch, Munich; D. Pacini, Bologna; M.A.A.M. Schepens, Brugge

10:15 **Shockwave treatment reduces neuronal degeneration upon spinal cord ischaemia after aortic cross clamp** *Johannes Holfeld*

10:45 **The assessment of collateral communication after staged hybrid repair for Crawford extent II thoraco-abdominal aortic aneurysms** *Takayuki Shijo*

11:00 **Spinal cord injury after endovascular treatment for thoraco-abdominal aneurysm or dissection** *Masaaki Kato*

11:15 **Intraoperative motor evoked potential changes, procedure alterations and neurological outcome in thoracic and thoraco-abdominal aortic aneurysm repair** *Fatemeh Jafarzadeh*

11:30 **Evaluation of the downstream aorta after frozen elephant trunk repair for aortic dissections in terms of diameter and false lumen status** *Gabriel Weiss*

Focus Session

Training in minimally invasive cardiothoracic surgery

Amber 6

Moderators: V. Falk, Zurich; A.P. Kappetein, Rotterdam; J. Maessen, Maastricht

10:15 **How to start a minimally invasive program: 'surgeon experience'** *Peyman Sardari Nia*

10:45 **How to incorporate a minimally invasive surgery in training programs: 'Trainers Perspective'** *Rafael Sádaba*

11:15 **How the industry can help with minimally invasive education: 'industry experience'** *Francis Duhay*

Plenary

Honoured Guest Lecture

Gold Room

11:50 **Genetics of aortic disease** *Bart Loeys*

Luncheon: The clash of the titans return!

Amber 3

12:45 **Table I: Nuss versus Ravitch** *Mustafa Yuksel*

12:46 **Table 2: Endoscopic thymectomy or open** *Marcin Zielinski*

12:47 **Table 3: Hybrid or open for extensive aortic disease** *John Pepper*

12:48 **Table 4: Sutureless mini-AVR versus TAVI** *Mattia Glauber*

12:49 **Table 5: Minimally invasive ASD closure versus open** *Viktor Hraska*

Abstract

Long-term results of mitral valve surgery

Gold Room

Moderators: O. Alfieri, Milan; J.-F. Obadia, Lyon

14:15 **Negative impact of atrial fibrillation and pulmonary hypertension after mitral valve surgery in asymptomatic patients with severe mitral**

Continued on page 12

Cost/benefit of endoscopic vein harvest

In patients undergoing coronary artery bypass graft surgery who are at high-risk of developing wound complications

P Kaur[1], H Luckraz[1], M Bhabra[2], A Nevill[3], K Nagarajan[1], K Saleem[1] *1 Heart & Lung Centre, Wolverhampton; 2 Queen Elizabeth Hospital, Birmingham; 3 University of Wolverhampton, UK*

Endoscopic vein harvesting (EVH) provides better outcomes for patients undergoing Coronary Artery Bypass surgery. Benefits such as reductions in Surgical Site Infection (SSI) and leg-wound complication rates; length of hospital stay, and greater patient satisfaction have been consistently demonstrated. However, in the UK, EVH is still limited to a few cardiac centres due to cost implications.

This study by Kaur et al assessed the cost/benefit of EVH compared to open vein harvest (OVH) in patients who are at high-risk of developing wound complications.

Patients with at least two high-risk factors for wound complications (Age >75 years, female, diabetes, peripheral vascular disease, BMI over 28 Kg/m^2, smoker) were selected for EVH (n=50). Patients who underwent OVH (n=50) were matched with the EVH group for the same risk factors. Their data was collected prospectively and all leg wounds were followed up and treated in the Cardiothoracic Wound Clinic. This enabled them to judge the true scale of leg wound complications and the actual cost of treating them.

Kaur et al confirmed the findings of previous studies which assess the benefits of EVH, namely less wound pain, earlier hospital discharge and fewer leg-wound complications. They also calculated the costs associated with treating OVH leg wound complications (£78,036) and demonstrated that despite the increased procedural cost of EVH (£650/patient) there was a cost-benefit of £42,778. They concluded that the use of EVH in patients who are at high-risk of developing wound complications is cost effective.

(left to right) Heyman Luckraz, Kumar Nagarajan, Kamran Saleem, Prabhjeet Kaur, and Moninder S Bhabra

The impact of a modified Safe Surgery Saves Lives checklist developed specifically for the cardiac surgical patient

Helen Löblein[1], Omer Dzemali[1], Burkhardt Seifert[2], Kirk Graves[1], Murat Ylmaz[1], Alicja Zientara[1], Achim Häussler[1], Dragan Odavic[1], Michele Genoni[1]
1 Triemli City Hospital Zürich, Switzerland; 2 University of Zurich, Switzerland

Many patients saved or significantly improved with the cardiac surgery. Although mortality and morbidity of cardiac surgery has decreased during the past decade[1]. complications can lead to major morbidity and mortality to the patients and constitute an important public health problem. Studies suggest that half of all surgical complications are preventable[2]. Preventable errors are mostly due to cognitive, system and teamwork failures. Consistency in doing the right thing, for every patient, is the value of surgical checklists recently introduced in healthcare to minimize post-operative complications and mortality. In 2008, the World Health Organization (WHO introduced guidelines with multiple checklists to ensure the safety of surgical patients worldwide[3]. The modified SSSL is created since the perfusionist plays an important role in cardiac surgery and since cardiac surgical procedures are standardized similar to the aviation field. Similar to the aviation field before departure, all the standardized steps should be checked for their appropriateness so that the surgical staff is prepared to tackle fast and efficiently unplanned complications. Starting on the day of admission in collaboration with the cardiologist, the preoperative check list is completed. The nursing staff completes the safety and hygiene check list and the anesthesiologists complete the anesthesia checklist and premedication and informed consent. On surgical day the surgical nursing staff completes the patient identity and safety checklist. All these checklists are required for optimal surgical planning and is the basis used to make sure that all the required preoperative exams and procedures are done. In the operating room the perfusionist controls the completeness of all these documents. Once and only when this controlling procedure is accomplished then the second step, `time out period` takes place. In the time out period surgeon, anesthesiologist, perfusionist and nursing staff discuss the surgical procedure and review together the pertinent exams such as echocardiography, coronary angiography, computer tomography and lab work. This is important so that everyone have the same information and can interpret the results together (example the severity of a mitral valve insufficiency) and all speak the same language. Following this the involved parties will set their strategies and in addition, the surgeon tells the perfusionist, anesthesiologist and nursing staff what his requirements are for the surgical procedure. Only when all these steps are accomplished then the skin incision is made. These steps have lead to process optimization and shortening of surgical time which is more important than ever since on the post interventional period we have doubled the use of BIMA. Despite this increase, process optimization and shortening of surgical time have lead to a significant reduction in sternal infection. Our experience has shown that the use of this modified SSSL not only provides clear evidence of improved safety but also is a great tool for team-building. The modified SSSL has hanged the attitude of each involved parties and imbedded on them a sense of responsibility. It has also improved communications between the parties during the surgical period. The sign out period which guarantees the post operative care of the patient is also very important. During this time there is surgeon debriefing on information of unexpected complications and procedure to the anesthesiologist and the intensivist. These information are also recorded and analyzed in a data bank. The analyzed data is than reported in our twice a year held report. At this time there is also a chance to fill a critical incidence report (CIRS). The goal of the CIRS is an additional step to improve patient safety. CIRS allows us to focus on how avoid future mistakes with open discussions. The discussion on CIRS takes place once a month in our clinic and guarantees improvement in our performance and the completeness of our check list and as a result we have seen fewer changes in surgical strategies and fewer unexpected complications.

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Does screening for concomitant carotid artery disease in patient presenting for CABG reduces mortality or adverse neurological outcomes?

Pradeep Narayan
NH RN Tagore Hospital; Kolkata; India.

Coronary artery bypass grafting (CABG) is associated with adverse neurological outcomes in a small proportion of cases. However, when they do occur, the observed mortality is about 10 times higher than what one would normally associate with CABG. Also the hospital stay gets significantly prolonged. Carotid artery disease is often seen in patients presenting for CABG and has been identified as an important risk factor for adverse neurological outcomes. Based on this observation some centres carry out mandatory screening in all patients undergoing CABG in order to reduce the risk of stroke in the post operative period. However, this strategy leads to excessive utilization of resources with poor yield and the American College of Cardiology /American Heart Association as well as the European guidelines have identified a number of risk factors associated with presence of concomitant carotid artery disease in patients presenting for CABG. These risk factors are : age greater than 65 years, left main coronary stenosis, peripheral arterial disease, history of cerebrovascular disease, hypertension, smoking, and diabetes mellitus. Most centres utilize the presence of these risk factors to rationalize the use of pre-operative carotid duplex study to identify the patients who may have concomitant carotid artery disease. There is enough evidence in literature and also from our study that these risk factors reliably identify patients at risk of concomitant carotid artery disease. Our study also revealed that of all the risk factors history of previous neurological event was the most sensitive predictor of presence of concomitant carotid artery disease.

However, the bigger question is does screening for concomitant carotid artery disease in patients presenting for CABG lead to a reduction in neurological outcomes or mortality? It has been seen that patients who are asymptomatic there is not enough evidence to prove that screening leads to any reduction in adverse neurological outcomes. Also at least 60% of the strokes following CABG occur due to embolism. In fact our study, one of the largest of its kind, revealed some other very interesting facts. It showed that of all the major neurological events seen in the post-operative period only 14% of patients had concomitant carotid artery stenosis with more than 80% of the strokes occurring due to other causes. Also, screening seemed to have no effect on either all cause mortality or mortality due to adverse neurological events.

We therefore conclude that while the guidelines in place accurately predict presence of concomitant carotid artery disease the role of screening in reducing post-operative adverse events or mortality is questionable.

Cardiac – Professional challenges: Session 1

Midterm outcomes (>3 years) of percutaneous mitral repair in the real-world: A single-centre experience

Nicola Buzzatti[1], Paolo Denti[1], Davide Schiavi[1], Maurizio Taramasso[2], Giovanna Di Giannuario[1], Giovanni La Canna[1], Michele De Bonis[1] and Ottavio Alfieri[1]

1 Ospedale San Raffaele,Milan, Italy; 2 Zurich University Hospital, Zurich, Switzerland

Long-term results of MitraClip in the high-risk real world scenario are still lacking.

We retrospectively analysed the outcomes of patients submitted to MitraClip at our Institution and eligible for ≥3-year follow-up (median time 39, ranging up to 66 months): 53 functional (FMR, 68%) and 25 degenerative (DMR, 32%).

Results

Major pre-operative features are exposed in Table 1. Procedural mortality was 0%, procedural residual MR≤2 was 91% in FMR and 84% in DMR. Overall survival was 61% at 51 months. Advanced age (p=0.041) and higher creatinine (p=0.027) were associated with increased non-cardiac mortality. Freedom from cardiac death at 40 months was 78.3% vs 87.4% for FMR and DMR respectively (p=0.78, Figure 1). Cardiac mortality was associated with preoperative larger EDD (p=0.005), higher sPAP (p=0.049) and follow-up MR≥2 (p=0.019) in FMR. Freedom from recurrent MR3-4+ at 40 months was 71% vs 59% in FMR and DMR group (p=0.15, Figure 2). MR>2 recurrence was associated with higher baseline sPAP (p=0.044) in FMR and with acute residual MR2+ (p=0.039) in DMR. Partial clip detachment (PCD) was more frequent in DMR (5/25) compared to FMR (1/53) group, p=0.0053. At last follow-up, NYHA I-II was found in 96.1% of patients with MR≤2 vs 69.2% of patients with MR 3-4+ (p=0.0075, Figure 3).

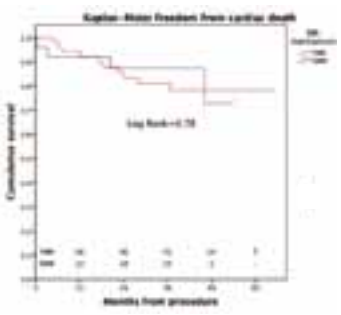

Figure 1. Freedom from cardiac death.

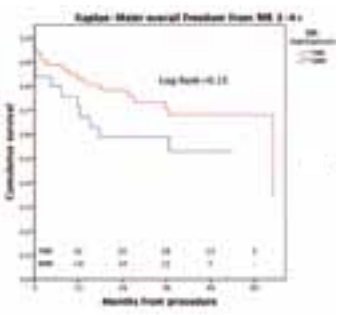

Figure 2. Freedom from recurrent MR 3-4+.

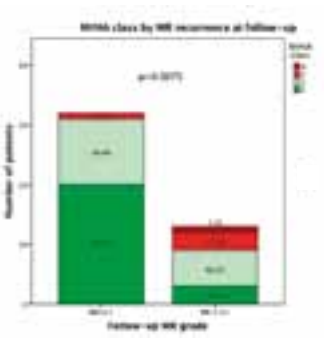

Figure 3. NYHA class at follow-up by recurrent MR 3-4+.

Table 1. Major pre-operative patients characteristics.

	FMR (n=53)	DMR (n=25)
Clinical		
Age	68.5±9.2	78.1±12.9
Male gender	43 (81.1%)	14 (56.0%)
LES	18.8 (10.3-27.7)	19.4 (12.2-25.0)
STS m	4.5 (2.5-12.3)	7.4 (3.1-18.6)
Serum Creatinine,mg/dL	1.5±0.9	1.2±0.4
CAD	38 (71.7%)	9 (36.0%)
COPD	11 (20.7%)	8 (32.0%)
CVD	5 (9.4%)	3 (12.0%)
Previous cardiac surgery	12 (22.6%)	4 (16.0%)
AFib	18 (34.0%)	11 (44.0%)
CRT	21 (39.6%)	1 (4%)
NYHA class III-IV	45 (84.9)	16 (64%)
pro-BNP, median	2434 (1437-5184)	933 (221-2020)
Echocardiographic		
EDD,mm	69.9±7.5	57.9±9.4
EF,%	27.7±9.9	61.1±7.4
sPAP,mmHg	47.4±15.5	47.6±13.7
EVEREST eligible anatomy	23 (43.4%)	18 (72.0%)

LES, Logistic EuroScore; STS, Society of Thoracic Surgeons; CAD, Coronary Artery Disease; COPD, Chronic Obstructive Pulmonary Disease; CVD, Cerebro-Vascular Disease; AFib, Atrial Fibrillation; ICD, Implantable Cardioverter-Defibrillator; CRT, Cardiac Resynchronization Therapy; BNP, Brain Natriuretic Peptide; EDD, end-diastolic diameter; ESD, end-systolic diameter; EF, ejection fraction; sPAP, systolic Pulmonary Artery Pressure; TR, tricuspid regurgitation; S-TDI, S wave at Tissue Doppler Imaging.

Discussion

In FMR most follow-up deaths were cardiac related and associated with pre-operative larger EDD and higher sPAP, irrespectively of residual MR. This means that smaller ventricles with MR perform better that big ventricles without MR: a too advanced stage of the disease may not allow a prognostic benefit[1]. Notably, in the DMR group 70% of the observed deaths were non-cardiac related, older age and higher pre-operative serum creatinine levels predicting increased mortality: DMR patients high-risk profile is usually due to advanced age and comorbidities rather than cardiac dysfunction.

PCD was clearly less frequent in FMR compared to DMR group: indeed functional valve are usually "easier", whereas degenerative valves are more difficult due to their intrinsic complex anatomy.

In FMR group sPAP >50mmHg was associated to recurrent MR 3-4+, likely being an indicator of a more advanced disease. Notably, in FMR the presence of MR≥2 at follow-up was associated with increased cardiac mortality (33.3% vs 7.4%, p=0.019). In DMR group post-procedural residual MR2+ was the only predictive factor for MR 3-4+ recurrence, in line with previous surgical data[2].

Symptoms and QoL improvement was sustained after a median of 3.5 years, although undermined by recurrent MR 3-4+. These patients have multiple factors that can impair symptoms and QoL, so the ability of MitraClip to improve these parameters is remarkable.

Until a better MR reduction efficacy will be achieved, indications to MitraClip should not be widened to mid-low risk patients, especially in the DMR setting.

Conclusions

Real-world MitraClip patients survival is impaired by advanced age and extra-cardiac comorbidities, especially in DMR. In FMR increased cardiac mortality was associated with pre-operative EDD, sPAP and follow-up MR≥2. Residual MR remains suboptimal. Persistent symptoms benefit is maintained past 3 years follow-up, although impaired by MR degree.

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Continued from page 10

regurgitation: Twenty-year follow-up *Gonçalo Freitas Coutinho*

14:30 Mitral valve repair has better long-term outcomes compared with mitral valve replacement in elderly patients with mitral regurgitation *Homare Okamura*

14:45 Minimally invasive mitral valve surgery without aortic cross clamping and with femoral cannulation not associated with increased risk for stroke compared to traditional mitral valve surgery: A propensity score matched analysis *Niv Ad*

15:00 Predictors of prolonged intensive care unit stay in patients undergoing minimally invasive right thoracotomy valve surgery: A single institution analysis with 2, 272 patients *Michele Murzi*

15:15 Is repair of the mitral valve still a gold standard in severe ischaemic mitral regurgitation? *Vadim Shumavets*

Developments in coronary artery bypass graft

Titian

Moderators: P. Kolh, Liege; M. Sousa Uva, Liege Lisboa

14:30 Off-pump coronary artery bypass surgery is associated with lower cardiac death at 1 year: Results from the on-pump versus off-pump (ON-OFF) study *Massimo Lemma*

14:45 Changes in cerebral oximetry and haemodynamics during off-pump coronary artery bypass: Mechanism for perioperative stroke? *Tarek Al-Badawi*

15:00 Influence of previous percutaneous coronary intervention on clinical outcome of coronary artery bypass grafting: A meta-analysis of comparative studies *Chikara Ueki*

15:15 Results of total arterial versus conventional versus hybrid myocardial revascularisation: A propensity match analysis of long-term follow-up *Claudio Muneretto*

15:30 Transit-time flow measurement unmasks competitive flow in arterial bypass grafts *Teresa Kieser*

Preventing problems after open cardiac surgery

Amber 3

14:15 Minimally invasive extracorporeal bypass in minimally invasive heart valve surgery: A prospective randomised trial *Hardy Baumbach*

14:45 Patient blood management in octogenarians: Predictors of transfusion and prognostic implications *Luca Salvatore De Santo*

15:00 How early is too early? Timing of tracheostomy after median sternotomy and risk of deep sternal wound infections *Kevin Pilarczyk*

15:15 Re-exploration for bleeding is an independent predictor of mortality in cardiac surgery patients also beyond the immediate postoperative period *Victoria Fröjdh*

15:30 Higher-than-spontaneous arterial pressure during extracorporeal circulation does not result in improved renal function after cardiac surgery *Kristian Kandler*

Heart transplantation

Amber 5

Moderators: S.R. Large, Elsworth; G. Rabago, Pamplona

14:15 Efficacy of mechanical postconditioning following warm, global ischaemia depends on circulating fatty acid levels in an isolated, working rat heart model *Maris Bartkevics*

14:30 Mechanical circulatory support in the Dutch National Paediatric Heart Transplantation Program *Marijke Van Der Meulen*

15:00 Has psychosocial compliance an impact on long-term outcome after heart transplantation? *Sandro Sponga*

15:15 Mild hypothermia during ex-vivo machine perfusion improves recovery of hearts donated after circulatory death *Herman Tolboom*

Focus Session

Mitral and tricuspid valve surgery: Why and how to transition to minimal invasive surgery?

Botticelli

Moderators: F. Musumeci, Rome; P. Perier, Bad Neustadt

14:20 Review of the latest clinical studies: Why should we set-up an minimal invasive surgery program? *Filip Casselman*

14:35 MIS vs. Full Sternotomy: Is minimal invasive surgery cost effective? *Paul Herijgers*

14:50 MIS patient Selection: How to pick the right patient? How to avoid problems? *Andreas Liebold*

Continued on page 14

Cardiac – Abstract session: The tricuspid a continuing problem

Prophylactic tricuspid annuloplasty in patients with mild tricuspid regurgitation undergoing double valve replacement improve late clinical outcomes and prevent late significant tricuspid regurgitation

Pyo Won Park *Samsung Medical Center, Seoul, Korea*

Double valve replacement (DVR, aortic and mitral valve replacement) is still common surgical procedure in developing countries in which rheumatic heart disease is prevalent. In Korea. new patients with rheumatic heart disease are gradually decreasing, but we frequently encounter progressive tricuspid regurgitation (TR) during late follow-up after left side valve surgery. Reported incidence of late significant TR after DVR was significantly higher than that after mitral valve surgery (Heart 2009;95:931). Previously we compared the long-term hemodynamic performance of Medtronic-Hall and ATS valve in aortic position (*Int J Cardiol* 2013;166:681). In that study, DVR and placement of small aortic valve were found to contribute to postoperative increase in transaortic mean pressure gradient (TMPG) and the TR grades at late follow-up correlated with TMPGs after surgery. Although the current indications of tricuspid annuloplasty (TAP) during left side valve surgery are widening to prevent late progress of TR, convincing data on the late clinical outcomes of prophylactic TAP are limited. Recently there are several reports on prophylactic TAP during mitral valve surgery, but published data on clinical impacts of prophylactic TAP with simultaneous DVR are not available.

In this study, we analyzed early and late clinical outcomes of concomitant TAP and evaluate its protective effect on late TR progression in patients with mild TR who underwent DVR.

From 1994 to 2009, 239 patients underwent primary DVR in Samsung Medical Center, Seoul, Korea. Among 93 patients who had mild TR preoperatively, concomitant TAP was performed in 55 patients. The mean follow-up duration was 7.3 years. We compared TAP group (n=55) with no TAP group (n=38). No early mortality occurred in both groups. There was no intergroup difference in postoperative morbidities including heart block and freedom from cardiac related mortality at 10 years. However, freedom from valve related events and freedom from significant TR (≥ moderate) at 10 years were significantly higher in TAP group.

Interestingly female gender was the predictor for cardiac related mortality (P = 0.022; HR,7.3). The possible explanation of this finding will be small prosthesis implantation and late follow-up increase of transprosthetic gradient in aortic and mitral position.

Transmitral pressure gradient was associated with valve related events (P = 0.025; HR, 1.367). Absence of TAP was predictive of late TR (P = 0.020; HR, 4.4).

In conclusion, concomitant TAP did not increase early postoperative risk and decreased valve related events and significant TR (≥ moderate) at 10 years after DVR for the patients with mild TR.

Cardiac – Abstract session: The tricuspid a continuing problem

Stentless extracellular matrix tricuspid tubegraft – a promising alternative to tricuspid valve replacement

Diana Ropcke, C Ilkjaer, T Hejslet, AV Sorensen, H Jensen, MOJ Jensen, VE Hjortdal, SL Nielsen *Aarhus University Hospital, Denmark*

Research presentation

Standard treatment of end stage valvular disease has been valve replacement with a mechanical or bioprosthetic valve. Complications are related to anticoagulant treatment, degeneration, or the foreign material itself. The ideal valve replacement material still needs to be found. A promising reconstructive material is examined in the present study.

Extracellular matrix (ECM) scaffolds have been developed. ECM stimulates cell repopulation and is eventually overgrown with recipient cells, a process called tissue engineering. This repopulation with host cells is followed by degradation of the scaffold. ECM possesses the potential to induce restoration of a lost structure with native tissue.

The aim of the entire study is construction, examination, and thorough description of an ECM tricuspid valve in vitro and *in vivo* (both acutely and after six months) in order to functionally and biomechanically describe this novel reconstructive concept in the tricuspid position. The overall aim is clinical implementation of ECM in future reconstructive heart valve surgery in order to offer better patient-tailored treatment.

The first step in this examination was an in vitro substudy. Five native and five ECM valves were examined, measuring force development in the papillary muscles correlated to pressure, and with a thorough analysis of coaptation geometry (data presented at SHVD Biennial Meeting in Venice, 2013).

The present study has been performed in an acute 60 kg porcine model, where eight native valves and eight ECM valves have been implanted and analyzed after randomization. Intracavitary pressures, force development in the anterior papillary muscle, 3D movement of annulus and leaflets, coaptation and regurgitation has been described, and some of the data are presented in the current abstract and presentation.

Lastly, a 60 kg porcine survival model has been chosen for survival studies. Five ECM valves have been implanted and will be analyzed histologically, with MRI, HD-X-ray and echocardiography six months after implantation. This study is ongoing.

Summary of current abstract/data

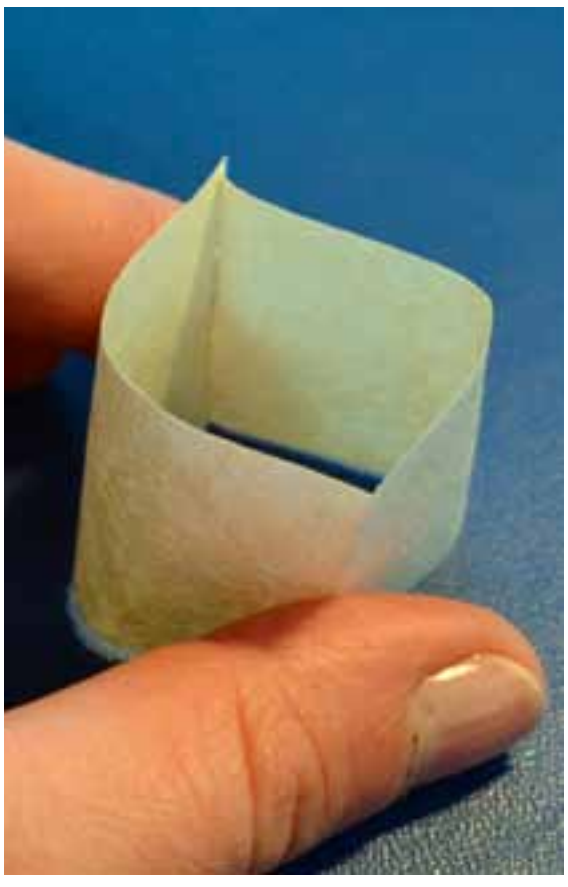
A stentless porcine extracellular matrix tricuspid tubegraft has been developed for tricuspid valve reconstruction. This study purpose was to compare biomechanical and functional performance of native and tubegraft tricuspid valves in an acute porcine model.

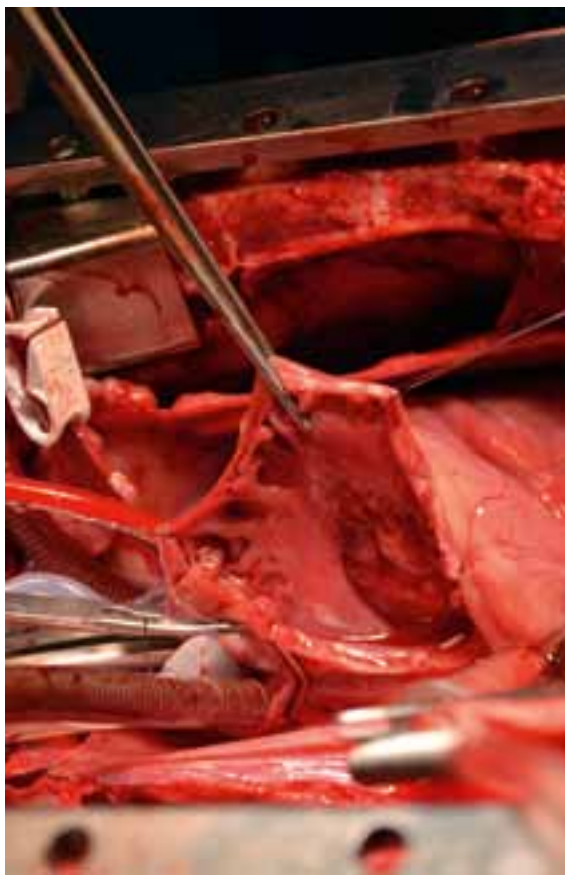
Diana Ropcke

Fourteen 65 kg pigs were randomized to a tubegraft (n = 7) or control with native valve preservation (n = 7). Anterior papillary muscle force plus atrial and ventricular pressures were measured. To assess dynamic 3D valve geometry and leaflet motion, thirteen sonomicrometry crystals were implanted in the tricuspid annulus and in subvalvular structures.

No tricuspid regurgitation was observed after tricuspid tubegraft implantation. No significant differences in intracavitary pressures, annular motion or leaflet function were found. Tricuspid annulus area, annular diameters and the septal segment of the annulus were significantly smaller in the tubegraft group, as was anterior papillary muscle force.

In conclusion, extracellular matrix tubegrafts were implanted in the tricuspid position, producing competent valves with physiological biomechanical and functional performance compared with native valves. The technology seems to be a promising alternative to tricuspid valve replacement for the future.





Sorin Group Solo Smart Tissue Heart Valve: Native-like Performance with Stented-like Implantability

Solo Smart is one of the latest Sorin' innovative solution for aortic valve replacement, incorporating unique features that provide a native-like performance with the ease of implant of a stented valve.

Solo Smart was designed to mimic the healthy native aortic valve and follow the natural motion of the aortic root for maximizing hemodynamic performances, in terms of low transvalvular gradient and large effective orifice area[1,2,3].

This unique bioprosthesis is a totally biological heart valve with no synthetic material added and it is implanted in a supra-annular position, adapting to the anatomy of the patient. This allows the full alignment of the valve orifice to the patient annulus and ensures a physiological blood flow through the valve, providing excellent hemodynamics at rest[1,2,3] and under stress[1] conditions.

This leads to a remarkable clinical improvement as well as to significant left ventricular reverse remodeling with a fast left ventricular restoration[1,2,3].

Solo Smart is the first removable stent aortic valve, featuring a temporary stent that gives support and facilitates implantation. The temporary stent maintains valve geometry and symmetry within the aortic root to simplify implant procedure and suturing. Once the valve is sutured to the aortic root, the temporary stent is removed leaving the valve in place.

Its innovative removable stent advances aortic valve replacement, providing an user friendly and reproducible implantation technique.

The Solo Smart valve has just received the FDA Approval and it is the first removable stent valve to be approved in the US market.

"As a cardiac surgeon, I am excited to have the Sorin Solo Smart stentless valve available in the United States," said, Dr. David Heimansohn, St. Vincent Heart Center (Indianapolis, Indiana). "Solo Smart is a step forward in the treatment of aortic valve disease, as this surgical valve has superior hemodynamic performance, and is much easier to implant, requiring only a single suture line. It more resembles a native aortic valve in appearance and performance, offering the best hemodynamics during all conditions, and improving patients' lives dramatically."

Sorin Group is committed to continuously provide innovative solutions tailored to the needs of cardiac surgeons and their patients worldwide.

For further information, please come and see us at the Sorin Group booth # 112

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Cardiac – Abstract session: The tricuspid a continuing problem

Untreating less than severe TR in dilated cardiomyopathy patients submitted to MV repair: what happens at long-term?

Michele De Bonis
San Raffaele Scientific Institute, Milan, Italy

Current guidelines recommend performing concomitant tricuspid annuloplasty at the time of left sided valve surgery even in patients with only mild functional tricuspid regurgitation (TR), in presence of tricuspid annular dilatation or prior evidence of right heart failure. Despite that, many surgeons still prefer a conservative approach when concomitant tricuspid regurgitation is less than severe, regardless of the annular dimensions. One of the reasons behind this attitude is that the studies supporting a more aggressive approach are often single center series with various etiologies of mitral regurgitation (MR) and different criteria do define the dilatation of the tricuspid annulus. In particular, only a few reports describe the evolution of mild or moderate tricuspid regurgitation (TR) in the context of dilated cardiomyopathy (DCM) and results are usually limited to early or mid-term follow-up. Therefore, we decided to evaluate the fate at long-term of secondary less than severe TR in patients submitted to mitral repair for functional MR, in whom a tricuspid annuloplasty was not performed due to the apparently not significant degree of preoperative TR, regardless of the size of the tricuspid annulus. We selected 84 patients (age 64±9.6 years, EF 31±6.4%) submitted to mitral repair for secondary MR in whom concomitant mild-to-moderate tricuspid regurgitation (TR≤2+) was left untreated. At a median follow-up of 7.3 years (IQR 4.5;9.3), in more than one quarter of the patients, uncorrected moderate or less TR becames at least moderately-severe (3+/4+) or showed a progression of at least two grades. Freedom from TR≥3+ or from progression of at least 2 grades of the baseline TR was 77±5% at 5 years and 56.7±8.4% at 10 years. Among the baseline characteristics of the patients, age and preoperative RV dysfunction were identified as independent risk factors for TR progression. Patients with DCM and secondary MR represent a particular population in which there are several peculiar conditions which might lead to progression of less than severe preoperative TR. Those predisposing factors include the natural history of the disease, the presence of low ejection fraction and pulmonary hypertension, the high prevalence of RV dysfunction, the subsequent need for ICD/biventricular pacing and the possibility of recurrence of MR. Not surprisingly, in our series, most of the cases of TR progression occurred in patients without reverse LV remodelling at follow-up in whom lower LVEF, higher MR recurrence, higher pulmonary hypertension and RV dysfunction were observed. Most likely all those factors, and in particular pulmonary hypertension and RV dysfunction, led to worsening of functional TR.

This study confirms that a significant number of DCM patients with no TR or with mild-to-moderate TR left untreated at the time of mitral repair show important TR at follow-up. In this setting a more aggressive policy should be used taking into consideration the degree of annular dilatation and the function of the right ventricle and not simply the grade of TR.

