Welcome to Amsterdam

Embracing the challenge
Welcome to the 26th European Association for Cardio-Thoracic Surgery (EACTS) Annual Meeting in Amsterdam! As ever the conference brings together a world-class faculty to present, debate and discuss the latest developments in cardiothoracic surgery. Through this year’s programme, the EACTS promises to deliver the highest quality of advanced education in the field of cardiovascular and thoracic surgery, as well as promote the benefits of research in thoracic physiology, pathology and therapy. We are ready to embrace the challenges of the rapid development of interventional techniques and the ageing population.

Techno College
Saturday will host the Techno College and the Acquired Cardiac Disease Programme will focus on four topics:
1. Transcatheter aortic valve implantation and aortic valve replacement
2. Tricuspid valve surgery
3. Heart failure

The Congenital Disease Programme covers 3D imaging modalities in congenital heart surgery and the management of the mechanical support of circulation. The Thoracic Disease Programme will look at malignant pleural mesothelioma. From biomolecular aspects to maximal invasive surgery: what thoracic surgeons should know.

Postgraduate Course
Sunday’s Postgraduate Course of the Acquired Cardiac Disease Domain covers a wide variety of topics related to surgical safety and quality improvement. The Thoracic Disease Programme covers an interactive session with a panel of experts. This year’s topics are: pneumonectomy controversies, oesophageal perforations management and acquired tracheal disorders management. Personal illustrative clinical cases will be shown by the panel to stimulate and encourage interactive discussion. The Congenital Disease Programme will provide sessions on the management of hypoplastic left heart syndrome, all aspects of Tetralogy of Fallot with pulmonary atresia (TOF-PA) and major aortopulmonary collateral arteries (MAPCAs). There will also be a meet the expert session where complex cases will be presented and discussed, and a surgical film session will illustrate complex repairs.

EACTS
If you appreciate what the EACTS presents during this event and you would like to support the work of the Association, I encourage you to visit the EACTS booth and become a member. The membership fee is low and you will receive the European Journal of Cardio-Thoracic Surgery and the Interactive Cardiovascular and Thoracic Surgery Journal, as well as a reduced rate for the Annual Meeting. You can complete your application online through the EACTS website (www.eacts.org) or by visiting the EACTS booth in the exhibition area. At the booth you will also find information on our new courses planned for 2016. We thank our industry partners for their continued support of the Annual Meeting, and all the presenters who have taken the time to contribute to this year’s EACTS Daily News newspaper. It is a great pleasure to welcome you in Amsterdam, and we are honoured and delighted by your presence at this year’s conference. We hope the information and techniques presented here will be of great interest.

In addition to an outstanding scientific programme, the opportunity to stroll through the narrow streets, explore the city by boat, and sample the rich cultural history the city has to offer visiting museums like the Stedelijk Museum, the Van Gogh Museum, and the Rijksmuseum with Rembrandt’s famous ‘Nachtwacht’ painting, will make your stay in Amsterdam unforgettable. I hope you enjoy the meeting and all Amsterdam has to offer.

Pieter Kappetein
EACTS Secretary General

Optimizing Vein Graft Outcomes for CABG: New Solutions

Monday October 5th 2015
Lunchen 12:45 -14:00
Amsterdam RAI, Room E 104/105

- Moderated by Professor David Taggart, Oxford University Hospital
Dear Colleagues

I would like to bring to your attention our exciting programme for this year’s Techno College (TC) Over the past 10 years under the leadership of Hugo Vanermen and Volkmar Falk the TC has evolved to become one of the most interesting days at medical conferences worldwide. My task, together with the EACTS New Technology Committee is to maintain and build on this level of expectation for attendees in future years. We want to ensure the that TC stays at its best and would therefore be very happy to receive your feedback on this year’s programme, as well as gather potential suggestions for future content.

This year’s 1-day programme combines excellent cardiac surgical and cardiological skills with new techniques and future scientific developments. Over the past months, during multiple discussions, we have put together a very exciting programme. Although confronted with clinical realities, individual expectations, and restrictions with the initiation of clinical studies, we have adapted our programme while maintaining the scope of the sessions which include general presentations, live-in-a-box and videos illustrating technical details and live cases. We are very thankful to Fred Mohr and the whole team from Leipzig for their kind hospitality in hosting the live cases at the Leipzig Heart Centre – once again over the weekend! In addition we would like to thank MediLive for their excellent audiovisual support.

Today you will see three very exciting sessions which focus on many aspects of modern cardiac and cardiac surgical therapies. In the morning session we will cover topics of conventional aortic valve diseases, valve repairs and (of course) transcatheter therapies. After the first break we will present the New Technology Award, for which there are several excellent applicants with brilliant ideas. The second session will focus on the aorta, heart failure and new techniques for ablation therapy. One of today’s absolute highlights will be the keynote lecture immediately prior to the lunch break, presented by Mike Mack from Dallas, USA. Within the third session we will focus on the atrioventricular valves, including the tricuspid and mitral valves. Besides many live-in-a-box presentations there will be two interesting live cases in this session.

Although we have worked hard to bring you an exciting programme, it is you, the audience, who can turn a good meeting into a great one. I would therefore like to thank all of you very much for coming to this year’s Techno College, and I look forward to seeing you in Amsterdam or at future meetings.

On behalf of the New Technology Committee, EACTS

Thomas Walther
Not only the demand for minimally invasive techniques but also excellent exposure of the valve and good results in terms of peripertative complications have made the video-assisted anterolateral mini-thoracotomy our standard approach in mitral valve surgery. Atrial fibrillation (AF) is associated with mitral valve disease and can effects up to 50% of patients who do not receive a surgical treatment in time. Besides significant hemodynamic compromises in some cases, stroke remains the most feared complication of AF with a 5-fold increase in risk. Despite these significant compromises many patients with AF still remain untreated during their mitral valve surgery. This is remarkable considering the fact that the left atrium is exposed anyway. This makes the decision of an ablation therapy additional complication. Indocyanine green (ICG) is a fluorescent dye with various complications, resulting in delayed treatment. The effective closure of the left atrial appendage in minimal invasive mitral valve surgery using an endocardial suture line is challenging because recanalisation is unfortunately not infrequent. We presented a safe and efficacious way to close the left atrial appendage electrically from the atrium and thus also eliminates an AF trigger source. The application is completely atraumatic and can be applied via the transverse sinus though a right-sided mini-thoracotomy.

I believe that these recent developments allow for an efficacious treatment of AF during minimally invasive mitral valve surgery and should be adopted for most of our concomitant procedures in patients with AF to not only warrant a perfect functioning valve but also to reduce any remaining stroke risk exposure in these patients.

1. A typical postoperative endoscopy after tracheal resection. White light endoscopy shows an inconspicuous anastomosis; however, ICG bronchoscopy reveals perfusion defects at the anterior parts of the anastomosis.

2. The components of the ICG bronchoscope. A near-infrared light source, fluid light cable, full HD camera-head, near-infrared filter, broncho-fibrescope (all by Karl Storz Endoscopy, Tuttlingen, Germany) (Figure 2). For video documentation, a media hub was connected to the bronchoscopy unit (Karl Storz Endoscopy, Tuttlingen, Germany) (Figure 2).

3. The ICG-bronchoscopy is based on the principle that ICG is rapidly biliary excreted and is therefore not captured by the light. However, its absorption at 750–900 nm is used. The ICG-bronchoscopy unit consists of a near-infrared filter (2), a fluid light cable and a near-infrared light source are needed (3). Images are recorded by an HD camera-head (4).

4. Figure 1. A typical postoperative endoscopy after tracheal resection. White light endoscopy shows an inconspicuous anastomosis; however, ICG bronchoscopy reveals perfusion defects at the anterior parts of the anastomosis.
Novel aortic clamp with equal pressure distribution along the clamp jaws

Figure 1. Stress distribution along the clamp jaws. In currently available clamps according to the law of the lever, cross-clamping, especially a large aorta, triggers a large difference in the stress placed on different parts of the aorta; the aortic area near the hinge is under more stress than the aortic area distal to the hinge. Even the least trauma-causing, currently available aortic clamp can lead to serious, potentially lethal aortic injuries in such patients.

Figure 2. Maximal clamping pressure generated at proximal, middle proximal, middle distal and distal jaws of the currently available aortic clamps. The maximal pressure is larger near the clamp hinge than at its top (Figure 1). In our study, which will be presented at the 6th October 2015 meeting, entitled ‘innovation and new strategies in thoracic aortic surgery’, we set up an in-vitro model for aortic cross-clamping and evaluated the pressure distribution of the following clamps: DeBakey, Satinsky, fenestrated, lacy, Chitwood, angular handle Fogarty and straight handle Fogarty. The pressure over the clamp was not found to be distributed equally for any of the vascular clamps analysed. The ratio between the highest and lowest maximal pressure measured along the jaws ranged between 1.5 and 3.6 (Figure 2).

To avoid these complications, at our institution, we advocate aortic clamping carried out by a novel device, the Kowalski–Rylski clamp, which is made of implant grade stainless steel (316L). It comprises of two claw-shaped clamping elements pivoted to the C-shaped arm in angular collapsible members (sliding into each other) forming a handle Fogarty and straight handle Fogarty. The pressure over the clamp was not found to be distributed equally for any of the vascular clamps analysed.

The ratio between the highest and lowest maximal pressure measured along the jaws ranged between 1.5 and 3.6 (Figure 2). All clamps seem to carry a risk of the ‘scissor’ effect. According to the law of the lever, cross-clamping, especially a large aorta, triggers a large difference in the stress placed on different parts of the aorta; the aortic area near the hinge is under more stress than the aortic area distal to the hinge. Even the least trauma-causing, currently available aortic clamp can lead to serious, potentially lethal aortic injuries in such patients.

Cross-clamping with the aortic clamps currently available may injure the aorta, especially large ones, or those of patients with connective tissue disorders. We propose a new aortic clamp design that causes less trauma by distributing the pressure equally. To address the unequal pressure distribution along the clamp jaws, we designed a novel Kowalski–Rylski aortic clamp (named after its designers) with an additional hinge (Figure 3). It is constructed to provide a homogeneous distribution of the clamping force, since the second hinge allows the upper jaw to adjust its position according to the pressure and thus provide the same pressure at the proximal and distal quadrants. We have analyzed the clamp prototype performance in the same in-vitro model and measured the pressure distribution along the jaws (Figure 2). Our experiments showed that the Kowalski–Rylski clamp distributes the pressure equally along the jaws and the ratio between the highest and lowest maximal pressure measured along the jaws was 1.0. The pressure measured near the Kowalski–Rylski clamp hinge and at the top of the clamp jaw was the same and was similar to the lowest pressures measured in other clamps (Figure 2). We believe that our less invasive solution to aortic clamping is a positive contribution to today’s surgical armamentarium. It may decrease the incidence of aortic injury associated with cross-clamping and enable surgeons to clamp aortas that are vulnerable to injury in patients with connective tissue disorders or those with aortic aneurysm, safety and with greater confidence.
Today intraoperative mitral valve analysis is based on visual assessment and 'eyeball guesstimates’. This conventional approach aims to obtain measurements using simple surgical tools, such as a ring sizer, calipers or clamps, although the application of these tools are highly subjective and cumbersome, especially during critical phases of cardiac arrest. Furthermore, current measurement procedures only provide a rough estimate of just a small number of desired measures of the surgical target. We have developed a new method for mitral valve analysis based on optical tracking technology that allows quantitative assessment of complex three-dimensional (3D) valve anatomy and the spatial relationship between the different valve components is substantially enhanced by the 3D visualisation of the geometrical parameters, always visible to the surgeon on a big screen ("viewstation") next to the operating table (Figure 1). This is very useful when the degree of chordal shortening needs to be determined (Figure 4) or the appropriate size for an annuloplasty ring needs to be selected (Figure 2). Concerning the latter procedure, our system computes automatically a suitable ring prosthesis for the patient and provides a virtual representation of the ring (green curve in Figure 2) matched onto the measured annulus, potentially overcoming ambiguous sizing procedures. This innovative computer-based surgical assistance system for analysing the complex patient-specific mitral valve geometry was evaluated several times during reconstructive mitral valve surgery. It was developed as part of larger collaborative research, which includes several interdisciplinary projects aiming to create a technical cognitive system to support the surgeon during different surgical procedures (http://www.cognitionguidedsurgery.de/). Our surgical assistant system integrates customised hardware- and software-based components which are specially tailored for minimally invasive mitral valve repair (Figure 5) and therefore also fully suitable for conventional sternotomy approaches in those patients who need associated surgical procedures such as coronary revascularisation or aortic valve surgery. Our surgical assistant overcomes the limitations of current subjective analysis, shows a unique ability to get precise, quantitative and highly reproducible measurements of mitral valve anatomy with manifold advantages. First, it can help the surgeon and his team choose the most suitable reconstruction procedure for reshaping valve geometry. Second, patient-specific valve morphology can be easily visualised and compared between different patients. Third, it can provide a tool for training surgeons, since all geometric anatomical details and the degree of surgical correction are recorded by the system. Fourth, it can improve the outcome of mitral valve repair by providing standardised and straightforward quantitative assessment procedures.

This new quantitative approach may provide a greater impact in future development of mitral valve repair surgery and promote a substantial philosophical change from an empirical procedure towards quantitative predictable modern reconstructive surgery. A video showing application of the assistance system in a patient undergoing mitral valve repair and coronary revascularisation can be viewed here: http://tinyurl.com/67f4x

This work was carried out with the support of the German Research Foundation (DFG) as part of project B01, SFB/TRR 125 Cognition-Guided Surgery.
Internal thoracic artery to SVG composite grafting: potent alternatives to enhance technical capabilities of conventional coronary artery bypass grafting

Mathias Hooman Azazi
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Complete revascularisation of both the right- and left-coronary artery branches in line with avoiding manipulating ascending aorta (proximal-less) have proven to be salient factors to enhance overall patient outcomes. At the same time, this reduces the perioperative occurrence of adverse cerebrovascular events by the time of coronary artery bypass graft (CABG). To meet the latter recommendations, encouraging the use of bilateral internal thoracic arteries (ITAs), and overcoming technical shortcomings in the frame of conventional CABG, two new patterns of ITA–SVG CG are described. The ‘Reverse-T’ CG is used for both the right and left coronary branches (Figure 1, A–D), while ‘Tripod’ CG is used for the left coronary artery system (Figure 1, E–H). These techniques can be adopted by both on- or off-pump approaches. An inter-coronary-bridge (SIB) is constructed between the coronary-artery targets using a segment of saphenous vein graft (SVG) (Figure 1). Orientations of each distal SIB-anastomosis is tailored in an attempt to avoid angulations or kinking of SIB-segments by varying the placement of grafts’ feet’ (5–90°) in respect to the arteriotomy axis. Care is taken to choose an adequate SIB-segment with respect to the topology of SVG semi-lunar-valves and to determine a suitable site for the composite ITA-SIB anastomosis, to avoid tactical errors in target perfusion by the feeding-ITA. The composite anastomosis is then performed as end-to-side for Reverse-T and side-to-side for Tripod CG.

These two new patterns of CG were conducted on 31 patients (mean age: 64.5±10.3 years; female: 44%; preoperative left ventricular ejection fraction [LVEF]: 43.4±11%; LM disease: 44%; EuroSCORE II: 5.5±5.8%) during 2013 and 2014. All patients were considered not suitable for all CABG. Bilateral ITAs were used in 31% of patients. The mean total number of distal anastomoses per patient was 3.9±0.89.

A left- or right-sided left internal thoracic artery (LITA)-SVG CG was constructed in 90.7% and 15.6% of patients, respectively. Of all patients, 9.4% had bilateral left- and right-sided ITA–SVG CG. The mean number of distal anastomoses achieved by ITA–SVG CG was 5±0.86 per patient, of which 2.7±0.8 were performed using SVG. 81% of distal anastomoses performed by SVG were assigned to ITA–SVG grafting. Resorting ITA–SVG CG resulted in 53% of patients benefiting from a proximal-less CABG approach. All patients survived the operation, there was no occurrence of major adverse cardiac and cerebrovascular events (MACCE), none of the patients required inotropic or intra-aortic balloon pump (IABP) support. The mean time of ICU stay was 2.25 days and the mean postoperative LVEF was 45±10%. The mean follow-up time was 12.5 months; all patients remain free from angina recurrence. The current series sustains operational safety and excellent operative outcomes of these two new patterns of ITA–SVG CG. The latter enables moving towards reducing ascending aorta manipulations, reaching more complete revascularisation in high Syntax scoring patients, while encouraging the use of bilateral ITA in the frame of conventional CABG. The conduit-spawning feature offered by SIB reduces the extent of siccacities to harvest SVG. Anastomosing ITA on SIB is an effective measure to deal with short ITA length that may otherwise not reach the expected coronary artery targets. Reducing the number of side-to-side distal anastomosis make these two new CG patterns technically more attractive and attainable. ITAs are known to protect the assigned coronary territory by releasing endothelin-protecting factors that may favourably impact the longevity of SVG used as SIB and deserved by ITA. The shorter segment of SVG used as SIB and a real in-series pattern do provide haemodynamic benefits by lowering CG-system resistances. Considering the aforementioned technical and physiological benefits, these two new CG patterns can actually enhance tactical-technical potency, as well as perioperative outcomes of conventional CABG.

RESTAURANTS
Mossel and Gin
Dutch residents love it: mussels. Everyone loves it: gin and tonic. Go to this restaurant for the best of both. Located in Westerpark, one of Amsterdam’s hip areas with many bars and concert venues. Located at Rozengracht 12.

Fyra
A great taste of everything from fish to meat to vegetarian. Located at Noorderstraat 19-21.

ACTIVITY
Dutch National Opera and Ballet
A real must-go when in Amsterdam. The Dutch National Opera and Ballet has multiple shows a week, largely sold-out throughout the entire year. During FACTS, you can visit ‘Narnia the Lion, the Witch and the Wardrobe’ ballet on October 1st-4th or the ‘Hans van Manen Live’ ballet from legendary choreographer Hans van Manen on the 3rd or 4th Galal ballet. Or are you looking for a short lunch intermezzo? Enjoy a free concert on Tuesday at 12.30 (doors open 12.15), which lasts about 30 minutes, just enough time for you to get back to the meeting! Check www.operaballet.nl/en/program for tickets or just visit the location at Amsterdam.

BREAKFAST
Bakers and Roasters
We all know a good breakfast will get you through the day.

SWEET SNACK
Strawpuflet
If you ever visited the Netherlands before, this is what you have probably already tried. You can eat warm strawpuflet at the side of the street or in a candy shop, but you can also buy them in the supermarket to take home.

SNACK
Bitterballen
You will be able to get this tasty snack at every bar in Amsterdam, the ‘bitterballen’ Just give it a try and you will want to eat it for the rest of your stay in Amsterdam. Enjoy it with a nice beer or glass of wine.

Saturday 3 October 2015

Inside Amsterdam
WHERE TO GO AND WHAT TO DO?
Stuart Head

Every day, this section will give you a few things to do in Amsterdam and suggests a restaurant for you to go to.

breakfast
Bakers and Roasters
We all know a good breakfast will get you through the day.

MUSEUM
The Anne Frank House
Nothing much needs to be said about this place as the world already knows the story of Anne Frank. You can easily fit this in between the meeting and dinner, as the museum is open daily until 9:00 pm. If you choose to visit, make sure to buy a ticket in advance to avoid standing in the line for hours. www.annefrank.org/en/Museum/Practical-information/Opening-hours-prices-and-locations/
Redo-aortic arch surgery after limited repair of acute type A aortic dissection using the Evita-open antegrade stent graft

Martin Grabenwöger Department of Cardiovascular Surgery, Hospital Hietzing, Vienna, Austria

There is an ongoing debate, whether the primary operation for acute type A aortic dissection should be kept as simple as possible and mainly aim to save the patient’s life, or should initial surgery be more extensive and complex in order to reduce the need for reoperations and consequently improve long-term results.

Reviewing the literature one can find numerous studies indicating in approximately 30% of patients after successful operation of an acute type A aortic dissection complications of the downstream aorta in a follow-up period of 7 years. This means that patients who survived the first operation still face a high risk from late distal aortic events. This fact stimulated aortic surgeons around the world to work on the concept of a more extended initial aortic arch procedure to reduce late aortic complications.

The “frozen elephant trunk” operation offers the possibility to treat the ascending aorta, the aortic arch and the proximal descending aorta in a one-stage procedure. Open antegrade stent grafting of the true lumen of the downstream aorta promotes thrombosis of the false lumen of the proximal descending aorta resulting in an improved perfusion of the true lumen and shrinkage of the false lumen. This hybrid technique not only has its value in the first operation, but in particular in redo-arch operations after failed initial repair.

The video presents the case of a 58-year-old male patient, who developed a pseudoaneurysm at the distal anastomotic site and a chronic dissection of the aortic arch with a diameter of 7 cm, 1-year after limited operation of an acute type A aortic dissection. The operative technique includes auxiliary artery cannulation, moderate hypothermia (26°C), bilateral aortic clamp, perfusion with balloon-occlusion of the left subclavian artery and open antegrade stent grafting of the true lumen of the proximal descending aorta. The “collar” of the Evita-open hybrid prosthesis (Jotec, Hechingen, Germany) was anastomosed to the proximal descending aorta, thereby occluding the large false lumen.

Supra-aortic vessels were re-implanted into the prostheses using the island technique. The proximal anastomosis was performed just above the sinotubular junction. Due to this very complex redo operation, antegrade cerebral perfusion time was 90 minutes. Despite that fact, postoperative recovery was uneventful and the patient could be discharged from hospital 12 days after the operation.

In conclusion, the frozen elephant trunk procedure is extremely helpful to overcome complex anatomical situations in redo aortic arch surgery after limited operation for acute type A aortic dissection.

Techno College – Development of a simple reusable stabiliser for OPCAB

Murali Vettath Malabar Institute of Medical Sciences, Kollam, India

Over the past two decades, beating heart surgery (off-pump coronary artery bypass [OPCAB]) has evolved to become a definitive surgical technique with which to perform coronary artery bypass grafting (CABG) for patients with coronary artery disease (CAD). At present, <5% of centres worldwide perform 100% of their CABG’s without the pump. Another 10% of centres are able to perform nearly 98% of their CABG’s off pump.

With the aim of performing all our CABG’s without the heart-lung machine, we have so far invented, fabricated, modified and developed several novel devices, equipment and techniques to help us achieve this. These include: Vettath’s anastomotic obturator (patented in 2008); Vettath’s blower and blower/mister; a modified aorto-coronary shunt; Vettath’s technique of long mammary patch; modified use of the intra-aortic balloon pump (IABP) in OPCAB; and a re-engineered technique of OPCAB. Despite all these advances, it was still necessary to use either the Octopus® (Medtronic, MN, USA) or the Acornat system (Maquet, Rastatt, Germany) for performing OPCAB. Previously, we had attempted to develop a similar stabiliser, which though successful, was still not cost effective because it was disposable; it was made of plastic and had to be replaced after a few uses.

For this reason, the challenge was set to develop our own indigenous reusable metallic stabiliser, to enable us to reduce, reuse and recycle the stabilisers used for OPCAB, thereby reducing our carbon footprint. The design we came up with is a simple metallic stabiliser with a similar suction pod to the type commercially available that can be changed if needed.

This stabiliser is made of a curved, metallic hollow tube, with a screw, which tightens a small metal piece (locking rod) in front of it. This small metal piece with a scooped end in front, in turn rotates the ball end of the U-shaped suction pod. The pod, when placed parallel to the coronary artery to be grafted, stabilises the part of the heart on which surgery is to take place. The stabiliser rod is in turn tightened on a vertical metal stand (2 inches in length) with a screw, which is fixed to the sternal spreader with another screw. The sternal spreader is also modified in such a way that the vertical metal stand can slide on to it and be tightened at any point along the spreader rail.

We have used this stabiliser on more than two hundred patients consecutively over the past six months, and have been able to perform OPCAB on all types of patients without any problems. In conclusion, this stabiliser was found to be stable, steady and reusable, like any metallic instrument. It will therefore definitely reduce the carbon footprint and the escalating cost of surgery that would result from using hundreds of disposable stabilisers.

Techno College – Personalised external aortic root support

Tal Golesworthy Member of the Energy Institute and Member of the Royal Society of Chemistry

The perspective from the sharp end of a scalpel – that is from the patient perspective – is necessarily different from that of the surgeon. When Tal Golesworthy discovered that his Marfan syndrome involved aortic dissection and that he was facing root replacement surgery, after the initial shock, he was told that the subsequent operation and the slow acceptance of this reality, he set about finding a better solution. As a research and development engineer, putting together an appropriate team and project wasn’t too much of a problem but he needed help from the medical professional and was fortunate in meeting Professor Tom Treasure. With his introduction to the medical and producing the ExoVasc® PEARS device, the following steps were done:

- Imaging the aorta (to acquire dimensional data)
- CAD modelling the aorta (to generate a 3D computer model)
- Converting the CAD model into a physical model of the aorta (using 3D printing to produce a manufacturing former)

So what is different about the PEARS approach? The principal problem with congenital connective tissue disorders, such as Marfan syndrome, is the reduced strength of fibrillin-deficient tissues. In vascular tissues, particularly the ascending aorta, this renders them liable to dilating permanently with the repetitive internal pressure loading. When aortic dilatation reaches limits dictated by size, rate of change of size and family history, surgery is indicated. Conventionally, the aortic root is replaced either by a composite graft (Total Root Replacement, TRR) or a valve sparing graft (Valve Sparing Root Replacement, VSRR). However, aside from the need for cardiopulmonary bypass, both of these approaches have drawbacks. TRR requires a lifetime of anticoagulant therapy and VSRR is associated with a high incidence of subsequent valve failure and a need for reoperation. It was these drawbacks that led Tal Golesworthy to suggest a better approach – that of providing an external support, tailored to fit the exact shape of the patient’s aortic root. In developing and producing the ExoVasc® PEARS device, the following steps were done:

- Specifying and producing a biocompatible material that takes its shape from the manufacturing former to produce the finished implant

As the principal engineer and first patient, Tal Golesworthy is proud to point out that, 11 years after his ground-breaking surgery, he and those who have followed him have a dimensionally stable aortic root, a fully functional aortic valve, and a quality of life that is the envy of many of who have had root replacement surgery.
A novel external stent for saphenous vein grafts

INTRODUCING THE NEW CAPIOX FX® ADVANCE OXYGENATOR – ENHANCED FLOW DYNAMICS AND EXPANDED PATIENT RANGE

First launched in 2008, the CAPIOX FX Oxygenator pioneered a fully integrated arterial filter. Integrating the arterial filter into the oxygenator fiber bundle housing facilitates removal of gaseous and solid emboli without increasing the oxygenator’s priming volume. Compared to a conventional circuit with a separate arterial line filter, the CAPIOX FX significantly lowered priming volume and foreign surface area contact, helping to minimize the entire perfusion circuit.1 Smaller perfusion circuits are essential to patient blood conservation and reducing homologous blood transfusions in cardiac surgery patients.2,3 Built around Terumo Cardiovascular Group’s integrated arterial filter with self-venting technology, the CAPIOX FX helps reduce hemodilution, preserving the patient’s hemoglobin and oxygen delivery (DO2). Studies have shown that reducing hemodilution with a low prime volume oxygenator, by as little as even 150 mL, is associated with fewer blood transfusions and reduced risk of post-operative Acute Kidney Injury.4–7

The CAPIOX FX Oxygenator is available in different sizes, allowing clinicians to choose the optimal oxygenator and reservoir combination based on the patient’s size and metabolic needs, a concept known as Prescriptive Oxygenation.8 Independent researchers have documented the CAPIOX FX15’s contributions to helping clinicians reduce prime volume and lower hemodilution, leading to fewer blood transfusions and reduced hospital costs.9 Building on the success of the CAPIOX FX Oxygenator, Terumo Cardiovascular Group is pleased to announce the introduction of the CAPIOX FX Advance Oxygenator.

Advancements include an increased blood flow rate on the 3,000 mL reservoir – available on the CAPIOX FX15 Advance Oxygenator – and a lower minimum operating level on the 4,000 mL reservoir – available on the CAPIOX FX15 and FX25 Advance Oxygenators. The new CAPIOX FX Advance Oxygenator is currently pending CE Mark and is expected to be available for sale in Europe within a few months.

For further information, please visit us at the Terumo booth # 3.21 in Hall 3 and register for Terumo’s Perfusion Product Theater from October 4–6, 2015, Elicium Building, Room 408, 4th floor.

References
Introducing
CAPIOX® FX Advance Oxygenator
With Integrated Arterial Filter and Hardshell Reservoir

Enhanced flow dynamics.¹
Expanded patient range.

Patients come in all shapes and sizes — so do CAPIOX FX Oxygenators. Now, you can expand the use of CAPIOX FX Oxygenators through the enhanced flow dynamics¹ offered on the CAPIOX Advance Hardshell Reservoir.

Choose the oxygenator that expands your options. Choose the CAPIOX FX Advance Oxygenator.

Terumo Cardiovascular Group

Attend Terumo’s Perfusion Product Theater
4-6 October 2015, Elicitum Building, Room 408, 4th Floor

Visit Hall 3, Booth# 3.21
and learn about our new CAPIOX® FX Advance Oxygenator

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Reference: Internal testing
CE Mark Pending

TERUMO
Suturing on annulus.

Pericardium treatment.

Making commissures.

New aortic valve.

Figure 1. The surgical procedures involved in the Aortic Valve Neo-Cuspidization (AVneo) with autologous pericardium.

Figure 2. Freedom from re-operation and overall survival using the Aortic Valve Neo-Cuspidization (AVneo) with autologous pericardium procedure.

Figure 3. The OZAKI VRec Sizer™

OZAKI’s Autologous Pericardium Aortic Valve Neo-Cuspidization and OZAKI VRec Sizer

OZAKI’s Autologous Pericardium Aortic Valve Neo-Cuspidization and OZAKI VRec Sizer

We have performed the AVneo in almost 900 patients over the past 8 years, and teams in other countries have already done longer than the native valve. The elongated coaptation zone warrants the minimised postoperative aortic insufficiency. Of course, anti-coagulation is not necessary because there is no stent or any prosthesis left in the circulation system.

We have performed the AVneo in almost 900 patients over the past 8 years, and teams in other countries have already done approximately 500 cases. The overall outcome of this procedure is remarkable, as shown in Figure 2. The rate of freedom from re-operation reached 98.3% for the 765 cases whose longest follow-up is close to 100 months; this rate is 99.0% for patients below 60 years of age. Quite recently, a few hospitals in the US have started the Ozaki procedure and the short-term outcomes are equally excellent in all cases, proving the reproducibility of this operation.