Continued from page 12

15:05 **Real life example: How did I start a minimal invasive surgery program in my centre?** *Riccardo Cocchieri*

15:20 **Next step concomitant minimal invasive surgery procedures: Mitral and tricuspid combined, tips and tricks** *Ludwig Mueller*

Transcatheter heart valve therapy: a look to the future

Michelangelo

Moderators: M. De Bonis, Milan; A. Vahanian, Paris

14:15 **Trans-catheter aortic valve implantation: what's next?** *Antonio Colombo*

14:30 **Long-term results of the MitraClip therapy: what can we forsee at more than 10 years from the surgical experience** *Michele De Bonis*

14:45 **Robotic mitral valve repair: the future is there** *Robert Dion*

15:00 **The tricuspid valve: the next target?** *Georg Lutter*

15:15 **First experience with transcatheter mitral valve implantation: what the future holds** *Vinayak Bapat*

15:30 **Wrap up** *Alec Vahanian*

Abstract

Mechanical support and transplantation

Amber 1&2

Moderators: M. Griselli, Newcastle Upon Tyne; M. Huebler, Zurich

14:15 **Results of heart transplantation following failed staged palliation of hypoplastic left heart syndrome and related single ventricle anomalies** *Bahaaldin Alsoufi*

14:30 **Paediatric mechanical cardiac support with Berlin Heart Excor pulsatile ventricular assist device: Twenty-three-year single-centre experience** *Michele Musci*

14:45 **Outcome of mechanical cardiac support in children using more than one modality as bridge to heart transplantation** *Fabrizio de Rita*

15:00 **Long-term mechanical circulatory support in paediatric patients: The Bad Oeynhausen experience** *Eugen Sandica*

15:15 **Higher volume load in congenital heart surgery is associated with better early outcomes** *Andrzej Kansy*

15:30 **Outcomes and risk factors for heart transplantation in children with end-stage cardiomyopathy** *Bahaaldin Alsoufi*

Basic science

Brown 2

Moderators: H.J. Ankersmit, Vienna; P.B. Licht, Odense

14:15 **Discovery of different temporal free radical bursts during pulmonary ischaemia-reperfusion injury** *Jan Gielis*

14:30 **Haemofiltration in ex-vivo lung perfusion: A study in experimentally-induced pulmonary oedema** *Tobias Nilsson*

14:45 **Nanoliposomal-mediated siRNA targeting of Ea.hy926: A promising delivery method** *Attila Nemeth*

15:00 **Integrating biodegradable 3D-bioprinting technology into tracheal reconstruction** *Todd Goldstein*

15:15 **Antitumour efficacy of the double suicide genes in lung cancer cells** *Cheng Shen*

15:30 **Effect of repeated administration of adipocyte-derived mesenchymal stem cells on a murine model of bronchiolitis obliterans** *William Lorenzi*

Controversies in thoracic surgery

Amber 8

Moderators: M. Dusmet, London; L. Spaggiari, Milan

14:15 **Predictors of non-cancerous lesion in lung tumour showing ground glass opacity on thin-section computed tomography based on a multi-institutional prospective study** *Kenji Suzuki*

14:30 **Lobectomy vs sublobar resection for T1a lung cancer: Pro Lobectomy** *Michael Dusmet*

14:45 **Lobectomy vs sublobar resection for T1a lung cancer: Pro sublobar resection** *Alan Sihoe*

15:00 **Long-term results of surgical treatment of non-small-cell lung cancer with N2 involvement: Institutional experience** *Cezary Piwkowski*

15:15 **Discussion – Stage IIIA-N2 is a surgical disease: Pro** *Ralph Schmid*

15:30 **Discussion – Stage IIIA-N2 is a surgical disease: Con** *Suresh Senan*

How today's challenges translate into tomorrow's outcome

Brown 1

14:15 **Long-term follow-up assessment of surgical treatment of chronic thromboembolic pulmonary**

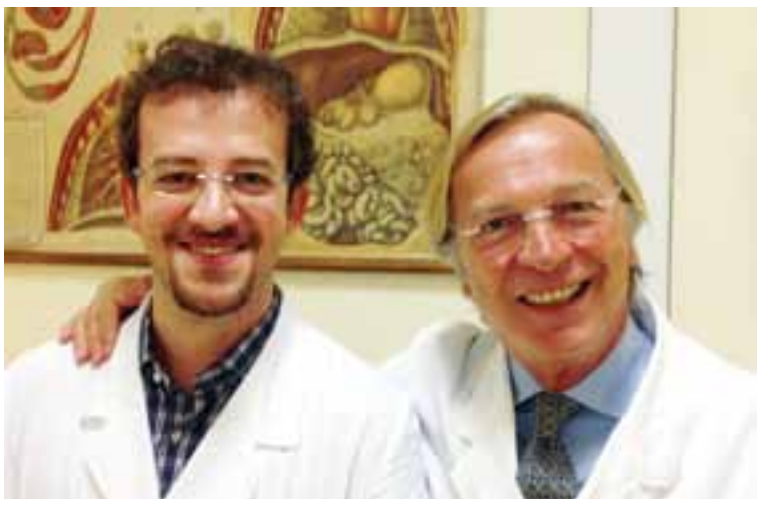
Continued on page 16

Cardiac – Abstract session: TAVI the treatment of choice

What is the best surgical strategy for aortic disease in redo scenarios?

A comparison between traditional aortic valve replacement and transapical transcatheter aortic valve implantation from two real-world multicentre surgical registries

Francesco Onorati *University of Verona Medical School, Verona Italy*



Francesco Onorati (left) and Giuseppe Faggian

The exponential growth of the geriatric population together with significant improvement in surgical techniques and skills, anesthetic management and medical care of fragile patients, has yielded to a significant raise of requests for reinterventions on the aortic valve (RAVR), because of either a primary aortic valve disease or a prosthetic valve dysfunction. The positive results – in terms of early-to-mid-term mortality and morbidity – achieved with the recently-developed trans-catheter valves (TAVI) has on the opposite led to their widespread use in the last years in several traditional high-risk scenarios, such as patients requiring repeated surgical procedure. From a "strict" surgical point of view indeed the trans-apical approach (TaTAVI) has been claimed as a safer less-invasive procedure compared to traditional RAVR. Despite that, literature still lacks comparisons between the traditional RAVR and the recently developed TaTAVI in redo aortic surgery, and the scarce studies trying to address this topic did not comply with VARC-2 criteria.

Therefore, the Division of Cardiac Surgery of the University of Verona Medical School already "coagulated" a multicenter European experience on RAVR in the RECORD (REdo Cardiac Operations Research Database) Registry, whose results have been extensively published in the literature. On the opposite, the Division of Cardiac Surgery of the University of Padua [Dr Augusto D'Onofrio and Prof Gino Gerosa] collected the multicenter Italian experience on TaTAVI in the ITA-Registry, which included the great majority of TaTAVI performed in Italy since trans-apical valves became commercially available in 2008, and whose results have been also extensively published. However, despite both registries complied with VARC-2 definitions, they lack comparative analyses.

Therefore RECORD- and ITA-Investigators decided to share these two experiences, and compared the concurrent RAVR and TaTAVI procedures collected in the two multicenter Registries performed in the last five years in redo-patients. In the analysis presented today at the 28th EACTS Annual Meeting, the Authors first prove that baseline characteristics of the two populations differed, with TaTAVI-patients being older and sicker. Overall, TaTAVI reported higher all-cause mortality at 30-days (8.8% vs 3.1%, p<.01) and lower freedom from all-cause mortality and cardiovascular mortality at two-year follow-up (Figure 2 panels A and B respectively). Prolonged intubation (13.3% vs 4.1%, p<.01) and AKIN2/3 (15.8% vs 8.8%, p=.02) favored TaTAVI, whereas major bleeding (7.1% vs 2.1%, p<.01), early safety (15.8% vs 22.9%, p=.04), and NYHA-class at follow-up (NYHA I-II: 89.8% vs 83.2%, NYHA III-IV: 10.2% vs 16.8%, p<.01) favored RAVR. However, when a propensity-score analysis was used to compare similar populations of patients, an intermediate-risk (Euroscore II= RAVR: 17.1±12.0 vs TaTAVI:15.9±6.9) propensity-matched cohort was selected, demonstrating absent 30-day mortality, and comparable two-year freedom from all-cause and cardiovascular mortality (Figure 3 panels A and B), early safety, stroke and NYHA-class at follow-up between the two groups. TaTAVI also reported lower AKIN2/3 (2.2% vs 15.6%, p=.03) and hospitalization (9.5±3.4 vs 12.0±7.0 days, p=.03).

The Authors concluded that outcome differences between RAVR and TaTAVI in redo-scenarios reflect actual methodological differences related to the two techniques, as well as the different baseline risk-profiles of the enrolled populations. Both RAVR and TaTAVI proved to be excellent techniques in intermediate-risk patients, demonstrating remarkable hospital and two-year outcome, given the absent 30-day mortality and the overall low cumulative morbidity.

Figure 2

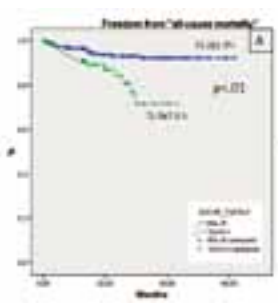
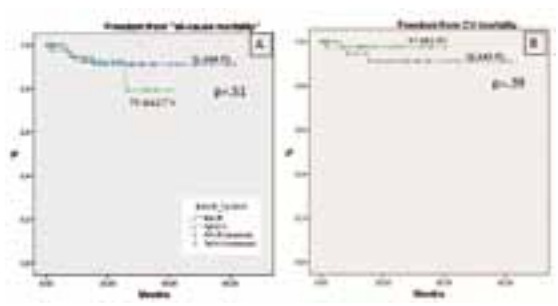


Figure 3



Cardiac – Abstract session: Surgical remodelling of the left ventricle

Improved results twelve years after surgical ventricular restoration

Significance of the evolving concept of reshaping compared to the volume reduction approach

Guglielmo Stefanelli[1], Fabrizio Pirro[1], Alina Olaru[1], Davide Trevisan[1], Clorinda Labia[1], Marco Meli[1], and Giuseppe Gioia2 *1 Hesperia Hospital, Modena ITALY; AtlantiCare; 2 Heart Institute, NJ,USA*

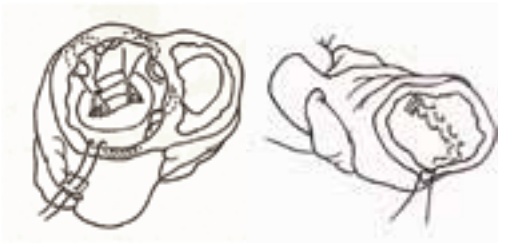


Figure 1 : Re-shaping technique addressing the left ventricular equatorial zone.

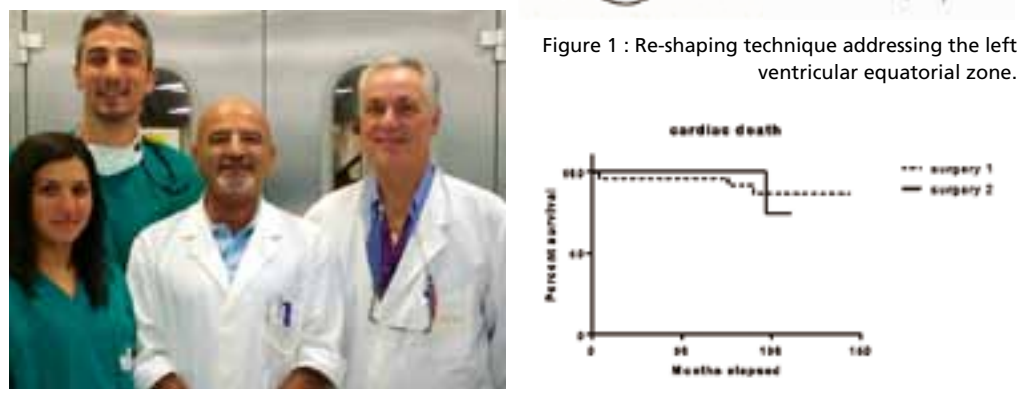


Figure2 : Cardiac mortality at 12 years in the two groups of SVR patients

Figure3: Images of TEEcho Control after SVR with Modified Technique showing the Impressive reduction of LV chamber

The authors report in this paper a single institution, single surgeon, 12 years experience, with patients affected by ischemic dilatation of left ventricle and mean ejection fraction < 30%, and submitted to surgical ventricular restoration (SVR) since 2002. The operative technique has changed with time, moving from the concept of 'volume reduction surgery ' to the idea of reshaping the ventricular chamber to a more elliptical geometry. Therefore the last 29 patients, out of 59 treated by SVR (group B) underwent a modified surgical technique different from the classical DOR operation adopted in the first cases (group A) (Figure1). An aggressive approach to the mitral valve, often incompetent in these cases, has been associated in 61% of patients, and consisted of annular undersizing and, in selected cases, of papillary muscles approximation.

As adjunct to the surgical treatment, since 2007, a randomized clinical trial was initiated, with the aim of verify the impact on left ventricular function of direct subendocardial implant of autologous bone marrow derived mononuclear cells (BMMNCs) into the scarred myocardium, as a concomitant procedure during SVR.

The results of our experience seem encouraging. The total early mortality for the entire group was 3% (0% for group B). During a mean follow up time of 7,7 years (12 yrs – 8 mo.) 25 patient died (44%). If we exclude the non cardiac deaths, mortality rate for heart failure was 17,2%, (Figure 2), with a freedom from hospitalization of 78%. A multivaried analysis has identified pre-operative euroscore, degree of mitral incompetence and renal failure as risk factors for early and late mortality While no statistical difference exist for mortality and clinical outcome between the two groups of patients, impact of surgical technique on left ventricular end diastolic diameter and HYHA class is remarkable (Figure 3), in favor of the modified one. In conclusion SVR is an promising and evolving technical solution for heart failure patients. It has to be considered as a part of a more complex and articulate approach. Cardiac regenerative medicine represent an innovative, adjunctive tool for the treatment of this severe disease.

Cardiac – Abstract session: Surgical remodelling of the left ventricle

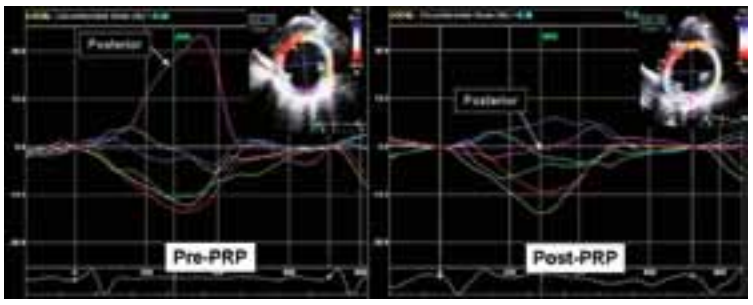
Posterior restoration procedures and the long-term results in indicated patients with dilated cardiomyopathy

Tadashi Isomura, Masanori Hirota, Yuichi Notomi, Joji Hoshino, Taichi Kondo, Yu Takahashi, Minoru Yoshida *Hayama Heart Center, Kanagawa, Japan*

Non-transplant surgery for dilated cardiomyopathy (DCM) has been in the process of development. Between July in 2005 and December in 2013, we performed non-transplant cardiac surgery in 275 patients with DCM (90 with ischemic and 185 with non-ischemic DCM) at Hayama Heart centre in Japan. Among them, we developed and performed posterior restoration procedures (PRP) in dilated akinetic or dyskinetic posterior lesion of the left ventricle (LV) and obtained favorable outcome. The early and long-term results of the procedures are discussed.

In 2005, we found the preoperative examination of speckle tracking echocardiography GE ultrasound machine, Vivid 7 or Vivid E9 was very useful to detect the accurate lesion of the LV for patients with DCM. Since then, we developed PRP which was consisted of incision and resection of the posterior LV wall between bilateral papillary muscles, cryoablation of the LV muscle between the edge of the incision and the mitral annulus, and restoration of the LV by closing the posterior wall with approximation of bilateral papillary muscle. The PRP was indicated and electively performed in both ischemic (n=17) or non-ischemic (n=41) DCM. There were 45 men and 13 women with a mean age of 56+/-12 years. The mean preoperative ejection fraction was 24% and the preoperative New York Heart Association (NYHA) classification was class III in 24 patients and class IV in 34 with intra-venous inotropic support.

In addition to PRP, mitral surgery was in 56 (plasty 51, replacement 5), tricuspid annuloplasty in 21, coronary artery bypass grafting in 17, cardiac resynchronization therapy (CRT) in six, and LV lead implant in 27 patients. Perioperative intra-aortic balloon pumping (IABP) was used in nine and there was no hospital mortality. In the late follow-up, there were 14 cardiac deaths (CHF10, VT4). However, 35 patients (60.3%) improved their functional class into class I or II. The three- and eight-years survival rate was 75.7% or 63.0% respectively.



Post operative speckle tracking echocardiography showed that the desynchronized lesion of the posterior wall was removed and the other wall motion of the LV showed synchronization in addition to reduction of the LV volume (Figure above).

Patients with DCM showing akinesis or dyskinesis of the posterior LV wall indicated by speckle-tracking echocardiography can be surgically treated with PRP. The effect of the procedures was not only volume reduction of the LV but also surgical synchronization of the LV wall motion by removing desynchronized posterior wall. Our results demonstrated that 60% of indicated patients could avoid heart transplantation and relieved their symptom.

Cardiac – Adult cardiac rapid response 2

Endoaortic balloon clamping and trans aortic clamping are both safe and effective in minimally invasive mitral valve surgery

Mauro Rinaldi[1], Mohamed Bentala[2] *1 University of Turin, Italy, 2 Amphia Hospital, Breda, The Netherlands*

Minimally invasive mitral valve surgery (MIMVS) has been performed for over 15 years and we are all aware of the benefits that this approach brings to our patients when compared to standard sternotomy, such as less pain, blood loss and a shorter length of hospital stay. In addition recent clinical papers can demonstrate a reduction in procedural costs and a quicker return to a normal activity and quality of life which in itself has a large cost saving implication to the health services.

Yet despite this the MIMVS approach has its critics who question the fact that a limited operating field may compromise the surgeon's ability in providing the best possible outcome.

In our centre (Amphia Breda, Netherlands) we have performed MIMVS since 2010, originally starting with the external clamp (Chitwood) and in 2011 changed our clamping approach to the endoaortic balloon.

Having experience in both clamping techniques we wanted to address the current concept that one may be superior to the other. We analyzed data from three centres in Europe where the surgeon's have experience in both clamping techniques. Five hundred consecutive patients undergoing MIMVS were included and we also included concomitant surgery such as mitral with tricuspid and atrial fibrillation patients.

A higher incidence of previous cardiac operations was observed in EAC compared to the TCC group which was expected due to the fact the Endoballoon facilitates easier aortic occlusion in these patients.

Between both groups the results for X-clamp and extracorporeal circulation times were similar as was 30 day mortality. No difference was found in respiratory failure, renal failure, and major vascular complications. Stroke rate was 0.8% in both groups. However we did see reoperation for bleeding and blood transfusion were higher in the TTC group despite the higher rate of complex redo cases performed with the EAC.

Despite recent concerns arising about EAC, our study shows equivalence in term of safety and effectiveness of this technique compared with TTC. Today, the full findings will be presented at this meeting.

In our opinion and according to our experience with the use of EAC in MIMVS, the EAC adds safety to the procedure in terms that it can be used in complex MIMS redo-operations without the need of tissue dissection for clamp positioning and aortic root needle placement. In addition we found that this device makes the total thoracoscopic approach of the mitral valve possible without the use of additional or larger incisions and without the need for mechanical rib spreading devices. The hazards of bleeding or dissections from the ascending aorta are avoided in this way which we demonstrated in our study, while the thoracotomy incision can be kept small. These reasons led us to adopt the EAC as our preferred technique for clamping the aorta during MIMVS. On the other hand the device has a learning curve; one should understand the device and use it in the proper way. The hemodynamic features of the EAC should be understood and one should be trained in the use of this device before adopting it to the daily practice.

Continued from page 14

	hypertension	*Alexander Chernyavski*
14:30	**Peripheral or central cannulation in acute Type A dissection: Does it really matter?**	*Stefan Klotz*
14:45	**Early and late outcome after surgery for acute type A aortic dissection in the elderly**	*Pietro Giorgio Malvindi*
15:00	**Long-term results after open aortic arch surgery for aneurysms and type A aortic dissections: Comparable outcomes beyond the perioperative period**	*Alexander Bernhardt*
15:15	**Twelve-year surgical experience with Type A aortic dissection: The impact of age on early and long-term outcomes**	*Massimiliano Carrozzini*
15:30	**Gender-specific differences in outcome of ascending aortic surgery**	*Carsten Beller*

Quick Fire

Aortic rapid fire session – fire and ice in aortic medicine

Brown 3

Moderators:

14:25	**Virtual angioscopic evaluation of formation and progression of ulcer-like projection in patients with thrombosed-type acute aortic dissection**	*Takuma Miyamoto*
14:35	**Elastic properties of the juvenile aorta: New insights from a novel porcine ex vivo perfusion model**	*Tobias Krüger*
14:45	**Impact of clinical factors and surgical techniques on early outcome of patients treated with frozen elephant trunk technique: Results of a multicentre study**	*Sergey Leontyev*
14:55	**Xenopericardial roll graft replacement to treat infectious pseudoaneurysm or graft infection of thoracic and thoraco-abdominal aorta**	*Hiroshi Kubota*
15:15	**Impact of cystic medial necrosis on the early and late outcome of patients with aortic dissection**	*Toshiki Fujiyoshi*

Focus Session

Pitfalls and trouble shooting in minimally-invasive surgery

Amber 6

Moderators: M. Glauber, Massa; F.-W. Mohr, Leipzig

14:15	**Peripheral cannulation pitfalls**	*Mattia Glauber*
14:45	**Cardio protection in minimally invasive surgery**	*Volkmar Falk*
15:00	**Pitfalls in port-access mitral valve surgery**	*Friedrich-Wilhelm Mohr*
15:15	**Pitfalls in minimally invasive aortic valve replacement**	*Peyman Sardari Nia*
15:30	**Pitfalls in transcatheter valve therapies**	*Pieter Kappetein*

Abstract

Infective endocarditis and outcomes

Amber 4

Moderators: T. Bahrami, Harefield; C.A. Mestres, Barcelona

16:00	**Early and late outcomes of complex aortic root surgery in patients with aortic root abscesses**	*Piroze Davierwala*
16:15	**Quality of life in 9985 patients following aortic valve replacement: One-year results from the German Aortic Valve Registry**	*Andreas Beckmann*
16:30	**Surgical management of destructive aortic endocarditis: Left ventricular outflow reconstruction with Sorin Pericarbon Freedom stentless bioprosthesis**	*Sandro Sponga*
17:00	**Mitral valve abnormalities in patients with bicuspid aortic valve: Prevalence, mechanisms and impact on associated aortic dilatation risk**	*Alessandro Della Corte*
17:15	**Full sternotomy versus right anterior mini-thoracotomy for isolated aortic valve replacement in octogenarians: A propensity matched study**	*Daniyar Gilmanov*

Can minimally invasive ablation keep up its promise for lone atrial fibrillation

Michelangelo

Moderators: M. Castella, Barcelona; M. La Meir, Brussels

16:00	**Systematic review comparing endocardial full maze to epicardial ablation and hybrid procedure on safety and efficacy of minimally invasive surgical ablation for lone atrial fibrillation**	*Niv Ad*
16:15	**The double-isolation lesion set provides superior outcomes to the box lesion in patients with stand-alone, persistent atrial fibrillation**	*Claudio Muneretto*
16:30	**A new approach to determine the results of**	

Continued on page 18

Cardiac – Adult cardiac rapid response 2

A new pressure mapping system towards optimizing cardiac prosthetic attachment

Angelo J Martellaro[1], J.S. Sauer[1], C.Y. Lee[2], H.R. Gorea[1], P.A. Knight[2]

1 LSI Solutions, Victor, NY, USA 2 University of Rochester Medical Center, Rochester, NY, USA

To quantitatively evaluate attachment pressures between cardiac valve prostheses sutured to simulated annular tissue, we developed a digital pressure mapping system incorporating thin film transducers with real time data collection and analysis software. Our goal was to enhance the understanding of cardiac prosthetic attachment variables such as the number of sutures used, suture bite spacing, knot strength and prosthetic selection towards the reduction of surgical operative times and improved clinical outcomes.

For this study, we tested Mitral Valve Repair (MVR) and Aortic Valve Replacement (AVR) models consisting of mitral prosthetic rings and bioprosthetic aortic valves attached with pledgeted sutures in a sub-annular orientation.

To prove the system feasibility, a study was conducted by an attending cardiac surgeon who performed simulated MVRs and AVRs in which the prosthetic was attached with sutures secured using either manual suture tying (MVR-MT, AVR-MT) or mechanical titanium fasteners (MVR-TF, AVR-TF). With the thin film pressure transducer positioned between the prosthetic and the simulated annulus, pressure data were captured and displayed in two-dimensional (2-D) and three-dimensional (3-D) color-gradient pressure distribution maps.

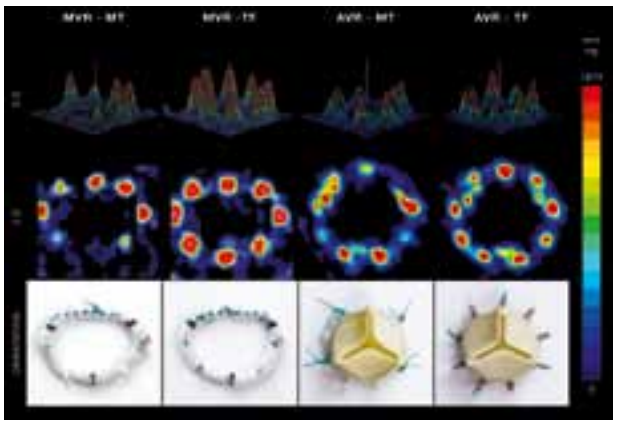


Figure 1: 3-D pressure magnitude graphs (top row), the corresponding 2-D topographic maps (middle row), and representative orientation (bottom row) for two mitral valve repairs (MVR) with annuloplasty rings and two aortic valve replacements (AVR) secured with manually-tied knots (MT) using a knot pusher or mechanical titanium fasteners (TF).

This study demonstrated that the surgeon's qualitative perception of knot effectiveness did not correlate well with the actual measured pressure readings (i.e., some tied knots were perceived to strongly secure suture, but failed to yield high measured pressures). Mechanical titanium fasteners presented more consistent and higher average pressure readings. Average MVR sutured prosthetic attachment pressures were 670mm Hg for MVR-MT vs. 1,299mm Hg for MVR-TF per knot, with pressures ranging from 74 – 1,151mm Hg and 1,132 – 1,584mm Hg, respectively. Average AVR suture attachment pressures were 686mm Hg for AVR-MT vs. 841mm Hg for AVR-TF, 223 – 1,079mm Hg and 578 – 1,013mm Hg, respectively.

This research utilizing the pressure mapping system encourages continued exploration of technical factors that may contribute to optimal cardiac prosthetic attachment. Further developments to this technology will allow for an improved means of assessing prosthetic security in cardiac procedures and also allow for future application of this simulator as a training tool for surgeons.

Cardiac – Adult cardiac rapid response 2

Focused ultrasound of the pleural cavities and the pericardium performed by nurses in patients in the early phase after cardiac surgery

Torbjørn Graven *Levanger Hospital, Levanger, Norway*

Pericardial (PE) – and pleural effusion (PLE) are common complications of cardiac surgery and may cause increased morbidity, prolonged hospitalization or hospital readmission.

In clinical practice the detection and follow-up of PE and PLE are frequently done by physical examination and chest x-ray. However, the diagnostic accuracy of physical examination in this context is clearly inferior and standard chest x-ray has been shown to be inaccurate in detecting and quantifying effusions. Ultrasound (US) has been proven to be a sensitive and accurate tool to detect and quantify PE and PLE.

Focused US performed by trained nurses caring for these patients may perform better than chest x-ray and lead to earlier detection of complications in terms of PE and PLE.

The aim of the present study was to assess the feasibility and reliability of focused US of the pericardium and the pleural cavities to quantify PE and PLE with a pocket-size imaging device (PSID) performed by nurses in patients in the early phase after cardiac surgery. Prior to study start two nurses underwent a three month training period with cardiologists as supervisors. During the study 59 patients (20 women) were examined with US by two nurses using PSID at a median of five days after surgery. PE was quantified by averaging the measurement at four positions (right atrium, right ventricle, left ventricle, apex) and classified as large if it exceeded 15mm. The amount of PLE was classified as large if the dimension between the diaphragm and basal lung exceeded 30mm with the patient in sitting position. High-end echocardiography, including the assessment of both pleural cavities, by one of four experienced cardiologists was used as reference.

Table.

	Mean (SD)
Time consumption PSID, min	13 (3)
Time delay PSID to reference, h	4.6 (5.2)
Correlation, PE, nurse–cardiologist r (95% CI)	0.65 (0.39–0.81)
Correlation PLE, nurse–cardiologist, r (95% CI)	0.81 (0.73–0.87)
Severe amount PE/Large amount PLE (drained PE/PLE)	2/37 (1/8)

Abbreviations: CI; confidence interval, SD; standard deviation, others as in text.

The present study shows that nurses specialized in cardiology were able to perform focused cardiac and chest US with a PSID for the evaluation of PE and PLE with a high feasibility of 100% after a relative short period of training. Moreover the nurses were able to reliably detect and quantify both PE and PLE with substantial to high correlations (r 0.65 and 0.81 (both $p<0.001$) with the reference (Table).

Thus, we conclude that after a short dedicated training program cardiac nurses were able to obtain reliable measurements and quantification of both PE and PLE bedside by a PSID in the early postoperative period after cardiac surgery. This may allow for change in clinical practice.

Thoracic – Abstract session: Oesophagus

External validation of the Ferguson pulmonary risk score for predicting major pulmonary complications after oesophagectomy

J. Matthew Reinersman, Mark S. Allen, Claude Deschamps, Mark K. Ferguson, Francis C. Nichols, K. Robert Shen, Dennis A. Wigle, Stephen D. Cassivi *Mayo Clinic, Rochester, USA*

Oesophageal cancer is the sixth leading cause of cancer-related mortality worldwide and continues to demonstrate increasing incidence. Oesophagectomy remains the mainstay of therapy offering the best chance of long-term survival in appropriate surgical candidates. Nevertheless, oesophagectomy is a major surgical procedure as demonstrated by the fact that over half of these patients suffer at least one adverse postoperative event. Risk stratification has been proposed as possible tool to preoperatively identify an individual patient's risk of postoperative complications and potentially allow for preemptive mitigation of that risk.

Recent research in risk assessment proposed a model for risk stratification and prediction of postoperative pulmonary complications. This pulmonary risk score comprises performance status, age, percent predicted FEV1, and percent predicted DLCO. Mayo Clinic thoracic surgeons proceeded to analyse a cohort of 136 oesophagectomy patients from their institutional database. The proposed risk model was used to assess its ability to predict and stratify the risk of major pulmonary complications such as need for reintubation for respiratory failure and pneumonia following oesophagectomy. Receiver operating characteristic curve analysis was utilized to evaluate the accuracy of the system.

Major pulmonary complications occurred in 34.6% of patients with an operative mortality of 5.9%. The five risk-score groupings were: 0-2, 8 patients (5.8%); 3-4, 24 patients (17.6%); 5-6, 49 patients (36%); 29 patients (21.3%); 9-14, 26 patients (19.1%). The incidence of major pulmonary complications in these categories was 0%, 16.7%, 20.4%, 41.4%, and 76.9% respectively. Thus, with an increasing score, the incidence pulmonary complications also comparatively increased. The overall accuracy of the risk score system for predicting major pulmonary complications was 76.2% ($p<0.0001$), revealing a moderate discriminative ability. The Mayo Clinic research team concludes that this pulmonary risk scoring system appears to be a reliable instrument to be used during the preoperative phase to differentiate patients who may be at higher risk for pulmonary complications after oesophagectomy and potentially identify opportunities for mitigating this risk. These data can also assist in patient selection, education, and informed consent, as well as guiding postoperative management.

Stephen Cassivi (left) and Matthew Reinersman

Thoracic – Abstract session: Oesophagus

Repair of post-intubation tracheo-esophageal fistulas through the left pre-sternocleidomastoid approach: A recent case series of 13 patients

Christophoros N. Foroulis
AHEPA University Hospital, Thessaloniki, Greece

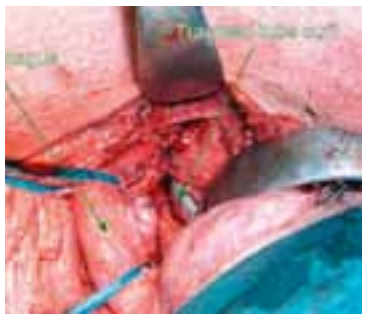


Figure 1

Figure 2

Figure 3

Post-intubation tracheoesophageal fistula (TEF) is a late and rare (<1%) complication of tracheotomy. Membranous trachea laceration during percutaneous dilational tracheostomy is implicated in recent years for the development of early post-tracheotomy TEFs. Surgical repair is the only viable option for these patients and the technique of repair depends on the extent of fistula, presence of circumferential tracheal stenosis and dependence of the patient from mechanical ventilation. The best way to repair a TEF is considered by the expert's in the field to be tracheal resection including the damaged trachea and repair of the esophagus in two layers irrespective to the presence of tracheal stenosis or not. In the other hand, the left pre-sternocleidomastoid approach permits easy access to perform direct closure of the fistula which should always followed by interposition of the whole pedicled left sternocleidomastoid muscle (SCMM) between the two suture lines. A recent case series of 13 post-intubation TEFs that underwent direct closure and SCMM interposition with the left pre-sternocleidomastoid approach is reported looking for the advantages and drawbacks of the approach.