This surgery is also very promising in the paediatric and congenital fields. While most of the 900 cases in our hospital are elderly patients, we have confirmed the good mid-term outcomes for patients who are in their teens to 30s or 40s. At the Boston Children’s Hospital (Boston, MA, USA), a 23-month-old child with an annular diameter of less than 13 mm was treated successfully with the procedure. Although mid- to long-term outcomes in paediatrics is not yet clear, AVneo may be a good substitute for the Ross procedure or other aortic valve repairs, whose long-term outcomes are not always satisfactory.

Cost-efficiency is another appealing feature of the Ozaki procedure. A cost-effectiveness analysis conducted in Japan revealed that the in-hospital cost of AVneo is reduced by approximately US$8000 (per case) compared with that of conventional AVR. Savings are much more when the unnecessary of anti-coagulation is taken into account. Reproducibility is particularly important in any surgical technique; therefore, we developed a set of propriety sizing and moulding devices, OZAKI VRec Sizer™ (Figure 3). This device is now registered and marketed as a medical device in the US, Japan, Europe, China and South Korea by the JOMDD, Inc. (Tokyo, Japan). Appropriate training for the Ozaki procedure is also necessary. High definition video clips, and other procedural instructions are available at http://ozaki-proc.com/en/, and a drylab training model is on sale. All of these materials will contribute to better reproducibility for many surgeons.

Dr Pettersson from the Cleveland Clinic (Ohio, USA), said “Up to 75% of the conventional surgical AVR could be replaced by this procedure if these excellent outcomes are maintained for a couple of more years.” The AVneo, the Ozaki procedure, may shift the paradigm of treatment for aortic valve diseases in the near future.

Coffee Reception for Residents

The Surgical Training and Manpower Committee (STMP) will host a coffee reception for all residents on Monday 5th October at 12:45–14:00 in room F002.

The aim of the meeting is to inform you about the activities of the STMP, both at the Annual Meeting and throughout the year.

We will also be looking for new members to join us and we will announce new vacancies for which residents can apply.

Furthermore, we will inform you about resident’s associations across Europe and their needs and explore how we can collaborate.

Peyman Sardari Nia
Cardiac defects

Cardiac defects, either congenital, acquired or iatrogenic, warrant effective and often rapid closure. Currently, open surgery remains the standard approach, but minimally invasive (catheter-based) strategies offer a potentially alternative with less surgical time and faster recovery periods. Intracardiac septal defects are the most common congenital defects in the young. The gold standard treatment is transcatheter closure using a system that requires cardiopulmonary bypass, which can increase exposure to pump-related complications.

Multiple transcatheter metallic occluder devices exist, but have inherent limitations of cardiac erosion, conduction system block and thrombus formation owing to their bulky and permanent nature. Biodegradable, hydrophobic light-activated adhesives represent an attractive alternative to sutures, but lack a specifically designed minimally invasive delivery tool, which limits their clinical translation.

We developed a catheter-based device that enables closure of congenital, and acquired, cardiac wall defects by deploying a biodegradable elastic patch, activating a photoco-curable adhesive and thereby attaching the patch to achieve closure of the defect site in a minimally invasive manner. The device uses a fibre optic system and reflective metallic coating to uniformly dispense UV light for activation of the adhesive. The concept is that UV light is delivered via an internal optical fibre to a reflective balloon where it is reflected onto a patch, precoated with photoco-curable adhesive, to affix the patch to the tissue prior to removal of the device. The functional components of the device include a reflective distal balloon fixed on an inner shaft and a proximal stabilising balloon on an intermediate shaft. All components can be loaded into an outer shaft. An optical fibre, connected to a UV source at one end, and a specifically designed conical tip for optimal light dispersion at the other, is housed in the inner shaft, and can be advanced into the inner lumen until the tip is located in the distal balloon. The reflective distal balloon has an outer layer that allows temporary suture-based attachment of a patch/adhesive system to the balloon, ensuring the patch unfolds with the balloon and can be released from the system in situ. All components are soft and can be deflated and loaded into the outer catheter shaft for delivery.

The procedural steps are as follows: i) the catheter is delivered through the defect, ii) the patch is released by pulling back the open suture loop connecting the patch to an outer membrane on the reflective balloon, iii) the distal and proximal balloons are sequentially deployed, iv) a UV source is turned on to activate the photoco-curable adhesive coated on the proximal side of the patch, and v) both balloons are fully deflated and removed from the body. In the last step, the distal reflective balloon is retrieved through a four-leaflet valve in the patch, leaving the patch adhered to the tissue. Each shaft can be connected to an ergonomic handle, which allows coupling and uncoupling of shafts, and enables volume-controlled inflation and deflation of the balloons via a syringe. In a small animal (rat) model with a miniaturised device we showed that inflammation was mild, and equivalent to suture-based patch attachment. In an in vivo porcine model, a 6 mm ventricular septal defect in a beating heart was reduced to <2 mm. With this device we have also demonstrated ex vivo and in vivo closure of tissue defects in the abdomen and stomach. This new therapeutic platform has broad utility in a vast range of clinical scenarios that warrant minimally invasive and non-traumatic repair of hard-to-reach defects, and could represent a paradigm shift to biodegradable, elastic materials from suture-based or metallic device-based closure of intracardiac defects.

Techno College – The right internal thoracic artery stump as a systematic graft inflow source for the aorta no-touch technique

Techno College – A catheter-based technology for minimally invasive atraumatic repair of intracardiac defects with light

A technique for better brain preservation in myocardial revascularisation: the right internal thoracic artery stump as a systematic vein graft inflow source for the aorta no-touch technique

A B

Figure 1. Black arrows point to the proximal anastomosis between the vein graft and the right internal thoracic artery (RITA) stump. The white arrow indicates the free RITA sutured end-to-side with left ITA in a Y configuration. With increasing experience, complete opening of the upper part of the pericardium was not required and the aorta was not even seen during the operation. The follow-up was completed in all patients by reviewing their hospital charts. Mean age of the patients was 64±6.9 years, and no hospital mortality, stroke or re-exploration occurred. The median number of grafts was 3, and no new interventions were required in this cohort.

Figures currently available for brain derangement after heart surgery are fairly inaccurate. A recent study performing postoperative magnetic resonance imaging has revealed that new brain infarcts after CABG are markedly more frequent than clinically evident stroke, reaching 27.6% of the operated patients, and most of the lesions were clinically silent. The long-term aftermaths of the induced cerebral damage is unknown as yet, and the introduction of strategies to reduce this high incidence is needed without delay.

The top end of vein grafts attached to the ascending aorta have poor long-term patency rate, likely due to the exposure of the suture line to direct pressure and circulatory stress from the ascending aorta. Conversely, recent evidence demonstrates that the SVG used as a composite graft based on the in situ LITA shows a patency rate comparable with that of ITA grafts, where exposure to the nitric oxide released from the in situ ITA plays a vital role.

The current fierce debate on whether on- or off-pump surgery is superior is extramyocardial and not constructive. Both techniques bear proper indications and therefore should be seen as complementary rather than antagonistic. Therefore, an additional benefit to patients is attained if the surgeon and staff master the two techniques, and henceforth they must be trained in both.

In conclusion, the proximal RITA stump is a logical and straightforward vein graft inflow source, avoiding handling of the aorta, theoretically granting further protection against neurological complications and stroke. Widening the experience of this and including more patients should bring additional information. Thus, a multicentre trial is warranted for making possible this goal.

Techno College – The right internal thoracic artery stump as a systematic graft inflow source for the aorta no-touch technique
Rapid deployment with the Edwards Intuity Elite bioprosthesis: MIAVR reoperations made simpler?

Tommaso Danesi Hinna, Loris Salvador, San Bortolo Hospital, Vincenza, Italy

Optimal application of new devices typically evolves naturally with time and experience. Yet despite the advantages of rapid deployment (or sutureless) valves, including ease of implantation, fast learning curves and the associated reduction of procedural times, clear-cut indications remain broadly undefined.

As Minimally Invasive Aortic Valve Replacement (MIAVR) requires easily implantable devices, rapid deployment devices are especially suitable for UHS and RAT videothoracoscopic surgery; in our view, potentially one of the more interesting applications is for redo-MIAVR patients.

Indeed patients undergoing redo-MIAVR due to a failed conventional stented, stentless or full root prosthesis, often require lengthy procedures, with a high risk of injury during debridement especially in small calcified annuli or during the removal of degenerated aortic root stentless bioprostheses. In these challenging cases RDAVR could prove the difference.

We report herein our first two implants of an Edwards INTUITY Elite valve in complex redo-MIAVR.

The first patient was a 55-year-old male with systemic and pulmonary hypertension, HCV chronic infection and persistent AFib. The patient underwent AVR in 2006 for severe AR and a 29 mm Toronto SPV (St. Jude Medical, Minneapolis, MN) bioprosthesis was implanted. In 2015, the patient underwent a minimally invasive upper J-resterotomy due to the recurrence of severe AR due to post-endocarditis with perforation of the non-coronary leaflet and a peak pressure gradient (PPG) of 37 mmHg.

Externally the aortic root was heavily calcified with massive mediastinal adhesions; the valve had a fully calcified root, and severe fibrosis with a perforation of the non-coronary cusp. After leaflet excision, a 23 mm EDWARDS INTUITY Elite valve was easily implanted. Aortic cross clamp and CPB time were 57 and 117 minutes respectively. The patient was weaned from CPB with minimal inotropic support. Postoperative TEE showed no PVls and low gradients. The patient was extubated after 5 hours of AMV. Inotropic agents were suspended after 6 hours. ICU stay and hospital stay were 2 and 9 days respectively. No transfusions were needed.

The second patient was a 57-year-old male affected by systemic hypertension. In 2009 the patient underwent AVR for severe AR due to aortic root enlargement; at that time a 25 mm homograft was implanted. In 2015, the patient presented with a severe calcific degeneration of the homograft and underwent a minimally invasive upper J-resterotomy with a 21 mm EDWARDS INTUITY Elite. Aortic cross clamp and CPB time were 62 and 113 minutes respectively. No inotropic agents were needed. AMV time, ICU stay and hospital stay were 3 hours, 1 and 6 days respectively.

These two cases demonstrate how the prosthetic choice at the time of the first and second operation is crucial. The classical surgical approach would have required a redo-Bentall procedure with a higher grade of surgical complexity and risk.

Rapid deployment bioprostheses demonstrated to be safe and suitable for redo-MIAVR patients, allowing performing fast and efficient reoperation in a safe minimally invasive fashion.

In our experience redo-MIAVR has finally become “minimal” for patients and “simpler” for surgeons.

Expert opinions, advice and all other information expressed represent contributors’ views and not necessarily those of Edwards Lifesciences.
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Edwards Lifesciences devices placed on the European market meeting the essential requirements referred to in Article 3 of the Medical Device Directive 93/42/EEC bear the CE marking of conformity.

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Transcatheter aided surgery to face the challenge of mitral annular calcification in mitral surgery – a brave new world

Christoph Huber, Bettina Langhammer, Thierry Carrel
Bern University Hospital, Swiss Cardiovascular Center, Bern, Switzerland

Large circumferential mitral annular calcifications (MAC) remain a major surgical obstacle in mitral valve surgery. Even for very experienced surgical hands, applying various skillful techniques like pericardial patch annulus reconstruction, atrial sliding and plication to bridge the calcified annulus, or direct annular reconstructions – in MAC surgery reaches its limits. Expanded indications and off-label use of transcatheter techniques have given rise to changed treatment modalities. Valve-in-valve implantation in degenerated aortic and mitral tissue valves or valve-in-ring implantations in the mitral and tricuspid position became easy to learn transcatheter techniques, increasing the armamentarium of treatment modalities (Figure 1). A translational approach was used when, in 2012, an 81-year-old lady presented with combined mitral disease and severe circumferential MAC. Only during surgery could the massive extent of MAC really be appreciated and operating surgeon, Thierry Carrel, decided to implant a SAPIEN XT transcatheter aortic valve implantation (TAVI) device. Via the left atrium and under full cardiopulmonary support, mitral valve balloon annuloplasty was performed, initially using a 20 mm balloon, followed by a 24 mm Osypka balloon, which enabled implantation of a 26 mm XT valve. Extreme care was taken to clip the valve in the appropriate (transapical) direction onto the Ascendra+ delivery system (Figure 2) and the tip of the delivery catheter was cut to ease the intra-annular device positioning. Finally, the 26 mm XT valve was deployed under direct visual control (Figure 3). Although digital evaluation confirmed the correct implantation and stable anchoring within the annulus, additional anchoring sutures of the prosthesis to the atrial tissue were placed at the level of the commissures and at the mid-P2 portion of the annulus using non-cautized right atrial tissue. Due to pre-existing atrial fibrillation, left atrial appendage exclusion and pulmonary vein ablation was performed concomitantly. Encouraged by the excellent immediate and medium-term clinical outcome this procedure was performed in three further patients. In the follow-up, no adverse events were reported and echocardiographic evaluation confirmed a good valve function in all four patients (all NYHA class II).

At this European Association for Cardio-Thoracic Surgery (EACTS) meeting our group will present the mid- to long-term outcomes of the worldwide first open TAVI device implantations in MAC. We will focus on technical considerations, as well as how to avoid pitfalls, drawing on our experience of this transcatheter-aided surgery to master challenging mitral valve operations in MAC.

Reference
**Video guided sutureless aortic valve replacement**

In the past 10–15 years minimally invasive cardiac surgery has rapidly developed. In the treatment of mitral valve disease, the right anterior mini-thoracotomy has progressively been reduced to key-hole access. Consequently the surgical approach in experienced centres has become completely video-guided. With aortic valve disease, minimally invasive approach started with partial sternotomy and then moved to right anterior thoracotomy. Video-thoroscopically minimally invasive aortic valve surgery is an excellent choice for patients requiring minimally invasive approaches, or patients with comorbid conditions such as COPD, obesity, osteoporosis or in fragile patients not reaching the inclusion criteria for transcatheter aortic valve implantation.

Using sternal sparing to reduce surgical trauma results in faster recovery after surgery, a lower need for transfusions, and fewer perioperative complications. In the Western world most mitral surgery consists of in valve repair whereas aortic valve surgery in the elderly is usually valve replacement. Aortic valve replacement by standard stented prosthesis in a minimally invasive fashion is typically associated with longer cross clamp and CPB times. These elements reduce the advantages of the minimally invasive approach.

In our centre we’ve applied our experience of minimally invasive mitral valve surgery to the aortic valve position. Independently of the underlying pathology, standardizing the sequence of the operative manoeuvres has become key for successful results. We do not perform any additional preoperative assessment, including CT scans, for the majority of patients undergoing minimally invasive surgery. The completely video-guided approach allows us to operate on aortic valve even if it is in left sided position. The patient lays supine with a 30° elevation of the right shoulder in order to facilitate the insertion of ports, and to extend the intercostal spaces. A single lumen on-tracheal intubation is achieved. CPB in our minimally invasive surgery strategy is performed through a peripheral cannulation with surgical exposure of the femoral artery through a small skin incision and counter-lateral percutaneous femoral venous drainage. A mini, right-sided, thoracotomy (about 4 cm) in the 2nd or 3rd intercostal space is performed with soft-tissue reflector placement; two 5 mm ports are made to place the 30° thoracoscope with CO2 insufflation and the left atrial/ventricle venting line, and a 3rd port is made for a Chitwood clamp.