Thirteen patients (mean age: 54.1±12.6 years, male: eight) with post-intubation TEF were managed between 2007 and 2013. The diagnosis was always made through esophagoscopy followed by endoscopic gastrostomy and bronchoscopy for repositioning of the tracheal tube just above the carina. Early development of TEF (6th to 11th post-tracheotomy day) was noted in three patients. Repair of the fistula was made in all patients through a left pre-sternocleidomastoid incision followed by dissection of the fistulous tract, suturing of esophagus and trachea and interposition of the whole pedicled left sternocleidomastoid muscle between the two suture lines.

Five out of the 13 procedures were performed in mechanically ventilated patients; three of them died from septic complications during the postoperative period while fistula recurred in one of those three patients due to the extent of the fistula, to the inflammation of the trachea and to the small volume of the left SCMM because of long ICU-stay associated myatrophy. The results of TEF repair were favorable in the rest eight patients who underwent fistula repair after their final weaning from mechanical ventilation. Temporary T-tube insertion was obviated in one patient to manage extensive tracheomalacia. Permanent left vocal cord paralysis was noted in one out of the 10 survivors (10%).

According to the results of our case-series, the direct one-stage closure of trachea and esophagus with SCMM interposition through the left pre-sternocleidomastoid approach is very effective and easily reproducible technique for the repair of post-intubation TEFs. Mobilization of the esophagus to a large extent after dissection of the fistulous tract (Figure 1) and interposition of the whole SCMM between the suture lines (Figure 2 and 3) makes a very durable construction which is able to prevent fistula recurrence and to be applied in mechanically ventilated patients. The main drawbacks of the technique are the risk to damage the left recurrent laryngeal nerve and the unsuitability of the technique in the presence of concomitant tracheal or laryngotracheal stenosis.

Thoracic – Abstract session: Lung transplantation

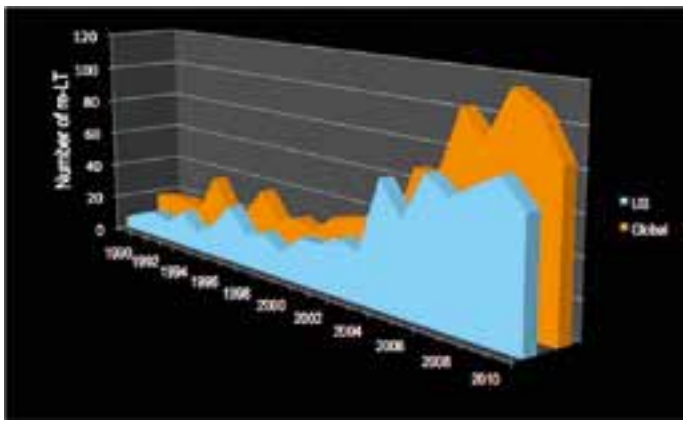
Contemporary trends in lung re-transplantation

J.W. Awori Hayanga and colleagues *DeVos Heart & Lung Specialized Clinics, Grand Rapids, MIchigan, USA*

Lung re-transplantation is a rare entity with comparatively poor outcomes. It constitutes less than 5% of the total volume of transplantations. As the numbers continue to grow, however, the allocation of the donor organs engenders considerable scrutiny centered upon the ongoing ethical debate over allocation of this scarce resource. Proponents for re-transplantation proffer the argument for utility. According to this, the very existence of any recipient in need justifies objective consideration for organ allocation. The counterargument, however, is that of equity, with the prioritization of first-time recipients rather than the endorsement of multiple allocations to the same recipient. Re-transplantation may thus be considered a triumph of the utilitarian moral argument over the egalitarian. The ethical argument may be tempered somewhat by the steadily improving outcomes following re-transplantation.

Our research into re-transplantation has sought to guide decision-making in this regard. In previously published work we have identified risk factors associated with re-transplantation, focusing on pre-transplant characteristics associated with graft failure. We identified that increased recipient and donor age, as well as clinical acuity of recipient may each carry an increased risk of graft failure. We also confirmed that primary double lung recipients fare better and require re-transplantation less frequently. Chronic allograft failure or bronchiolitis obliterans syndrome (BOS) have comparable survival to primary recipients, and have rendered this the most justifiable indication for re-transplantation. Conversely, patients who develop acute graft failure or airway complications carry the worst prognosis, with recipient five-year survival demonstrated in prior studies to be as low as 25%.

Our most current study entitled "A Global Analysis of Contemporary Trends in Lung Re-transplantation: A Question of Selection " is an evaluation of trends and survival following re-transplantation over time. In addition, we provide an assessment of risk factors for mortality post re-transplantation. We identified that, with time, survival has improved. The median survival after re-transplantation still remains comparatively low at under three years. This, however, represents an eight-month increase in the survival of this particularly challenging recipient population that has occurred since 2005. Once again, we have identified that increased clinical acuity of the recipient is associated with higher mortality post re-transplantation. Owing to inconsistent data recording, our study provides only a limited insight into the complex relationship between primary pulmonary diagnoses, type of allograft failure, and



outcomes. Identifying which primary pulmonary diagnosis has the worst outcomes may further allow us to identify specific groups of patients particularly at risk.

Elucidation of mortality risk factors may lead to earlier aggressive management geared specifically at prevention, pre-transplant risk counseling, as well as enhanced evidence-based selection practices. Furthermore the quest for answers to these questions affords advancement in the ethical debate by providing evidence as to when re-transplantation is most justifiable, when it constitutes a risky but worthy endeavor, and when we should simply opt against it.

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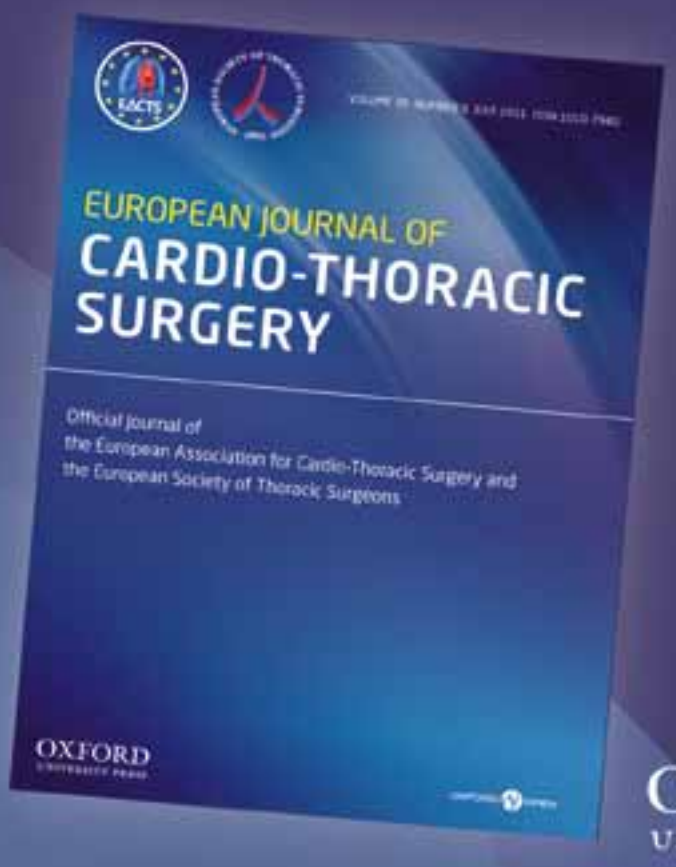

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Continued from page 16

minimally invasive pulmonary vein isolation using a continuous loop monitor: Preliminary results *Maurice Oudeman*

16:45 Implantable loop recorder monitoring after concomitant surgical ablation for atrial fibrillation: Insights from more than two hundred continuously-monitored patients *Simon Pecha*

17:15 Exiting the maze to walk into the hybrid labyrinth *Manuel Castella*

Cardiac surgery in marginal patients

Amber 3

Moderators: A.A. Hassouna, Cairo; P. Leprince, Paris

16:00 Surgical thrombectomy of mechanical valve thrombosis *Pablo Pomerantzeff*

16:15 Treatment strategy for infective endocarditis associated with cerebral complication *Genya Muraoka*

16:30 Preoperative intra-aortic balloon pumping in high-risk patients undergoing cardiac surgery: A meta-analysis of randomised controlled trials *Kevin Pilarczyk*

17:00 Cardiac reoperations in octogenarians: Do patients really benefit? *Heinz Deschka*

17:15 Effect of carotid revascularisation on cerebral autoregulation in combined cardiac surgery *Daijiro Hori*

Focus Session

All alone in the operating room – Tips and tricks in urgent disasters

Amber 5

Moderators: F.-W. Mohr, Leipzig; A. Pavie, Paris

16:00 10 minute rules of disaster management *Samer Nashef*

16:30 A standard operating procedure for aortic dissection *Martin Grabenwöger*

16:45 A standard operating procedure for pulmonary embolus *Rune Haaverstad*

17:00 A standard operating procedure for ischemic ventricular septal defect *Anthony De Souza*

17:10 A standard operating procedure weaning patients from bypass *Friedhelm Beyersdorf*

17:25 Wrap up *Friedrich-Wilhelm Mohr*

Translational cardiovascular research

Botticelli

Moderators: G. Ferrari, Philadelphia; J.B. Grau, Ridgewood

16:00 Subclinical aortic valve disease: new tools for risk stratification and therapy *Giovanni Ferrari*

16:15 Clinical implication of genomicsin the use of bilateral internal mammary artery for coronary artery bypass graft *Juan Grau*

16:30 Decellularized whole heart for bioartificial heart *Payam Akhyari*

16:45 Biological features of thoracic aortic diseases. Where are we now, where are we heading to: established and emerging biomarkers and molecular pathways *Alessandro Parolari*

17:00 Cellular mechanism driving fibrosis and matrix remodeling in myxomatous mitral valves *Jordan Miller*

17:15 Tricupsid valve replacement with as decelluraised extra cellular matrix cylinder. The reason behind remodelling after implantation *James Cox*

Treating Mitral regurgitation in 2014 with Percutaneous Mitral Valve Repair

Brown 3

Moderator: H. Reichenspurner, Hamburg

17:00 Why should I treat with or refer my patient to MitraClip? *Hendrik Treede*

Abstract

Congenital Miscellaneous

Amber 1&2

Moderators: W. Brawn, Birmingham; G.E. Sarris, Athens

16:00 Anatomic repair of complex transposition with en bloc rotation of the truncus arteriosus: Ten years' experience *Rudolf Mair*

16:15 Fate of right ventricle to pulmonary atresia conduits following complete repair of pulmonary atresia with major aortopulmonary collaterals *Richard Mainwaring*

16:30 Biventricular repair for double outlet right ventricle with non-committed ventricular septal defect *Shoujun Li*

17:00 Early and mid-term clinical experience with extracellular matrix graft for congenital cardiac and vascular reconstructive surgery:

Continued on page 20

Vascular – Abstract session: Thoracoabdominal aortic pathology a functional approach in preserving spinal cord integrity

Shock wave treatment reduces neuronal degeneration and improves functional outcome after spinal cord ischemia

Johannes Holdfeld
Innsbruck Medical University, Innsbruck, Austria

Paraplegia or paraparesis due to spinal cord ischemia (SCI) still represent rare but devastating complications of aortic surgery as well as of endovascular aortic repair. The incidence of postoperative paraplegia is strongly dependent on the underlying aortic pathology, the location of the pathology and on the used repair technique.

Protection of the spinal cord commonly is achieved by moderate or deep hypothermia under circulatory arrest and thereby still remains a matter of ischemia duration. Pharmacological neuroprotection and cerebral fluid drainage are routinely used, however the preventive effect remains not always sufficient.

Tissue regenerative approaches nowadays mainly include (stem) cell and gene based therapies. Both of which have not gained broad clinical use due to complexity in application or severe adverse events. A new approach for tissue engineering involves shockwave therapy.

Low-energy shockwave therapy (SWT) established for tissue regeneration based on the incidental finding of iliac bone thickening in patients undergoing shockwave lithotripsy. Since then, SWT has developed as a standard of care for a variety of orthopaedic and soft tissues diseases, e.g. wound healing disturbances. Even cardiac regeneration upon SWT has shown promising results in patients suffering from ischemic heart failure and refractory angina[1]. In experimental studies our group has shown that SWT induces angiogenesis (vessel sprouting) via the release of pivotal growth factors (VEGF, PlGF) as well as recruitment of endothelial progenitor cells from the bone marrow for vasculogenesis (de novo vessel formation) in ischemic myocardium[2,3]. Additionally, SWT was shown to positively influence inflammation[4]. The findings from small animal experiments could be translated into a large animal model closely resembling the human heart[5].

In the current work we aimed to investigate, whether the positive effects on ischemic myocardium can be achieved in spinal cord ischemia as well and whether SWT may therefore be a feasible adjunct for the treatment of complex aortic pathology. This was investigated in mice with 10 minutes clamping of the aorta between left carotid and subclavian artery plus destruction of the left mammary artery (Figure 1A). Shockwaves were applied immediately after spinal cord ischemia.

Quantification of degenerating neurons within the spinal cord (via Fluoro Jade B immunostaining) revealed an ongoing degenerative process up to seven days post ischemia in untreated controls. In contrast shockwave treated animals showed a stable number of degenerating neurons over time. Neurons that were not injured after 24 hours did neither get injured at a later time point in the treatment group (Figure 1B).

In line with this morphological findings we found improved functional outcome. Numerous functional measurements of mobility, coordination, strength and speed were performed every day showing that treated animals rapidly enhanced their lower limb function to normal, whereas untreated controls remained impaired over time. This even resulted in a higher mortality of the control group!

The results of the current study clearly exceeded our expectations. We therefore think that it would be very reasonable to test this new treatment option in a clinical setting!

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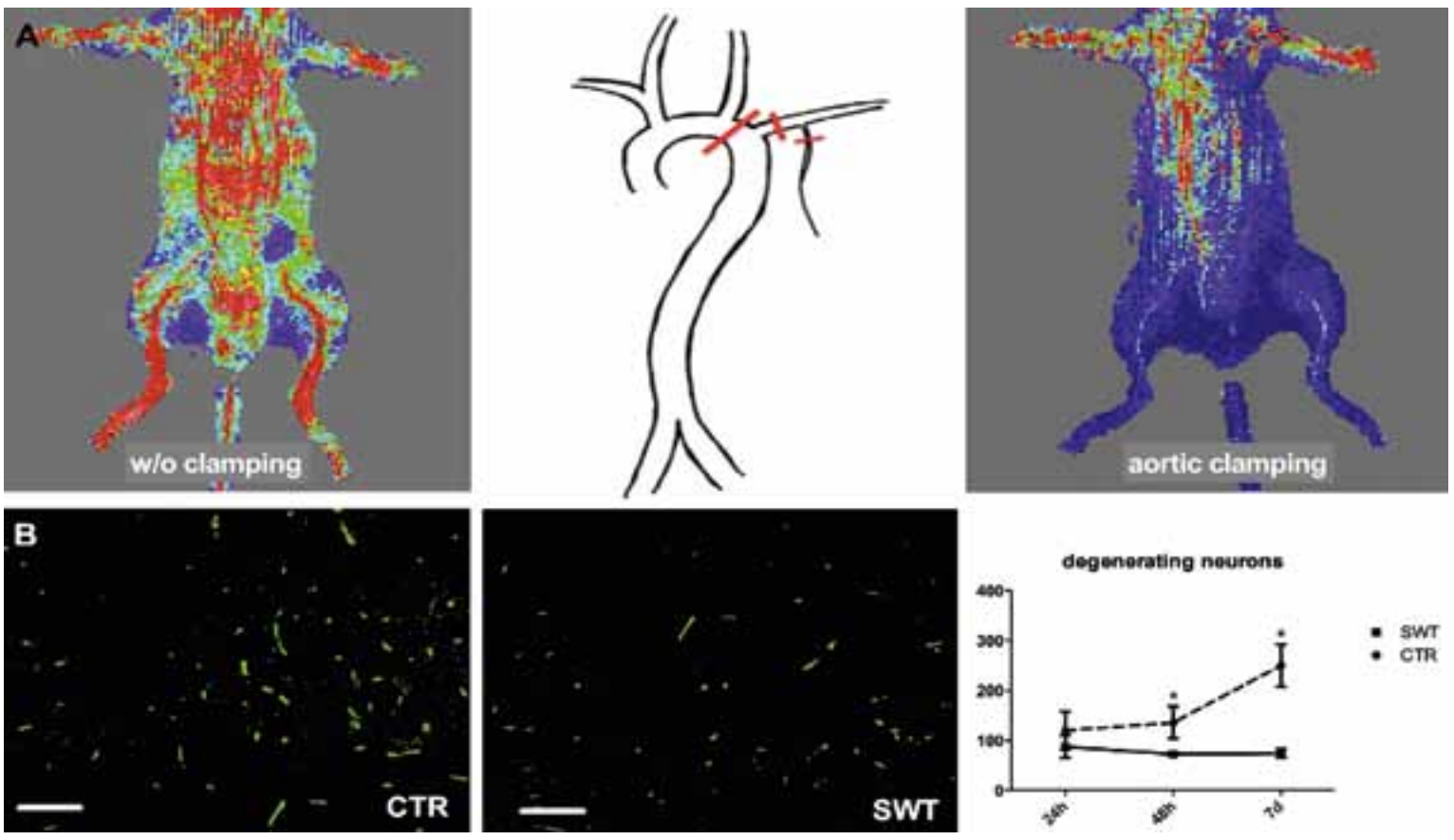


Cardiac – Focus session: Training in minimally cardiothoracic surgery

Training in minimally invasive cardiothoracic surgery

Rafa Sadaba
Hospital de Navarra, Pamplona, Spain

Recently there has been a growth in the body of published literature on minimally invasive cardio-thoracic surgery (MICTS) long-term outcomes. Most reports suggest that major cardiac and thoracic operations that have traditionally been performed through a median sternotomy or a lateral thoracotomy, can be performed through a variety of minimally invasive approaches with equivalent safety and durability.

When considering training in MICTS, one must consider some potential difficulties because of the fact that organizational structures can limit an organization's ability to adopt new technologies that disrupt existing routines and relationships. This is the case in a number of cardio-thoracic surgical units. There are a number of variables that affect the adoption of minimally invasive techniques in surgery and therefore the facility to train in these techniques: team leader behavior, team psychological safety and organizational factors are the main ones. Interestingly, a recent survey suggests that the surgeon's age may play an important role in the preference for less-invasive techniques.

The skills required to perform MICTS are different to those of open surgery, being more allied to endoscopy and interventional cardiology than to traditional surgery. The surgeon has to enter the thorax using a smaller incision, very often use long instruments with only their tips visible and become accustomed to the fulcrum effect. Procedures are performed by viewing a two-dimensional video image on a screen up to 2 m away, with limited tactile feedback.

Advances in surgery are constantly being made and surgeons are being trained on new procedures and devices from thoracoscopic to robotic, to single-incision surgeries and to transcatheter therapies. With this advancement, another body of literature is emerging on the associated learning curves. The existence of a learning curve clearly has implications for training and adoption of new procedures and devices. In addition, learning curves impact the, and have been noted as a stumbling block to, rigorous evaluation of new procedures. Different techniques have different learning curves and require different training methods outside the operating room. This is why a paradigm shift in the way training for certain types of MICTS is conducted is emerging in the form of virtual simulation.

To ensure that virtual simulation can be incorporated into current training programmes there is a need to develop validated curricula for basic, intermediate and advanced level training. Current simulators should enable basic and some forms of intermediate level training, although the methods for achieving this remain unclear. The correct frequency of training and whether tutors need to be present at all times should be determined. Competency levels should be defined using at least a national approach, enabling standardization of training programmes. It is not necessary for every hospital to have a virtual reality simulation laboratory; training can be provided at regional skills centres. Currently, training occurs in the form of isolated 2- or 3-day courses but, with the establishment of regional centres, it should prove possible to develop training programmes over periods of months and years. The virtues of virtual simulation as an "out of hours" form of training in a "working hours restriction" environment should not be underestimated.

Vascular – Abstract session: Thoracoabdominal aortic pathology a functional approach in preserving spinal cord integrity

Evaluation of the downstream aorta after frozen elephant trunk repair for aortic dissections in terms of diameter and false lumen status

Gabriel Weiss *Hospital Hietzing, Vienna, Austria*

Due to improvements in surgical techniques and perioperative care, the outcome of surgical repair for aortic dissection (AD) has improved substantially over the last decades. However, most survivors who have undergone conventional surgery have a residual dissected aorta, often with a patent false lumen. There is certain evidence that a patent FL associates with significantly lower freedom from reoperation and survival rates due to an increased risk of late aortic growth. Therefore, an alternative operative strategy that promotes the obliteration of the FL without increasing the operative risk is needed. Feasible and safe therapeutic options may be the new hybrid procedures that combine open antegrade stent grafting with conventional aortic arch surgery. One promising approach is the frozen elephant trunk (FET) procedure. The aim of the present case series study was to analyse the clinical outcomes of surgical repair of DeBakey type I and III AD via the FET technique, and to assess the behaviour of the FL and the diameter in the residual aorta after surgery.

In total, 27 consecutive patients underwent treatment of the thoracic aorta for AD with the FET technique in a tertiary-care hospital in Vienna/Austria between 2005 and 2012 and were enrolled in this case series study. All operations were performed under circulatory arrest and bilateral antegrade cerebral perfusion. During follow-up, a clinical examination was performed as well as aortic diameters and false lumen patency (FL) evaluated by computed tomography (CT) imaging at following levels: pulmonary bifurcation, diaphragm, and celiac trunk.

The mean age of the patient cohort was 56 ± 12 years; 21 patients were male gender. Twenty-two (82%) and five (18%) patients presented with DeBakey type I and type III AD, respectively. The hospital mortality rate was 7% (2/28); two patients died due to non-aortic-related reasons during a follow-up period of 48 ± 26 months. Three (11%) patients had a stroke and two (7%) a spinal cord injury. Follow-up CT scans revealed FL thrombosis in 96% of the patients at the level of the pulmonary bifurcation ($p < 0.001$). Distal to the stent graft, at the level of the diaphragm and celiac trunk, FL patency was observed in 52% ($p = 0.1$) and 78% ($p = 0.6$) of the patients, respectively. The true lumen (TL) of all analysed aortic segments increased significantly while the mean aortic diameter remained stable.

Gabriel Weiss

Compared to traditional surgery for AD, the FET technique yielded a high rate of FL thrombosis and stable aortic dimensions in the thoracic aorta without significantly increasing the risk of the operation.

Cardiac – Abstract session: Can minimally invasive ablation keep up its promise for lone AF?

A systematic review of the safety and efficacy of minimally invasive techniques for the surgical ablation of AF

Niv Ad *Inova Heart and Vascular Institute, Fall Church, VA, USA*

With the considerable advances that have been made in video-assisted thoracoscopic surgery, epicardial surgical ablation utilizing different lesion sets can be performed with relative safety on the beating heart. The majority of these cases are done with bipolar radiofrequency. Recent reports have demonstrated promising clinical results with various energy sources and lesion sets, although most of these studies have been done with very short follow-up periods. There is a perception that these thoracoscopic approaches are safer than the Cox maze procedure with cardiopulmonary bypass. As a result, there is a growing trend to perform minimally invasive epicardial surgical ablation for AF without cardiopulmonary bypass. Furthermore, recent reports have described a more extensive epicardial and endocardial lesion set, performed as a hybrid approach with minimally invasive, off-bypass, epicardial surgical ablation and additional percutaneous endocardial catheter ablation, and have suggested that its effectiveness is comparable to that of the Cox maze procedure.

We conducted a systematic review of the safety and effectiveness of three minimally invasive surgical ablation procedures for lone AF: the endocardial minimally invasive Cox maze procedure with cardiopulmonary bypass, epicardial surgical ablation, and hybrid surgical ablation. Among the 37 publications that met our inclusion criteria, the operative mortality rate was comparable for all three surgical techniques (0% for endocardial Cox maze, 0.5% for epicardial ablation, and 0.9% for hybrid procedures). The Cox maze procedure was also the most effective minimally invasive strategy for treating stand-alone AF, despite the fact that the majority of the patients in this subgroup were treated for non-paroxysmal AF. Although we did not conduct statistical analysis of the three minimally invasive surgical techniques, the Cox maze studies reported the lowest incidences of mortality, conversion to sternotomy, reoperation for bleeding, perioperative stroke, pulmonary complications, and renal failure. In addition, despite the larger surgical incisions used in this approach, the lengths of hospital stay were comparable to those of the other two techniques.

The surgical treatment of cardiovascular disease has undergone rapid advancements in recent decades with the development of new surgical strategies, not all of which have proved successful. The results of this systematic review indicate that the endocardial Cox-Maze procedure is the most effective minimally invasive surgical strategy for the treatment of stand alone AF. Patients should be made aware of these findings when planning to undergo minimally invasive surgical ablation for AF. In addition, surgeons should work with industry to improve ablation tools and provide consistent ablation devices that can effectively deliver transmural lesions when applied epicardially on the beating heart.

Continued from page 18

	A multicentre Italian study	*Massimo Padalino*
17:15	**Surgical outcome of heterotaxy syndrome: A single-centre experience**	*Min-Kai Chuang*

Focus Session

Linking resection and reconstruction of intrathoracic organs

Brown 2

Moderators: M. Czerny, Zurich; D.J. Mathisen, Boston; E. Quintana, Rochester

16:15	**Surgical treatment of superior sulcus tumours: A fifteen-year single-centre experience**	*Piergiorgio Solli*
16:45	**Safety and effectiveness of concomitant induction chemo-radiation followed by surgical resection for Pancoast tumour**	*Giuseppe Marulli*
17:00	**Thoracic aortic repair warranting additional treatment of extraaortic structures**	*Martin Czerny*
17:15	**Prosthetic vascular graft infection complicated by mediastinitis: A multi-centre review**	*Tatsuya Oda*

Wednesday 16 October

Advanced Techniques

Part I: Cannulation and extraction techniques – Putting it in and taking it out

Brown 2

Moderators: C. Starck, Zurich; T.M. Sundt, Boston

08:40	**Video: Lead extraction: laser or sheath**	*Christoph Starck*
09:15	**Video: Cannulation technique: femoral in redo surgery**	*Fabio De Robertis*
09:25	**Video: Cannulation technique: subclavian**	*Fabio De Robertis*
09:35	**Video: Carotid artery and jugular vein cannulation in aortic redo surgery**	*Paul Urbanski*

Fine-tuning coronary revascularisation

Amber 4

Moderators: G. D'Ancona, Palermo; M.G. Lemma, Milan

08:30	**Fractional flow reserve and instantaneous wave-free ratio for the surgeon**	*Simon Davies*
08:50	**Intraoperative graft patency control: Transit time**	*Teresa Kieser*
09:00	**Intraoperative graft patency control: SPY**	*Teresa Kieser*
09:10	**Intraoperative graft patency control: Doppler**	*Tomas Holubec*
09:30	**Optimising arterial grafting: Configuration**	*Brian Buxton*

Transcatheter aortic valve implantation complications

Amber 1&2

Moderators: N. Moat, London; H. Treede, Hamburg

09:00	**How important are embolic events?**	*Hendrik Treede*
09:10	**Paravalvular leak: can we measure it, can we prevent it?**	*Thierry Folliguet*
09:20	**Circulatory support for high risk transcatheter aortic valve implantation**	*Neil Moat*
09:45	**Valve embolisation: how to prevent, how to retrieve.**	*Gry Dahle*
09:55	**Coronary obstruction: practical tips**	*Simon Davies*
10:05	**Ilio-femoral problems: stenting or surgery?**	*Hendrik Treede*

Controversies and catastrophes in adult cardiac surgery – Part I

Brown 3

Moderators: R. Haaverstad, Bergen; M. Shrestha, Hannover

09:00	**Introduction**	*Malakh Shrestha*
09:10	**Patients with acute aortic dissection: Type I should never get mechanical valves**	*Eric Roselli*
09:30	**Endovascular aneurysm repair will be the gold standard for peri-renal aortic aneurysms?**	*Ajay Chavan*
09:50	**Thoracic endovascular aortic repair for all Type B aortic dissections**	*Ali Khoynezhad*

Abstract

Thoracic video session

Amber 8

Moderators: H. Decaluwe, Leuven; R. Milton, Leeds; P.B. Rajesh, Birmingham

09:00	**Complete anterior chest wall resection and reconstruction for locally advanced breast cancer**	

Continued on page 22

Cardiac – Abstract session: Long term results of mitral valve surgery

Is repair of the mitral valve still a 'gold standard' in severe ischemic MR: propensity-matched analysis of long-term survival?

Vadim Shumavets, Alexander Shket, Andrey Janushko, Irina Grinchuk, Natalia Semenova, Svetlana Kurganovich, Youry Ostrovski *Belarus Center Cardiology, Minsk, Belarus*

Ischemic mitral regurgitation (IMR) is associated with reduced long-term survival and optimal treatment still remains controversial. Our study focused on patients with serious compromised ischemic left ventricle and severe functional IMR to understand how mitral valve replacement versus repair affects survival and provide the predictors of long-term mortality.

1,068 patients (mean age 57.9 ± 8.3 years) with coronary artery diseases and ischemic mitral regurgitation were operated – in 989 patients mitral valve (MV) repair and in 79 patients MV replacement were combined with CABG. Groups were matched by propensity score using demographics dates, co-morbidity, LV remodeling and MR grade by quantitative echocardiography. Survival (with mean follow-up 7.34 ± 1.8 years) and NYHA class were compared. Uni- and multivariate analyses were performed and the predictors of long-term mortality were identified.

The unmatched comparisons of preoperative variables revealed that patients in MV replacement group were significantly advanced in heart failure symptoms (p = 0.001) with higher BNP level (p = 0.001). Moreover the unmatched patients in MV replacement group had a significantly dilated LV with lower LVEF than patients in MV repair group (p- ANOVA < 0.001 for all Echo parameters). We observed no significant difference in hospital mortality between group before matching: 6.3% in MV repair patients vs. 8.9% in MV replacement patients (p= 0.273). Before matching 10-year survival was significantly worse in replacement group (HR (95% CI) 2.14; 1.43–3.21; p = 0.001). After propensity matching 1:1 we've received homogenous cohort of 138 patients with severe compromised LV (EDD 71.1 ± 7.9mm, ESD 59.1 ± 9.7mm, iEDV 126 ± 33.9 ml/m2 with EF 31.5 ± 5.7%) and severe MR (ERO PISA 0.43 ± 0.18mm2). There was no significance difference in NYHA functional class preoperatively (p = 0.139). In matching MV repair group in 75.9% patients undersized rigid ring mitral annuloplasty were performed. In matched cohort four patients who underwent mitral valve repair died at 30 days postoperatively and five patients died after valve replacement (p = 0.5). NYHA functional class in follow-up significantly improved (Figure 1) and was comparable between matched groups (with mean 2.3 ± 0.6 after MV replacement vs. 2.2 ± 0.9 for MV repair, p=0.49). Although the MV replacement group appeared to have a slightly higher percentage of patients with severe symptoms (NYHA functional class III and IV) in follow-up, this difference was not statistically significant (43.2% vs. 33.3%, p=0.136). The fact of mitral valve replacement versus repair did not influence long-term survival (HR (95% CI) 1.35; 0.82–2.29; p=0.26) and overall in 1- and 5-year (Figure 2) were 91.8 ± 0.14% and 57.2 ± 0.48% respectively (long-rank p=0.251). In multivariate Cox regression LV ESD (HR (95% CI) 1.038; 1.004–1.072; p=0.013) and advanced NYHA (HR (95% CI) 2.55; 1.57–6.1; p=0.037) were found as independent risk factors for an increased long-term mortality after surgery.

The mitral valve chordal-sparing replacement versus repair did not negatively affect survival in patients with severe damaged ischemic LV and it mostly depends on factors related to the patient's condition at the time of surgery.

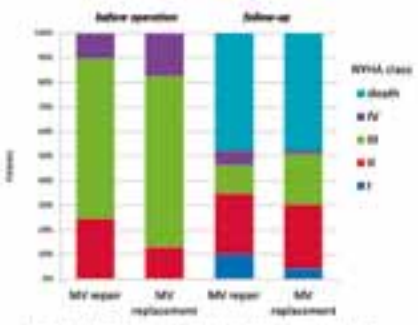


Figure 3. Distribution of NYHA functional class and death in matched groups at baseline and in follow-up

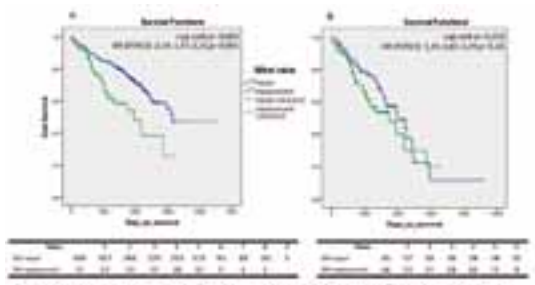


Figure 2. Long-term survival after MV repair or replacement for ischemic mitral regurgitation: A) overall survival curves for unmatched patients, based on 98 deaths after MV repair and 36 after MV replacement; B) survival after propensity matching, based on 33 deaths in each group.

Cardiac – Abstract session: Developments in coronary artery byapss graft

Off-pump coronary artery bypass surgery is associated with lower cardiac death at one-year: results from the on-pump vs off-pump study (ON-OFF study)

Massimo Lemma *Luigi Sacco University General Hospital, Milano, Italy*

Off-pump coronary artery bypass grafting was introduced in the mid-1990s to reduce operative mortality and postoperative morbidity related to the use of cardiopulmonary bypass, including systemic inflammatory response, neurologic complications, global myocardial ischemia, renal failure, hemodynamic instability, and lung disfunction. However, several prospective randomized clinical trials (RCTs) comparing off-pump (OPCAB) and on-pump CABG (ECC) in low risk patients have not been able to demonstrate any significant reduction in mortality or major postoperative complications. To further investigate the relative efficacy of ECC and OPCAB in high-risk patients (euroScore ≥ 6), a RCT (on-off study, clinicaltrials.gov identifier NCT01290952) was designed to asses operative, preoperative, and one year clinical outcomes in patients referred for isolated CABG. Previously we reported the 30-day outcomes of the trial[1]. The rate of the primary outcome (a composite of death, myocardial infarction (MI), neurologic complications, renal failure, adult respiratory distress syndrome, re-operation for bleeding) was in favor of OPCAB at 30 days. The present study reports the secondary end point at one year, that consisted of 6 acute postoperative outcomes [atrial fibrillation (AF), low cardiac output with intra-aortic ballon pump insertion, mechanical ventilation > 24 hours, sternal wound infection or dehiscence, intensive care unit (ICU) length of stay, hospital length of stay] and three outcomes at one year [overall mortality, major adverse cardiac events (MACE) (cardiac death, myocardial infarction, repeat revascularization) and evidence of myocardial ischemia (angina and/or positive stress test)].

The incidence of acute secondary end points (AF, low cardiac output with intra-aortic ballon pump insertion, mechanical ventilation > 24 hours, sternal wound infection or dehiscence, ICU length of stay, hospital length of stay) did not show any significant difference between ECC and OPCAB treatment.

Among secondary end point at one year overall mortality was not different between the two groups while the incidence of MACE (cardiac death, myocardial infarction and repeat revascularization) was significantly lower in OPCAB patients and the evidence of myocardial ischemia was comparable both as recurrence of angina and stress test result (table 1).

The separate analysis of outcomes included in MACE showed a significant lower incidence in cardiac death and a trend of less repeat revascularization for OPCAB patients (table 2).

A logistic regression analysis was applied to check for differences in baseline characteristics between patients dead for cardiac causes and those still alive or dead for other causes. Univariate analysis showed that EF > 50% had a protective effect with respect to cardiac death and that there was a trend of protection from cardiac death for OPCAB patients. The same results were confirmed in the multivariate analysis (table 3).

The on-off study is the first multicentre RCT showing a significant advantage of OPCAB over ECC in high risk patients both at 30 days and at 1-year follow-up.

References

1 Lemma M, Coscioni E, Tritto FP, Centofanti P, Fondacone C, Salica A, et al. On-pump versus off-pump coronary artery bypass surgery in high-risk patients: operative results of a prospective randomized trial (on-off study). J Thorac Cardiovasc Surg 2012;143(3):625-631

Table 1: One-year end points

End-point	ECC		OPCAB		p value
	N available	Rate	N available	Rate	
Overall mortality	195	14 (7.2%)	200	12 (6.0%)	0.637
MACE	195	16 (8.2%)	200	4 (2.0%)	0.005
Angina	188	6 (3.2%)	196	5 (2.6%)	0.707
Positive stress test °	80	7 (8.8%)	78	8 (10.3%)	0.747

ECC, on pump coronary artery bypass; OPCAB, off-pump coronary artery bypass; MACE, major adverse cardiac events
°stress test performed by 158 patients.

Table 2: One-year MACE

MACE	ECC	OPCAB	p value
Cardiac death	10 (5.1%)	3 (1.5%)	0.043
Myocardial infarction	1 (0.5%)	0	0.311
Repeat revascularization	5 (2.6%)	1 (0.5%)	0.094

ECC, on pump coronary artery bypass; OPCAB, off-pump coronary artery bypass; MACE, major adverse cardiac events

Table 3: Predictors of cardiac death

Covariate	Cardiac Death (n=13)	No Cardiac Death (n=382)	Univariate			Multivariate		
			OR	95%CI	p-value	OR	95%CI	p-value
OPCAB	3 (23%)	197 (52%)	0.28	0.08-1.04	0.057	0.28	0.08-1.06	0.061
3 vessels	11 (85%)	241 (64%)	3.10	0.68-14.20	0.144			
Previous MI	12 (92%)	279 (74%)	4.13	0.53-32.17	0.176			
EF>50%	1 (8%)	161 (43%)	0.11	0.01-0.87	0.037	0.11	0.01-0.88	0.038

OPCAB, off-pump coronary artery bypass; MI, myocardial infarction; EF, ejection fraction; OR, odds ratio; CI, confidence interval

Cardiac – Abstract session: Developments in coronary artery byapss graft

Influence of previous percutaneous coronary intervention on clinical outcome of CABG

A meta-analysis of comparative studies

Chikara Ueki
Shizuoka General Hospital, Japan

Several studies have reported significantly increased postoperative mortality in patients with previous PCI procedures undergoing subsequent CABG. However, some studies reported that a history of previous PCI was not associated with increased mortality and morbidity after CABG. This heterogeneity between studies is an important issue to be confronted in establishing a sound treatment strategy for patients requiring repeat coronary revascularization. We conducted this first meta-analysis to assess whether previous PCI increases postoperative mortality in CABG.

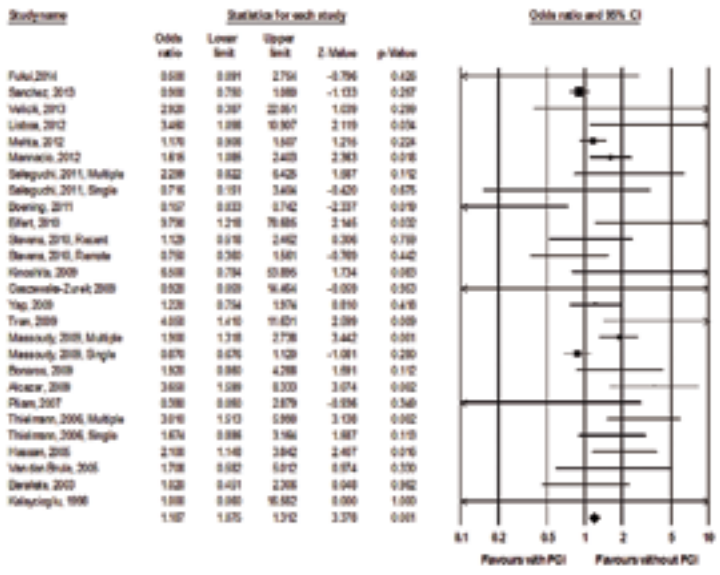
MEDLINE and EMBASE were searched for relevant articles up to and including April 2014. Studies published in English satisfying the following criteria were included in the meta-analysis:

1 comparing CABG patients with previous PCI versus without previous PCI; and
2 reporting hospital mortality.

Our search identified 23 comparative studies, including 174,777 patients: 19,179 with previous PCI and 155,598 without previous PCI. Pooled analysis demonstrated that previous PCI had an adverse effect on hospital mortality: odds ratio (OR) 1.187, 95% confidence interval (CI) 1.075–1.312. Although there was a significant heterogeneity in the primary analysis, random-effects meta-analysis also confirmed that previous PCI history caused a significant increase in hospital mortality (OR 1.455, 95% CI 1.171–1.809).

To detect the source of significant heterogeneity of the initial meta-analysis, subgroup analysis stratified by the proportion of multiple previous PCI (i.e. number of patients with multiple previous PCI/number of patients with single or multiple previous PCI) was performed. In the subgroup of studies with the proportion <40%, the adverse effect was not significant: OR 0.897 (95% CI 0.723–1.113); however, in the subgroup of studies with the proportion ≥40%, the adverse effect of previous PCI was significant: OR 1.987 (95% CI 1.563–2.526). A meta-regression coefficient was significantly positive for the proportion of patients with a history of multiple PCI (coefficient 0.841; 95% CI 0.457–1.226; p<0.001). This result suggests that the proportion of patients with a history of multiple PCI could be a source of heterogeneity between the studies.

In conclusion, current evidence from observational comparative studies suggests that patients with previous PCI procedures undergoing subsequent CABG have significantly increased hospital mortality. Our meta-regression analysis would argue that as the proportion of patients with a history of multiple PCI in the CABG cohort increases, postoperative mortality also increases. Patients at potential risk of repeat coronary revascularization should be encouraged to undergo CABG before they have received multiple PCI procedures. The present study re-emphasizes the importance of the heart team approach to coronary revascularization, not only in first-time but also repeat coronary revascularization.



Cardiac – Abstract session: Heart transplantation

Moderate hypothermia during *ex-vivo* machine perfusion promotes recovery of hearts donated after circulatory death

Herman Tolboom
University of Zurich, Switzerland

The use of organs from donation after circulatory death (DCD) has become routine clinical practice in both solid organ and lung transplantation and has led to a significant rise in the number of transplantation performed annually. Although the use of DCD hearts could increase the number of donor hearts by 15-40%, these are currently not used for transplantation due to concerns about the negative impact of the warm ischemia inherent to DCD, on graft viability. Nevertheless, a growing body of experimental evidence suggests that hearts from DCD can be transplanted successfully if exposure to ischemia is limited. Moreover, a variety of pre- and post-conditioning methods have been shown to substantially improve graft viability. Our group's research focuses on the ex-vivo machine perfusion as tool for preservation and viability assessment of hearts from DCD. Using a rodent DCD model, we have previously found that the negative effect of DCD can be ameliorated significantly by reconditioning the heart with 60 minutes of normothermic (37°C) ex-vivo machine perfusion directly after exposure to ischemia. Although graft function was restored to near normal levels and tissue adenosine triphosphate (ATP) was partially replenished, there was still evidence of substantial myocardial damage. In order to increase the efficacy of our approach, we hypothesized that mild to moderate hypothermia during ex-vivo reperfusion would lower myocardial oxygen demand, hereby reducing further ischemia/reperfusion (I/R) damage during reconditioning. To evaluate this, hearts from male Lewis rats (N=16/group) were subjected to 25 minutes of in-situ warm (37°C) ischemia, explanted and then reconditioned for 60 minutes at 20, 25, 30, 33 or 37°C, after which they were stored in Custodiol preservation solution at 4°C for 240 minutes. Fresh-excised cold stored hearts and cold stored ischemic hearts served as controls. Heart function was then assessed in a Langendorff perfusion system to simulate transplantation. Our most important findings were that: 1) Functional recovery of hearts subjected to 25 minutes of global ischemia can occur between 20 and 37°C. 2) Temperatures in 25-30°C range appear to best stimulate functional recovery, mild to moderate hypothermia hence has a protective effect. 3) Replenishment of tissue ATP levels occurred at an equal rate in all reconditioned groups. Once further refined and validated, we expect warm machine perfusion to be a valuable tool for recovery of hearts from DCD.

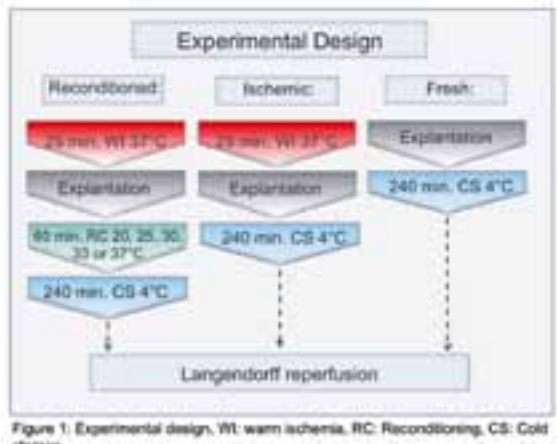


Figure 1: Experimental design. WI: warm ischemia. RC: Reconditioning. CS: Cold storage

Continued from page 20

Hide Wee

10:15 **VATS Tunnel technique: early division of the fissure with staplers in the fissureless patient.** *Herbert Decaluwe*

Advanced Techniques

Introduction to mitral valve repair & Wetlab

Raphael

Moderators: S. Cánovas, Murcia; S. Livesey, Southampton; J.I. Saez De Ibarra, Palma De Mallorca

09:00 **Introduction and aims of the programme anatomy of the mitral valve Pathophysiology of mitral regurgitation – Carpentier Classification – Leaflet pathologies Essential echo for the surgeon** *Steven Livesey*

09:20 **Approaches to the mitral valve; surgical exposure; Valve analysis; Principles of valve repair; Role of annuloplasty rings** *Jose Ignacio Saez De Ibarra*

Advanced transcatheter aortic valve implantation – Computerised tomography imaging for surgeons & Drylab

Amber 5

Moderators: V. Alvarez Asiain, R. Sádaba, Pamplona

09:20 **Computerised tomography imaging for the selection of patients, access route and type of prosthesis** *Victoria Delgado*

Wetlab – Aortic valve repair/sparing for bicuspid and tricuspid valve

Titian

09:20 **Effective height and geometric height to standardise cusp repair** *Diana Aicher*

09:40 **Repair of isolated aortic insufficiency** *Jaroslav Hlubocky*

10:00 **AVIATOR: an international registry to evaluate aortic valve repair** *Jolanda Kluin*

How to do it: with live in a box

Brown 1

Moderators: J.L. Pomar, Barcelona; E. Quintana, Rochester; P. Sardari Nia, Maastricht

09:20 **Minimally invasive lung volume reduction** *Marco Scarci*

09:40 **Pulmonary embolectomy** *Sacha Mussot*

10:00 **Mini-aortic valve replacement with sutureless valves** *Peyman Sardari Nia*

10:20 **David Procedure** *Gebrine El Khoury*

10:40 **Port-access double valve repair** *Mohamed Bentala*

11:20 **Transcatheter valve in valve** *Michael Borger*

11:40 **RVOT reconstruction with Homograft** *Rene Prêtre*

Part II: Cannulation and extraction techniques – Putting it in and taking it out

Brown 2

Moderators: C. Starck, Zurich; T.M. Sundt, Boston

10:30 **Strategy of cannulation: minimally invasive valve surgery** *Michele De Bonis*

10:50 **Strategy of cannulation: redo** *Ulrich Rosendahl*

11:00 **Acute dissection: strategy of cannulation** *Joseph Bavaria*

11:10 **Video: Cannulation technique: Left ventricular apex** *Joseph Coselli*

11:30 **Video: Optimising venous grafting: Endoscopic vein** *Rashmi Yadav*

11:40 **Video: Endoscopic radial artery** *Piroze Davierwala*

Optimizing arterial grafting: Configuration

Amber 4

Moderators: D. Fullerton, Aurora; A.J. Rastan, Rotenburg

10:30 **Optimizing arterial grafting: Endoscopic radial** *Toufan Bahrami*

10:40 **Optimizing venous grafting: Endoscopic vein** *Toufan Bahrami*

11:05 **How to do minimally invasive coronary artery bypass** *Stephan Jacobs*

11:20 **How to do endoscopic coronary artery bypass** *Nikolaos Bonaros*

11:35 **One flow serves all targets** *Olaf Wendler*

Controversies and catastrophes in adult cardiac surgery – Part II

Brown 3

Moderators: G.P. Fontana, New York

10:40 **Innovations in cardiac valve prostheses: the view from the other side** *Andy Campbell*

Continued on page 22

Cardiac – Focus session: Mitral and tricuspid valve surgery – why and how to transition to minimally invasive surgery?

Why should we set up an MIS program?

Filip Casselman
OLV Ziekenhuis Aalst, Belgium

On Tuesday afternoon a focus session is dedicated to 'Mitral and Tricuspid valve surgery : Why and How to make the transition to MIS ?' An overview of the latest clinical trials will be given by Filip Casselman MD PhD FETCS from Aalst, Belgium.

During the last few years, more and more evidence is becoming available favoring outcomes in minimally invasive mitral and tricuspid valve surgery versus standard sternotomy. There are now a multitude of studies available and these include both observational studies as well as comparative investigations between minimally invasive surgical approaches (thoracoscopic and robotic) and the standard sternotomy approach.

All of these papers univoquely reiterate the following findings : minimally invasive surgery is associated with an increased time of surgery, increased aortic cross clamp time and increased cardiopulmonary bypass time versus the standard sternotomy approach. Despite this apparently increased complexity of surgery, minimally invasive surgery has an equal or lower mortality risk of surgery versus standard sternotomy, decreased postoperative morbidity (e.g. renal failure, wound complications, …) and provides at least equal to better quality of care with demonstrated at least equal repair durability of mitral valve procedures on long-term follow-up.

Minimally invasive mitral and tricuspid valve surgery is associated with a decreased usage of blood products, a decreased incidence of pacemaker need postoperatively, decreased pain sensation by patients and a decreased length of hospital stay. Cosmetic and quality of life advantages are also well appreciated by the patients. This in turn leads to a proven earlier return to work or expected activity versus the standard sternotomy approach.

There is however on the contrary an increased incidence of phrenic nerve palsy associated with minimally invasive atrioventricular valve surgery. Some papers in the past have also suggested a higher risk of stroke associated with minimally invasive surgery versus standard sternotomy but some recent studies question this suggestion. More evidence on this topic is to be awaited in the near future as several groups are working on this issue.

These findings are not only demonstrated in routine, low risk patient populations but even more convincingly in higher risk groups : obese patients, patients with decreased left ventricular function, patients on dialysis or with COPD, all experience a decreased mortality and morbidity risk when operated minimally invasively versus via classical sternotomy. In addition, patients undergoing reoperations are also better off (lower postoperative mortality and morbidity risk) when operated minimally invasively.

When considering all the available evidence, the today's cardiac surgeon should not question why to set-up a MIS program but rather why not to do so.

Cardiac – Focus session: Mitral and tricuspid valve surgery – why and how to transition to minimally invasive surgery?

Mitral Valve Surgery: Why Transition to MIS?

Andreas Liebold *Ulm University, Germany*

Minimally invasive mitral valve surgeries account for the majority of MIS procedures performed in cardiac surgery. However, only a small percentage of eligible patients are effectively treated by MIS techniques. The reasons why conservative surgeons are reluctant may be diverse but mainly because MIS techniques are not standardised and too demanding. They may pose additional risk to the patient while proven scientific benefit is lacking. The understanding of what minimally invasive mitral valve surgery really means comprises a wide range of techniques from partial sternotomy and direct vision to true endoscopic approaches without rib spreading. Various tools and devices proved to be ideal accessories in order to establish a standard approach and help surgeons in their learning curve. The video-assisted right mini-thoracotomy with a 3-4cm skin incision, ideally performed periaureolar (Figure 1) without rib spreading turned out to be the preferred approach of experienced surgeons. Although not scientifically proven the benefits of this approach (Table 1) are obvious.

Which patients should be selected for MIS?

In experienced hands, no patient should be denied evaluation for minimally invasive mitral valve surgery. With few exceptions (Table 2) MV repair can be accomplished using MIS techniques in most cases. To address individual anatomic situation and risk profile each patient should be subject to a standardised pre-operative check-up including evaluation of access vessels, thoracic aorta, aortic valve and lung function. Several technical modifications (Table 3) can help the surgeon to find his preferred personal strategy. The use of an intra-aortic balloon occlusion catheter facilitating antegrade cardioplegia, aortic venting, and air evacuation offers several advantages over transthoracic clamping (less aortic trauma, less bleeding, minimized incision).

Meticulous attention to detail is mandatory to avoid devastating complications associated with MIS (vascular complications of the femoral vessels, aortic dissection, stroke, phrenic nerve injury, myocardial injury due to insufficient protection or coronary vessel obstruction). Whether an extensive use of this minimal invasive approach translates into better repair results needs to be further investigated.

Table 1: Possible benefits of minimally invasive mitral valve surgery

Possible Benefits of MIS
Undistorted endoscopic view of the mitral valve
Higher repair rate for better visualization
Stable chest wall
Reduced pain
Reduced blood loss
Reduced risk of infection
Shorter hospital stay
Faster recovery
Faster return to work
Less scarring
Improved appearance after surgery

Figure 1: Periaureolar access for minimal-invasive mitral valve repair

Table 2: Relative contra-indications for minimal invasive mitral valve surgery

Relative Contra-Indications for MIS
Severe pleural adhesions
Severe lung function impairment
Access vessel arteriopathy
Aortic valve incompetence
Severe aortic calcification (transthoracic clamp)
Ascending aortic diameter >4.5cm (endoballoon)
Unavailability of intra-operative TOE

Table 3: Modifications of minimal invasive mitral valve surgery

Operative Step	Modifications
Vessel Access	Cutdown vs. Puncture
Venous Cannulation	Bicaval vs. Multistage
Skin Incision	Submammary vs. Periaureolar
Spreading	Rib Spreading vs. Soft Tissue Retraction
Aortic Clamping	Transthoracic Clamp vs. Endoballoon
Visualization	Direct Vision vs. Endoscopic View

Cardiac – Abstract session: Preventing problems after open cardiac surgery

Patient blood management in octogenarians: predictors of transfusion and prognostic implications

Caparrotti SM, De Santo LS *Casa di Cura Montevergine, Mercogliano, Italy*

In developed countries, octogenarians represent the fastest-growing segment of the population. Despite significant improvements, mortality, morbidity, and resource utilization in this high-risk group remain substantial. In particular, elderly presenting for cardiac surgery are often anaemic and require larger amounts of perioperative transfusion. Clinical studies emphasize the paradox that both anaemia and transfusion are associated with organ injury and worse outcomes after surgery. Nevertheless, data on outcomes of patient blood management in octogenarians are dismissingly few and contradictory. The goal of this study was to survey blood transfusion practice and define its prognostic impact on outcomes after cardiac surgical procedure with a particular focus on any interaction by age (<80 years versus ≥ 80 years). A propensity score for the likelihood to receive RBC transfusion was calculated with multivariable logistic regression to balance the effect of confounding factors. Logistical estimation curve was developed to seek for the interaction between this propensity score and age. Age, propensity score for transfusions and RBC were then forced into multivariable logistic models for study outcomes. Elderly represent nearly 10% of all-comers, and the gap in postoperative mortality and morbidity rates between octogenarians and younger patients appears to be more narrow. Notably, elderly without a significant comorbidity profile experienced an in-hospital mortality rate as low as 1.2%. Though octogenarians received a significantly higher amount of transfusion, age per se did not prove a determinant of RBC need. Indeed predictors of transfusion were preoperative haemoglobin, baseline eGFR, antiplatelet medication up to 24 hours prior surgery, BSA, surgical priority, redo procedure, extent of surgery and length of cardiopulmonary bypass. Optimization of patient blood management is mainly based on careful patient selection, enhancement of preoperative health status, improvement of extracorporeal circulation equipment and management, along with meticulous surgical planning and execution. A final consideration goes to the logistic regression for mortality that disclosed transfusion and propensity score for transfusion as independent predictors. With the obvious restraints of an observational design, this experience adds to the knowledge that transfusions are associated with death. Nevertheless propensity score for transfusion is as well an independent predictor of survival. Such a statistical entity encompasses at least two biological features, anemia and renal function, that are known for their inherent prognostic implications. In other words the debate on the harmful effects of transfusion and the intrinsic vulnerability of the transfused patient still remains unanswered.

Caparrotti SM, De Santo LS and the surgical staff at Casa di Cura Montevergine, Mercogliano, Italy

Cardiac – Abstract session: Preventing problems after open cardiac surgery

Re-exploration due to bleeding is an independent predictor of both early and mid-term mortality in cardiac surgery patients

Victoria Fröjd
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Bleeding remains a severe complication after cardiac surgery and excessive bleeding or tamponade sometimes necessitates re-exploration. The reported re-exploration rates vary between two and seven percent in different studies. Re-exploration due to bleeding after cardiac surgery is not a trivial event and it has been identified as an independent risk factor for both early postoperative morbidity and mortality in several studies. Still, even though an independent association between re-exploration and early mortality after cardiac surgery has been described, it has not been clarified whether the need for re-exploration also predict mortality beyond the immediate postoperative period. We sought to describe the correlation between re-exploration due to bleeding and short- and mid-term mortality and perioperative morbidity, and to identify independent predictors for re-exploration. To do so we did a retrospective observational study based on prospectively registered data, and 5,392 cardiac surgery operations performed during 2009-2013 were included. Re-exploration due to bleeding, peri- and postoperative morbidity as well as short- and mid-term mortality were registered. Furthermore, preoperative, intra- and perioperative factors associated with re-exploration and mortality were added into multivariate regression models to identify independent risk factors.

In our material 320 patients (6.0%) were re-explored. All cause short- and midterm mortality was significantly higher in re-explored patients (11.4 vs. 3.2% and 10.3% vs. 5.0%, respectively) and unadjusted regression models presented a four-fold increased risk for short-term mortality and a two-fold increased risk for mid-term mortality. The adjusted models presented a two-fold increased risk for both short- and midterm mortality. Re-exploration due to bleeding was found as an independent risk factor for short- and mid-term mortality, prolonged ICU stay, perioperative renal injury, postoperative need for dialysis and prolonged mechanical ventilation (two- to four-fold increased risks). When identifying independent risk factors for re-exploration, body mass index, EuroSCORE, preoperative fibrinogen plasma concentration, extracorporeal circulation time, dual antiplatelet therapy less than five days before surgery and intraoperative bleeding more than 500 ml were found as such.

The link between re-exploration due to bleeding and increased early and mid-term mortality is still unclear. Whether it is the re-sternotomy, the blood loss, the use of allogenic blood product transfusions and volume expanders or other unknown factors related to re-exploration is not known for certain. Regardless, if the severe bleeding can be avoided the need for re-exploration and the subsequent increased risk for the bleeding patients both at and beyond the immediate postoperative period may be prevented.

Cardiac – Abstract session: Developments in coroanry artery byapss surgery

Transit-time flow measurement unmasks competitive flow in arterial bypass grafts

Flow Patterns in 200 LIMA-LAD OPCAB Grafts

Teresa M Kieser *University of Calgary, Foothills Medical Centre Calgary, Canada*

Although arterial grafts are preferred to venous, the very aspect that allows graft longevity compared to vein grafts, (increased musculature of the vessel wall) presents a problem of competition by virtue of their sensitivity to native flow. Lesser degrees of stenosis of native coronary arteries are sensed by arterial grafts – they realize that they are not 'so-very-needed' and diminish their own flow, which may be detrimental to the long-term efficacy of arterial grafts.

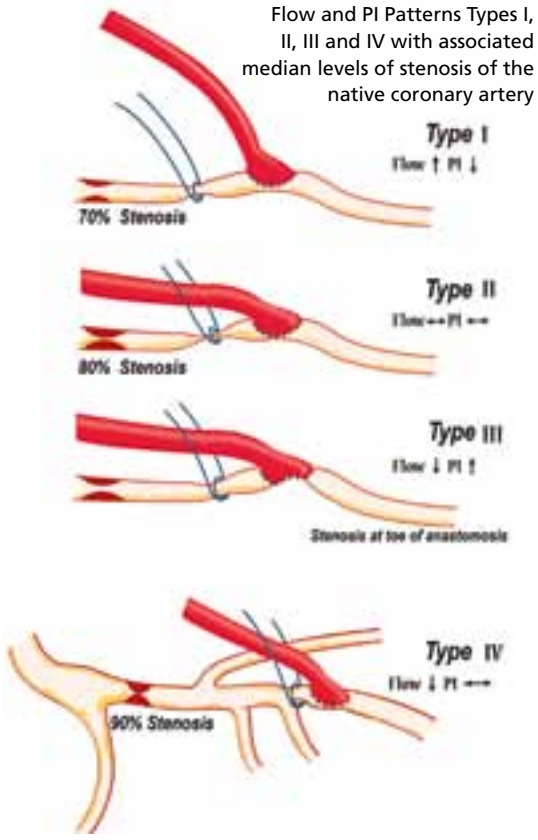
Competitive flow in an arterial graft can be identified in the operating room with transit-time flow measurement (TTFM) simply by temporarily occluding the native coronary artery either digitally or with a proximal snare and then re-measuring flow and pulsatility index (PI) in the graft. Two hundred non-sequential LIMA-LAD (left internal mammary artery to left anterior descending artery) off-pump bypass grafts with testing intra-operatively for competitive flow were reviewed.

Upon analysis of TTFM before and after snaring the native LAD just proximal to the LIMA-LAD anastomosis, five patterns emerged: (see also figure)

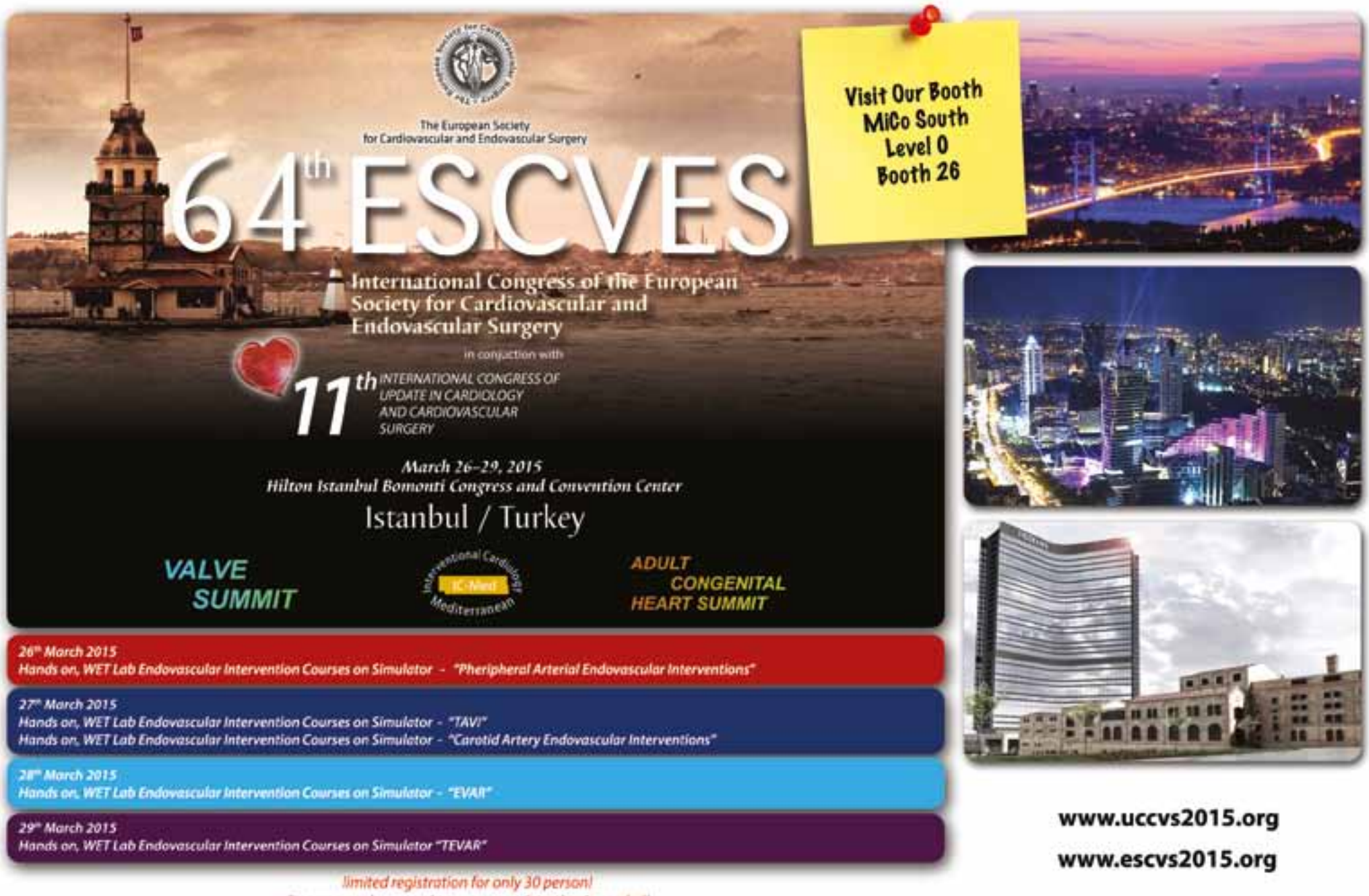
- Type I Competitive Flow: Flow↑; PI↓↑or↔ – moderate stenosis (70%) in 27% (53/200) grafts.
- Type II No Competitive Flow: Flow↔; PI↔, high-grade stenosis (80%) in 33% (67/200) grafts.
- Type III Possible Suboptimal Grafts: Flow↓ or↔; PI↑ in 11% (22/200) grafts.
- Type IV Large Retrograde Coronary Bed: Flow↓; PI↔ severe stenosis (90%) in 18% (37/200).
- Type V Etiology Indeterminate: Flow/ PI not fitting any pattern in 21/200(11.5%) grafts.
- (PI=Pulsatility index; ↑ means 'increased'; ↓ means 'decreased'; ↔ means 'no change')

The snare test with TTFM identifies the following: 1) competitive flow when present, preventing needless re-doing of grafts 2) grafts with no competitive flow 3) false negative TTFM readings (the Achilles heel of TTFM-poor graft with good flow and low PI readings), allowing for correction while still in the operating room and 4) grafts with retrograde flow as significant as anterograde. In these grafts, the construction of the heel of the anastomosis is just as important as the toe.