Aortic cross clamps, under video-thorascoposcopic vision, anterograd Custodiol® cardioplegic solution is given directly into the aortic root or selectively in the coronary cula after incision of the ascending aorta. Accurate excision of native aortic leaflets and annular decalcification is made to achieve a smooth and regular annular surface to reduce the risk of paravalvular leaks. A precise bioprosthesis sizing is mandatory. In normal, non-dilated ascending aorta, or preferably when the aortic diameter is small, we implant a sutureless bioprosthesis, while in mildly dilated aorta our choice is to implant a rapid deployment bioprosthesis. The two bioprostheses are implanted following the usual techniques recommended by the manufacturers. When the aorta and the aortic annulus are anatomically

favourable, the use of a sutureless bioprosthesis over a rapid deployment bioprosthesis, is a matter of personal choice for the surgeon. Reduced aortic cross-clamp time and CPB time are the main advantages that have become evident for the patient, while the minor need for sutures have made the bioprosthetic implant less difficult for the surgeon.

Video-thorascopically minimally invasive surgery is a technique that provides real benefits to the patients in centres with specific experience. The development of sutureless and rapid deployment bioprostheses has made minimally invasive aortic surgery even easier and safer. Good results are now more apparent in particular groups of patients.

**Hypertrophic obstructive cardiomyopathy**

H Bjursten | Skane University Hospital, Lund, Sweden

Hypertrophic obstructive cardiomyopathy (HOCM) and other forms of septal hypertrophy is an underserved condition in cardiac patients. It has been estimated that 1 in 5000 from HOCM globally, which translates to 1.5 million people in Europe and the United States. At the same time only 5–10,000 patients undergo surgery for this condition annually due to the lack of a simple and effective treatment.

Patients with HOCM have septal hypertrophy, which is defined as a thickening of the septum from a normal 6–10 mm to up to 25–30 mm. This thickening leads to an outflow obstruction of the left ventricle, requiring the heart to work harder to maintain blood pressure and cardiac output. When severe, the condition decreases a patient’s cardiac output and physical strength and increases the likelihood of death prematurely from heart failure. Physicians currently have two modalities for treating septal hypertrophy: surgical myectomy and Alcohol Septal Ablation (ASA). While both procedures reduce symptoms and increase the heart’s work capacity, surgical myectomy shows far better results in terms of survival, pacemaker implantation rate, and repeat procedures. The main disadvantage of surgical myectomy compared with ASA is the invasiveness of the procedure and the subsequent risk of complications. The Septuslus technology was developed to accomplish septal myectomy less invasively and in a more controlled manner. It is performed through a transapical or transaortic approach, allowing the surgeon to resect the septum of a beating heart. The technology permits a controlled sequential resection of hypertrophic tissue, with continuous monitoring of resected volume by transesophageal echocardiography and continuous measurement of pressure gradient. The device has undergone testing in live animals with good results. Based on these animal tests, the Septuslus technology appears to offer the effectiveness of surgical myectomy, but with the less invasiveness, rapid recovery, and lower cost of ASA. The technology should result in fewer complications and better control of the amount of tissue removed from the heart than either surgical myectomy or ASA. With a new and less invasive technology, large groups of patients that previously were not treated according to guidelines can now be offered a procedure.

**Techno College – Septuslus a novel device for minimally invasive treating hypertrophic cardiomyopathy**

A novel transcatheter repair device for treatment of tricuspid regurgitation

Azeem Latiff | San Raffaele Scientific Institute & EMD-GEFCentro Cuore Columbus, Milano, Italy

Functional Tricuspid Regurgitation (TR) is the most common aetiology of severe TR in the Western world.1 The prevalence of functional TR with mitral valve disease is ~30%,2,3 with some studies suggesting over 1.6 million patients in the US may currently be suffering from this disease.4 Only 8000 undergo tricuspid surgery annually and consequently a large number of patients remain untreated, while a growing number of studies suggest that severe TR is associated with a poor prognosis.4,5 Compared with patients with no, or mild, TR the one year survival changes significantly with no, or mild, TR the one year survival changes significantly with no, or mild, TR the one year survival changes significantly with no, or mild, TR the one year survival changes significantly with no, or mild, TR the one year survival changes significantly with no, or mild, TR the one year survival changes significantly with no, or mild, TR the one year survival changes significantly with no, or mild, TR the one year survival changes significantly with no, or mild, TR the one year survival changes significantly with no, or mild, TR the one year survival changes significantly.

Interest in treatments for the tricuspid valve has increased in recent years with the recognition of the impact of TR on outcomes and the benefits of tricuspid repair. Conservative management of FTR includes optimisation of right ventricle preload and afterload with diuretics and angiotensin-converting enzyme inhibitors. Severe FTR is usually corrected at the same time as left-heart surgery. Mitralign Inc has designed a system to perform percutaneous suture annuloplasty of the tricuspid annulus to treat functional tricuspid regurgitation. The procedure replicates a surgical procedure first described by Kay which involved suture plications of the posterior annulus to stabilise and to reduce the annulus area in order to restore the tricuspid valve function.

The procedure utilises catheters and wires to deliver a pair of surgical pledged sutures across the tricuspid annulus at the septal/posterior and the posterior/anterior commissure. The implants are then plicated together to perform an annuloplasty of the posterior tricuspid annulus. To date, 9 procedures have been performed in non-surgical candidates, with excellent safety results. The goal for the company is to commence a European CE Mark trial in 2015 with strict inclusion and exclusion criteria, in order to demonstrate the safety and efficacy of the device.

**References**

Cardio-circulatory dysfunction is frequent in paediatric cardiac patients after cardiac surgery. This challenging situation is multifactorial but typically of cardiogenic origin, due to pump dysfunction: ischaemia-reperfusion injuries, myocardial swelling, cerebral oedema, arterial pressure waveform analysis may be useful in selected scenarios, but they have significant restrictions and lack reliability in certain patient populations.20 Current developing technologies aim to provide more advanced, sensitive, specific and consistently reliable, early information about tissue oxygenation, micro- circulation and the development of scores through the use of big data. As take-home messages, it may be meaningful to recognize that more tests or tools do not necessarily mean better diagnosis, that the less invasive the tools the better, and that trends matter more than absolute values.

References

Techno College – Congenital Session 2: Supportive management

Update on haemodynamic monitoring in paediatric cardiac patients

Eduardo M da Cruz  Children’s Hospital of Colorado, Denver, CO, USA

Cardio-circulatory dysfunction is frequent in paediatric cardiac patients after cardiac surgery. This challenging situation is multifactorial but typically of cardiogenic origin, due to pump dysfunction: ischaemia-reperfusion injuries, myocardial swelling, cerebral oedema, arterial pressure waveform analysis may be useful in selected scenarios, but they have significant restrictions and lack reliability in certain patient populations.20 Current developing technologies aim to provide more advanced, sensitive, specific and consistently reliable, early information about tissue oxygenation, micro-circulation and the development of scores through the use of big data. As take-home messages, it may be meaningful to recognize that more tests or tools do not necessarily mean better diagnosis, that the less invasive the tools the better, and that trends matter more than absolute values.

References

Techno College – Acquired Cardiac: Atrioventricular valves (mitral plus tricuspid)

Matta Glauber Centro Cardiochirurgia Sant'Ambrogio – Centro Cardiochirurgia Sant'Ambrogio

Minimally invasive mitral valve repair for complex bilaefular disease using a new 3D ring

Minimally invasive mitral valve surgery (MIVS) has shown excellent postoperative outcomes in terms of mortality and morbidity as well as patient satisfaction, providing faster recovery, fewer blood transfusions, less wound infection and shorter hospital stays. Despite these results, traditionalists have claimed that MIVS is technically more demanding, has a longer learning curve and reduces the chances of mitral valve repair in favour of mitral valve replacement, especially in the presence of complex mitral valve disease. In the setting of degenerative mitral regurgitation, several studies and my own group have demonstrated the high success rate of mitral valve repair and a high freedom from reoperation at 10 years, even for those patients with mitral valve Barlow disease. Whatever the type of approach, the rules for mitral valve repair for degenerative mitral valve regurgitation are: 1. Preservation or restoration of normal motions for both leaflets; 2. Stabilization of the mitral apparatus using a prosthctic ring; 3. Creation of a large surface of coaptation. Despite the ‘French correction’ still being widely performed among surgeons, in recent years the concept of ‘respect rather than reset’ has become very popular based on the use of artificial PTFE mitral chordae. This technique may correct the prolapsed area of the mitral valve and restore the surface of coaptation. However, the high success rate of mitral valve repair in complex cases is not compromised, and the technique will be definitively standardized the ‘respect rather than reset’ technique, further facilitating the minimally invasive mitral valve approach.

Bibliography

Techno College – Congenital Session 1: Surgical management

Course topics
1. Fallots tetralogy
2. Double outlet right ventricle
3. Truncus arteriosus
4. Total anomalous pulmonary venous return and anomalous venous drainage
5. Atrioventricular septal defect both partial, and complete and complex
6. Mitral and tricuspid valve disease
7. Left ventricular outflow tract and aortic valve disease
8. Vascular rings, coartation of the aorta and interruption of the aortic arch
9. Transposition of the great arteries
10. Complex transposition and congenitally corrected transposition
11. Univentricular heart – neonatal palliation, including hybrid approach
12. Univentricular heart – staged palliations, bidirectional Glenn, Fontan

A wetlab will be held on the final day. This 4-day course aims to provide an update on surgical and medical management of children with congenital heart diseases. The main objective is to provide interactive teaching on the specific forms of congenital heart disease by renowned experts in the field. The course is divided into 12 modules, each covering one of the major types of congenital heart disease. Each module consists of a keynote presentation on the management of the specific form of congenital heart disease being focused on, followed by a clinical discussion about individual cases and live-in-a-box surgery. The keynote presentation will elaborate on the anatomy, nomenclature, principles of perfusions, diagnostic tools, and principles of surgical and non-surgical treatment of the specific congenital heart disease. Clinical discussion will involve, joint conferences with cardiologists, where the patient is comprehensively presented, different treatment pathways are outlined, and finally a treatment decision is made. More than 30 live-in-a-box high-quality surgical videos will cover all practical aspects of surgical management. In a wetlab, hands on training of different techniques of aortic valve reconstruction and right ventricular outflow tract construction will be provided.

Date/duration: 27–30 October 2015 (4 day course)
Location: Windsor, UK
Course Director: V Hraska, Sankt Augustin
Programme Committee: V Hraska, Sankt Augustin, Germany M Kostolny, London, UK M Danton, Glasgow, UK J Photiadis, Berlin, Germany R Cesnjevar, Erlangen, Germany M Helvind, Copenhagen, Denmark O Ghez, London, UK
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Cardiopulmonary bypass (CPB) has revolutionized cardiac surgery since its introduction to clinical practice in the mid-1900s.1 Despite the undisputed clinical benefits of CPB, the potential detrimental perioperative risks such as hemodilution, gaseous and fat microemboli (GME), and homologous RBC transfusions, must not be underestimated.2 The evidence-based literature shows the positive correlation between introduced risks and adverse patient outcomes—such as neurological disorders and acute renal failure—which often result in longer ICU and hospital length of stay and/or higher mortality rates.3

Another critical factor in patient outcomes is the perfusionist, whose role has significantly expanded. In addition to operating the heart lung machine (HLM), perfusionists must monitor and interpret vital patient parameters from multiple devices in complex clinical situations during extracorporeal circulation.

Sorin Group is the only cardiac surgery company that offers a comprehensive, innovative, integrated solution for CPB perfusion management, addressing all aspects of extracorporeal support—The Sorin HEARTLINK™ System. This advanced platform integrates: the Sorin SS™ HLM; the Sorin INSPIRE™ adult oxygenator; the CONNECT™ perfusion data management system; XTRAx™ autotransfusion system; the new FlexTherm™ heater-cooler; and the GDP Monitor—an optional software function of CONNECT that allows monitoring and trending of metabolic parameter variations according to the goal-directed perfusion (GDP) principles of Marco Ranucci et al.

The Sorin HEARTLINK System integrates the following components:

- **INSPIRE** with a low dynamic operating volume (DOV), proven to help maintain a high hematocrit throughout the case as demonstrated during Ranucci M et al. recent studies.3,4
- **CONNECT** recording application, which enables the automatic and recording of all relevant parameters during perfusion, freeing perfusionists from manual paper charting duties. Customizable reports, statistical tools and the ability to interface with equipment present in the OR, makes CONNECT a useful tool for research and post-case analysis to improve clinical practice.

- **HEARTLINK** card that links CONNECT and INSPIRE to enable the GDP Monitor function and allow instant transfer of detailed INSPIRE data and other perfusion tubing systems (PTS) components to support traceability and reduce the need for manual input. These capabilities directly improve quality standards for medical electronic recordings.
- **GDP Monitor** to enable implementation of a Goal-Directed Perfusion strategy. Real-time patient metabolism parameters are enabled, including continuous monitoring of oxygen delivery and several other critical patient metabolic parameters. Using Goal-Directed Perfusion principles, the perfusionist can increase the pump flow to compensate for a low hematocrit or limit hemodilution to raise the hematocrit to achieve oxygen delivery goals.
- **XTRA**, an innovative, intuitive and fast autotransfusion system offering a valuable alternative to homologous transfusion in addition to potential cost savings when RBC transfusion is needed to increase oxygen delivery.

The Sorin HeartLink™ System represents a fully-integrated approach to perfusion to improve patient outcomes and increased clinical efficiency through the intuitive and innovative design of its individual components and their effective, seamless interaction.

Find out more at Sorin Group Booth 3.15

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**References**


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**Techno College – Acquired Cardiac: Atrioventricular valves (mitral plus tricuspid)**

Mitral bridge implantation in a patient with functional mitral regurgitation

Cardiopulmonary bypass (CPB) has revolutionized cardiac surgery since its introduction to clinical practice in the mid-1900s.1 Despite the undisputed clinical benefits of CPB, the potential detrimental perioperative risks such as hemodilution, gaseous and fat microemboli (GME), and homologous RBC transfusions, must not be underestimated.2 The evidence-based literature shows the positive correlation between introduced risks and adverse patient outcomes—such as neurological disorders and acute renal failure—which often result in longer ICU and hospital length of stay and/or higher mortality rates.3

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- **HEARTLINK** card that links CONNECT and INSPIRE to enable the GDP Monitor function and allow instant transfer of detailed INSPIRE data and other perfusion tubing systems (PTS) components to support traceability and reduce the need for manual input. These capabilities directly improve quality standards for medical electronic recordings.
- **GDP Monitor** to enable implementation of a Goal-Directed Perfusion strategy. Real-time patient metabolism parameters are enabled, including continuous monitoring of oxygen delivery and several other critical patient metabolic parameters. Using Goal-Directed Perfusion principles, the perfusionist can increase the pump flow to compensate for a low hematocrit or limit hemodilution to raise the hematocrit to achieve oxygen delivery goals.
- **XTRA**, an innovative, intuitive and fast autotransfusion system offering a valuable alternative to homologous transfusion in addition to potential cost savings when RBC transfusion is needed to increase oxygen delivery.

The Sorin HeartLink™ System represents a fully-integrated approach to perfusion to improve patient outcomes and increased clinical efficiency through the intuitive and innovative design of its individual components and their effective, seamless interaction.

Find out more at Sorin Group Booth 3.15

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**References**

Course overview

This course aims to teach the indications, techniques and follow-up of minimally invasive and open surgery in pectus deformities, alternative treatments for pectus deformities, chest wall resection and reconstruction techniques in chest wall diseases, the surgical techniques in thoracic outlet syndrome. As well as learning the treatment options in sternal dehiscence.