Flow and PI Patterns Types I, II, III and IV with associated median levels of stenosis of the native coronary artery



Of all 200 LIMA-LAD off-pump bypass grafts, only 1/3 showed no change of flow or pulsatility index with proximal snaring of the native LAD, leaving possibly 2/3 of LIMA-LAD grafts with a question as to their patency/efficacy. Use of TTFM affords a more in-depth analysis of the function of arterial grafts in relation to the severity of stenosis of the coronary artery which they are intended to replace.



Cardiac – Abstract session: Heart transplantation

Efficacy of mechanical postconditioning following warm, global ischemia depends on circulating fatty acid levels in an isolated, working rat heart model

M. Bartkevics, S. Huber, V. Mathys, J. Sourdon, M. Dornbierer, N. Carmona Mendez, B. Gahl, T.P. Carrel, H.T. Tevaearai, S.L. Longnus *University Clinic for Cardiovascular Surgery, Inselspital, Berne University Hospital and University of Berne, Switzerland*

Approaches to reduce cardiac ischemia-reperfusion injury have been the subject of many years of intense research activity, yet effective and robust clinical reperfusion strategies are still lacking. Mechanical postconditioning (MPC), defined as brief, intermittent periods of re-occlusion applied during the first minutes of reperfusion, has been demonstrated to be cardioprotective in pre-clinical studies; however, clinical benefits remain controversial and incompletely characterized[1].

Importantly, high levels of circulating fatty acids at the time of reperfusion are known to be detrimental to post-ischemic hemodynamic recovery[2-4]. This is particularly relevant for the heart as circulating fatty acid level is elevated during cardiac surgery[5]. High circulating levels of fat lead to increased fatty acid oxidation, which is believed to impart negative effects on post-ischemic recovery through the inhibition of glycolysis and the even greater inhibition of glucose oxidation[5,6]. Importantly, the exaggerated imbalance between rates of glycolysis and glucose oxidation increases lactate production and tissue acidosis, thereby exacerbating calcium overload at reperfusion.

Isolated Heart Preparation

Although postconditioning and circulating fat levels are recognized individually to impact upon post-ischemic cardiac recovery, interplay between the two remains to be characterized. Interestingly, MPC has been demonstrated to promote glucose metabolism through elevated glucose uptake, glycolysis and glycogenolysis, whereas interventions that inhibit glycolysis or glycogenolysis attenuate cardioprotective effects of MPC, suggesting that metabolic effects play a key role in MPC-induced cardioprotection[7,8].

Thus, we aimed to investigate whether circulating fat levels influence MPC-induced cardioprotection. We have developed an isolated, working rat heart model that simulates conditions of donation after circulatory determination of death (DCDD)[9-11]. Our model has been designed to study procurement and reperfusion strategies that could possibly enable optimization of post-ischemic recovery and graft evaluation, with the ultimate aim of increasing donor heart availability[12]. In addition, we aim to identify early markers that could predict post-transplantation heart function[9,11]. We hypothesized that MPC-induced effects on recovery depend on the presence of fatty acids in the reperfusion solution, and that hemodynamic parameters measured during early reperfusion provide information that aid in the prediction of subsequent recovery.

(left to right) HT Tevaearai, Maris Bartkevics, S.L. Longnus

Our results demonstrate that the cardioprotective efficacy of MPC is greatly influenced by energy substrate availability. Indeed, the application of MPC improved post-ischemic recovery in hearts reperfused with high fat, however it did not alter post-ischemic recovery in hearts reperfused without fat. Furthermore, we have identified hemodynamic parameters, which may aid in predicting the subsequent recovery of these hearts, when measured at the time of procurement. We consider these results to be an early step towards the understanding and identification of a controlled reperfusion protocol that may be used to improve post-ischemic recovery of cardiac DCDD grafts, and ultimately aid in increasing donor heart availability.

Maris Bartkevics will be presenting more detailed results this week.

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Cardiac – Focus session: Transcatheter heart valve therapy a look into the future

Off-pump tricuspid valved stent implantation: Future prospects

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Off-pump replacement of the tricuspid valve (TV) in humans is limited to selected cases that either require preliminary TV operations (replacement or annuloplasty) or suggest heterotopic implantation of valved stents. Due to a possible ventricularization of the right atrium with combined right atrial dilatation, hypertrophy and disturbed venous drainage of the sinus coronarius in cases of heterotopic implantation, we favor orthotopic replacement by valvedstents.

A handful of studies on primary off-pump TV replacement have been published. We have reported on our advances with a transventricular approach and thus implantation of a nitinol stent supported by a pouch filled with hygroscopic material to reduce paravalvular leakages in the orthotopic position[1]. Due to the anatomical structure of the TV annulus, annular attachment of the prosthesis – is still a challenge. The aim of our studies has been to develop of a suitable aligned prosthesis with proper fixation: we have developed an atrial fixation (anatomical atrial crown), a small amount of annular force (stent expansion), and an apical right ventricular fixation (transventricular tethers as neo-chords).

Our results show the qualification of the valved stent to be securely implanted transventricularly via a lower mini-thoracotomy into the native TV annulus.

With a semi rigid delivery system, the annular level can be directly reached and larger valved stent diameters can be implanted. Our stent design consists of a fully-PTFE-covered stent to reduce paravalvular leakages and to protect from endothelium lesions. At a body weight of 51.9±1.9kg, an atrial crown-diameter of 48mm (oversizing of 53%) was most suitable for fixation without the risk of migration. An oval shape had been formed in 50% of all cases in our study[2]. Although it is known that a diseased TV annulus is rather circular and planar, we are also investigating an appropriate oval prosthesis with warranted coaptation to face these difficulties.

Georg Lutter (left) and Jan-Paul Gundlach

Our aim to implant the prosthesis without hemodynamical changes was largely accomplished, except for the heart rate which increased significantly post implantation[2]. This was mainly caused by irritation of the delivery system during implantation as well as the nearness of the prosthesis to the conduction system. Nevertheless, our four-week results lead us to assume this increase to be temporary. Post mortem, an atrial thrombus was found in only one animal. We have already emphasized the need of postoperative anticoagulation.

In addition, we analyzed the biocompatibility of the pouch using immunohistologic research and assume it does not harm the organism, although these findings need to be confirmed in larger series[2].

In additional to histological analyzes, von Kossa staining revealed a calcification process on a newly formed tissue on the atrial crown (2). Examination of the tissue character and incorporation will be published soon. Furthermore, we plan to investigate transfemoral tissue-engineered valves for the tricuspid position, as we are gaining experience with pulmonary valved stents[3].

Our results demonstrate the possibility of an off-pump transventricular TV replacement with satisfying hemodynamics. They also show that long-term implantation of our prosthesis is possible, and histological findings imply biocompatibility.

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Congenital – Abstract: Mechanical support and implantation

Results of heart transplantation following failed staged palliation of hypoplastic left heart syndrome and related single ventricle anomalies

Bahaaldin Alsoufi *Sorsola-malpighi hospital, university of Bologna, Italy*

Multi-stage palliation is the current management strategy for the treatment of children with hypoplastic left heart syndrome (HLHS) and related single ventricle cardiac malformations. The success of this strategy depends on the presence of well identified anatomic and hemodynamic criteria. However, several unfavorable hemodynamic or anatomic factors might disqualify those patients from progressing through subsequent palliative stages following the Norwood first stage palliation or might cause late deterioration following completion of all palliative stages (Fontan circulation); all necessitating enlistment to receive heart transplantation.

Those patients might have several immunologic, clinical and anatomic risk factors that could preclude proper donor heart allocation, increase early operative risk and diminish late survival.

Some previous studies have demonstrated that this group of patients is associated with the worst outcomes following heart transplantation among children receiving heart transplantation for various congenital and non-congenital etiologies.

We aimed in our study to describe outcomes of all HLHS and related single ventricle patients who have received heart transplantation at various stages following initial Norwood-type palliation with focus on examining factors that affected their early and late outcomes.

During the study period (1994-2013), 107 children with congenital heart disease received heart transplantation at our institution. Among those, 77 patients (72%) had underlying single ventricle anomalies including 24 patients (22%) who had undergone a prior Norwood palliation for HLHS (n=22) or other single ventricle variants (n=22). Those patients were listed and received heart transplantation following various stages of palliation: Norwood (n=3), Glenn (n=16), or Fontan (n=5).

Overall 10 year survival following transplantation in those 24 patients was 52% and was not related to the last palliation stage prior to listing. Moreover, when compared to other patients with congenital heart disease who received transplantation, early and late outcomes were not inferior to those with other underlying single ventricle or two ventricles heart malformations. Although 10/24 patients (42%) were sensitized with high panel reactive antibodies > 10%, the outcomes of those patients were not worse than those who were not sensitized. Additionally, we noted that the outcomes in this group of patients have specifically improved in the latter half of our series (after 2004) with no early or late mortality so far. The last two findings demonstrate that better detection and management of high risk sensitized patients have led to improved results in those selected patients who received heart transplantation.

Our results are encouraging and indicate that heart transplantation outcomes in this difficult group of patients have improved and are no longer worse than those following transplantation in children with other congenital heart malformations. The small number of patients in single institution series suggests the need for multi-institutional and transplantation registry studies to allow a more critical analysis of factors affecting outcomes following listing and successive transplantation.

Bahaaldin Alsoufi

Cardiac – Focus session: Transcatheter heart valve therapy a look into the future

Trascatheter Mitral Valve Replacement – current status and what the future holds

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Mitral valve regurgitation (MR) is the most common valvular heart disease – its prevalence increasing along with population aging and heart failure. Significant MR is three times as common as aortic stenosis in an elderly high-risk surgical population and has a poor outcome if left untreated. Depending on the cause and severity of symptoms, treatment ranges from medication to open-heart surgery to repair or replace the valve. However, up to 50% of symptomatic patients hospitalized with severe MR are not referred for surgery, mainly due to advanced age, co-morbidities, and impaired left ventricular (LV) function – which makes the surgical risk unacceptably high. The risk of mitral valve surgery increases markedly with age; in the subgroup of patients >/= 80 years, reported mortality and morbidity rates are 17.0% and 35.5%, respectively (STS database). In patients aged >/= 80 years, surgical treatment was performed only in 15%, compared to in 60% in patients aged </= 70 years. Also, it is known that medically treated patients with severe symptomatic MR have a 50% mortality within five years. Although minimally invasive mitral valve surgery has become a well-established and increasingly used option, the demand for alternative less invasive treatment options is rapidly growing for these high risk patients.

Transcatheter devices:

As a result, various novel percutaneous transcatheter valvular technologies have emerged as possible alternatives to open surgery for high-risk patients. Without the necessity for open-heart surgery and cardio-pulmonary bypass, these percutaneous procedures are of particular benefit to multi-morbid and frail patients. These different technologies can be classified according to the part of the MV apparatus being targeted: (1) leaflets – percutaneous leaflet plication (edge-to-edge leaflet repair), leaflet co-aptation, or radio-frequency leaflet ablation, (2) annulus – indirect annuloplasty through the coronary sinus, or direct annuloplasty either percutaneous or by hybrid approach through the left atrium, (3) chordae – percutaneous chordal implantation, and (4) valve replacement.

The device with the largest amount of clinical experience is the Mitraclip™ system, which obtained FDA approval in October 2013 for patients with significant symptomatic degenerative MR who are at prohibitive risk for mitral valve surgery. Trials studying the role of this system in patients with symptomatic functional MR are still ongoing. The other percutaneous technologies employing the concepts of annuloplasty, chordal implantation and LV remodeling have only shown limited efficacy and/or are still in a very premature phase of development. Nevertheless, it can be anticipated that these repair technologies will have limited applicability due to the heterogeneous nature of the disease and, therefore, mitral valve replacement may be a more attractive alternative.

Figure: Trans-catheter mitral valve devices with first-in-man success
A) Fortis valve (Edwards lifesciences, B) Tiara (Neovasc), C) CardiAQ (CardiAQ technology)

Transcatheter mitral valve implantation

Although the first experimental off-pump transcatheter mitral valve stent implantation via the Left atrium has been reported by Ma et al. in 2005, it was 2014 for the first-in-man implants to take place with three different devices. Fortis (Edwards Lifesciences), CardiaQ and Tiara (Neovasc) have reported successful implants with proof of principle with short term survival and excellent function (Figure).

Mitral valve apparatuus is complex and has reflected in the design of these three devices. All three devices are made of Nitinol and have a central functioning portion, which harbours the leaflets. Each however, has a unique fixing/retaining mechanism to prevent dislodgmeent of the device. All three devices are implanted through the left ventricular apex but CardiaQ can also be implanted through trans-septal approach.

Careful selection of patients, pre-op evaluation of mitral valve anatomy and pathology, echo and fluoroscopy guidance during the procedure and post-procedure anticoagulation are the necessary features of this technique. Due to the complex nature of the pathology, clinical benefit after treatment may take longer to be obvious in the mitral patient as compared to the aortic patient.

Congenital – Abstract: Mechanical support and implantation

Outcomes and risk factors for heart transplantation in children with end stage cardiomyopathy

Bahaaldin Alsoufi *S orsola-malpighi hospital, university of Bologna, Italy*

Heart transplantation is required for the treatment of end stage pediatric heart disease. Cardiomyopathy is the most common indication for heart transplantation in children ranging from 41% of patients < 1 year of age to 65% of patients between 11-17 years of age. Dilated cardiomyopathy is the most common type necessitating heart transplantation, although other types such as restrictive, hypertrophic, adriamycin-induced cardiomyopathy can also require heart transplantation in patients with end stage heart failure.

We aimed in the current study to report a large single center experience with heart transplantation in children with end stage cardiomyopathy over 25 years (1988-2013) and to examine risks factors that affected early and late outcomes.

Our experience included 125 children with end stage cardiomyopathy who received heart transplantation. The type of cardiomyopathy was dilated in the majority of patients (n=104, 83%) followed by restrictive (n=10, 8%) and other types (n=11, 9%). Median listing duration was 29 days (1-746) with 106 (85%) at UNOS status 1. Median age at time of transplantation was 7.4 years with 34 patients (27%) < 1 year of age, 36 (29%) between 1-10 years of age, and 55 (44%) between 10-18 years of age. Prior to transplantation, 25 patients (20%) were ventilated and 17 (14%) had mechanical cardiac support.

Our competing risks analysis showed that 10 years following transplantation, 31% have died,11% have undergone retransplantation and 58% were alive free from retransplantation.

Risk factors for diminished overall survival on multivariable analysis included age more than 10 years at time of transplantation (likely due to poor compliance and a more robust immune system), the need for pre-transplant mechanical support (likely due to sensitization affecting early and late graft survival). Additional factors associated with poor survival on univariate analysis include African American race and bicaval anastomosis.

Importantly, the risk of operative and one year mortality has greatly improved in the latter era however late attrition has remained constant without any significant improvement in the latter era. This finding suggests that while improved pre-operative stabilization, operative technique, post-operative management and immune suppression have contributed to improved early outcomes; there is an opportunity to improve late survival and efforts should be focused on methods combat the causes of late death, mainly allograft vasculopathy and noncompliance leading to sudden death.

Congenital – Abstract: Mechanical support and implantation

Long-term mechanical circulatory support in paediatric patients **The Bad Oeynhausen experience**

Eugen Sandica *Heart and Diabetes Center NRW, Bad Oeynhausen, Germany*

Long-term mechanical circulatory support in the paediatric population is still a challenge in current practice. Many factors have been incriminated: age and size of the children, etiology of heart failure, complex anatomy in patients with congenital heart defects, complications related to ventricular assist devices (VADs). The development of VADs in paediatric population lasted longer than in adult population. Nowadays, there are several devices that can provide mechanical support for the failing heart in children as bridge-to-transplant, bridge-to-recovery or, in very rare cases, as destination therapy. Another indication for VAD implantation emerged from our experience: "bridge-to-transplant candidate". Currently, we use two types of VADs for paediatric patients: Berlin Heart EXCOR (Berlin Heart AG, Berlin, Germany) and HeartWare Ventricular Assist System (HeartWare Incorporated, Framingham, Massachusetts, USA).

We implanted the Berlin Heart EXCOR in 29 patients (median weight 13 kg, median age 3.4 years). All patients but one were on inotropes, eight patients required mechanical ventilation, five patients experienced cardiopulmonary resuscitation. 75.8% of the patients received a LVAD. Two patients had a failing Fontan, one patient had a failing ventricle after Glenn procedure. One patient had mechanical mitral valve prosthesis. The HeartWare System was implanted in nine patients. The median weight was 54.9 kg and the median age was 15.6 years. All patients but one was on inotropes.

In the Berlin Heart group the mean support time was 125.7 days, with 3647 days of cardiac support. 65.5% of the patients were transplanted, 20.7% were explanted, 3.4% are on support and 10.3% died on support. Survival rate was 89.7%. 14 blood pumps had been change. 13.8% of the patients had local signs of infection and 10.3% had neurological complication but no major neurologic deficit. In the HeartWare group the mean support time was 315.4 days, with 2839 days of cardiac support. Four patients had local signs of infection and three had neurological complication but no major neurologic deficit. Eight patients have been transplanted, one patient died on support. Survival rate was 88.9%.

Our experience with Berlin Heart EXCOR and HeartWare systems proved that excellent survival is possible with a low rate of adverse events after long term of support in patients with two- as well as single-ventricle physiology.

VAD therapy in the paediatric population made significant progress in the last decade. Increased survival and improved quality of life is nowadays a reality for children with end-stage heart failure. There is still a need for developing total implantable VADs with transcutaneous wireless energy transfer. This will not only increase the quality of life but will also open more wide the door to destination therapy for the group of very sick patients.

Eugen Sandica

Congenital – Abstract: Mechanical support and implantation

Higher volume load in congenital heart surgery is associated with better early outcomes

Andrzej Kansy, T. Ebels, C. Schreiber, J.P. Jacobs, Z. Tobota, B. Maruszewski *The Children's Memorial Health Institute, Warsaw, Poland*

Evidence that hospital volume influences outcomes has been verified in nearly every major type of surgery. It is important to know whether the volume-outcome relationship has persisted in the modern era. Recent improvements in surgical outcomes could change the relationship between volume and outcome. Advance in surgical care could weaken or eliminate the influence of hospital volume on patient outcomes. Reames and colleagues, in a large, national data set of Medicare patients found that both, absolute and relative differences in adjusted mortality between hospital with lowest and highest volume persist in the modern era. In congenital heart surgery this relationship was investigated and documented for overall programmatic outcomes involving the entire case-mix as well as for operations including the Norwood operation and the arterial switch procedure. In the big national STS studies, authors introduced the adjustment for patients risk factors and complexity of procedures what made the relationship between volume and outcomes even more prominent. Pasquali and colleagues stressed that analysis of outcomes and quality improvement should not only focus on early mortality, but should also include the recognition and management of complications. Furthermore, the need exists to develop a measure to assess "failure to rescue" in pediatric heart surgery. The aim of our study was to determine the association between center volume and outcomes including in-hospital mortality, postoperative complications, and mortality in those who suffer a complication (failure to rescue).

All patients 18 years or younger undergoing heart surgery at centers participating in the European Association for Cardiothoracic Surgery (EACTS) Congenital Database (2003 – 2013) were included. Programs were grouped as: small <150; medium 150-250; large 251-349; very large >350. The dataset consists of 119345 procedures performed in 99 centers. Overall, in-hospital mortality was 4.63%, and complications occurred in 23.4%. In- hospital mortality in patients with complications was 13.82%. Multivariate logistic regression showed that the risk of in-hospital death was higher in low and medium volume centers ($p<0.001$; odds ratio in low and medium center vs. very large 1.50 and 1.84). The rate of the occurrence of any postoperative complications in small, medium, and large programs was lower than in very large centers ($p<0.001$). Low and medium center volumes were significantly associated with higher mortality in patients with any complications ($p<0.001$; odds ratio in low and medium center vs. very large 1.48 and 1.59 respectively).

The accumulation of team experience and expertise in big centers, especially when dealing with relatively rare congenital cardiac malformations and high risk procedures, provides better chance for survival. At the same time, the risk of complications is higher in large and busy centers. However the chance of rescue from these complications is higher because of the acquired experience of the large and busy team. Our study suggests that concentration of work in the large and busy centers increases the safety of patients and improves the quality of care in congenital heart surgery. Further studies are necessary to define the specific risk factors in different congenital cardiac conditions demanding rare and high risk procedures.

Andrzej Kansy

Thoracic – Abstract session: Basic science

Direct measurement of free radicals in lung tissue

Jan Gielis *University of Antwerp, Antwerp, Belgium*

Free radicals, like superoxide anion and nitric oxide, are highly reactive toxic molecules that damage proteins, DNA and other cell components. These molecules are heavily involved in the pathogenesis and pathophysiology of ischemia-reperfusion injury.

Researchers at Antwerp University (Belgium), in collaboration with Maastricht University (The Netherlands) have developed a method to study free radical generation during pulmonary ischemia-reperfusion injury in a mouse model. Jan Gielis, surgical research fellow at Antwerp University, uses a technique called ESR, or Electron Spin Resonance, for this purpose.

"The ESR spectrometer is a tool developed for and by physicists, who study protein configurations and the properties of solid materials with it. However, with some tweaking, it can be used to detect free radicals in ischemic tissue and blood, too", says Gielis. "At first, our colleagues from the physics department looked a bit fuzzed when we talked about this project, but they quickly turned around".

"The problem with these free radicals is that they are extremely short-lived. Therefore, we use a sort of 'molecular fixative' that stabilizes the radicals and allows us to detect them directly in a tissue sample", explains Gielis. "With ESR, we can directly quantify the amount of free radicals present in a sample at various time points during ischemia and reperfusion."

"The extent of ischemia-reperfusion injury is a determinant of the later occurrence of organ failure through the bronchiolitis obliterans syndrome after lung transplantation."

"Our goal is to develop strategies that counteract free radical formation during pulmonary ischemia-reperfusion injury and attenuate the damage these radicals cause to the ischemic tissue. This could improve patient outcome after lung transplantation and reduce post-operative complications."

"In my presentation, I will address the experimental techniques we have developed using a murine model of warm pulmonary ischemia-reperfusion injury at our lab and discuss their applicability for future research and perhaps even in the clinic." concludes Jan Gielis.

Thoracic – Abstract session: Controversies in thoracic surgery

Predictors of non-neoplastic lesion in lung tumor showing ground glass opacity on thin-section computed tomography based on the multi-institutional prospective study

Kenji Suzukia, Shunichi Watanabeb, Junki Mizusawac, Yasumitsu Moriyad, Ichiro Yoshinoe, Masahiro Tsuboif, Tomonori Mizutanic, Kenichi Nakamurac, Hirohito Tadag, Haruhiko Fukudac, Hisao Asamurab *Japan Lung Cancer Surgical Study Group (JCOG LCSSG)*

Recent advance in non-surgical treatment for lung cancer, such as stereotactic radiotherapy, result in definitive treatment of lung nodules without histological diagnosis. Principally, treatment strategy should be based on pathology of the tumor, but some lung nodules would permit physician to obtain definitive diagnosis without surgery. In this situation, it is very important for physicians to exclude non-malignant lesions from definitive treatment, such as radiotherapy. There were 4.1% NNLs and 4.9% PCLs in this study, confirming previous reports which showed not all lesions are malignant for GGO tumor. Just 11 (3.3%) LTs were diagnosed before surgery in this study. Preoperative histological diagnosis could be made by bronchoscopy or transthoracic needle cytology for lung cancers. However LTs with wide range of GGO usually have few cancer cells compared with lung cancer having consolidation appearance and it is generally difficult to obtain preoperative histological diagnosis from these tumors. This manuscript investigated the relationship between preoperative factors and histological diagnosis in peripherally located lung cancer with wide range of ground glass opacity, which have been enrolled in clinical trial of sublobar resection for early lung cancer, JCOG0804/WJOG4507L. The key eligibility criteria of JCOG0804/WJOG4507L were: 1) peripherally located definitive or suspected LC with maximum diameter=<2cm, and 2) radiological non-invasive tumor with consolidation/tumor ratio (CTR) of =<0.25 based on thin-section CT (Suzuki J Thorac Oncol. 2011;6:751-6). Among all resected LTs, the incidences of NNL and pre-cancerous lesions were examined. Also, the logistic regression analysis was conducted to investigate a predictor of NNL using the maximum tumor dimension (=<1cm/>1cm) and CTR (0/>0) as an explanatory variable. Between May 2009 and April 2011, 333 patients were prospectively enrolled from 51 institutions to JCOG0804/WJOG4507L. Among 333 patients, 345 LTs were included in the analysis. There were 314 (91.0%) LC, 17 (4.9%) pre-cancerous lesions, and 14 (4.1%) NCLs. The maximum tumor dimension=<1cm was detected to be a significant predictor of NNLs with logistic regression analysis. There were 10 (8.6%) NNLs in 116 LT=<1cm, while four (1.7%) NNLs in 229 LTs>1cm. In conclusion, NNLs were found only in 4.1% of peripheral LTs with GGO. However, when tumor diameter was 1cm or smaller, approximately 10% was NNLs, necessitating histological diagnosis when non-surgical treatment is considered. Based on our results LTs 1cm or less in size tends to be NNLs independent of the status of GGO. Thus subcentimeter lung cancer should not be treated with non-surgical modality. On the other hands, subcentimeter lung cancer with consolidation component would metastasize and careless follow up is not recommended. Treatment strategy for subcentimeter lung cancer should be based on the status of GGO. Subcentimeter GGO should not be treated without histological confirmation by non-surgical modality, and solid subcentimeter LTs should be diagnosed and treated if lung cancer was suspected radiologically. Thus we elucidated preoperative factor related to histological benign tumor. We believe this findings contribute further advance in the treatment of lung cancer in the world.

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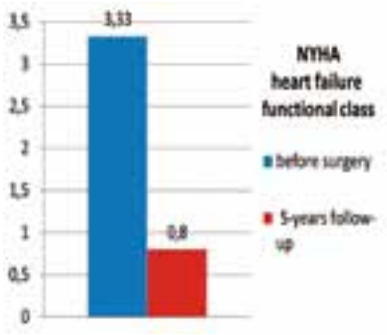
Raising Standards through Education and Training

Vascular – Abstract session: How today's challeneges translate into tomorrow's outcome

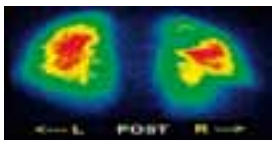
Long-term follow-up assessement of surgical treatment of chronic thromboembolic pulmonary hypertension

AM Chernyavskiy, AG Edemskiy, MA Chernyavskiy, AR Tarkova, VG Efimenko, SN Ivanov
Novosibirsk Research Institute of Blood Circulation Pathology, Novosibirsk, Russia

Chronic thromboembolic pulmonary hypertension according to different literature sources occurs in 4-5% after acute pulmonary embolism, which is characterized by increased pressure in the pulmonary artery and is associated with progressive right heart failure and a high risk of death. As you can see from the picture this is a result of narrowing and occlusion of pulmonary artery branches with organized thrombi. We present long-term follow-up after pulmonary thromboendarterectomy in 170 patients with chronic thromboembolic pulmonary hypertension. All operations were performed by a standard technique with deep hypothermic circulatory arrest. In the five-years follow-up period we examined 47 patients (mean age 48 ± 21,5 years). In these patients we observed increase of right ventricle ejection fraction from 36±2,3% to 51,8 ± 4,1%, decrease in the right ventricle end diastolic volume from 109,4 ± 39,2 ml preoperatively to 39,1 ± 6,8 ml in the long term follow-up. According to the right heart catheterization data we noticed significant decrease in the mean pulmonary artery pressure from 54,04±23,35mm Hg to 25,16 ± 15,41mmHg in long-term follow-up. In five years after pulmonary thromboendarterectomy pulmonary vascular resistance decreased from 539,66 ± 120,59 dyn • sec •cm-5 to 101,39 ± 89,20 dyn • sec •cm-5. Along with this, there was a decrease of heart failure functional class (NYHA) as presented on the picture and increase of exercise tolerance – covered distance increased from 166,66±105,27m to 472,22±80,02m according to the six-minute walking distance test. All patients before surgery and in five-year follow-up were examined with VQ-scanning (picture). Analysis of long-term results indicates sufficient efficacy and safety of surgical treatment in patients with chronic thromboembolic pulmonary hypertension.



VQ scan before surgery



VQ scan after surgery

Removed thrombi

Vascular – Abstract session: How today's challeneges translate into tomorrow's outcome

Long-term results after open aortic arch surgery for aneurysms and type A aortic dissections – comparable outcomes beyond the perioperative period

Alexander M. Bernhardt and Christian Detter *University Heart Center Hamburg, Germany*

Type A aortic dissection (TAAD) is a life threatening disease associated with high mortality, if untreated. With recent improvements in cannulation and cerebral protection strategies, surgery can be performed safely with acceptable operative mortality and neurologic outcomes. However, operative mortality in acute TAAD is still higher than in patients with aortic aneurysms and long-term survival may be reduced due to complications by the remaining dissection in the descending aorta.

We compared the long-term outcome after open aortic arch replacement for type A aortic dissection and aneurysmal disease in 204 patients. We found that once patients survived the perioperative period, long-term survival of patients with aortic dissection was not inferior compared to patients with complex aortic aneurysm affecting the aortic arch. Although the reasons for death during follow-up were comparable between both patients cohorts, the reason for death in the majority of patients remains unknown and follow-up of these patients is seldom performed. Those deaths might be related to cardiac or vascular complications, such as further progression of aneurysmal formation or false lumen aneurysm and rupture of the remaining dissection. Because imaging is not available in all patients and follow-up is not routinely performed, little is known about the aorta during follow-up. Current guidelines on the management of patients with aortic diseases by the European Society of Cardiology (ESC) recommend annually clinical follow-up and imaging if necessary[1]. Therefore, we implemented an aortic center with a dedicated aortic outpatient clinic for regular follow-up of this complex patient cohort by either CT or MRI scan. This allows examination of further progress of aortic pathologies as well as medical management of aortic patients that often have high and refractory arterial hypertension[2]. Eventually, this might increase patient outcome during follow-up.

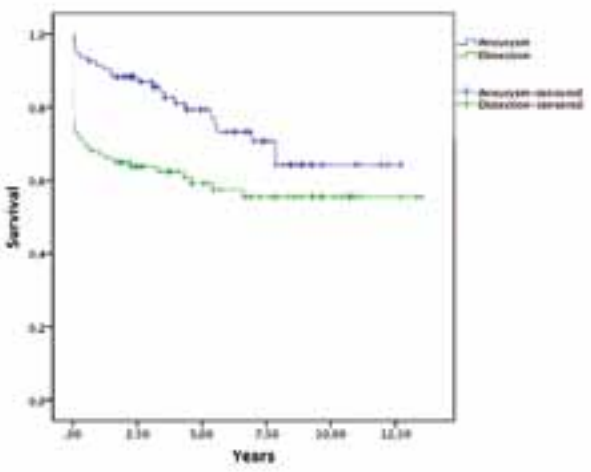


Figure 1: Long-term survival after open aortic arch replacement. Survival rate at 10 years is 64.3% for patients with aortic arch aneurysms and 55.5% for patients with aortic arch dissections. P(log-rank)=0.005

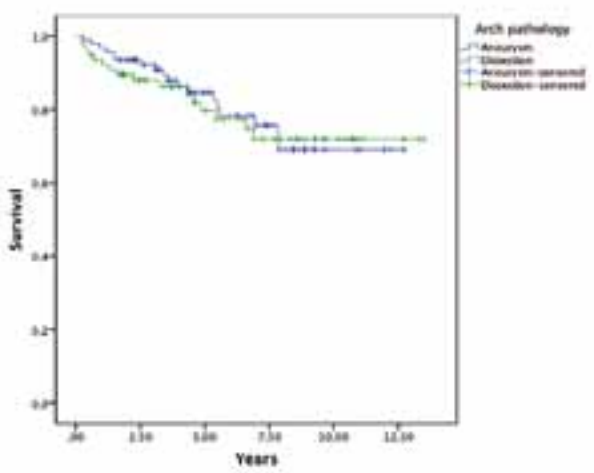


Figure 2: 30-day landmark analysis in patients after open aortic arch replacement who survived the first 30 days. p(log-rank)=0.793

Christian Detter

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Vascular – Abstract session: How today's challeneges translate into tomorrow's outcome

Peripheral or central cannulation in acute type a dissection – does it really matter?

Stefan Klotz *University Hospital Luebeck, Germany*

Acute Type A aortic dissection is still an emergency situation which needed urged operation, because the untreated dissection has a high morbidity and mortality. The only option for these patients is connecting to the heart-lung-machine with systemic cooling and performing a replacement of the ascending aorta or aortic arch, sometimes in combination with repair or replacement of the aortic valve.