The programme will include a combination of both high level interactive discussion and lectures delivering theoretical knowledge.
Stentless bioprosthetic valves, first introduced in the late 1990s, represented a major change in valve design and performance, with reported superior hemodynamic properties compared to stented valves due to lower pressure gradients and reduced turbulence in the aortic sinuses. The Sorin Group Solo Smart®, launched in Europe in 2013 and now available to U.S. surgeons, represents the first and only valve with a removable stent to be approved in the U.S. market. Surgeons will appreciate the removable nickel-titanium alloy stent that sets this valve apart from all others. Following implantation, the Solo Smart becomes an entirely stentless valve. Made from bovine pericardium, this unique valve has no synthetic material added, allowing it to mimic the healthy native aortic valve. By aligning to the patient’s annulus with a 100 percent orifice-to-annulus ratio, Solo Smart maximises blood flow and delivers excellent hemodynamic performance while providing the ease of implantability of a stented valve.

Having conducted the first U.S. implant of the Solo Smart at St. Vincent’s Heart Hospital in Indianapolis in 2014, I was able to directly experience the ease of implantation, with only a single suture line required. Most striking about this device is that it so closely resembles a native aortic valve in appearance and performance, offering optimal hemodynamics and the opportunity to dramatically improve patients’ lives.

Clinical evidence supporting individual surgeon experiences includes: a prospective North American trial by Heimansohn et al., the results of which were used to obtain Solo Food and Drug Administration approval; March 2015 published results from a prospective multicenter study of 804 patients by Grubitzsch et al. that showed beneficial survival, morbidity and clinical status outcomes with Solo Smart up to three years following surgery; and research from Thalmann, et al. that followed 277 patients out to five years with 100 percent freedom from structural valve deterioration. Individual surgeon experience coupled with the early clinical evidence and outcomes data represents an important and significant step forward in the treatment of aortic valve disease.

Find out more at Sorin Group Booth # 3.15

References


2. Koster R, grazie to the management of atrial fibrillation by catheter ablation; J Am Coll Cardiol 2008;52:324–33.


Redefining the risk of reoperation with valve-in-valve procedures

Vinayak (Vinnie) Nilkanth Bapat
Cardiovascular Directorate, Guys and St. Thomas’ Hospital, London

Transcatheter heart valve (THV) therapy has now established itself as one of the treatment options for patients with aortic stenosis. Confidence in this technology has led to its use in novel indications, such as in the treatment of a degenerated bioprosthetic surgical heart valve (SHV). During the past 5 years, multiple reports of valve-in-valve (VIV) procedures have appeared in the literature, with substantial experience acquired in treating degenerated SHV in aortic position and increasing experience in mitral, tricuspid and pulmonary positions.

Initial experience was limited to two devices – the Sapien/Sapien XT (Edwards Lifesciences Ltd, Irvine, CA, USA) and CoreValve/Evolute (Medtronic Inc., Minneapolis, MN, USA). During early clinical experience, the focus was on implanting the THV device in the correct position but it became obvious that there are unique problems associated with VIV therapy, such as increased gradients (especially in small size SHVs), risk of coronary artery obstruction and malposition including embolisation. Availability of newer devices, which can be repositioned and retrieved, and the ability to assess the possibility of complication before release of the device, has become a reality and will reduce the incidence of complications.

Clinical and bench research has provided excellent guidance for VIV because the success of a VIV procedure is based on the correct identification of the surgical valve, choosing the correct size of the transcatheter aortic valve implantation (TAVI) valve and its subsequent accurate placement. VIV aortic and VIV Apps are now available to address the majority of clinical situations.

Experience with VIV procedures has now been widened to newer indications, such as failed stentless valves, failed mitral repairs, failed tricuspid repairs and mitral annular calcification (MAC). Owing to the nature of device size and delivery system, only the Sapien THV platform has been used for these indications. Mitral VV and VR can be associated with left ventricular outflow tract obstruction and delayed embolisation. This can also be an issue with Sapien in MAC. Sapien THV is balloon expandable and once deployed cannot be retrieved and repositioned. However, recently Lotus THV (Boston Scientific, MA, USA) has been used to treat failed SHV and rings in Mitral position. Lotus THV can be deployed fully and results assessed before release. The valve can be repositioned for optimal position and can even be retrieved fully if the result is unsatisfactory. Similar experience with another THV platform (Direct Flow, CA, USA) has now been reported. Although these new indications, and the use of new devices, are promising, we have to be cautious and understand the strengths and limitations of this expanding therapy area.

Techno College – Acquired Cardiac: Transcatheter aortic valve implantation/aortic valve

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Agenda

Saturday 3 October
Techino College
08:00 Transcatheter aortic valve implantation/aortic valve replacement: new valves and devices – current and future perspectives Auditorium
10:15 Avoiding disasters in cardiac surgery Auditorium
16:00 Joint Session EACTS SBCOV PASCaTS – Cardiac surgery in the emerging economies: the evolving management strategies Auditorium
10:15 Minimally invasive surgery for lung cancer: up-to-date debates Auditorium
14:15 Meet the experts in robotic cardiothoracic surgery Auditorium
16:00 TNM classification: 8th edition Auditorium

Sunday 4 October
Professional Challenge
08:15 Challenges in mitral valve repair Auditorium

Focus Session
08:15 Safer surgery for who? G104+G105
10:15 Quality improvement E106+E107
10:15 Safer surgery for who? G104+G105
13:45 Women in cardiac surgery F003
13:45 Quality improvement programme update F002
13:45 Basic science – heart G109
10:15 Basic science – lung G109

Abstract Rapid Response
10:15 Transcatheter aortic valve implantation versus surgical aortic valve replacement E102
13:45 Aortic valve substitutes: the long-term view E102

Plenary
12:00 CanBetter: optimising training programmes in cardiothoracic surgery Auditorium

Postgraduate Education
08:15 Perfusion Forum
08:15 Nurse and nurse physician postgraduate programme E108
13:15 Update on the results and rationale and design of ongoing clinical trials Auditorium
13:45 Extracorporeal life support devices and strategies for management of acute cardiopulmonary failure G104+G105
08:15 Pneumonectomy controversies: what is the problem? E104+E105
10:15 Management of oesophageal perforations E104+E105
13:45 Management of acquired tracheal disorders: from stenosis to laceration E104+E105
08:15 Update on hypoplastic left heart syndrome management G106+G107
10:15 Update on Tetralogy of Fallot with pulmonary valve atresia at the great arteries/abdominal collateral arteries G106+G107
13:45 Meet the experts G106+G107
14:45 Surgical film session G106+G107
08:15 Basics in proximal thoracic aortic surgery: session 1 G102+G103
10:15 Basics in proximal thoracic aortic surgery: session 2 G102+G103
13:45 Outcome and follow-up after major thoracic aortic surgery: session 3 G102+G103
14:45 Thoraco-abdominal aneurysms revisited: session 4 G102+G103

Monday 5 October
Professional Challenge
08:15 A lifetime living with transposition of the great arteries – part I G106+G107
10:15 A lifetime living with transposition of the great arteries – part II G106+G107
08:15 Arch involvement in acute aortic dissection: a surgical challenge EACTS/STS G102+G103
10:15 Uncertainties in the treatment of chronic dissection EACTS/STS G102+G103
08:15 Wire skills for the surgeon Auditorium
10:15 Wire skills for the surgeon Auditorium

Focus Session
10:15 Avoiding disasters in cardiac surgery E106+E107
10:15 Meet the experts Emerald Room
14:15 Coronary artery bypass graft is on the rise, don’t give it up Auditorium
14:15 Infectious problems E106+E107
10:15 Transcatheter aortic valve implantation: current and future perspectives E104+E105
14:15 Joint session EACTS SBCOV PASCaTS – Cardiothoracic surgery Auditorium
16:00 Fast-track management E104+E105
16:00 Live-heart team of complex pathologies Auditorium
16:00 Transcatheter mitral valve replacement: new valves and experiences G104+G105

Abstract
08:15 Heart transplantation in the modern era Forum
08:15 Endocarditis: a continuous dilemma G104+G105
08:15 Risk models in coronary surgery E104+E105
08:15 Work in progress Emerald Room
10:15 Left ventricle – strategies in left ventricular modulations Forum
10:15 Aortic valve replacement: what is new? G104+G105
10:15 Cardiac general E104+E105
10:15 Basic science 1 G109
14:15 Future of sutureless valves Forum
14:15 Challenges in surgical aortic valve replacement G104+G105
14:15 Basic science 2 F002
16:00 The two faces of arterial revascularisation Auditorium
16:00 Results of Ross procedures and homografts in aortic surgery E106+E107
08:15 Thoracic oncology I: staging E103
08:15 Non-oncology I E108
10:15 Thoracic oncology II: peroperative management E103
14:15 Mediastinum E108
16:00 Fontan circulation G106+G107
14:15 A broad view on acute dissection G102+G103
16:00 A 4D view of the aortic root G102+G103

22 Saturday 3 October 2015
Tuesday 6 October

**Professional Challenge**

08:15 Less invasive procedures for complex patients  
08:15 Less invasive procedures for complex patients  
08:15 Aortic valve disease and heart failure: how do they connect?  
10:15 Acute extracorporeal support and mechanical circulatory assist  
10:15 Is minimally invasive cardiac surgery the present and the future of mitral valve repair?  
10:15 Perioperative complications in cardiac surgery  
10:15 Nightmares in cardiothoracic surgery  
14:15 Pilots and passengers after cardiac surgery: so you want to fly again?  
14:15 Challenging the options for younger patients: minimising long-term risks with biological valves along the patient journey  
14:15 Pre-operative planning, simulation, 3D printing and intra-operative navigation in cardiothoracic surgery  
16:00 Aortic valve replacement: ever had any problems?  
16:00 Better outcomes through optimising international normalised ratio management and anticoagulation in aortic valve replacement  
16:00 A contemporary approach to the aortic valve and aortic root  
14:15 Guidelines  
14:15 Infections and chylothorax  
08:15 Inflammatory and infectious aortic disease: a difficult environment  
14:15 Arch repair  
16:00 A contemporary approach to the aortic valve and aortic root  

**Abstract**

08:15 Current challenges for extracorporeal life support  
08:15 Native and prosthetic valve endocarditis: an update  
08:15 Revisiting the tricuspid valve  
10:15 Functional mitral regurgitation  
14:15 Optimising outcomes in coronary surgery  
14:15 Left ventricular assist device: Latest advances  
14:15 Degenerative mitral regurgitation  
16:00 What is new in transcatheter aortic valve implantation  
16:00 Case reports and videos  
08:15 Thoracic oncology III: Postoperative follow-up  
08:15 Thoracic non oncology II  
10:15 Session case report  
10:15 Lung transplantation  
14:15 Basic science and education  
16:00 Chest wall  
08:15 Tetralogy of Fallot  
10:15 Valve surgery  
16:00 Congenital miscellaneous  

**Abstract Rapid Response**

08:15 How to perform an effective surgical atrial fibrillation ablation  
14:15 General cardiac  
16:00 New technology in mitral surgery  
10:15 Innovation and new strategies in thoracic aortic surgery  

**Plenary**

11:50 Presidential Address  
10:15 EACTS Cardithoracic Masters Jeopardy  
12:45 All you need to know for your next research project – part I  
14:15 How to statistically analyse your next research project  
16:00 Endoscopic port access mitral valve repair  
10:15 Innovation and new strategies in thoracic aortic surgery  
16:00 New technology in mitral surgery  
14:15 Left ventricular assist device: Latest advances  
14:15 Degenerative mitral regurgitation  
16:00 What is new in transcatheter aortic valve implantation  
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08:15 Tetralogy of Fallot  
10:15 Valve surgery  
16:00 Congenital miscellaneous  

**Wednesday 7 October**

**Advanced Techniques**

09:00 Controversies and catastrophes in adult cardiac surgery  
09:00 A future without suture  
09:00 Advance technique session on multiple arterial grafting  

**Focus Session**

09:00 Learn from the experts how to do it? With live in a box  

**Wetlab**

09:00 Learn from the experts how to do a remodelling or a re-implantation procedure  
09:00 Mitral valve repair  
10:30 Learn from the experts how to do a remodelling or a re-implantation procedure  
09:00 VATS lobectomy  
09:00 AV reconstruction and Senning  

**Abstract**

09:00 Video session  

**Key**

Cardiac  
Thoracic  
Congenital  
Vascular  
Plenary
Transcatheter mitral valve implantation with the Tendyne TMVI device. An apically tethered device for the treatment of mitral regurgitation

Mitra regurgitation (MR) is a leading cause of valvular heart disease. Although conventional mitral valve surgery is the gold standard, as many as 49% of patients with severe MR may not undergo conventional surgery.1 Following on from the successful roll-out of transcatheter aortic valve replacement (TAVR), there have been some recent reports of transcatheter mitral valve implantation (TMVI).2-4 This communication introduces the Tendyne (Roseville, Minnesota) TMVI system.

The Tendyne TMVI device is a trileaflet porcine pericardial valve sewn onto an apically tethered, self-expanding nitinol frame (Figure 1). The valve is designed to fit the anatomically complex mitral annulus and can accommodate a wide range of sizes. The outer stent is D-shaped, which helps seat the valve in relation to the aortic-mitral continuity. The tether stabilises the device, passing through the ventricular myocardium where it is fixed to an epicardial pad. The device can be retrieved and/or repositioned intraoperatively, even after full deployment.

A total of 15 patients with either degenerative/primary or functional/secondary MR have been treated with the Tendyne TMVI system (TMVI investigators). All patients were deemed to be at high or extreme risk for conventional mitral valve surgery and had symptomatic severe MR. All patients had no or trivial paravalvular leak. The in-hospital outcomes of an apically tethered device. Moat N, Duncan A, Lindsay P, et al. Transcatheter mitral valve repair/replacement for the treatment of mitral regurgitation: a single centre experience. J Am Coll Cardiol 2015;65:1231–43.

The complex pathoanatomy of the mitral valve will present a much more difficult challenge for TMVI compared with TAVI. All the devices with early clinical experience have their advantages and disadvantages, and much work remains to be done before TMVI becomes a viable therapeutic alternative to surgical valve repair/replacement. However, the RH1 experience with this system is a very promising beginning. Stabilisation by means of an apical tether is a novel way to attempt to minimise the risk of device migration, left ventricular outflow tract obstruction and paravalvular leakage. The unique design features of this device also offer the potential for it to be useful across a wide range of mitral valve pathologies.

References

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Surgical treatment of heart failure

Date: 18–20 November 2015. Location: Windsor, UK

The programme will include highly interactive lectures, video presentations and practical demonstrations. This course is aimed at consultant surgeons engaged in the management of patients with end-stage heart disease. Key learning objectives are to understand:

- the principles underlying the mechanical support of the heart
- how to manage very sick and unstable patients
- how to avoid and how to manage complications arising from mechanical support
- how to build a programme in your own unit and develop a successful team from all specialities

Full details regarding the programme and registration can be found via the EACTS Academy website – www.eacts.org/academy/courses/surgical-treatment-of-heart-failure

The surgical treatment of lung and heart failure courses will run consecutively in Windsor, UK.

A specially discounted fee is available for delegates wishing to attend both.