Quick cannulation to the heart-lung-machine is therefore lifesaving. The easiest and fastest accesses are the femoral vessels. However, this access leads to an arterial backflow in the descending aorta with the likelihood of plaque rupture and cerebral embolism. Central cannulation leads to an antegrade arterial flow, but cannulation trough the dissected ascending aorta could be difficult and cannulation the subclavian or carotid artery is time consuming.

For our study we evaluated all patients with acute Type A aortic dissection operated between January 2003 and December 2012 for the type of arterial cannulation for initial bypass. In these patients preoperative demographic data and outcome parameters were accessed.

During the last 10 years 177 patients were operated with acute Type A dissection in our unit. 94 (53.1%) were initially cannulated in the central aortic vessels (79 ascending aorta, 14 subclavian artery, one carotid artery) and 83 (46.9%) in the femoral artery.

All patients were comparable between age, gender, BMI, EuroScore and previous sternotomy as the main preoperative demographic data between the peripheral and central cannulation group. However, the peripheral cannulation group was significant sicker as measured by the higher, NYHA-Classification and the ASA Physical Status Classification System. All intraoperative data (Bypass-, X-clamp and circulatory arrest time) were similar as were lowest temperature with no differences regarding the cannulation technique. From the outcome data, postoperative cerebral infarction and 30-day-mortality were comparable between the cannulation groups. Only postoperative need for dialysis was borderline significant higher in the femoral cannulation group. Additional analyses showed that age above 68 years with an EuroScore I above 13 in combination with depressed hemodynamics (NYHA- and ASA-Classification, cardiopulmonary reanimation, inotropes, intubated) are the main risk factor for early mortality after operation of an acute Type A dissection.

This single center study with nearly 200 patients could show that an acute Type A dissection can be operated safely with central and peripheral cannulation with similar results. Risk for early mortality was driven by the preoperative clinical and hemodynamic status before operation rather than the cannulation technique.

Vascular – Abstract session: How today's challeneges translate into tomorrow's outcome

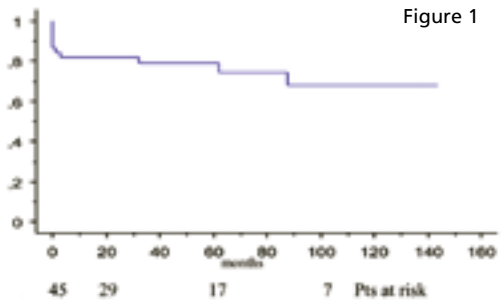
Acute type A aortic dissection repair in elderly patients

Pietro G. Malvindi, Amit Modi, Szabolcs Miskolczi, Sunil K Ohri, Clifford Barlow, Steve Livesey, Geoffrey Tsang, Theodore Velissaris *Southampton University Hospital NHS Trust, Southampton, UK*

The increase of life expectancy results in a growing number of elderly patients requiring major surgery. Cardiothoracic surgeons are therefore more frequently facing an elderly population with a better preserved clinical and functional status. Acute Type A Aortic Dissection (ATAAD) is a classic example of life-threatening disease where prompt surgical treatment offers a significantly higher chance of survival; however, until recently, the indication of emergency surgical repair for ATAAD in elderly patients has been questioned. The outcome of conservative management in this condition is dismal, with an early mortality rate of more than 60% and one-year survival of 10%. These findings coupled with recent evidence of improving post-operative mortality and morbidity, suggest that the benefits of surgical treatment should be offered to more aged patients.

We reviewed our experience in ATAAD repair in patients aged above 75 years and we assessed the role of preoperative clinical presentation and surgical strategies in predicting early outcome and mid-term survival. During the period 2000-2013, 45 patients (mean age 79 ± 3 years; range 75 – 89 years) underwent emergency repair of ATAAD at the University Hospital Southampton (United Kingdom). The presentation of ATAAD was complicated preoperatively in 17 cases (37%) by at least one of the following: myocardial ischaemia (n=5), cardiac tamponade (n=12), cerebrovascular accident (n=5), respiratory failure needing mechanical ventilation (n=3) and acute renal failure (n=2). The hospital mortality was 15% (n=7); preoperative acute neurologic deficit emerged as the only independent predictor of mortality. The postoperative course was complicated in 23 patients (52%) with a high incidence of postoperative stroke (21%). During the follow up (mean time 52 ± 38 months) there were three late deaths; the cumulative one-year, five-year and eight-year survival rate (including hospital mortality) was 82%, 76% and 68% respectively (Figure 1). We did not find any difference in mortality and incidence of postoperative complications between patients who received hypothermic circulatory arrest with open distal anastomosis (n=22) and patients who underwent distal repair on cross clamp (n=23).

Figure 1



The presence of new neurologic deficit at the presentation was not favourable (of the five patients, three died in hospital and one patient recovered partially and was discharged with left sided hemiparesis) and we registered a substantially high incidence of postoperative cerebral stroke, which is however, in keeping with previous reports. Even though a more radical proximal or distal repair was not associated with higher in-hospital mortality and morbidity, the aim of surgical repair during acute aortic dissection is to save the patient's life by resolving tamponade and malperfusion and preventing ascending aortic rupture. More extensive procedures should be reserved only for cases of severe proximal tissue disruption or in the presence of a tear extending distally towards the arch.

Our data showed that emergency surgery for acute type A aortic dissection in elderly patients can be performed with excellent early and mid-term outcomes and that therefore advanced age per se should not be a contraindication to what is potentially lifesaving surgery.

Vascular – Abstract session: How today's challeneges translate into tomorrow's outcome

Twelve-year surgical experience with type A aortic dissection

The impact of age on early and long-term outcomes

Andrea Colli, Massimiliano Carrozzini, Marco Galuppo, Dario Gregori, Marina Comisso, Francesca Toto, Gino Gerosa *University of Padova, Italy*

Stanford Type A aortic dissection is a severe condition, requiring emergent surgical treatment. Despite increased understanding of the pathophysiology and improved surgical techniques and perioperative care, surgical mortality has remained high trough years. Several studies report the influence of pre- and peri-operative variables on outcome, but findings are often controversial and there is still debate on optimal management.

We reviewed our institutional experience with Stanford type A aortic dissection, aiming to identify determinants of early and long-term results.

Methods

Between March-1998 and August-2013, 227 patients underwent surgery at our Institution for a type A aortic dissection. Two patients with no data were excluded from the study. The follow-up was complete for 219 patients (97%). We performed a multivariate analysis of all preoperative, operative and postoperative data.

Results

Mean age was 63 years, 73% had a DeBakey type I, 18% a type II and 9% an intramural hematoma. Two-hundred-two (90%) were acute dissections and 23 (10%) chronic. Eleven patients (5%) died intraoperatively. Postoperative complications occurred in 145 cases (64%) and were classified according to the latest consensus statement from the International Aortic Arch Surgery Study Group. Most common complications included global or focal neurological deficit (19% and 11% respectively), arrhythmia (29%, mainly atrial fibrillation), respiratory parenchymal complications (17%), renal dysfunction (14%) and postoperative bleeding (17%). Thirty-day mortality was 17% (39 patients). Median ICU and hospital stay were 6 and 15 days respectively. During a mean follow-up time of 6±4 years we observed 53 deaths (29%). Twenty-seven patients (15%) needed late cardiac or thoracic aorta reoperation. Results from the multivariate analysis are as follows. Thirty-day mortality was associated with abdominal pain at presentation (p<0.01). The incidence of postoperative complications was related to age at intervention (p<0.01) and CPBP time (p<0.01). Mortality at follow-up was significantly increased by age at intervention (p=0.02), with a logarithmic growth after 60 years, female sex (p<0.01), preoperative limb ischemia (p=0.02) and DHCA (p=0.02). Reintervention occurred more frequently in patients older at intervention (p=0.01) or with aortic diseases familiarity (p<0.01). By plotting the mortality hazard with age at intervention, we revealed a logarithmic growth in patients older than 60 years (Figure 1). On this basis we stratified survival rate according to age, with a cut-off of 60 years and the results showed a significant divergence of the two curves (Figure 2).

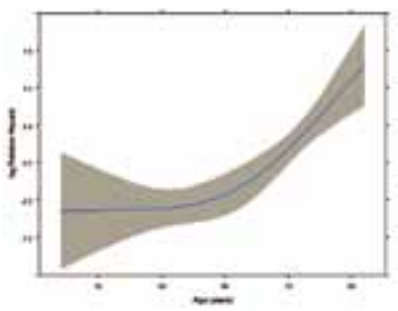


Figure 1. Effect of age on mortality hazard (log-scale). P-value for non-linearity 0.02

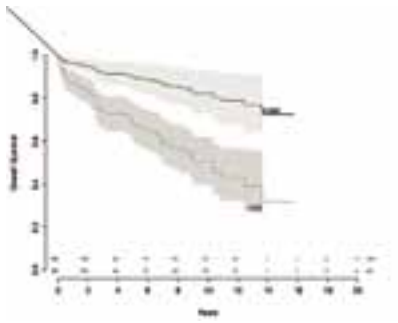


Figure 2. Survival curves stratified according to age with a cut-off of 60 years, chosen on the basis of Figure 1

Conclusions

The surgical results of type A aortic dissection are still characterized by a high early and late mortality and incidence of postoperative complications. Outcomes are affected by age at intervention with a logarithmic increase of late mortality in patients older than 60 years.

Vascular – Abstract rapid response session: Aortic rapid fire session fire and and ice in aortic surgery

Xenopericardial roll graft replacement to treat infectious pseudoaneurysm or graft infection of thoracic and thoracoabdominal aorta

Hiroshi Kubota *Kyorin University School of Medicine, Tokyo, Japan*

The standard procedure for treating infected aortic aneurysms or graft infection after aortic procedures is to resect the infected aorta / graft, debridement of the surrounding tissue, in situ graft replacement, and omentopexy. As a graft material, Dacron grafts, rifampicin-soaked Dacron grafts, cryopreserved arterial homografts are accepted clinically. However, the question of which graft material is optimal to treat infected aortic aneurysm or graft infection is still a matter of controversy. Because ungarded foreign materials are easily propagated by bacteria, if available, omentopexy is thought to be a most reliable barrier to prevent the recurrence of the infection. However, we often face the patients who are thought to be better to avoid harvesting the omentum for some reasons, e.g. previous abdominal operation, abdominal infection lesion, preoperative deteriorated status. Orthotopic aortic reconstruction using self-made xenopericardial roll grafts without omentopexy were performed to treat infectious pseudoaneurysms as "initial" operation or to treat graft infection as "rescue" operation. Mid-term outcomes were evaluated.

From 2009 to 2013, Orthotopic xenopericardial roll graft replacement was performed for eight patients. Male/Female: 6/2, Mean age: 69.5 (55-80) y.o.. Graft material: equine /bovine pericardium: 2/6, Type of operation: initial 4/rescue 4, omentpexy: 0. Additional operation: esophagectomy 2. Mean follow-up duration: 2.3+1.6 (0.8-4.9) y.

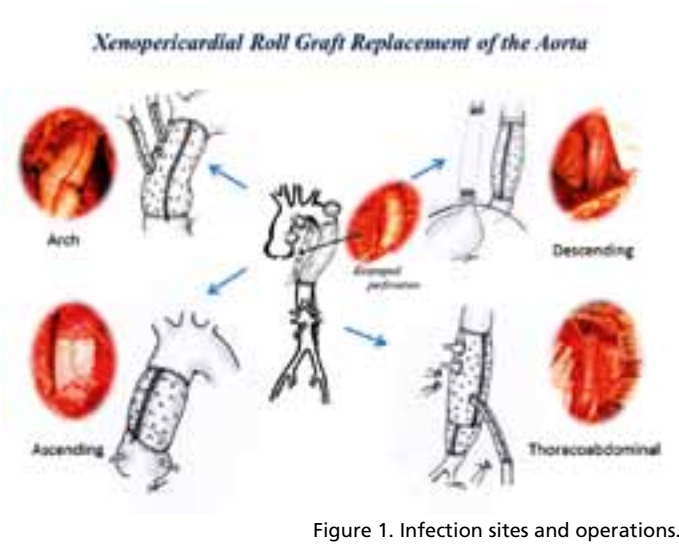


Figure 1. Infection sites and operations.
To treat the patient with esophageal perforation and Dacron graft infection, the esophagectomy and xenopericardial roll graft replacement were performed. The esophageal reconstruction using a stomach roll was performed three month after the "rescue" operation.

Replacement: ascending 3, arch 1 (with reconstruction for neck vessels by using small xenopericardial roll grafts), descending 3, and thoracoabdominal 1. Seven patients underwent the operation under deep hypothermic circulatory arrest + intermittent pressure augmented retrograde cerebral perfusion, and one patient underwent replacement of the thoracic descending aorta under normothermic beating heart with the assistance of lower body circulation. Pathogen: MRSA 2, MSSA 1, Candida 1, E. coli 1, oral bacillus 1, and culture negative 2. Postoperative local recurrence of the infection: 0. Graft related complication: stenosis 0, calcification 0, non-infectious pseudoaneurysm of the anastomosis 2 (surgical repair: 1 / TEVAR 1). In hospital mortality: 2 (MOF: initial 1 / rescue 1), Survival rate without in hospital death (~3y): 100%, but one patient died from lung cancer (3.6y).

This bioprosthetic material as the softness of the biological tissue which allows easy surgical handling, the nice coaptation to suture lines resulting in a hemostatic anastomosis, decreased thrombogenicity of aldehyde-treated collagen tissue. The storage in bacteriostatic glutalaldehyde solution might provide long-term protection from graft infection.

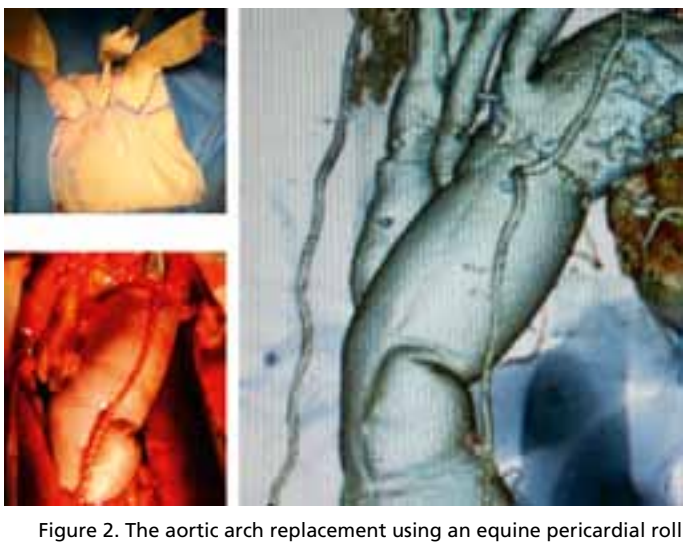


Figure 2. The aortic arch replacement using an equine pericardial roll graft as an "initial" operation.
A three-branched pericardial sheet was made on another small sterile operative table simultaneously to the operation. The infected pseudoaneurysm located in the proximal arch. The aortic arch was transected between the left common carotid artery and the left subclavian artery. The innominate artery and the left common carotid artery were reconstructed separately. The middle branch of the xenopericardial roll graft was used as the inflow root of the antegrade perfusion.

As a non-synthetic material, xenopericardial roll graft replacement is simple and less invasive than the standard procedure. In the near future, bioengineered tissue using pluripotent or multipotent stem cells, so-called tissue-engeneered vascular graft may have the potential to be a method for creating the ideal vascular conduit, considering our good results, our procedure may also have the potential to serve as one of the choices to treat the aortic /graft infection not only as "rescue" but also "initial" treatment.

Cardiac – Focus session: translational cardiovascular research

Translational medicine's transformative opportunity for cardiac surgery

A commentary on "subclinical aortic valve disease: new tools for risk stratification and therapy"

Giovanni Ferrari *University of Pennsylvania, Philadelphia, USA*

Translational medicine—the ability to translate findings in basic research into medical practice—is slowly, but steadily, reshaping clinical departments and research institutes around the world. This new approach represents a game change for many clinical groups, and Cardiothoracic Surgery is no exception. More than ever, basic scientists are working side-by-side with physicians and surgeons in planning and executing complex patient-centered research, leading cardiothoracic surgery departments and research centers to add translational research to their current clinical and surgical studies. This year's first Translational Cardiovascular Research Section represents an opportunity to introduce EACTS attendees to a series of pre-clinical studies based on human-derived specimens.

"Subclinical Aortic Valve Disease: New Tools for Risk Stratification and Therapy" offers an example of how the Division of Cardiothoracic Surgery at the Perelman School of Medicine at the University of Pennsylvania is at the frontline of this new approach. Since 2009, based on IRB approved protocols, an active bioregistry program is collecting virtually all valve and aortic specimens resected during surgery. While the concept of a cardiac bioregistry is not new, utilizing the tissue and blood collection for the isolation of human primary-derived cells, ex vivo biomechanical testing, imaging, and biomarker profile studies, represents an untapped resource for diagnostic and therapeutic strategies as well as for personalized medicine. This large bioregistry also includes a collaborative research agreement with the Penn Transplant Institute. As of 2014, over two thousand patients have been enrolled in our programmes.

Aortic valve sclerosis (AVSc) is a hallmark of several cardiovascular conditions including chronic heart failure, myocardial infarction and, most prevalently, severe aortic valve stenosis (AS), the most severe phase of Calcific Aortic Valve Disease. AVSc, which presents in 25%-30% of patients over 65 years of age and in up to 40% of those over 75 years of age, is characterized by thickening of AV leaflets, activation of Valve Interstitial Cells (VICs) towards an osteogenic phenotype, and remodeling of the Extracellular matrix. These events have, initially, marginal effects on the mechanical properties of the valve, making the presentation of the disease largely asymptomatic in the early stages. While the final stages of the disease (mild, moderate, and severe Aortic Stenosis) are well described, the cellular mechanisms responsible for the initial phases remain largely unknown due to its subclinical presentation. Our lecture will address some of the new findings in the progression of aortic valve diseases, from the asymptomatic phase to the end-stage disease, and will include Bicuspid Aortic Valve predisposition to AS and to aortic aneurysm and dissection. We will highlight some of the recent, most promising targets to diagnose AV disease and to halt the progression before symptoms occur.

This lecture, as well as the others in this new session, will highlight the transformative opportunity offered by translational science to cardiothoracic surgery research. In a rapidly changing research environment, the field of cardiac surgery must reposition itself at the center of a multi-disciplinary strategy to reshape an efficient partnership between academia and industry, and improve patient care through innovation.

Cardiac – Abstract session: infective endocarditis and outcomes

Full sternotomy versus right anterior minithoracotomy for isolated aortic valve replacement in octogenarians

A propensity matched study

Daniyar Gilmanov[1], G. Pasquinucci[2] *1 Department of Adult Cardiac Surgery, 2 Heart hospital, Gabriele Monasterio Foundation, Massa (MS), Italy.*

Surgical aortic valve replacement AVR has been shown to improve symptoms and survival, yet, patients with advanced age are at increased risk of surgical complications or death, therefore, a less invasive treatment strategy is desired in such patients. This study aimed to evaluate the outcome of patients aged ≥80 years undergoing isolated AVR through right anterior minithoracotomy (RAMT) and compare it with full sternotomy (FS).

With propensity score matching, the outcomes of patients having minimally invasive surgery (RAMT) were compared with those in whom FS approach had been employed (100 patients vs 100 patients). TAVRs and partial sternotomy cases were excluded from the analysis.

Operative times did not significantly differ in the two groups. Patients in the RAMT group received bigger prosthesis size and were more likely to receive sutureless valves (p=0.000). Shorter time for extubation (p=0.000) and shorter hospital stay (p=0.005) were observed in the RAMT group. Four vs 0 (p=0.043) patients had postoperative stroke and 0 vs two (p=0.16) – transient ischemic attack, FS vs RAMT, respectively. Six patients died, with no significant difference for in-hospital mortality (p=0.68). No variable had statistically significant predictive value for in-hospital mortality. RAMT patients were more likely to be discharged home directly or via rehabilitation (p=0.031). Importantly, significant difference in the prolonged hospital stay between the propensity matched RAMT and FS groups, revealed by univariate analysis, was confirmed also by means of multivariable regression model. FS along with other four factors independently predicted longer hospital stay. Though longer was median follow-up duration in the FS group (59 vs 24 months, p=0.000), the two groups had similar survival rate at five years (80% vs 81%, p=0.37). Ten factors were associated with long-term survival by Cox regression analysis, and RAMT had no statistical impact (p=0.38).

As far as we know, our report is the first direct comparative study of minimally invasive and full sternotomy AVR in octogenarian patients to demonstrate the lower incidence of stroke in RAMT approach.

There has been relatively good long-term survival in this very elderly population – about 80% at five years in both study groups, compared with 72% by Saxena et al (2012), 77% by the L. Cohn group (2011) and 65.4% by review after Vasques et al (2012).

Summarizing the survival data, one may observe that in the present study RAMT compared with FS allowed improved immediate outcomes in terms of morbidity, with faster recovery, with lower incidence of irreversible cerebrovascular accident – stroke, and did not compromise survival rate: neither early, nor late one (Figure 1).

Postdischarge care requirement determined in the present study by discharge destination was undoubtedly in favour of MIAVR group (26.5% of survivors vs 44.3% in the FS group), suggesting that minimally invasive technique might have contributed to lower perioperative morbidity and faster recovery, resulting in less need for continuous hospital care.

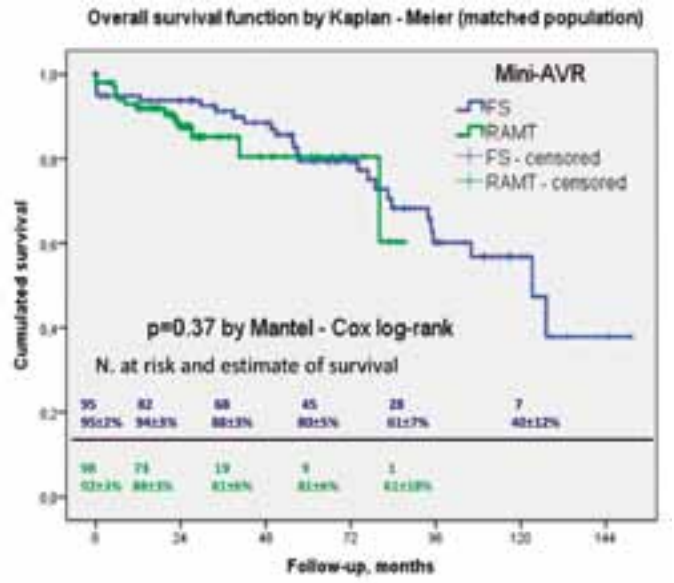


Figure 1. Overall survival by Kaplan – Meier for matched population. Green line and numbers represent right anterior minithoracotomy (RAMT) cohort (n=100), and blue ones – full sternotomy (FS) cohort (n=100). P=0.37 by Mantel – Cox log rank. Note longer follow-up duration for FS.

To conclude, minimally invasive AVR through right anterior minithoracotomy can be safely performed in patients aged ≥ 80 years with acceptable morbidity and mortality rates. It is expeditious and effective alternative to full sternotomy AVR and might be associated with lower postoperative stroke incidence, earlier extubation and shorter hospital stay.

Cardiac – Abstract session: infective endocarditis and outcomes

Mitral valve abnormalities in patients with bicuspid aortic valve: prevalence, mechanisms and impact on associated aortic dilatation risk

Alessandro Della Corte
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Bicuspid aortic valve (BAV)-related aortopathy is still a matter of controversies, mainly regarding the level of aggressiveness that should be used in the surgical approach to it[1].

Given the clinical and prognostic heterogeneity of the disease, new criteria for individualized management should be identified, rather than seeking a consensus on how to treat all BAV-aortopathy patients[2]. Such criteria could include functional biomarkers (e.g. metrics of mechanical aortic wall properties or aortic flow features), genotypic markers and phenotypic markers.

As a part of our ongoing project on BAV aortopathy risk stratification, after having investigated the potential prognostic value of aortic valve morphology[3] and pattern of aortic dimensions[4], we now focused on the potential impact of associated mitral valve mild regurgitation on the "aortic risk". For this purpose, we retrospectively analysed our consecutive echocardiographic series of 770 BAV patients.

Mitral valve abnormalities were observed in 23% patients: myxomatous mitral valve (MMV) in 3%, most frequently due to prolapse of the anterior leaflet, and functional mild regurgitation (FMR) in 20%. No patient had mitral stenosis. Notably, patients with coronary artery disease or ischemic cardiomyopathy were excluded from this study, and cases of overt left ventricular systolic dysfunction accounted for only 4% of the overall study population. However, a FMR was observed in one fifth of the study cohort, and as expected, it was associated with lower EF and thicker ventricular septum, indicating a relation with longer-lasting aortic valve dysfunction, causing more extensive left ventricle remodelling and either overt or subtle systolic dysfunction. The present study's most interesting results, concerning FMR are: 1) patients with BAV dysfunction showed significantly increasing rates of associated FMR with increasing age; 2) patients with "normally functioning" BAV were not exempt from FMR; 3) patients with right-non-coronary type of BAV had consistently greater rates of associated FMR, also in the setting of "normally functioning" BAV. Altogether, these observations support the concept that BAV function may be intrinsically stenotic, secondary to the altered morphology of valve orifice.

We also aimed at identifying a clinical phenotype of BAV patients more prone to present with associatedmmV: we disclosed a significant association with younger age (mean: 35 years), tall stature and low BMI, in patients (>80% male) with regurgitant BAV and either normal aortic diameters or dilatation prevailing at the sinus level ("root phenotype"). This mirrors the evidence in Marfan Syndrome, of significantly greater dimensions of sinuses, STJ, arch and descending aorta (but not ascending aorta proper) in patients with MVP compared to those without MVP[5]. We therefore found here a further confirmation to our hypothesis that, within the spectrum of phenotypic expression of BAV-aortopathy, the "root phenotype" should be considered a marker of more severe aortopathy[4], i.e. a form subtended by a genetically determined aortic wall defect. Indeed in the longitudinal arm of the present study (159 patients), which however requires confirmation in larger populations,mmV was associated with faster growth of the ascending aorta, an evidence promising possible clinical usefulness of themmV as a phenotypic risk marker in BAV patients.

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Alessandro Della Corte

Cardiac – Abstract session: long term results of mitral valve surgery

Minimally invasive mitral valve surgery without aortic cross-clamping and with femoral cannulation does not increase the risk of stroke

Niv Ad *Inova Heart and Vascular Institute, Falls Church, VA, USA*

The development of minimally invasive techniques for cardiac surgery began to take shape in the mid-1990s, as surgeons explored the potential of these techniques to decrease cardiopulmonary perfusion times, incision size, wound infection, and other complications. Since the first demonstration of the relative safety of minimally invasive techniques in mitral valve surgery, the variety of instruments, devices, and perfusion techniques has continued to grow. Today, these approaches are increasingly preferred over median sternotomy. At the same time, there has been concern that minimally invasive approaches with retrograde femoral perfusion may increase the risk of stroke and/or transient ischemic attack (TIA) compared with median sternotomy, especially in patients with significant peripheral vascular disease. Moreover, reports from experienced centers have contradicted the notion that minimally invasive mitral valve surgery with fibrillating heart techniques is associated with increased risk.

We conducted a propensity score–matched analysis of prospectively collected data to examine the effect of operative approach on the risk of stroke/TIA and major morbidity in patients who had undergone mitral valve surgery with either a minimally invasive approach or median sternotomy. All of the minimally invasive mitral valve surgeries were performed by experienced surgeons using a right mini-thoracotomy on a fibrillating heart with no aortic cross-clamping. Before matching, the incidence of stroke/TIA did not differ between the two patient groups, although the incidence of major morbidity was lower in the minimally invasive group (0.8%) than in the median sternotomy group (6.1%). After propensity score matching, patients were balanced on preoperative characteristics, and there were no differences in the incidence of permanent stroke/TIA or in major morbidity between the two groups.

At our institution, we have experience with more than 450 minimally invasive surgical procedures with femoral cannulation and retrograde perfusion for isolated mitral valve surgery, mitral valve surgery combined with a Cox maze procedure, or stand-alone Cox maze surgery. We have had only one incident of perioperative stroke and two incidents of TIA. It is important to note that we use this approach only when a computed tomography angiogram shows no evidence of significant vascular disease. When significant vascular pathology is present, median sternotomy or alternative access, such as axillary artery cannulation, should be considered to allow antegrade flow and minimize the risk of stroke.

Since their initial development, minimally invasive techniques have consistently been shown to yield improved outcomes, including decreases in bleeding, blood product transfusion, wound infection, ventilation time, length of stay, and time to return to normal activity. The increasing preference of both patients and physicians for minimally invasive approaches, together with a growing body of evidence on the safety and efficacy of these techniques, have led major centers to prefer minimally invasive techniques over median sternotomy procedures for mitral valve surgery. Screening patients for significant vascular disease will further improve our ability to select patients and deliver excellent outcomes.

Cardiac – Abstract session: can minimally invasive ablation keep up with its promise for lone atrial fibrillation?

Implantable loop recorder monitoring after concomitant surgical ablation for AF

Insights from more than 200 continuously-monitored patients

Simon Pecha
University Heart Center, Hamburg, Germany

Background and Methods:

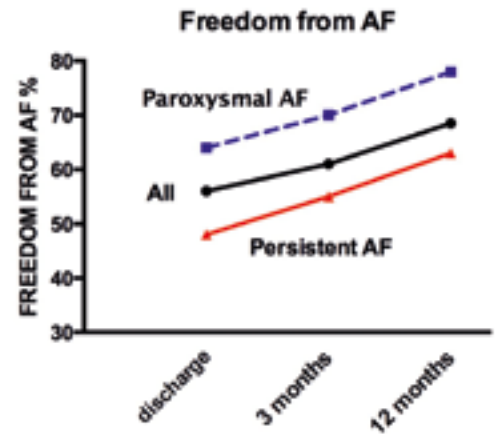
Different follow-up methods have been used to report success rates after AF ablation. Recent studies have shown that intermittent rhythm monitoring underestimates the actual AF recurrence rate. We therefore report our experience with continuous rhythm monitoring by implantable loop recorder (ILR) in a large patient cohort. Between 09/2008 and 12/2012 343 cardiac surgical patients underwent concomitant surgical AF ablation. ILR implantation was performed in 206 patients. ILR interrogation was accomplished at 3, 6 and 12 months postoperatively. Successful ablation was defined as AF Burden <0.5%. Primary outcome of the study was freedom from AF at 12 months follow-up.

Results

Mean patient's age was 70.5+/-7.4 years. No major ablation- or ILR related complications occurred. In 4 patients (1.9%) ILR had to be explanted due to ILR-related wound infection (n=2) or chronic pain (n=2). Survival rate at one-year follow-up was 96.6%. Freedom from AF rate after one-year follow-up was 68.5% and 63.6% off antiarrhythmic drugs, respectively. Statistically significant predictors for successful ablation at one-year follow-up were LA diameter, duration of AF and preoperative paroxysmal AF. Demographic data, indication for surgery, lesion set and used energy source had no impact on freedom from AF after one year. Mean AF burden in patients with failure of ablation was 33.1±23.1% and mean time spent in AF was 7.9 hours/day.

Conclusion

Continuous ILR monitoring after concomitant surgical AF ablation was safe and feasible, registered freedom from AF rate 68.5% at one-year follow-up. Continuous rhythm monitoring, helps to guide antiarrhythmic therapy and allows for safer withdrawal of anticoagulation therapy.



Cardiac – Abstract session: cardiac surgery in marginal patients

Effect of carotid revascularization on cerebral autoregulation in combined cardiac surgery

Daijiro Hori *The Johns Hopkins University School of Medicine, Baltimore, MD, USA*

Cerebral autoregulation is a physiological mechanism, where cerebral perfusion is maintained over a range of blood pressure to protect from brain injury. Monitoring of cerebral autoregulation in real time during cardiac surgery can be performed by processing regional cerebral oxygen saturation ($rScO_2$) data obtained using near infrared spectroscopy (NIRS) in relation to changes in mean arterial pressure (MAP). A continuous, moving Pearson's correlation coefficient between MAP and rScO2 can be calculated rendering variable cerebral oximetry index (COx). COx approaching 1 indicates changes are pressure dependent, thus cerebral autoregulation is impaired. On the other hand, when COx approaches 0 or is negative, the changes in rScO2 are not pressure dependent and cerebral autoregulation is considered as functional. Using this method, we have previously found that impaired autoregulation is associated with higher risk for stroke after cardiac surgery. Further, blood pressure excursions below the lower limit of cerebral autoregulation were independently associated with post-operative acute kidney injury and major morbidity and mortality, while blood pressure excursions above the upper limit of cerebral autoregulation were associated with higher incidence of delirium. These data suggest the usage of cerebral autoregulation monitoring may in fact be useful in guiding individualized hemodynamic management.

The management of concomitant severe carotid artery stenosis for patients in need of cardiac surgery remains controversial today. Guidelines have been provided by the EACTS and ACCF/AHA to refer to the severity of carotid stenosis, the presence of related symptoms and the surgical team's combined stroke and death rate for consideration of combined carotid artery revascularization at the time of cardiac surgery. There is little data, however, on the effect of carotid revascularization on cerebral circulation in patients undergoing carotid endareterectomy just prior to usage of cardiopulmonary bypass. The purpose of our study was to assess physiological changes in cerebral circulation by cerebral autoregulation monitoring in patients undergoing combined carotid endarterectomy (CEA) and cardiac surgery.