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### 2015 Courses

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<td>27–30 October</td>
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<td>Mitral valve surgery</td>
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<td>Surgical treatment of lung failure</td>
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<td>Surgical treatment of heart failure</td>
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<td>Endoscopic port-access mitral valve repair drylab training using high-fidelity simulators</td>
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<td>Advanced course on anatomic correction of ccTGA</td>
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<tr>
<td>Endoscopic port-access mitral valve repair drylab training using high-fidelity simulators</td>
<td>17–18 December</td>
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All courses to take place at EACTS House in Windsor, UK, unless stated otherwise.
The duties and responsibilities of perfusionists have changed significantly over the past decade, expanding from basic management of extracorporeal circulation to multiple responsibilities demanding a more automated, integrated approach to data management. Today’s perfusionist is charged with managing numerous physiological parameters during cardiopulmonary bypass (CPB), including anticoagulation, blood gas, metabolism, hemofiltration and blood flow along with manual case recording and incident reporting.

The concept and process of electronic data management was driven forward in part by the Perfusion Downunder Collaboration (PUDC) formed in 2005: PUDC established a multicenter, perfusion-focused database aimed at achieving a set of quality indicator (QI) goals (glucose levels, arterial outlet temperature, blood gas levels) through structured benchmarking, providing a platform for quality improvement of perfusion practice.

This foundational research project led to an emphasis on reducing transcription errors, minimizing bias reporting, and greater focus on the patient and circuit. The PUDC collaborative dataset now provides ongoing clinical research support through continuous improvement in efficiency, traceability and best practices to improve outcomes and facilitate optimal patient management.

Further research by Ottens et al.iii directly comparing automated data collection to manual recording of the perfusion record demonstrates that rigorous measurement of CPB quality indicators (QI)—facilitated by electronic data management—creates the opportunity for the perfusionist to improve adherence to care guidelines through access to performance data. Several heart-lung machine (HLM) electronic charting and data management systems are evolving to meet increasingly complex clinical, regulatory and safety challenges. As Newland et al. described in their 2006 paper, automated data collection systems can minimise transcription errors and bias, and these systems also positively and powerfully influence procedural quality control.

One of the most advanced systems available to meet these challenges is the Sorin CONNECT™ electronic perfusion data management system. Launched on world basis in 2013, this system presents the perfusion community with an automated alternative to manual data recording, providing valuable support and assistance during and after cardiac surgery. The Sorin CONNECT electronic charting system is a robust combination of hardware and software tools, including a recorder application that enables collection of all clinical and patient data during CPB cases. The system’s capabilities include being able to rapidly import hundreds of HLM and other device values, thus improving the frequency and quantity of data documentation, potentially improving outcomes.

Looking forward, electronic data collection and management for CPB procedures represents an enormous opportunity for tracking, analysis and achievement of QI goals, as well as for improving patient care and procedural outcomes.

**Find out more at Sorin Group Booth # 3.15**

**References**


**Techno College – Acquired Cardiac: Transcatheter aortic valve implantation/aortic valve**

**Transcatheter transcatheter aortic valve implantation**

In actual fact, it is reserved mainly for patients with contraindications to femoral access and/or for whom a transapical or a direct aortic route is not preferred (chest radiation, previous mastectomy, respiratory insufficiency, poor ejection fraction). Another indication is for patients who are morbidly obese, since the neck is usually exempt from fat and femoral access can be a source of haematomas and lymphoceles in these patients.

Transcatheter transcatheter aortic valve implantation can be performed either under local or general anesthesia, which represents an added value compared with other invasive routes requiring general anesthesia.

Preoperative work-up includes an echo Doppler of the cervical vessels as well as a CT of the cervical vessels and a cranial CT.

An adequate diameter of the common carotid vessel is required (6–7 mm according to the valve model chosen), as well as minimal vessel tortuosity and the absence of calcifications. Either left or right carotid can be chosen, but the left carotid artery usually offers a more direct approach. Cranial CT should search for previous ischaemic lesions. Finally echo Doppler or MRI can be performed to assess the patency of the circle of Willis.

After making a small incision two fingers above the sternal notch in the right or left side, the common carotid artery is easily exposed and controlled with vessels loops. The artery is punctured under direct vision and a small introducer is placed to allow for valve valvuloplasty. Only then a valve introducer sheath is punctured under direct vision and a small introducer is placed to easily exposed and controlled with vessels loops. The artery is

![Figure 1. Preoperative CT scan shows direct access to the aortic valve via the left carotid artery](image1)

![Figure 2. Left carotid approach with placement of the valve sheath through a counter incision](image2)
Surgical outcomes for acute type A aortic dissection with aggressive primary entry resection

Yosuke Inoue
National Cerebral and Cardiovascular Center, Osaka, Japan

Acute type A aortic dissection (AAAD) remains a challenging and fatal emergent disease with extremely poor prognosis without surgical therapy. There is still no consensus about the ‘ideal surgical therapy’ for AAAD. Although primary entry resection is an important principle, the operation itself could be too invasive due to aggressive primary entry resection. Since the implementation of the frozen elephant trunk (FET) technique, FET has been widely used to achieve the primary entry closure or the downstream false lumen thrombosis. The FET is applied not only to total arch replacement, but also to hemiarch replacement. However, concerns still remain regarding the FET such as long-term outcomes without primary entry resection or postoperative paraplegia.

Since 2000, we have routinely performed the aggressive primary resection for 334 AAAD repairs without FET. We retrospectively reviewed the outcomes of these patients. The mean age was 67±13 years (range, 20–95). Ninety-five patients (28%) presented with shock vital status and 84 patients manifested malperfusion of branched arteries. The proportion of the DeBakey classification were type I 69%; type II 21%; retrograde dissection 8.7%; and unknown 1.3%. The hospital mortality rate was 8.4% (28/334) for all cases, 5.2 % (16/309) in cases without preoperative cardiopulmonary arrest (CPA) status and 44% (12/25) in cases with preoperative CPA status. Ninety-five percent of patients underwent primary entry resection, 173 patients underwent hemiarch replacement and 161 underwent total arch replacement. Concomitant procedures were root repair in 38 (11%) and CABG in 22 (6.6%). Prolonged ventilation time (>72 h) was required for 106 patients (32%), tracheotomy in 28 (8%), and newly permanent haemodialysis in 7 (2%). No spinal cord injury was found. Postoperative contrast CT angiography was done in 91% (304/334) of patients and revealed 57% (173/304) of patients had thrombosed false lumen.

The mean follow-up time was 46±44 months with a follow-up ratio of 97% (323/334). The survival rate was 81% at 3 years, 74% at 5 years, and 65% at 10 years after surgery in all patients. Freedom from dissection-related downstream aortic reoperation rate was 89% at 3 years, 86% at 5 years, and 80% at 10 years.

The frequency of downstream aortic reoperation in patients with patent false lumen was significantly higher than in patients with thrombosed false lumen.

Surgical outcomes for acute type A aortic dissection with the aggressive primary entry resection were satisfactory. Even though FET was not used in this series, thrombosed false lumen was achieved in a relatively high proportion (57%) of patients, who significantly avoided downstream aortic reoperation other than those with a patent false lumen. Ideally, a randomised study would be helpful to answer the question whether a more aggressive approach, like our strategy, should be adopted or not. However, we should be aware that use of FET to effect the primary entry closure and downstream false lumen thrombosis without entry resection might pose both operative and endovascular potential risks.
Early and mid-term results of no-touch aorta multi-vessel small thoracotomy versus conventional off-pump coronary artery bypass grafting: a propensity score matched study

The invasiveness of coronary artery bypass grafting (CABG) remains considerable and has not been reduced in over 40 years. Various minimally invasive methods for myocardial revascularisation have been developed, including minimally invasive multi-vessel small thoracotomy (MVST-CABG), totally endoscopic CABG and hybrid myocardial revascularisation; however, as these methods are in the process of becoming established, basic comparative studies of immediate and long-term results are a matter for future research. The present study is a comparative analysis of early and mid-term results of no-touch aorta MVST-CABG and conventional off-pump CABG (OPCABG). From 2007 to 2014, a total of 396 patients underwent CABG: MVST-CABG – 219 patients, and OPCABG – 177 patients. Patients in the MVST-CABG group had lower body mass index, greater left ventricular ejection fraction, smaller average number of diseased coronary territories and less complexity of coronary disease (SYNTAX score). Propensity score computer (nearest-neighbour) matching using caliper widths equal to at least 0.2 of standard deviation of the logit of the propensity score was performed to correct for and minimise selection bias. Covariates that affected treatment assignment and/or the outcome were included in the propensity score model: age, body mass index, left ventricular ejection fraction, left ventricular mass, left ventricular end diastolic volume, number of diseased coronary territories, EuroSCORE, SYNTAX score, preoperative haemoglobin level and preoperative creatinine level. A total of 304 patients were successfully matched in two groups of 152 patients.

In group 1 the minimally invasive CABG strategy was directed to perform multi-vessel arterial revascularisation via the left small thoracotomy on the beating heart with the aortic no-touch technique. In group 2 conventional OPCABG was performed via median sternotomy (aortic no-touch technique or aortocoronary bypass). Criteria for inclusion were multi-vessel coronary artery disease, II–IV Canadian Cardiovascular Society functional class of angina and patients at 1 month after acute myocardial infarction. Exclusion criteria were previous CABG, single vessel disease and need for emergency revascularisation.

Significant differences were found between the MVST-CABG and OPCABG groups, respectively, in intraoperative blood loss – 220 (180, 300) mL versus 400 (300, 550) mL (p = 0.039); first 24 hour postoperative blood loss – 220 (150, 350) mL versus 370 (200; 570) mL (p = 0.034); operation time – 352 ± 74.4 min versus 289.3 ± 55.0 min (p = 0.001); median time to return to full physical activity – 14 (7; 21) days and 58 (42; 77) days (p = 0.001); rate of wound infection – 2.6% and 7.9% (p = 0.040); and physical health component of the SF-36 health status survey – 51.5 (45.2; 52.6) versus 51.5 (45.1; 50.0) (p = 0.012). The mean follow-up duration in the MVST-CABG and OPCABG groups was 39.7 ± 15.5 months and 47.6 ± 21.3 months, respectively. At the 3-year postoperative follow-up (Figure 1) no significant differences were observed in rates of cumulative mid-term survival (log-rank test, p = 0.876; HR: 1.12, 95% CI: 0.35 to 3.56, p = 0.847) and freedom from major adverse cardiac and cerebrovascular events (log-rank test, p = 0.996; HR: 1.12, 95% CI: 0.48 to 2.62, p = 0.796).

In conclusion, MVST-CABG is as safe as OPCABG and is associated with less wound infection, perioperative blood loss and time to return to full physical activity and greater improvement in physical-health-related quality of life. MVST-CABG can be applied to the majority of multi-vessel patients, saving the effectiveness during mid-term follow-up. The present study has several limitations. Firstly, it was retrospective. Secondly, in the MVST-CABG group total arterial revascularisation was performed in 94.0% of patients and the aortic no-touch technique was used in all patients versus the OPCABG group, which could have an influence on postoperative results. Finally, long-term follow-up is ongoing and comparative long-term results concerning survival rate, quality of life, frequency of major cardiovascular events and bypass patency are needed.

Table. Operative characteristics and early postoperative results

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>MVST-CABG (n=152)</th>
<th>OPCABG (n=152)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average number of distal anastomoses</td>
<td>290±15</td>
<td>300±15</td>
<td>0.662</td>
</tr>
<tr>
<td>Operation time, min</td>
<td>352±47.4</td>
<td>289±56.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Intraoperative blood loss, mL</td>
<td>220 (180; 300)</td>
<td>400 (300; 550)</td>
<td>0.039</td>
</tr>
<tr>
<td>First twenty-four hours postoperative blood loss, mL</td>
<td>220 (150; 300)</td>
<td>370 (300; 570)</td>
<td>0.034</td>
</tr>
<tr>
<td>Transfusion of blood and/or derivatives</td>
<td>17 (11.2)</td>
<td>28 (18.4)</td>
<td>0.076</td>
</tr>
<tr>
<td>Postoperative ventilation time, hours</td>
<td>4.0 (3.0; 11.5)</td>
<td>5.5 (3.0; 15.0)</td>
<td>0.536</td>
</tr>
<tr>
<td>Intensive care unit stay, hours</td>
<td>18 (16.5; 21)</td>
<td>22 (16.5; 28)</td>
<td>0.457</td>
</tr>
<tr>
<td>Nave onset atrial fibrillation</td>
<td>18 (11.8)</td>
<td>27 (17.8)</td>
<td>0.146</td>
</tr>
<tr>
<td>Wound infection</td>
<td>4 (2.6)</td>
<td>12 (7.6)</td>
<td>0.040</td>
</tr>
<tr>
<td>Superficial wound infection</td>
<td>4 (2.6)</td>
<td>9 (5.9)</td>
<td>0.156</td>
</tr>
<tr>
<td>Deep wound infection</td>
<td>2 (1.3)</td>
<td>3 (2.0)</td>
<td>0.082</td>
</tr>
<tr>
<td>Postoperative pneumonia</td>
<td>10 (6.6)</td>
<td>8 (5.3)</td>
<td>0.627</td>
</tr>
<tr>
<td>Stroke</td>
<td>–</td>
<td>1 (0.7)</td>
<td>0.317</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>1 (0.7)</td>
<td>2 (1.3)</td>
<td>0.562</td>
</tr>
</tbody>
</table>

Tissue scaffold technologies may be the answer to repairing damaged hearts

Tissue scaffold technology started with the father of modern mitral valve repair, Alain Frederic Carpentier when he used a glutaraldehyde-fixed bovine pericardium to repair a heart valve in the 1960s. However, in recent years, stem cells have come to the fore in many clinical studies as a promising treatment for repair. Many animal studies have demonstrated the ability of stem cells to affect repair of damaged tissues, including heart muscle after infarction. Results from such models have shown some efficacy, but the technology has some way to go before it is considered an established solution.

Meanwhile, tissue scaffold technologies have been improving for several decades now, providing highly biocompatible tissue products, with low toxicity, limited calcification, good durability and the ability to remodel when implanted in the body. New products such as CardioCel® have shown postoperative remodelling. Data suggests that this remodelling occurs through the action of native stem cells and vascularisation, with scaffolds being repopulated with these cells followed by remodelling over time. Animal studies have shown how next-generation tissues can offer advantages over current industry standards. For example, CardioCel® used to repair sheep mitral and pulmonary valves shows, seven months after implant, highly functional and normal valves. Total aortic valve reconstructions with Cardiocel® in a sheep model demonstrated complete surface endothelialisation, new collagen formation, and infiltration of native cells without any calcification of the scaffold after 6 months. These next generation tissue products provide a better repair path forward, at least until stem cell treatments come of age. Given the initial evidence for products like CardioCel® and autologous regeneration around these tissues, it may be that cellular therapies like stem cells will not be needed after all and better patient outcomes could be achieved with these new types of tissue scaffolds which allows normal repair and tissue regeneration.
Your Tissue Solution.

CardioCel® is a single-ply bioscaffold that remains functional, durable and free from calcification for all your tissue needs.

Please visit **booth #2.51** to experience the CardioCel difference.

The only tissue product you need for your broad spectrum of surgical procedures.

Patented ADAPT® Tissue Engineering Process
- Detoxification & Sterilization = 0 Aldehydes
EuroSCORE II and SYNTAX score to evaluate coronary artery bypass grafting outcomes

Table 1: Four groups stratified by EuroSCORE II and SYNTAX score

<table>
<thead>
<tr>
<th>Group</th>
<th>EuroSCORE II</th>
<th>SYNTAX</th>
<th>SYNTAX</th>
<th>SYNTAX</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;1.45</td>
<td>n=93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>&gt;1.45</td>
<td>n=103</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>&gt;1.45</td>
<td>n=125</td>
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</tr>
</tbody>
</table>

Figure 1.

Minimally invasive coronary surgery in third world countries

The public health system in third world countries is completely different from that of developed countries, most don’t include Cardiac Surgery, and therefore most patients die without any assistance. Cardiac surgeons are under huge pressure not only to produce good results but also to find a way to reduce costs, in order to increase the number of operations, sometimes creating foundations to collect funds for this purpose. After the 1992 economic and political crisis in Venezuela, we established Fundacard, a charity institution to help patients with limited economic resources, and, at the same time, to improve the techniques and technologies of the surgical team. We organised seven workshops with life surgeons inviting prominent surgeons to learn new techniques and many of our team members were also trained abroad with the same intention. In order to decrease costs, we started a ‘Fast Track Protocol’ in 1993, extubating patients in the operating room and reducing the length of hospital stay. Afterwards we were trained in ‘Off-Pump’ coronary artery by-pass surgery to further reduce the surgical budget. In this way we significantly increased the number of patients, doubling the number of operations. By 1998 we averaged 100% off-pump coronary artery by-pass surgery and improved our fast track protocol. With the same motivation we then started a ‘Midcab’ programme for single patients, doubling the number of operations.

By 1998 we averaged 100% off-pump coronary artery by-pass surgery in third world countries, always following some recommendations:
1. Must be implemented gradually.
2. Appropriate training for the surgical team.
3. Initiate with proctor assistance.
4. Backup from experienced centres.

However, the use of this new technique must never put under more risks the patient’s life, the primary endpoint is not the price of the surgery, but the results. Our experience in more than 2000 patients has demonstrated the feasibility of this procedure associated with a lower cost program, at a low risk.

Vascular – Abstract: A broad view on acute dissection

Acute type a dissection in octogenarians: does emergency surgery impact long-term survival?

From January 2008 to December 2014, 371 patients had elective open repair of ChAD. Mean age was 60.2 years and 79.0% were male. In total, 100 (27.0%) patients were chronic type A dissection; 64 patients had undergone hemi-arch replacement, and 23 total arch replacement emergently. Thirteen patients had received other treatment. A total of 271 (73.0%) patients were chronic type B dissection, and the majority received optimal treatment initially. Descending thoracic aortic repair (DTAR) was performed in 220 cases (59.3%) and thoraco-abdominal aortic aneurysm repair (TAAR) in 151 cases (40.7%). Of TAAR, Crawford extent II repair were 25.6%. During the same period, no patient underwent TEVAR as primary treatment for descending aorta, and no patient underwent hybrid procedure for thoraco- abdominal aorta. We used left heart bypass in 196 cases of DTAR, and 147 cases of TAAR, and deep hypothermia and circulatory arrest (DHCA) in 23 cases of DTAR. In TAAR, DHCA was none. A cerebral spinal fluid drain was placed for 155 (41.8%) patients preemptively (in 10 cases of DTAR and 145 cases of TAAR).

Overall, major adverse outcomes (including in-hospital death, tracheostomy, paraplegia, new dialysis at discharge) occurred in 13.2%. Operative mortality was 3.5%. In-hospital mortality was 6.5%. Spinal cord deficits (paraplegia and paraparesis) occurred in 5.1% patients.

Comparing the latter half (2012–2014) with the first half (2008–2011) of the study population by year, these rates have generally decreased in both DTAR and TAAR (Figure 1). The operative mortality has improved from 2.0% in DTAR and 9.6% in TAAR during the first half of the term (2008–2011) to 1.7% and 1.5%, respectively in the second half (2012–2014). Mean follow-up was 16.6 months. During the follow-up period, 12-, 36-, 60-months survival was 90.4%, 88.5%, and 88.5%, respectively. Re-intervention for pseudo-aneurysm formation was necessary in 2.2%. During the follow-up period, contrast agent use is not mandatory. Our open surgery of ChAD had acceptable early outcomes and improvements are apparent over time. Our surgical low intervention rates. These results should be compared with those of evolving approaches including endovascular and hybrid repairs.
Ten-year follow-up after minimally invasive left anterior descending revascularisation

Candidate was patients with isolated LAD disease (MIDCAB group) in whom a PCI was not advisable (type B and C lesions) or not possible (occluded LAD); patients with LAD disease and multivessel disease with lesions that should not be treated anyway for small diameter, diffuse disease, irreversible ischaemic damage or distal hypoplasia, or patients with multivessel disease in whom CPB had a presumed high morbidity (cancer, severe renal failure, diffuse cerebrovascular disease) and MIDCAB was performed as a palliative procedure (MIDCAB and optional medical therapy (OMT)); and patients with LAD disease and a second vessel disease that could be treated by PCI before or after surgical treatment and evaluation of residual ischaemia (Hybrid group, HCR). The total surgical procedure time was 91±12 min. No conversion to CPB was necessary due to haemodynamic reasons. No ventilatory fibrillation occurred. The perioperative (30 days) mortality was 0.7%.

A 10-year follow-up was completed for 97.6% of patients. Actuarial overall survival at the 5-year follow-up was 82.6% (95% CI: 79.1%–86.1%) and at 10 years was 70.6% (95% CI: 67.5%–73.7%). Kaplan–Meier analysis for cardiac-related mortality at 5 years was 88.4% (95% CI: 84.7%–92.1%) and at 10 years was 75.5% (95% CI: 69.9%–81.1%). freedom from MACCE at 5-years was 84.2% (95% CI: 79.1%–89.7%) and at 10-years was 75.5% (95% CI: 69.1%–81.3%). Moreover a comparison between the two propensity-matched groups of multivessel disease patients (HCR versus MIDCAB+OMT) surprisingly showed no significant differences in both survival and MACCE, with an obviously higher target vessel revascularisation rate in the HCR group. MIDCAB is a safe revascularisation option with excellent short- and long-term results. MIDCAB should be considered as a valuable strategy both for LAD complex lesions alone and also in MVD patients, having lower invasiveness than conventional surgery. Moreover in the HCR group, patients with LAD complex coronary lesions should take advantage of LIMA-LAD revascularisation, ensuring a long-term duration in terms of graft patency, reducing the SYNTAX score when due to LAD lesions, and lowering target vessel revascularisation rate and cardiac adverse events when compared with PCI.

As a surgeon involved in minimally invasive techniques, I think we must make MIDCAB more accessible to all cardiac surgery centres as a major determinant for wider diffusion of the hybrid revascularisation strategy.

References
A novel technique of harvesting bilateral internal thoracic arteries under direct vision via left small thoracotomy in MICS CABG

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In this article we introduce novel techniques of bilateral internal thoracic artery (BITA) harvesting under direct vision in minimally invasive coronary artery bypass grafting (MICS CABG). Preoperatively, we routinely examine the length and diameter of the BITA with enhanced computed tomography (CT). Patients are positioned in an approximately 30-degree right lateral decubitus position. An 8-10 cm left thoracotomy is made on the fifth intercostal space (ICS) below the left nipple. A Thorotrak Retractor (Medtronic Inc., MN, USA) is used to retract the ribs and is pulled in a cephalad and rightward direction with an additional Kent Retractor. The mediastinal space is dissected beneath the sternum with an electrocautery until the right lung is visible. The right internal thoracic artery (RITA) is identified above the right lung, which is depressed using an Octopus NUVO Stabilizer (Medtronic Inc.) that is inserted via a 1 cm subxiphoid incision. We avoid entering the right pleura to prevent the protrusion of the right lung that interferes with RITA harvesting. A 5 mm surgical port is inserted into the fifth ICS 5 cm away from the incision. A 32 cm high-type harmonic scalpel (Ethicon Endo-Surgery Inc., NJ, USA) is inserted through the surgical port to harvest the RITA (Figure 1). The surgical port assists the precise use of the long harmonic scalpel by providing an axis of movement. The RITA is carefully skeletonised under direct vision with the Harmonic scalpel to remove fat tissues and the internal thoracic vein. In cases where bleeding from the internal thoracic artery (ITA) is observed, we stitch the point of bleeding with 0-0 monofilament and tie using a knot pusher. After harvesting the distal and mid-portion of the RITA, we reposition the Octopus NUVO Stabilizer next to the superior vena cava to harvest the proximity of the first intercostal branch of the RITA. After harvesting the RITA, mediastinal fat tissue and pericardium are removed with electrocautery to minimise the distance to the left anterior descending artery (LAD). The left internal thoracic artery (LITA) is harvested in a similar fashion (Figure 2). Distal anastomoses are completed as done in on-pump coronary artery bypass graft (CABG) through the thoracotomy. Our preferred method is to use RITA as an in-situ graft to the LAD. A total of 11 cases of MICS CABG using BITA were completed between February 2014 and November 2014. All BITAs were harvested without any difficulties. In five cases, the in-situ RITA was grafted to the LAD, and one in-situ RITA was grafted to the LITA. In three cases, a Y-composed graft was constructed using the BITA. The mean number of distal anastomoses was 2.5±0.8. The mean operative time was 343.2±62.1 minutes. There was no mortality or conversion to sternotomy. The patency of all ITA grafts was confirmed with a coronary CT scan 1 week after operation.

Our outcomes demonstrated the safety and reproducibility of this technique. All steps of the operation are carried out under direct vision, ensuring additional safety. Important and novel steps in the procedure are to be followed: firstly, the use of the Octopus NUVO Stabilizer (Medtronic Inc.) to depress the right lung, which provides a wide operative view under the sternum; and secondly, the use of a surgical port for the long harmonic scalpel (Ethicon Endo-Surgery Inc.), which provides sufficient length to dissect the proximal RITA under an excellent surgical view through a small incision. By using the port, the surgeon’s right arm holding the harmonic scalpel does not obscure the view through the small thoracotomy. In conclusion, BITAs can be safely harvested under direct vision via a small left thoracotomy. MICS CABG using BITA may offer excellent long-term results, while providing the advantages of minimally invasive coronary surgery. We believe the procedure has a potential to become an alternative standard for routine CABG.
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Raising Standards through Education and Training
Cardiac – Abstract: Aortic valve replacement: what is new?

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A tremendous increase in the number of veno-aortal extracorporeal membrane oxygenation (VA-ECMO) implantations has been observed worldwide. While the primary goal for every patient on VA-ECMO is to wean them off mechanical support, selected patients who receive VA-ECMO may be considered for long-term left ventricular assist devices (LVADs). These high-risk patients are usually converted to a cardiopulmonary bypass (CPB) machine at the time of VAD implantation surgery. Activation of the systemic inflammatory response due to CPB and associated deleterious effects on the coagulation system have been well documented in the literature. Since June 2012 we have routinely used a CPB machine for patients on VA-ECMO who require long-term VAD support at our institution, unless a simultaneous aortic valve procedure is necessary. The aim of this study was to compare the outcome of patients receiving VAD after VA-ECMO with or without CPB.

Data from patients undergoing VAD support after VA-ECMO implantation between January 2010 and April 2015 were retrospectively reviewed. Perioperative characteristics of and postoperative outcomes in patients who received VAD after VA-ECMO with and without CPB were compared. A total of 37 patients received permanent VAD after VA-ECMO. CPB was used in 23 patients with a mean age of 51±12 years. A total of 14 patients with a mean age of 52±11 years received VAD on VA-ECMO without using CPB. A HeartWare HVAD was used as a long-term mechanical support in all patients except for three patients in the CPB group. None of the patients required simultaneous valve procedures. The average ECMO support duration prior to LVAD implantation was 5±4 days and 7±7 days in patients with and without CPB respectively (p=0.356). A median sternotomy approach was used in all patients.

No technical issues were encountered at the time of VAD implantation surgery. One patient was converted to a CPB machine on an emergency basis after rupture of the left ventricle at the time of VAD surgery. This patient was operated on a few days after a massive myocardial infarction. On the day of surgery, a significantly lower number of blood products were necessary in patients who underwent LVAD implantation without using CPB compared with patients who underwent implantation with CPB. Blood product utilization in both groups was as follows: PRBC 15±15 Units (CPB) versus 8±4 Units (no CPB) (p=0.02); FFP 8±13 Units (CPB) versus 1±2 Units (no CPB) (p=0.04) and platelets 6±4 Units (CPB) versus 4±4 Units (no CPB) (p=0.08). A postoperative temporary VRAD was necessary in 61% versus 49% of the patients with or without CPB respectively (p=0.286). Resternotomy for bleeding was necessary in 35% versus 14% of patients with or without CPB respectively (p=0.026).

However, no significant difference in postoperative survival between these two groups was observed (p=0.629) (Figure 1). In summary, this study showed the feasibility of implanting a long-term VAD on VA-ECMO support without using CPB. A significantly lower number of blood products were necessary in these patients compared with patients in whom a CPB machine was used. A trend towards lower rates of postoperative bleeding and right ventricular failure was seen. However, no significant difference in the survival rate between these two groups was observed.

References

Figure 1. Survival after VAD implantation in VA-ECMO patients with or without using a CPB machine.

Cardiac – Rapid Response: Supporting the heart and lung

Claudio Romagnoni, Andrea Mangani, Monica Contino, Rubina Rosa, Sonia Ioppolo, Massimo Giovanni Leonno, Guido Gelati Cello Antonia
University of Sassari General Hospital, Sassari, Italy

Today, aortic valve repair is commonly recognised as a good option for the treatment of aortic valve repair insufficiency. Aortic regurgitation can be determined by different mechanisms; among these, one of the most frequent is the dilatation involving aortic root functional unit. Subcommisural triangles are key elements of this unit and play a fundamental role in the absorption of the aortic regurgitation. In our surgical experience we can identify three classes of triangles: the acute-angle that can be considered normal, the equilator ones that are moderately dilated, and the obtuse ones that are severely dilated. Our reparative approach differs according to the degree of dilatation. In the last case we would perform an interfaitet triangles reshaping procedure to increase the coaptation, or a remodeling procedure in the case of aortic root dilatation; in the second case, a stabilisation of the ventriculo-aortic junction is mandatory and this can be achieved with an external ring, a circular annuloplasty or a re-implantation procedure. Finally, in the latter case, stabilisation alone would not be enough to achieve a successful repair, since the anatomy of the triangles has been lost, preventing them from performing their function of stress absorption. In cases like this where the triangles are severe dilated, we would perform a re-implantation technique with a different positioning of the proximal suture line in order to simultaneously reshape the ventriculo-aortic junction. Interleaflet triangles cannot be well visualised on echocardiogram; however, the electrocardiogram-triggered CT scan, thanks to the possibility of performing post-processing multiple reconstructions, allows a complete evaluation of all the root elements. For this reason, we chose to focus our attention on the subcommisural triangles apical angles with the aim to better plan the surgical reparative strategy. To validate this method of measurement, data obtained from CT scan reconstructions were compared with those collected in a previous post-mortem study, coupling each triangle. No statistically significant difference was highlighted by this comparison, thus demonstrating that electrocardiogram-triggered preoperative CT scan is a useful tool for the measurement of the interleaflet triangles. This approach enables the surgical team to fully analyse the aortic root preoperatively, with the final goal of better tailoring the surgical reparative procedure to each individual patient’s anatomical characteristics.

References

Figure 1. Above an aortic root post-mortem specimen completely spread apart; below CT scan reconstructions of interleaflet triangles (LC LC=non coronary; crony coronary; LC RC=right non coronary triangle).
Cylinder reconstruction of tricuspid valve in children

The research team at the Ukrainian Children’s Cardiac Centre, lead by Professor Ilya Yemets is focusing its efforts on developing and implementing new surgical methods and strategies in neonatal cardiac surgery. The main goal is to make surgery as physiological as possible for the newborn. Examples are: successfully established programmes of arterial switch operation in the first hours of patients’ life and use of autologous umbilical cord blood for peripartal transfusion instead of homologous blood components. We strongly believe that such strategies will improve not only surgical results, but also the ongoing quality of life for patients.