Using the cerebral autoregulation monitoring described above, we found that patients with severe carotid artery stenosis had a trend towards dysfunctional autoregulation compared to patients with non-significant stenosis prior to CPB. Interestingly, patients undergoing combined carotid revascularization and cardiac surgery had significantly higher COx compared to patients without significant stenosis at baseline. Further, patients undergoing CEA immediately before cardiac surgery had cerebral autoregulation measurement similar to those patients with non-significant carotid stenosis during CPB. In contrast, patients with uncorrected severe carotid stenosis had evidence of impaired autoregulation and lower rScO2 during CPB compared to patients with non-significant stenosis.

Although sample size of the study was small precluding any inferences on the relationship between impaired autoregulation and patient outcomes, these preliminary results suggest the potential utility of cerebral autoregulation monitoring possibly for complimenting patient selection for CEA as well as guidance of individual patient management during surgery.

Vascular – Abstract rapid response session: Aortic rapid fire session fire and and ice in aortic surgery

Impact of cystic medial necrosis with hereditary connective tissue disease on the early and late outcomes of patients with aortic dissection

Toshiki Fujiyoshi[4], Kenji Minatoya[1], Hiroaki Sasaki[1], Hiroshi Tanaka[1], Tatsuya Oda[1], Masayoshi Seike[1], Yoshihiko Ikeda[2], Hatsue Ishibashi-Ueda[2], Takayuki Morisaki[3], Hitoshi Ogino[4] *1 Cardiovascular Surgery, 2 Pathology, 3 Molecular physiology, National Cerebral and Cardiovascular Center, Osaka, Japan, 4 Cardiovascular Surgery, Tokyo Medical University, Tokyo, Japan*

A retrospective analysis was performed to determine the impact ofcmN with hereditary connective tissue disease on the early and late outcomes of patients requiring surgical repairs for aortic dissection.

Between 2003 and 2013, 298 patients (56% male, 64.0 ± 15.7 years) including 31 patients (10%) with Marfan's syndrome or other connective tissue disorders underwent surgical treatments for type A (n = 179) and type B (n = 119) aortic dissection at National Cerebral and Cardiovascular Center, Osaka, Japan. The presence ofcmN in the pathological examinations of surgical specimen and its impact on the early and late outcomeswere determined. The mean follow-up period was 3.8 ± 3.1 years with the follow-up rate of 100%.

In results,cmN was present in141 of 298 patients (CMN positive), whereas it was not found in the remaining 157 patients (CMN negative). The mean age was significant younger incmN positive; 59.4 ± 17.5 versus 68.1 ± 12.5 (p< 0.01). Type A aortic dissection was observed in 66% vs 55% (p= 0.049). There were no significant difference in the initial surgical procedures between the two patient-groups; 43% vs. 30% in the ascending aorta, 34% vs. 43% in the arch, 12% vs. 12% in the descending aorta, 6% vs 6% in the thoracoabdominal aorta, 4% vs 9% in the abdominal aorta, 2% vs 1% in the others. However, surgical intervention to the aortic root was significantly higher incmN positive; 16% vs 1% (p < 0.01). The early mortality (30-day and in-hospital ones) and late-mortality rates was 4% vs. 4% (p = 0.93) and 3% vs. 5% (p= 0.32). The long-term survival curve showed a tendency of better long-term survival incmN positive (log-rank, p=0.276). There were no significant differences in the re-operation rates (30% vs. 27%, p= 0.47) and the freedom from aortic re-operation (log-rank, p=0.569). According to age brackets, the incidences ofcmN were higher in the younger patients; 78% in 51 patients aged under 50, 52% in 42 (51 – 60), 41% in 88 (61 – 70), 37% in 86 (71 – 80) and 35% in 31 (> 80) (<50 vs 50, p <0.01). The early mortality was 5.0% in all, which was lower in the younger patients: 0%, 2%, 3%, 8%, and 6%. Conversely, the late-mortality was higher in the younger patients: 8%, 5%, 1%, 3%, and 6%, although there were no statistical significances between the patients under 50 and over 50 years old (log-rank p=0.570). The re-operation rate was also higher in the younger patients: 73%, 19%, 27%, 14%, and 13%, and there was a statistical significance between under 50 and over 50 years old (log-rank, p< 0.01).

The presence ofcmN of the aortic wall does not affect the early and late outcomes after aortic repairs for aortic dissection. However, younger patients aged < 50 years had significantly higher rates ofcmN, which might be related to the earlier onset of aortic dissection and subsequent higher reoperation and lower long-term survival rates. For such youngercmN positive patients, closer postoperative surveillance with adequate-timing surgical interventions is mandatory for more favorable long-term outcomes.

Focus session: Alone in the operating theatre, tips and tricks in urgent disasters

A standard operating procedure: Weaning patients from bypass

Friedhelm Beyersdorf
Freiburg, Germany

Over the last 20 years cardiopulmonary bypass itself has evolved to a very safe and reliable tool in cardiac surgery. The technology of extracorporeal perfusion is being used in all fields of cardiac surgery for short-, intermediate and long-term use. Today even the most complex cardiac procedures in high risk patients can be performed with an acceptable risk. Consequently weaning patients from bypass is a routine procedure and is done very quickly after the basic cardiac procedure has been successfully performed. Nevertheless there are rare circumstances when weaning a patient from bypass is difficult. For these patients certain considerations have to be taken into account.

Complex weaning from bypass in low to medium risk patients

1. Find out the cause for the inadequate hemodynamics:

- Was the surgical technique perfect? ("If it doesn´t look right, it probably isn´t")
- Control of all intraoperative factors, e.g.
  - myocardial protection technique?
  - operative concept?
  - protamine reaction?
  - pulmonary vascular resistance?
  - distention of the left and/or right ventricle?
  - * unknown (??)

2. Use extended monitoring:

- TEE
- Pulmonary artery catheter
- Laboratory data
- Graft flow measurements
- Angiographic control (Hybrid-OR)

3. Examples of surgical considerations:

- Use of a vein graft, if ITA is inadequate
- Bypass grafting, if new regional dyskinesis is seen after valve operations
- New graft, if bypass occlusion occurred after optimization of coagulation (e.g. NovoSeven)
- Bypass graft, if coronary artery occlusion is diagnosed after recent PCI, especially after intraoperative delivery of thrombocytes and coagulation factors to counteract the anticoagulative action of thrombocyte-inhibitors.
- Change of surgical technique, e.g.
  - MV repair → MV replacement
  - DAVID procedure → conduit implantation

Complex weaning from bypass in high risk patients

1. Preoperative considerations:

- "Cannulate pessimistic, operate optimistic"
- Full monitoring
- Preoperative surgical plan ("Failure to prepare is preparing to fail")
- Preoperative plan for what to do if the patient can not be weaned from bypass
- Preoperative IABP?
- Warm blood cardioplegic induction?
- Perfect surgical technique ("Details count for final results")

2. Look for potential causes of inadequate hemodynamics

3. Examples of surgical considerations:

- Start adequate (not maximal) inotropic support
- Reduce bypass slowly (over 15-20 min)
- Use nitric oxid (NO) for reduction of pulmonary vascular resistance
- Intraaortic ballon pump (IABP)
- Arterio-venous extracorporeal life support (ECLS)
- Call senior surgeon

Focus session: translational cardiovascular research

Translational research in aortic diseases: Where are we now?

Alessandro Parolari
University of Milano, Italy

DIFFERENT BIOMARKERS FOR DIFFERENT GOALS	
AIM	BIOMARKER
Detection of TAAs	Static or dynamic
Monitoring TAA progession in size	Dynamic (static)
Outcomes prediction	Static or dynamic
Quick diagnosis of acute aortic syndromes	Dynamic

Figure 1

The concept of translational research has been recently introduced in the field of aortic diseases; its aim is to apply basic discoveries, that are generated during research in laboratories and in preclinical studies, to the development of trials that will sensibly impact patient's health. Translational research in the field of thoracic aortic diseases (TADs) has been mainly addressed to the discovery of molecular mechanisms and biological markers affecting the development and progression of thoracic aortic diseases. Currently, research on this field has focused on four different areas of interest: 1) detection of TADs; 2) monitoring TADs progression in size; 3) outcomes prediction; and 4) quick diagnosis of acute aortic syndromes. The challenges that have been encountered are mainly due to the fact that TADs recognize 1) different locations (e.g. biomarkers and molecular mechanisms may not be the same in ascending and descending thoracic aorta); 2) variable aortic valve anatomy (tricuspid vs. bicuspid); 3) different clinical presentation (chronic aneurysms vs. acute aortic syndromes), and 4) variable inheritance (molecular mechanisms and biomarkers may not always be the same in genetically triggered vs. familial vs. sporadic TADs). Finally, another challenge depends on behavior over time of the biomarkers itself: in fact, it is useful to categorize biomarkers, depending on their possibility to change over time into: 1) static markers, almost a synonymous of genetic markers (they do not change over time) and 2) dynamic markers, that are the ones changing over time. Static and dynamic markers can be useful in different clinical scenarios (Figure 1); e.g., for a quick, rapid diagnosis of acute aortic syndrome only dynamic biomarkers can be used, and the same generally applies also for monitoring the progression of an aortic dilatation or aneurysm. Moreover, concerning dynamic markers, the timing of blood collection for the assessment of their levels is crucial for the diagnosis or for the outcome of interest, as a blood collection performed near to surgery may not be representative of baseline levels of biomarker, especially in acute aortic syndromes.

What emerges from current research is that several perturbations of the cytoskeleton-receptor-extracellular matrix complex are mediated via an increased activity of TGF-β1, a growth factor and a multifunctional cytokine that elicits its effects on endothelial and mural cells through specific cell membrane receptors (TGF-β receptor type I and II); this determines an increase in matrix degradation due to an amplified production of some metalloproteases such as mmP-2 and mmP-9, and of plasminogen activators thus favoring the weakening of the aortic wall and TAAs development. It is known that this mechanism is actually involved not only in different syndromic forms of TADs (Marfan, Marfan-like, and Loeys-Dietz syndromes) but also in some familial forms of the disease (TAA2, TAA4, TAA5), and in sporadic forms too. Recently, another piece of this puzzle has come to attention, as it has recently emerged that some microRNA families (microRNA are small non-coding RNA molecules which function in RNA silencing thus modulating protein expression) may be dysregulated in TADs, and they may also play an important biological role in the weakening of the aortic wall as well as a central clinical role, being the milestones for the development of predictive models of this disease. We expect in a near future the implementation of some diagnostic and prognostic tools encompassing biomarkers to be of help to the clinicians in the most challenging situations.

In fact, TADs are an important cause of mortality and morbidity in western countries. Overall, they are among the top 15 causes of death in western countries, and have an estimated incidence of one case per 10,000 persons/year, whereas the incidence for acute aortic syndromes is around three per 100,000 persons/year. The two major etiologies of TAAs are, in order of importance, degenerative/atherosclerotic and genetic; interestingly, more than 20% of patients affected by TAA has a first-degree relative with the same problem; less frequently, TAAs recognize an inflammatory/infective problem or trauma as a possible cause. The main problem a physician encounter when dealing with TAAs is that the diagnosis is usually made by an imaging study done for unrelated problems; otherwise, TAAs are usually clinically silent until the onset of one dramatic complications (acute aortic syndromes) that usually threatens not only patient's life in the immediate but also often prejudicing survival and quality of life at follow-up.

For these reasons, prevention and prediction have become a very active area of research in this field and translational research is expected in a near future to fill the last gaps still remaining between laboratory investigations and patients' bedside.

Vascular – Focus session: Linking resection and reconstruction of intrathoracic organs

Thoracic aortic repair warranting additional treatment of extraaortic structure

Martin Czerny *University Hospital Zurich, Switzerland*

Since its broad introduction in the late 1990's, thoracic endovascular aortic repair (TEVAR) has gained widespread acceptance for the treatment of various acute and chronic thoracic aortic pathology. However, as indications were more broadened, several limitations of and complications by the method became apparent. Some of these are very rare and merely reported as anecdotical and it is difficult to develop an algorithm to understand, anticipate and thereby prevent them.

One of these complications is aorto-bronchial or aorto-pulmonary fistulation (ABPF) after TEVAR presenting either as central airway (aorto-bronchial) or as pulmonary parenchymal (aorto-pulmonary) fistulations. We intended to learn upon incidence, underlying mechanisms and effectiveness of treatment strategies in patients with ABPF after TEVAR. Thereby we analyzed data of an international multi-center registry (European Registry of Endovascular Aortic Repair Complications- EuREC) between 2001 and 2012 with a total caseload of 4680 TEVAR procedures in 14 centers. This analysis elucidated ABPF as a rare but highly lethal complication after TEVAR. The leading mechanism behind ABPF seems to be a continuing external compression of either the bronchial tree or left upper lobe parenchyma.

In this setting persisting or newly developing endoleak formation seems to play a crucial role. Prognosis does not differ in patients with central airway or pulmonary parenchymal fistulation. Radical bronchial or pulmonary parenchymal repair in combination with stent-graft removal and aortic reconstruction seems to be the most durable treatment strategy.

Martin Czerny

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CLASH OF THE TITANS

RETURNS

Residents' Luncheon

Tuesday 14 October, 12:45

Panorama Lounge, Level 3, Mico Congressi

We invite Residents to attend this year's luncheon which will be held on Tuesday 14 October during the Annual Meeting. Prominent surgeons with conflicting views on surgical approaches have been invited to host informal discussions over lunch, touching on subjects that are generally not discussed during the scientific sessions. If you would like to attend the luncheon, please sign up at the Information Desk in the main registration area on site in Milan.

PROGRAMME

Table 1: Nuss versus Ravitch

H K Pilegaard (Aarhus) vs. M Yuksel (Istanbul)

Table 2: Minimally invasive ASD closure versus open

R Prêtre (Lausanne) vs. V Hraska (Augustin)

Table 3: Endoscopic thymectomy or open?

F Melfi (Pisa) vs. M Zielinski (Zakopane)

Table 4: Hybrid/robotic versus total arterial revascularization

J L Pomar (Barcelona) vs. J Bonatti (Abu Dhabi)

Table 5: Hybrid or open for extensive aortic disease

J Bavaria (Philadelphia) vs. J Pepper (London)

Table 6: Repair or replacement for ischemic mitral valve repair

O Alfieri (Milan) vs. D Adams (New York)

Table 7: Sutureless mini-AVR versus TAVI

A P Kappetein (Rotterdam) vs. M Glauber (Milan)

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Advanced techniques - Session 1 cannulation and extraction techniques - putting it in and taking it out

Transvenous lead extraction

An increasing challenge due to rising numbers of long implanted leads

Christoph Starck *University Hospital Zurich, Switzerland*

More than 50 years after the first human pacemaker implant and more than 30 years after the first implantable cardioverter defibrillator (ICD) implantation, cardiac implantable electronic device (CIED) therapy is an important mainstay in the treatment of patients with heart rhythm disorders.[1,2] The Achilles' tendon of CIED systems are the leads. It was shown that after three years of implant time 15% of ICD leads show lead failure.[3] Just recently the FDA recall of two ICD lead models (Sprint Fidelis, Medtronic and Riata, St. Jude Medical) have underlined the fact that the weakest parts of a CIED systems are the leads.[4] The treatment approach to such problematic leads is addressed by the expert consensus on transvenous lead extraction procedures of the Heart Rhythm Society in the indication classes "functional leads" and "non-functional leads". Further indication classes defined by this expert consensus paper are "thrombosis and venous stenosis", "chronic pain" and the classical indication for lead extraction "infection".[5] Based on the presence of these multiple indication classes for lead extraction and the growing number of CIED implants worldwide, it is obvious that there exists an increasing need for lead extraction centers. The prevalence of lead extraction procedures is estimated by European Heart Rhythm Association to be 1.5 – 6% of all lead implants per year.[6]

Since endovascular leads are encapsulated by fibrotic tissue over time, transvenous lead extraction (TLE) procedures may be very challenging, especially in long implanted leads. Besides the difficulty, also the risk of the procedure is determined by the extent of such fibrotic adhesions.[7] TLE procedures may rarely result in major, life-threatening complications due to vascular or myocardial injuries. If emergent sternotomy is required, mortality increases tremendously.[8] Therefore and to assure maximum patient safety, certain precautionary measures are mandatory: excellent preoperative preparation, procedure performance in an operative environment under general anesthesia with extracorporeal circulation on stand-by and adequate cardiac surgical backup, if the procedure is not performed by a cardiac surgeon.

Nowadays a large variety of high-end extraction tools are available. They may be used in a staged approach according to the severity of encountered adhesions during the procedure, which leads to excellent results and allows a cost efficient use of these expensive tools.[9] Clinical success rates are currently well above 90% with low complication rates, if performed in an experienced center.[10] Besides different kinds of locking stylets, there are either simple or powered extraction sheaths available. Such powered sheaths are based on a mechanical concept, on laser technology or on electrosurgical dissection. In common, extraction sheaths are used by a subclavian approach. For a transfemoral or a transjugular approach different snare extraction tools are present. Reported results for the different tools are comparable and regardless of the preferred extraction instrument, the results are highly dependent on the operator experience.[7]

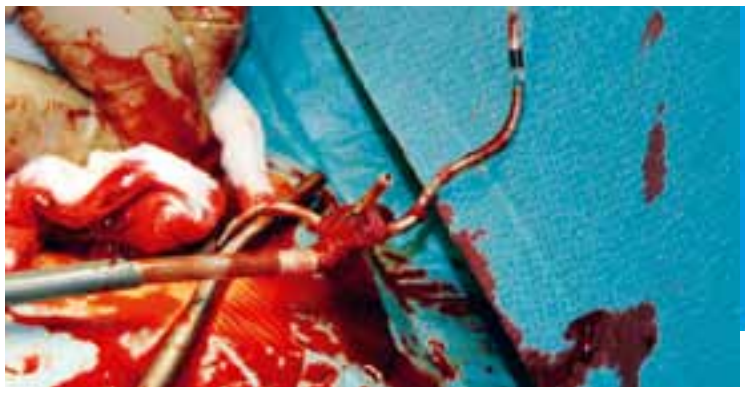

Figure 1: Despite high-end tools transvenous lead extraction procedures may be very challenging due to severe fibrotic adhesions along the course of the targeted lead.

Figure 2: Snare devices may be used for transfemoral or transjugular extraction procedures of completely intravascular leads.

TLE procedures gain growing importance and can be carried out with excellent results in experienced centers. A large variety of extraction tools are currently available. If not carried out by a cardiac surgeon, the involvement of cardiac surgery is mandatory to guarantee maximum patient safety.

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Advanced techniques - Session 1 cannulation and extraction techniques - putting it in and taking it out

Carotid artery and jugular vein cannulation in aortic redo surgery

Paul P Urbanski *Cardiovascular Clinic Bad Neustadt, Bad Neustadt, Germany*

Aneurysms that develop after previous aortic surgery pose a high risk of massive hemor-rhage during reopening of the thorax; and therefore, a femoro-femoral cannulation and deep hypothermia are usually recommended before sternotomy. Use of femoro-femoral cannula-tion for cardiopulmonary bypass is associated with a need for interruption of cerebral perfu-sion during circulatory arrest; and therefore, deep hypothermia is necessary, even if ante-grade cerebral perfusion is established by additional direct cannulation of the arch arteries after initial complete brain ischemia. Apart from the general negative side-effects of deep hypothermia, like coagulopathy or organ dysfunction, there is also a particular risk of left ventricle dilatation when the aortic valve is insufficient (this is common in aortic redo surgery) and a hypothermic ventricular fibrillation occurs before opening the thorax.

We present here an alternative approach with arterial cannulation of the right common carot-id artery via a vascular side-graft and venous cannulation of the right jugular vein. The ap-proach to the vessels in the neck is very fast and easy, even in very obese patients, and the placement of sufficient venous cannula into the jugular vein is easier than into the femoral vein. Most importantly, during circulatory arrest the cerebral perfusion is maintained, eliminat-ing the necessity of deep hypothermia.

For the approach to the right common carotid artery and to the right jugular vein, an incision is made on the neck along the margin of the sternocleidomastoid muscle before the median sternotomy. The neck vessels are isolated and after heparinization, the common carotid is cannulated through an 8mm vascular prosthesis anastomosed to the artery end-to side. The jugular vein is cannulated using the Seldinger technique. For this purpose, intraoperative transesophageal echocardiography is performed to ensure the echocardiographic guidance for correct positioning of the venous cannula in the inferior vena cava. In cases with addition-al mitral valve, and especially, tricuspid valve surgery, a dual-stage cannula can be used for cannulation. The re-sternotomy is not performed until establishment of cardiopulmonary bypass, achievement of mild hypothermia and lowering of the blood pressure to about 60mm Hg.

We use this approach in surgery of chronic (Figure1) or false (Figure2) aortic aneurysms present-ing a close contact with the back surface of the sternum. Regardless, if the circulatory arrest is necessary to control the bleeding or to replace the pathological arch, the cerebral perfu-sion has not to be interrupted at any time during surgery. In case of aortic injury, the carotid artery is cross-clamped below the side graft and the perfusion is reduced to few hundred milliliters a minute enabling the easy control of the bleeding. When prolonged circulatory arrest is necessary e.g.: for partial or complete arch replacement, the cerebral perfusion is constantly maintained unilaterally through the arterial line placed in the right carotid artery at the blood temperature of 28°C according to our protocol published previously[1], however a completion of bilateral perfusion can be performed at any time by additional cannulation of the left carotid artery in accordance to surgeon's preference or clinical necessity.

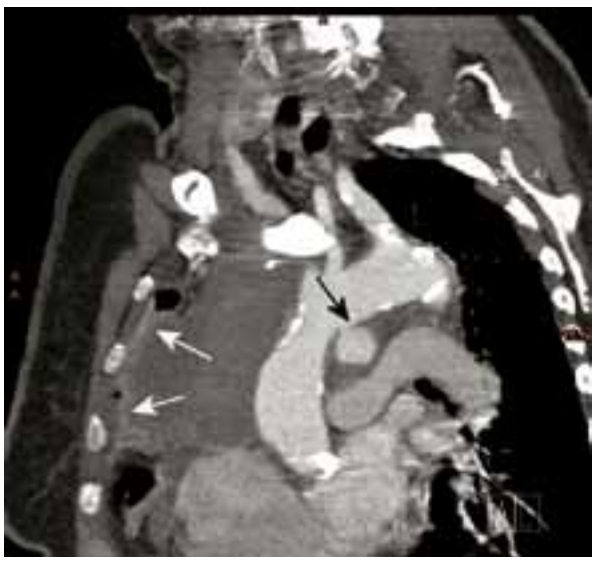

Figure 1 (above left): Preoperative CT-angiography showing huge aortic aneurysm with contact to sternum back surface. Figure 2: Preoperative CT-angiography showing huge false aortic aneurysm caused by infec-tion of vascular prosthesis after ascending aorta replacement. Extension of false aneurysm to the sternum is marked with white arrows. Leakage of contrast medium at the distal anas-tomosis is marked with black arrow.

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Advanced techniques - Session 1 cannulation and extraction techniques - putting it in and taking it out

Video: Cannulation technique: femoral in redo surgery

Fabio De Robertis *Harefield Hospital, UK*

De Robertis will be presenting two videos that illustrate peripheral arterial cannulation.

The femoral artery is by far the most common peripheral approach used worldwide. It provides an easy and quick access to the circulation but it isn't free from problems.

In recent years, subclavian artery approach has been adopted by an increasing number of surgeons. However the perception in the wider arena remains that this technique is more time consuming and technically challenging. There is also the fear it can lead to upper limb ischaemia and for all these reasons its popularity has remained somewhat confined to those centres with a large experience in redo surgery or complex aortic procedures.

The following videos will provide a step to step description of the techniques and will undoubtly stimulate an interesting discussion that will be of great interest for both senior and more junior surgeons

- Video: Cannulation technique: femoral in redo surgery
- Video: Cannulation technique: subclavian

Advanced techniques - Session 1 Fine-tuning coronary revascularization

Intraoperative graft patency control: Function (TTFM) and Anatomy (SPY and ECUS)

Teresa M Kieser
University of Calgary, Canada

Early graft failure (less than three weeks) is thought due to technical problems and causes undue morbidity (peri-operative myocardial infarction, re-intervention for graft failure) and mortality. Until recent developments in the field of intraoperative graft patency assessment, cardiac surgery was the only procedure on vessels without verification of results of said procedure. Results of percutaneous angioplasty of all vessels of the body are instantly verified by the injection of dye immediately following the procedure.

In an ideal world, assessment of both function and anatomy of bypass grafts is necessary for assurance of an acceptable graft. Intra-operatively, transit-time flow measurement (TTFM) measures function; the anatomy of a bypass graft anastomosis can be assessed by fluorescence imaging with indocyanine green (SPY by Novadaq) and epicardial ultrasound (ECUS), a relatively new method that is combined with TTFM on the same machine (VeriQc by Medistim).

TTFM is based on the difference between the transit-time of ultrasonic energy passing through flowing liquid and measures flow, pulsatility index (PI-a measure of resistance in a bypass graft), the amount of diastolic filling (DF) and has visual and auditory components of a waveform of the flow. DF is normally 2/3 of the cardiac cycle (66%) in left sided arteries and half of the cardiac cycle in right sided vessels because of the lower pressure exerted by a thinner walled right ventricle. Intraoperative graft patency assessment by this method is recommended since 2010 in Europe and also in the United Kingdom.[1,2,3]

Intraoperative anatomical assessment of bypass grafts has been attempted by multiple methods for the last 25 years and two methods have or have the potential to achieve this: use of fluorescent indocyanine green dye and epicardial ultrasound. The strengths of fluorescence imaging, used since the early 2000s, are its simplicity and safety[4] – no ionizing radiation, no adverse reactions, no need for arterial puncture, no nephrotoxicity and similarity to coronary angiography. Limitations of this technique include inability to quantify graft flow, need for skeletonization, time taken/ graft assessment is three minutes, and overlying fat/muscle obscures penetration and detection of fluorescence.

Epicardial ultrasound is the 'new kid on the block' with all the bells and whistles of state of the art echo: simultaneous 2D-B mode, pulsed wave Doppler, color flow mapping and a probe with up to 20 MHz ultrasound bandwidth, and within the same machine, the ability to measure TTFM (VeriQc.) First introduced at the EACTS meeting in 2009, Vienna, and in clinical use since 2011, this device has promising potential to improve the diagnostic accuracy of intra-operative graft verification to 100%.[5]

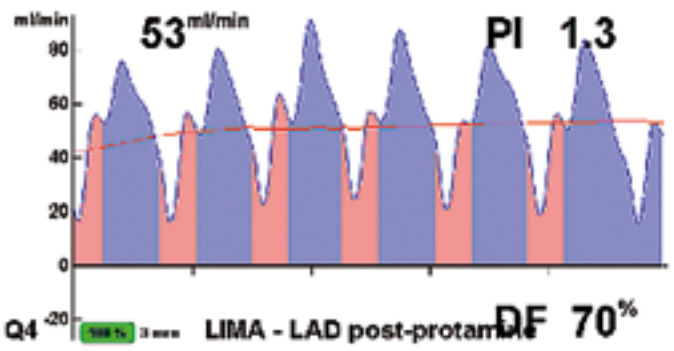
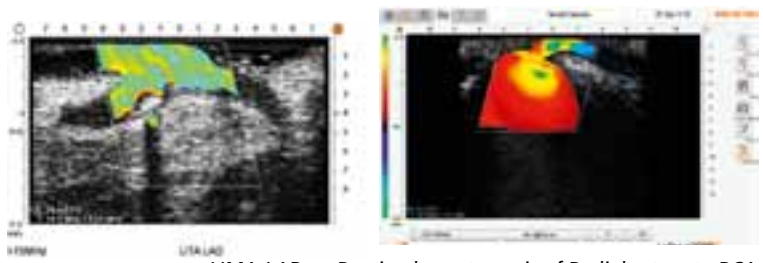
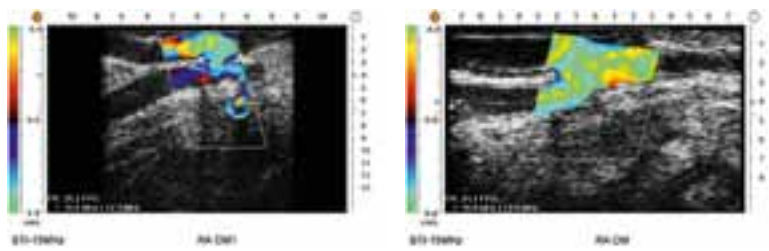


Figure 1. Normal tracing of left internal mammary artery graft to left anterior descending artery post –protamine. TTFM values: the flow is 53ml/min, the PI or resistance is 1.3 and the DF shows that diastolic filling occurs in 70% of the cardiac cycle.

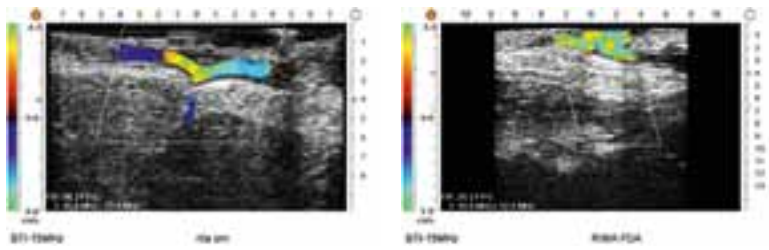
Figure 2. Fluorescence imaging examples of occluded LIMA-LAD (left image) and patent LIMA-LAD (right image) Dark spots on image correspond to suture area and pedicled area of vessel.



LIMA-LAD Proximal anastomosis of Radial artery to RCA



Side-to-side anastomosis of sequential radial graft to 1st marginal Radial graft to Marginal artery



Right internal mammary artery grafts to marginal and PDA arteries

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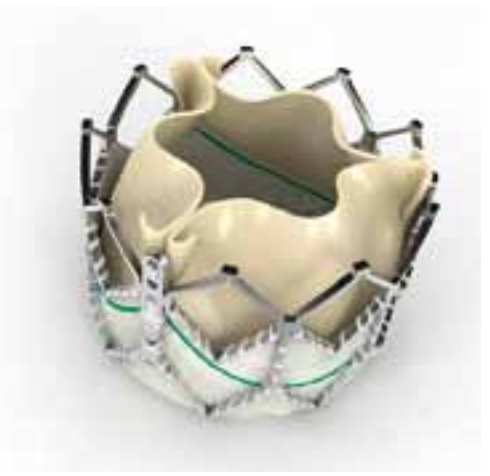
Advanced techniques - TAVI complications

Paravalvular leak: can we measure it, can we prevent it?

Thierry Folliguet *Université de Lorraine, Vandoeuvre les Nancy, France*

In those patients whose surgical risk profile prevents them from undergoing an open-heart procedure, due to well-known risk factors such as ; age with multiple comorbidities, low ejection fraction, lung disease, cirrhosis with portal hypertension, renal failure, frailty, degenerative neurocognitive dysfunction, previous cardiac surgery, porcelain aorta, trans catheter aortic valve implantation (TAVI) has emerged as a viable technique. However, TAVI is not without drawbacks and potential complications and aortic regurgitation (AR) is a known complication of TAVI. Furthermore, moderate and severe AR has previously been identified as independent risk factors for short- and midterm mortality following TAVI. In about 10-20% of cases, TAVI procedures are associated with the occurrence of a significant post-procedural aortic regurgitation (AR).

Understanding its mechanism and the factors which can predict AR is of paramount importance in order to reduce its occurrence.



Edwards SAPIEN XT Valve balloon expandable

Medtronic CoreValve Self expandable

Can we measure the severity of AR?

Evaluating the presence and severity of the AR post TAVI should include an assessment of two types of potential leaks:

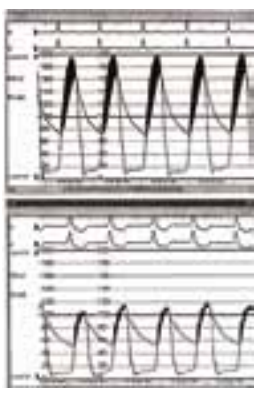
- Central (Transvalvular leaks): which originate in the center of the bioprosthetic valve as a result of poor leaflet coaptation
- Paravalvular leaks: originating from the outside perimeter of the bioprosthetic valve due to frame under-expansion or from a too low implant depth

Assessment of AR severity should be multimodal consisting of angiography, hemodynamic assessment, and echocardiographic assessment.

At the time of implantation it is necessary to confirm the severity of AR by angiography which shows an elevated left ventricle filling pressure post dilation. Residual PAR can be graded qualitatively after final device deployment and catheter removal by the amount of regurgitant contrast media during supraaortic angiography, using the Sellers criteria: Absence of PAR=0/4, mild=1/4, moderate=2/4, moderate-to severe=3/4, and severe=4/4.

Hemodynamic assessment of AR

Hemodynamic assessment AR includes diastolic pressure change and left ventricular end-diastolic pressure. The gradient between diastolic blood pressure (DBP) in the aorta and left ventricular diastolic pressure (LVEDP) can be calculated over several cardiac cycles to evaluate the severity of AR. To adjust the gradient for the respective systolic blood pressure (SBP) of the patient, a calculated dimensionless AR index according to the following formula can be obtained: [(DBP – LVEDP)/SBPx100].



The AR index decreases in parallel with increasing severity of AR. An AR index of 25 is found to be a good predictor of the severity of AR.

Echocardiography can confirm the presence of a central leak or periprosthetic regurgitation. Different parameters should be examined:

Valve structure & motion which can be abnormal, structural parameters such as LV size which is dilated, using Doppler parameters (qualitative or semi qualitative); a large (≥65%) central jets (% LVO diameter): by color Doppler; the jet density which is dense (CW Doppler); jet deceleration rate (PHT, ms): (CW Doppler) which is dense; LVO flow vs. pulmonary flow (PW Doppler) which is greatly increased; Diastolic flow reversal in the descending aorta (PW Doppler) which is prominent holodiastolic; and Doppler parameters (quantitative) with a regurgitant volume (mL/beat) >60 and a regurgitant fraction (%) >50.

Factors predicting of AR

Patients with greater than or equal to mild PVR have significantly greater calcification in all regions of the aortic valve complex and more asymmetry in the annulus and LVOT regions.

Calcification assessment can be performed using the Agatston score (AgS) which is calculated using multimodal CT scan.

Calcifications of the annulus or of the cusps of the native valve can result in under expansion of the prosthesis stent frame which is a major risk factor for paravalvular leak, which might be caused also by prosthesis malposition (implantation depth, that is, too deep or too shallow), and/or annulus prosthesis-size mismatch.

Central leak can be due to maldeployment of the prosthesis either from infolding of the prosthesis due to a non-circular annulus or from a structural valve dysfunction or from a too high implantation.

Periprosthetic AR can be the resultant from the presence of massive annular calcification, a too low implantation, or maldeployement of the prosthesis. Device size too small is associated with peri AR. When the device is undersized the native leaflets may provide some sealing in diastole. Prevention of device size too small is done with multimodal CT measurements, basal plane measurements, perimeter based sizing.

Coaxial alignment is a prerequisite to an optimal device placement. Accuracy of the implant is affected by the angle between the catheter and the aorta and between the device and the native valve. When the angle is greater than 45° between the aorta and the ventricle fast pacing should be performed to counteract parachute effect in SE device.

Large sub annular hypertrophy is a contraindication to TAVI as it will not allow adequate positioning of the device. Large annulus is also associated with peri AR.

The type of prosthesis can be a risk factor for AR. In the randomized CHOICE trial patients with a balloon expandable (BE) had less AR than patients with self-expandable (ES) prosthesis 12% vs. 45% at 30 days. Long term follow up should be awaited to determine whether the observed difference will translate in favor of BE prosthesis.

Can we prevent AR?

Prevention is based on careful valve sizing based on annulus measurement and accurate valve positioning. Appropriate pre-procedural planning for TAVI should include careful annulus sizing, quantification of the degree of calcification, and assessment of left ventricular outflow tract and annulus asymmetry by computed tomography imaging. Better valve positioning with new imaging systems can limit inadequate valve positioning.

WEDNESDAY'S HIGHLIGHTS... WEDNESDAY'S HIGHLIGHTS... WEDNESDAY'S HIGHLIGHTS... WEDNESDAY'S HIGHLIGHTS WEDNESDAY'S HIGHLIGHTS... WEDNESD

Advanced techniques - Session 1 Fine-tuning coronary revascularization

Optimising arterial grafting: configuration

Brian Buxton, James Tatoulis, Philip Hayward *University of Melbourne, Australia*

The use of the left internal thoracic artery graft to the anterior descending coronary artery has been widely accepted as the gold standard for surgical treatment of coronary artery disease for over 40 years. However the use of multiple arterial grafts have not been accepted readily. Many surgeons persist with the addition of one or more saphenous vein bypass grafts. As a result even today most patients with multivessel disease have not received the potential benefits of extensive arterial or complete arterial grafting.

The purpose of this study is to optimise configurations of arterial bypass grafts in patients with triple vessel or extensive coronary artery disease. Most coronary artery bypass units worldwide use only a single internal thoracic artery graft. Bilateral arterial grafting is used in 5 to 10% of most units in Europe and the United states. We have developed a technique of total arterial bypass grafting using internal thoracic artery and radial artery grafts, thus avoiding saphenous vein grafts in most patients. The purpose of this communication is to define techniques which optimise the use of arterial bypass grafts in patients with primary isolated coronary artery disease. Important factors are the techniques of choosing and harvesting bilateral internal thoracic and radial artery grafts. Of importance is the choice of arterial grafting to patients with extensive coronary artery disease. These techniques apply to both on and off pump coronary artery bypass surgery.

Graft harvesting techniques are important and the use of skeletonisation in patients who have one or both internal thoracic artery grafts. Extra pleural harvesting can be achieved using this technique particularly in elderly patients.

Graft configuration using bilateral internal thoracic artery grafting forms the cornerstone of total arterial reconstruction. The configurations of arterial grafting depend on the patient and anatomical variables. The greatest benefit is when both internal thoracic artery grafts are attached to the left coronary system. Bilateral internal thoracic artery grafts can be used in a number of different ways. The simplest and preferred technique is to attach the left internal thoracic artery to the circumflex or intermediate system.

The insitu right internal thoracic artery is then anastomosed to the distal LAD.

Alternatively the most popular technique after attaching the LITA to the LAD, is to use the insitu RITA as a graft to the anterior wall of the left ventricle. A free RITA graft can be attached to the circumflex coronary artery the same way as a saphenous vein graft. The free RITA can also be anastomosed proximally to the LITA as a T or Y and distally to a coronary artery.

The role of bilateral internal thoracic artery grafting has stood the test of time through observational studies. These data will not be finally proven until the ART study of Taggart is complete in 2017 or 2018.

James Tatoulis and Brian Buxton

Total artery grafting procedures provide a very durable reconstruction when both internal thoracic and radial artery grafts are combined in a variety of techniques. These will be demonstrated on Wednesday 15th October.

Advanced techniques - Session 1 Controversies and catastrophies in adult cardiac surgery

TEVAR for all patients with acute Type B aortic dissection?

Ali Khoynezhad *Cedars Sinai Hear Institute, Los Angeles, CA, USA*

Acute type B dissection is a devastating medical condition and the management is evolving. Complications such as malperfusion to distal branch-vessels or (impending) rupture has prompted open surgical repair in patients with type B aortic dissection. In recent years, primary stent grafting for complicated type B aortic dissection has been applied with favorable results for treatment of complicated acute type B aortic dissection. Thoracic aortic endovascular repair (TEVAR) can be offered with a relatively low postoperative morbidity and mortality in experienced hands, and it is considered standard of care. It also appears to have a favorable outcome in mid-term follow-up, however the longevity of the repair and durability of the stent grafts in the thoracic aorta in long-term follow-up is yet to be established.

In addition to the complicated cohort, there are a series of patients considered to be high-risk uncomplicated type B aortic dissection and they are currently offered early TEVAR in most centers. These patients, at significantly higher risk for early rupture, include patients with persistent pain, resistant hypertension, enlarged descending thoracic aorta above 4cm upon presentation, false lumen above 2.2cm and fusiform index over 0.64.

While the primary TEVAR is primary approach for patients with complicated and high-risk uncomplicated acute type B aortic dissection, uncomplicated cases have been managed in most centers with medical therapy.

Fig. 2. Proposed classification of type B aortic dissections relevant to endovascular repair. Types 1, 2, 3, and 4 are displayed sequentially from left to right.

However, acute type B dissection with poor natural history in conservatively managed patients. The average hospital mortality for medically managed patients is below 5% in most centers, however 1/3 of surviving patients require surgical or endovascular operation in the first 5-10 years for aneurysmal enlargement. Furthermore, many patients have significant issues with proper blood pressure control due to the presence of the intimomedial flap, not infrequently in the vicinity of the renal artery orifices. Therefore, there has been consideration for early TEVAR for patients with completely uncomplicated type B dissection. There are many single center studies supporting the concept of scaffolding of the descending thoracic aorta, and now we have the first multi-center prospective study supporting TAVAr for uncomplicated type B aortic dissections. Results of INSTEAD XL, published this year, was consistent with survival benefit and remodeling advantage at five-year follow-up. This is thought to be due to rerouting the blood flow completely through the true lumen, and enabling reverse aortic remodeling. This could obviate late complications of the patients with chronic type B aortic dissection, if the TEVAR can be performed with low mortality at in the sub-acute phase.

So, what is needed before we can recommend TEVAR for all type B aortic dissections? First it will be helpful to know which patients will have reverse aortic remodeling with TEVAR, thereby obviating need for future aortic interventions. The authors reviewed their data with patient with type B aortic dissection with an average follow-up of 4 years, and found out that location of intimomedial tears and size of the tears has a ramification on clinical malperfusion and reverse aortic remodeling. The classification predictive of reverse aortic remodeling after TEVAR (see fig 1), was first introduced by Khoynezhad and colleagues in Journal of Vascular Surgery in 2010. Base don't his study, patients with type 1 and 2 had 97% had reverse aortic remodeling at latest follow-up.

Ali Khoynezhad

Second, while we have now many smaller series and one multi-center series suggesting survival advantage, and conceptually this makes clinical sense, there is need for more multi-center studies supporting TEVAR in uncomplicated type B aortic dissection in long-term follow-up, before recommending an endovascular approach for all type B aortic dissections.

Advanced techniques - Aortic valve repair/sparing for bicuspid and tricuspid valve - WETLAB

Effective height and geometric height to standardize cusp repair

Diana Aicher, Hans-Joachim Schäfers *Leiterin der Sektion Klappenchirurgie, Homburg/Saar, Germany*

Valve-preserving aortic replacement and valve repair have become increasingly popular alternatives to aortic valve replacement. The normalization of aortic valve form and function has to take the geometric interrelation between cusps and root as a functional unit into consideration. Many different repair techniques have been defined so far. Intraoperative decision making requires objective assessment of the underlying pathology. While prolapse can be repaired successfully cusp retraction implies suboptimal repair durability and thus should not be considered for reconstruction.

For reproducible aortic valve repair normalization of cusp and thus valve configuration is essential. Surgical inspection (eye-balling) is subjective by definition and should thus be supported by objective measurements. Aortic valve geometry is dependent on by sinus dimensions, length of cusp insertion, cusp height, and length of free margin, i.e. denominators that determine the 3-dimensional configuration. Limited information has previously been available on normal cusp configuration. In a study on normal volunteers we found that the height difference between the free margin and the basal ring (effective height) is constant between 9 and 10mm in normal aortic valves in adult patients. A calliper was designed to allow for intraoperative measurement of effective height, thus facilitating the assessment of the preexistent pathology and the effect of repair.

Hans-Joachim Schäfers

The concept of using effective height for assessment of cusp configuration has normal amount of cusp tissue as prerequisite. In a large series of more than 600 patients we found that cusp tissue height in its center (geometric height) largely varied between 18 and 22mm in tricuspid valves, and 20 to 25mm in the nonfused cusp of bicuspid aortic valves. The determination of geometric height now allows the determination of cusp retraction (<18mm in tricuspid, < 20mm in bicuspid valves), thus excluding valves from repair that are simply poor substrates for preservation because of poor durability.

The use of these two objective parameters now allows for easier assessment of valve pathology, both for aortic valve repair and valve preserving aortic replacement. These parameters make surgical judgment less important and support it with "hard facts", thus facilitating aortic valve repair and making it more predictable and reproducible. An increasing number of surgeons has adopted this approach and found it helpful in starting or improving aortic valve repair.

Advanced techniques - Aortic valve repair/sparing for bicuspid and tricuspid valve - WETLAB

AVIATOR : an international registry to evaluate aortic valve repair

The Aviator Registry is one year in the air. What have we learned so far?

Jolanda Kluin *UMC Utrecht, The Netherlands*

AVIATOR stands for Aortic Valve Insufficiency and Ascending Aorta Aneurysm International Registry. It is an initiative of The Society of Heart Valve Disease (SHVD) Working Group on Aortic Valve Repair. The objective of this prospective registry is to ascertain a systematic uniform registration of patient characteristic, procedural aspects, and follow-up for the purpose of (1) optimized multidisciplinary patient care, (2) uniform scientific reporting, and (3) assessment of quality of care.

The surgical part of the registry was finalized in August 2013. All adult patients (≥ 18 years old) that are operated for (Isolated) Aortic Insufficiency and/or Ascending Aorta Aneurysm can be enrolled in the registry. This also includes congenital mixed aortic valve disease and aortic dissection. Moreover, both patients that undergo aortic valve repair as well as patients that undergo aortic valve replacement can be enrolled. Patients with pure aortic valve stenosis are excluded. The registry for the medically treated patients will follow in the upcoming year.

Currently, 470 patients are enrolled from 15 different institutions, located in France, Belgium, The Netherlands, Germany, Slovakia, Czech-Republic, Spain, Italy and Japan. Average age of the patients is 52 (±16) years and the majority (81%) is male. The aortic valve was tricuspid in 58%, bicuspid in 37% and unicuspid in 5%. The aortic valve was repaired in 90% of the cases, of which 62% using valve sparing root replacement, 21% isolated valve repair, 10% supracoronary (without sinus) ascending aorta replacement and 6% supracoronary (with sinus) ascending aorta replacement.

Every surgeon that treats patients that fulfill the inclusion criteria are welcome to participate. If you participate you will automatically become a member of the Working Group on Aortic Valve Repair. After data submission in the registry, you can export your own data at any time. Moreover, as a member you will receive an annual report with a summary of your population in addition to the Aviator benchmark.

The Aviator members meet bi-annually during SHVD and EACTS meetings to which all participants are invited. At the meeting you will be informed about the project-progress, outcome of research and/or audit originating from the registry.

Do you want to participate? Please visit the website for more information at www.shvd.org/Working-Groups/AV-repair. Here you can find the protocol, the paper CRF and a participation agreement. Send the participation agreement to AVIATOR@shvd.org.

Emmanuel Lansac, Jolanda Kluin, Hanneke Takkenberg, Hans-Joachim Schäfers and Frederiek de Heer, on behalf of all the members of the SHVD Aortic Valve Repair Working Group.

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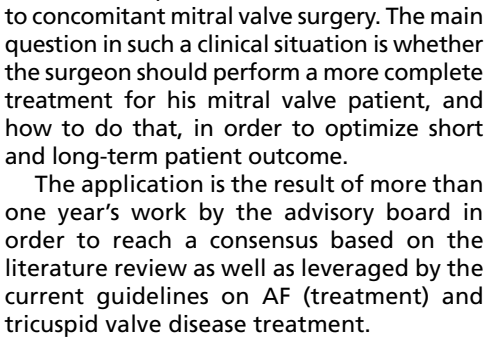
New Web App to help surgeons in decision-making for concomitant mitral therapies



Filip Casselman MD PhD FETCS, Jerry Braun MD PhD, Krishna Khargi MD PhD, Michael Knaut MD PhD

Up to 50% of patients due to undergo mitral valve surgery suffer either from atrial fibrillation (AF) or tricuspid valve disease[1]. Unfortunately, not yet all of these patients routinely receive a concomitant procedure, in particular for the AF treatment. Indeed, some degree of confusion still remains in the cardiac surgical world about 'when' to treat AF, what energy source to use and which lesion set to perform. These are the 3 main questions a surgeon should ask himself whenever faced with such a clinical situation.

The under scribing authors are all members of the Atrial Fibrillation advisory board sponsored by Medtronic. Together, and based on the currently available literature, they developed a web application (see www.concomitantmitraltherapies.com)to guide surgeons in this decision making process.

The first step is now available and is related to concomitant mitral valve surgery. The main question in such a clinical situation is whether the surgeon should perform a more complete treatment for his mitral valve patient, and how to do that, in order to optimize short and long-term patient outcome.

The application is the result of more than one year's work by the advisory board in order to reach a consensus based on the literature review as well as leveraged by the current guidelines on AF (treatment) and tricuspid valve disease treatment.

Once the surgeon has entered the application (4 languages are available !), he can add specific clinical information such as history and type of atrial fibrillation, left and right atrial size (derived from a transthoracic echocardiogram), and presence of tricuspid valve regurgitation or tricuspid annular dilatation.

On the basis of these parameters, the Web application will take the surgeon to an 'output' page where a suggested treatment is shown. The beauty of this App is that the advised treatment option is based on the author's opinion, which is based on their experience and knowledge of the literature in order to provide the surgical community with the most suitable tailor-made surgical procedure for the concomitant mitral valve patient.

For example, when clicking on AF, the application will suggest to either performing a left side only lesion set or a bi-atrial lesion set. The surgeon can then indicate which type of energy source he wishes to use (cryotherapy or radiofrequency energy) after which a specific lesion set will be presented by the application, based on the experience of the different board members. This lesion set suggestion is separate for left and right atrium (if applicable).

If the user wishes, he can receive additional product information but this is provided in a very discrete fashion and certainly does not take the overhand in the application. An extensive literature and guideline overview is also available if desired.

By providing this service, the authors hope to lower the threshold for surgeons to perform concomitant atrial fibrillation surgery and to assist their peers in the decision-making process.

GO and TRY it out!!
www.concomitantmitraltherapies.com

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EACTS Course preview 10–14 November

Heart Failure

State of the Art and Future Perspectives

In November 2014, the EACTS will host its third Advanced Module: Heart Failure – State of the Art and Future Perspectives course at EACTS House in Windsor, UK. *EACTS News* talked to one of the course directors, Professor Gino Gerosa (Padua, Italy), about the course…

"In the third Heart Failure Course we will again try to incorporate all aspects of heart failure from diagnosis and epidemiology, imaging and biomarkers, to advanced therapies such as LVADs, tissue engineering and the total artificial heart," said Gerosa. "The aim to provide a comprehensive overview of the current status of the available treatments for heart failure patients."

The course, which is aimed at residents and experienced cardiac surgeons with an interest in the heart failure field, will include a world-class faculty of heart failure experts including cardiac and congenital surgeons, cardiologists and scientists.

The course will begin with two presentations by pathologist Professor Angelini (Padua), who will explain the development of heart failure, why certain diseases lead to heart failure and the diagnosis of the condition. Professor Feltrin (Padua) will then examine the role of biomarkers in heart failure and Dr Osswald (Bad Oeynhausen, Germany) will then assess the current alternatives to medical therapy such as implantable cardioverter-defibrillator resynchronisation therapy and biventricular pacemakers.

Dr Schulze (New York) will then discuss optimal medical therapy and provide a cardiologist's point of view by evaluating the current medical therapies available for treating heart failure.

"We will also examine the surgical options for heart failure including mitral valve repair and replacement, as well as myocardial revascularisation," added Gerosa. "It is important that all the current therapies and treatment options are explained, discussed and understood. Heart failure is a highly complex condition and one that has multiple solutions, choosing the right solution is key."

Case reports

"We will again be presenting some case reports and asking the group for their opinion, allowing the group to discuss different treatment options and take part in the decision-making process," explained Gerosa. "The case reports discussions provide delegates with an opportunity to see how treatments options are evaluated depending on the conditions of the heart failure patient. The discussions from this session are always very interesting."

Gino Gerosa

The course will then discuss heart transplantation and specifically the issues surrounding donor shortage.

In many countries the availability of donor hearts is decreasing as fewer people with healthy hearts are dying early, as a result there is a real concern regarding the shortage of donor hearts, explained Gerosa. One solution could be found in tissue engineering, and during this year's course the 'Organ factory' session will discuss regenerative medicine and the possibilities it can offer the heart failure patient.

"It took almost 40 years from when mankind made the first transatlantic flight to when we took our first step on the moon," said Professor Gerosa. "Now, almost 40 years on from the first heart transplant, we are close to realising a similar dream – the bioengineered heart."

Wetlab

The course will also include the ever popular wetlab, sponsored by Thoratec. This is a hands-on session that allows attendees to implant Thoratec's HeartMate device.

"The wetlab session gives delegates an opportunity to apply their knowledge in a practical setting," he added. "It gives them the chance to assess and improve their surgical technique, as well as receive one-to-one advice from world renowned experts."

The course will also include a session on mechanical circulatory support with an assessment of short-term assist devices options and total artificial hearts.

The final day of the course is dedicated to industry presentations and allows companies to showcase their devices, giving the attendees the opportunity to see the latest technological advances and ask questions regarding patient selection, implantation and modification techniques.

"Overall, this course provides attendees with the opportunity to spend five days talking directly to heart failure specialists," concluded Gerosa. "I would strongly advocate that colleagues who are part of a heart failure programme attend this course."

For further information, please visit the EACTS website: www.eacts.org.

WEDNESDAY'S HIGHLIGHTS... WEDNESDAY'S HIGHLIGHTS... WEDNESDAY'S HIGHLIGHTS... WEDNESDAY'S HIGHLIGHTS WEDNESDAY'S HIGHLIGHTS... WEDNESD

Advanced techniques - Session 1 cannulation and extraction techniques - putting it in and taking it out

Optimising Venous Grafting: Endoscopic Vein

Rashmi Yadav, Saina Attaran, Richard Trimlett, John Pepper, Anthony DeSouza *Royal Brompton Hospital, London, United Kingdom.*

Coronary artery bypass surgery performed through median sternotomy remains an invasive operation. Efforts to reduce invasiveness include minimally invasive conduit harvest, already widely practised in the USA. Despite initial concerns regarding long-term vein graft patency, several studies have now demonstrated the safety of endoscopic vein harvesting (EVH). National Institute for Health and Care Excellence (NICE) guidance published in June 2014 concluded that there was no evidence for increased occlusion rates or incidences of re-intervention, myocardial infarction or death for endoscopically harvested grafts. NICE supports the use of EVH provided that normal arrangements are in place for clinical governance, consent and audit. We present the process of introduction of EVH at our centre with short and medium term results.

After a period of training, EVH was commenced in our unit in November 2009. Over a period of four years, the use of EVH expanded from 50% in 2010 to 90% in 2013. In hospital outcome data was audited and reported regularly. Mid-term data was collected using patient telephone survey and national outcome databases. Overall, 1,105 patients underwent EVH during this period. Of these patients, EVH was performed in 890 and open vein harvesting (OVH) in 878 patients undergoing isolated coronary artery bypass surgery. The incidence of diabetes and urgent or emergency cases was greater in the EVH group. There were no differences between the two groups with regard to number of diseased vessels, ventricular function or other co-morbidities.

In the first two years of our experience with EVH, the mean length of procedure was increased by 14 minutes when compared to OVH. However, this difference was no longer present in the latter two years of our experience demonstrating plateauing of the learning curve. Postoperatively, there were no statistical differences in the rate of complications between the groups. In-hospital mortality (p=0.31) and reoperation for graft problems (p=0.49) were similar between the groups. As expected and previously published, leg wound infection was significantly reduced with the use of EVH compared to OVH (0.7% versus 2.7%, p=0.004) despite the higher incidence of diabetes and urgent cases in the EVH group. Incidentally, we noted a statistically significant reduction in the incidence of superficial and deep sternal wounds in the EVH group during the study period. This is likely secondary to reduced cross infection of the sternal wound from an infected donor site. Medium term mortality data was collected from the UK Personal Demographics Service and showed no difference in survival at three years between the EVH and OVH groups (97.8% vs 97.5%, p=0.3).

Our initial results of EVH demonstrated comparable results between open and endoscopic vein harvesting techniques with significantly lesser degree of wound infection rates. Medium term follow up showed equivalent survival in the two groups. Patient satisfaction with EVH was high. Supported by the results of our regular and ongoing audit and the recent NICE guidelines, we continue to offer EVH to our patients and it has become our standard of care.

Rashmi Yadav

Advanced techniques - How to do it : with live in a box

Minimally invasive lung volume reduction

Macro Scarci
Papworth NHS Foundation Hospital Trust, Cambridge, UK

It is an honour for me to be able to present our technique for Lung Volume Reduction Surgery (LVRS) together with several other illustrious colleagues.

Apart from few exceptions, LVRS has not been generally very popular because of the potential mortality, reported in few series as high as 12%, and morbidity. Although the NETT study demonstrated the value of LVRs in patients with heterogeneous upper lobe emphysema and low exercise tolerance, this procedure, in our opinion, should be reserved to non-heterogeneous patients as well. In certain series dyspnea score improves in both groups. It emerged from a review of the literature that iIn the non-heterogeneous group the dyspnea score decreased by 1.6 points from 3.46 to 1.8 after LVRS and remained below baseline for up to 4 years. In the heterogeneous group it decreased by 2.1 points from 3.47 to 1.3 after LVRS and remained significantly decreased for up to five years. Similar improvements were noticed with FEV1 values. In the non-heterogeneous group FEV1 increased by 35% from 28% predicted to 38 predicted three months after LVRS. In patients with heterogeneous emphysema the FEV1 increase was 61% from 28% predicted to 44% predicted three months after LVRS. The improvement remained above baseline for up to three years.

We now recognise that LVRS does not only improve lung function tests and quality of life, but additionally it improves survival and COPD exacerbations compared to medical treatment.

The problem that remains is how to select the right patients and how to perform the operation. We recommend surgery in patient with emphysema and severe irreversible obstruction to airflow (FEV1 < 35%), marked hyperinflation of the lung (TLC >110% and RV >200%) and impaired exercise performance. We do not recommend surgery if patients are markedly hypercapnic, with pulmonary hypertension or if the lung is "destroyed" (TLCO<20%).

In our Institution we offer a complete one stop service to patients in the form of a monthly multidisciplinary meeting. We believe that the close cooperation between surgeons, chest physicians, chest radiologists, physiotherapists and specialist nurses improves outcomes. It also allows o decide which patients are suitable for bronchoscopic LVRS.

Regarding the conduct of the operation, we believe that it is not necessary to treat both sides at the same time. Ninety-eight percent of our cases are now performed thoracoscopically and we believe that this represents an important point in patient with limited reserve. Similarly we advocate not to position the ports beyond the posterior axillary line and we always insert an extrapleural catheter for analgesia at the beginning of the operation. We found that using pericardial reinforcement minimalise air leak and for the same reason with routinely perform a pleural tenting and talc pleurodesis between the tent and the remaining lung.

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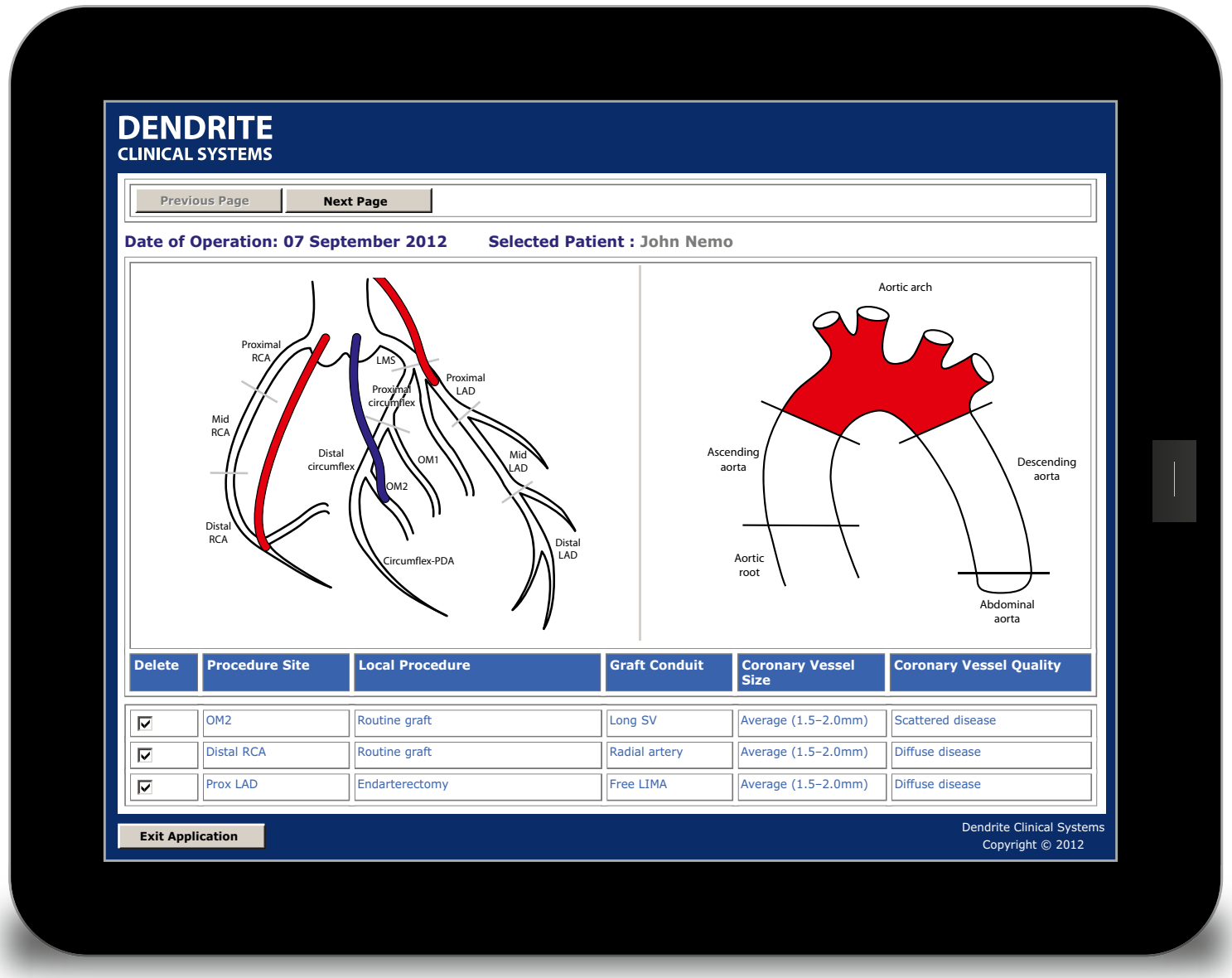

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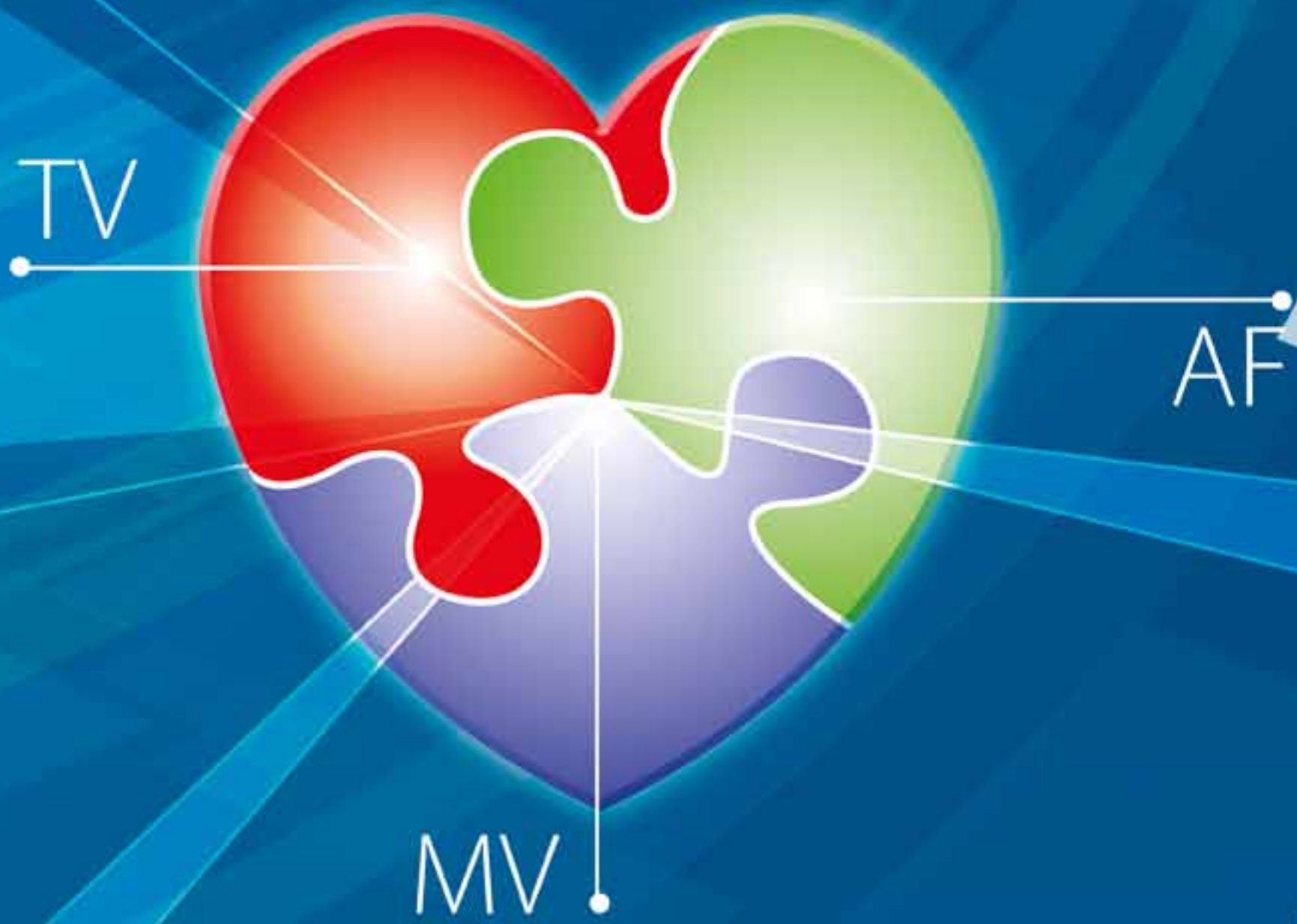

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