It is well known that replacement of atroventricular (AV) valves has very limited use in young children and is almost impossible in neonates, because of small annulus sizes, subsequent growth of the heart and reoperation burden. That often leaves patients and surgeons with valve repair as the only option, even in cases where it is impossible to construct a competent valve. We sought to overcome those limitations in a small series of patients with severe tricuspid dysfunction, where quality repair was not feasible. All cases were emergent because of critical haemodynamic condition. Our main goal was to find the most physiological solution to provide a patient with durable valve repair or replacement with potential to grow independently of native annulus size. Based on the experience of Dr-Cox and colleagues in adults with infective endocarditis, we used sewn out cylinder valve of decellularised equine pericardium. Between October 2014 and July 2015, five children with complex coronary heart disease (CHD) accompanied by severe tricuspid regurgitation, unsuitable for conventional repair, underwent tricuspid valve replacement during complex surgery. Patient 1: 4 hours old, 3.2 kg in weight with PA type 1, VSD, PDA, Ebstein-like TV dysplasia. Patient 2: 9 months old, 5.8 kg in weight with Ebstein’s anomaly type C, VSD, BP. Patient 3: 7 years old, 13 kg in weight with VSD and endocarditis. Patients 4 and 5: 9- and 15-year-old boys with severe tricuspid insufficiency after previously undergoing Ebstein’s anomaly repair. In all patients the tricuspid valves were replaced with a cylindrical construct sewn out of decellularised equine pericardium (Matrix Patch®, Auto Tissue Berlin GmbH, Germany). Cylinders were sized accordingly to normal annulus diameter. The base of the cylinders was attached to the tricuspid annulus by running suture and the apex attached to the papillary muscles by two diametral single sutures. All patients underwent successful complete repair of CHD. Patient 1 had delayed sternal closure on day 6 after surgery. There were no to mild regurgitation and no evidence of tricuspid stenosis by echocardiography immediately and 3 months after repair. MRI assessment of right ventricular function 3 months post-repair showed good performance of the cylindrical valve and improvement in right ventricular function. Cylinder reconstruction may be suitable for replacing the tricuspid valve in children, even neonates, when conventional repair techniques are inapplicable and may give these babies a chance to survive. 

Cardiac – Abstract: Challenges in surgical aortic valve replacement

Aortic prostheses – patient mismatch hampers regression of secondary mitral regurgitation after isolated aortic valve replacement: 6-year follow-up analysis

Emiliano Angelini, Giovani Malina, Simone Reffe, Fabio Capraro, Antonina Bosotti, Cosimo Contini, Riccardo Simonetti Speranza, Università di Roma, Department of Cardiac Surgery, Ospedale Sant’Andrea, Rome, Italy

Regurgitation present is in about two-thirds of patients with aortic stenoses, but secondary mitral regurgitation (SMR) is generally reduced after isolated aortic valve replacement (AVR). Notwithstanding the latter, there is important inter-individual variability in the magnitude of the reduction, and phenomena as prostheses – patient mismatch (PPM) may hinder normalisation of left ventricular geometry and pressure overload following AVR. We investigated the relationship between PPM and regression of SMR following AVR for aortic valve stenosis, previously reported a short-term analysis, whilst now present data from a 7-year propensity-matched follow-up study. A total of 578 patients with aortic stenosis who underwent isolated AVR at two institutions and presenting moderate SMR (mitral regurgitant volume (MRV) 30–45 mL/beat) not considered for surgical correction were included in this study.

Aortic PPM was defined as an indexed effective orifice area (EOA) ≤ 0.65 cm²/m². A total of 219/578 patients (37.9%) showed PPM, and there were no significant differences in baseline and operative characteristics between patients with or without PPM. Patients with PPM had less regression of SMR following AVR compared with those with no PPM (change in MRV: -12±5 versus -19±4 mL/beat, respectively; p<0.0001). Variables significantly associated with postoperative change in MRV on univariable analysis were entered in a multivariable linear regression model, which showed EOA (p=0.0001) and LA diameter (p=0.006) to be independently associated with MRV improvement. Patients with PPM also had less postoperative improvement in 6-minute walking distance test (+43±59 versus +82±74 m, p=0.0001). In conclusion, PPM is associated with lesser regression of SMR following AVR, and this unfavorable effect was associated with worse functional capacity. The mechanism probably responsible for the lack of SMR improvement after isolated AVR may be the following. The fall in LV cavity pressure achieved by AVR usually translates into an immediate decrease in the trans-mitral systolic pressure gradient and thereby into a reduction of SMR. Of note, this is also corroborated by the drop in pulmonary artery systolic pressures found among patients without PPM. Moreover, the regression of LV hypertrophy and positive remodelling of LV cavity and mitral annulus that occurs after AVR further contributes to the reduction of SMR. However, owing to various preoperative and operative factors including PPM, the reduction of trans-aortic gradient and thus of LV pressure overload as well as the regression of LV hypertrophy and dilatation varies extensively from one patient to the other and is often incomplete, thereby explaining the persistence of SMR in a substantial proportion of the patients. These findings emphasise the importance of operative strategies aiming to prevent PPM in patients with aortic stenosis and concomitant SMR.

Cardiac – Abstract: Basic Science

The extracellular isof orm of superoxide dismutase has a significant impact on cardiovascular ischaemia and reperfusion injury during cardiopulmonary bypass and hypoxia

Monte Benjamin Immohle, Antonio Pinto, Annette Jehn, Ulco Kranke, Arnd Lichtenberg Paaske Altekrueger, Heinrich-Heine University Hospital, Duesseldorf, Germany

Cardiac surgery employing extracorporeal circulation using cardiopulmonary bypass (CPB) is a powerful therapeutic option in the treatment of most forms of cardiovascular disease. Unfortunately, extracorporeal circulation using a heart-lung machine may cause ischemia and reperfusion injury. Therefore, extracorporeal circulation carries a 2%-10% risk of systemic inflammatory response syndrome, which may induce lethal multiple organ dysfunction syndrome. 1 Accumulation of toxic superoxide (O₂⁻) and its metabolite peroxynitrite (ONOO⁻) during ischemia and reperfusion is suggested as one of the main mediators of detrimental effects of cardiopulmonary bypass. 2 Superoxide dismutases, where extracellular superoxide dismutase (SOD3) is the prevailing isof orm in the cardiovascular system, detoxify superoxide and protect the physiological function of vasoactive nitric oxide (NO) in vascular smooth muscles. 3 By employing a delicate small animal model of extracorporeal circulation to a novel transgenic rat strain we demonstrated the multiple role of systemic SOD3 activity on the nature and extent of ischemia/reperfusion injury during major surgery using CPB and circulatory arrest. Rats with decreased SOD3 function resulting from an amino acid shift in the active site of the enzyme (SOD3-E124D) and SOD3 competent controls (SOD3/SS) were acquired and bred in-house under license agreements from Transposagen Biopharmaceuticals Inc. (Lexington, KY, USA). Animals were subjected to CPB including 45 minutes of deep hypothermic circulatory arrest followed by 60 minutes reperfusion in order to induce systemic ischaemia/reperfusion injury. 4 During the operative procedure, vital signs were monitored and blood gas analyses performed. After euthanasia, the heart and aorta were harvested and their protein levels analysed by western blots. In addition, in vitro studies on isolated cardiac myocytes were performed to further investigate mechanistic pathways involved in direct myocardial effects of SOD3. At euthanasia, mean heart rate and arterial blood pressure were decreased in rats with decreased SOD3 activity. Moreover, increased serum potassium and lactate levels were observed when compared with SOD3 competent controls. On the gene expression level, SOD3 expression was increased. However, a reduced SOD3 function was evident using activity assays, and decreased activation of cardioprotective anti-apoptotic and pro-proliferative p44/42 MAPK and STATT3 signalling in cultured cardiac myocytes, as well as in heart and aortic tissue, were observed after CPB. Further, cardiac myocytes with impaired SOD3 activity also showed decreased expression of the other superoxide dismutase isof orms and increased levels of the nitrosative stress marker 3-nitrotyrosine as compared to SOD3 competent controls. Our results suggest an impaired handling of oxidative stress and a misregulation of superoxide dismutases as a consequence of decreased SOD3 function. SOD3 impacts protective signalling pathways and directly affects the myocardium. Reduced SOD3 activity strengthens tissue injury after extracorporeal circulation, thereby increasing the risk of systemic inflammatory response syndrome with lethal multiple organ dysfunction syndrome. SOD3 has a significant protective effect against systemic ischaemia and reperfusion injury. Novel interventional strategies targeting SOD3 and dependent pathways may provide therapeutic options against major cardiac events.

References


The development of new minimally invasive methods in coronary surgery is a response to the aspiration to optimise the outcomes of surgical treatment of patients with coronary heart disease, especially those with an increased risk of complications associated with extracorporeal circulation, sternotomy and aortic manipulations. Another gap in practice is the probability of hyperperfusion and competitive blood flow at complex end-to-end anastomoses or when anastomosis is performed in a single distal anastomosis to the right coronary artery (RCA) branches or as a sequential graft with a side-to-side anastomosis to the posterior descending artery and an end-to-side anastomosis with the circumflex artery (CX) (Figures 1 and 2). The mean patient age was 60.3±6.2 years, and all patients were men. Eight (34.8%) patients had diabetes mellitus, 14 (60.9%) were obese, nine (31.1%) had chronic obstructive pulmonary disease and five (21.7%) had calcification of the ascending aorta. The median preoperative Canadian Cardiovascular Society angina class was 3.

The average number of distal anastomoses was 2.9±0.42, operation time was 375±68.4 min, intraoperative blood loss was 275 (200; 387) ml, first 24-hour postoperative blood loss was 270 (215; 310) ml, postoperative ventilation time was 2.3 (1.2; 4.7) hours and intensive care unit stay was 18 (16.5; 21) days. There were no cases of hypoperfusion, competitive or reversed blood flow at the intraoperative transit-time flow measurement. The mean volumetric blood flow was 67.1±22.7, 40.0±18.3 and 32.0±12.1 ml/min in LAD, RCA and CX territory, respectively, while the pulsatility index in LAD, CX and RCA territory was 1.8±0.72, 1.9±0.6 and 2.2±0.5, respectively. There were no cases of incomplete revascularisation, wound infection, conversion to cardiopulmonary bypass and sternotomy, deaths and major adverse cardiac and cerebrovascular events during the hospitalisation period. Twelve patients underwent contrast-enhanced CT coronary angiography to examine midterm (mean 16.7±5.5 months) graft patency. All grafts were patent without evidence of disease or suboptimal anastomoses. It is expected that use of composite in situ BITA-RA MVST-CABG will lead to the reduction of the perioperative complications rate, especially in high-risk patients. Two sources of the myocardium blood supply from both ITAs allow the prevention of incomplete revascularisation and reduce the probability of hyperperfusion and competitive blood flow in composite multi- vessel grafting.

**Mitrail valve surgery**

9–11 November 2015
Barcelona, Spain

**Course Directors**
R Klautz, Leiden, the Netherlands; R Lange, Munich, Germany; JL Pomar, Barcelona, Spain

This progressive course brings together leading figures in mitral valve surgery to discuss surgical approaches. A variety of stimulating topics, including mitral valve anatomy and pathology, the complete evaluation of all your mitral patients, valve analysis and tricuspid valve disease.

This course focuses on the technical aspects of mitral surgery and interventions, emphasising the success of teamwork through challenging live cases. The programme features lectures sharing peer to peer experience and tips and tricks, round table discussions, live surgeries from the Hospital Clinic Barcelona and a hands on wetlab. This 2-day interactive course will address knowledge and technical skills. Participants will have the opportunity to collaborate and determine the optimal approach, and practice their surgical skills in the wetlab. Upon completion surgeons should feel comfortable to use their learnings in their own units. Full details regarding the programme and registration can be found via the EACTS Academy website – www.eacts.org/academy/courses/mitral-valve/
Robotic surgery in patients with pulmonary tuberculosis: new technology against the old problem

Piotr Yablonskii
St Petersburg Research Institute Phthisiopulmonology, St Petersburg, Russian Federation

Today, pulmonary resection is not a well-established operation in the treatment of patients with TB. For many years, this problem was ignored by international surgical forums. However, three factors have led to increased interest in this problem today:

3. Publications demonstrating the high efficiency of the surgery in the treatment of such patients.

Minimally invasive surgery is a not well-known problem of modern cardiothoracic surgery. Most thoracic surgeons are unfamiliar with TB surgery due to the complexity of the surgical procedures required.

That is why the use of minimally invasive surgery in cases of TB is not widespread. Reports on the use of robotic surgical systems have been informal.

That is why our message on the effectiveness and safety of robotic surgery for cavitary pulmonary TB is very interesting. Our study demonstrates a short learning curve for robotic operations, which offer low postoperative morbidity and mortality.

The basic rules of robotic operations are the same as for video-assisted thoracoscopic surgery (VATS): no rib spreading, monitor-based procedure, anatomical hilar dissection. In addition features of robotic techniques have been published in multiple papers: 3D visualisation, precision divided of hilar structures, scaling movements, smooth movements, tremor filtration, high range of motion, simulation of operation angle without loss of movement speed, short learning curve.

Features of robotic-assisted thoracoscopic surgery (RATS) pulmonary resection for TB are a high rate of pleural adhesions and the presence of perivascular and peribronchial fibrosis. Division of adhesions in the apical area of the pleural cavity is conveniently carried out using robotic surgical systems, whereas its use in the lower portion is difficult and sometimes requires the use of the VATS technique. The rate of post-operative complication after robotic operations is significantly lower than after open or VATS operations for pulmonary TB (OTM & M classification).

I believe that the future of minimally invasive surgery for pulmonary tuberculosis is robotic surgery. In our presentation, I will try to convince you of that.
Moderate-to-severe early graft failure after cardiac transplantation: treatment strategies and predictive risk factors analysis

Giacomo Murana and Antonio Loforte
International Society for Heart and Lung Transplantation (ISHLT)

Examination of early mortality after heart transplant documented in the first 30 days after transplant are due to ‘graft failure’ and multi-organ dysfunction.1 Most of these events are the result of a fatal graft dysfunction (GD). Fortunately, at the 33rd Annual ISHLT Meeting, a consensus conference was organised to better define, diagnose and manage this syndrome. There were 71 participants (transplant cardiologists, surgeons, immunologists and pathologists) representing 42 heart transplant centres worldwide. According to the new consensus statement,2 early graft failure (EGF) is classified as primary GD (PGD) in the case of an unknown triggering factor, and secondary GD (SGD) where the cause is discernible, e.g. hyper-auto-rejection, pulmonary hypertension or known surgical complications. The risk of PGD occurrence is considered to be multifactorial and usually includes either donor, recipient or surgical variables. Severity scale for GD was divided into mild, moderate or severe depending on the level of cardiac function, and the extent of inotropic and mechanical circulatory support (MCS) required. In our study, GD was defined according to the new ISHLT consensus conference criteria. The primary aim was to evaluate the results of MCS treatment for EGF, with regards to intra-aortic balloon pump (IABP) support for moderate GD and extracorporeal membrane oxygenation (ECMO) for severe GD. It was also hoped to identify eventual predictive markers of GD occurrence. Among the 412 patients included, 46 (11%) experienced moderate-to-severe EGF. Twenty-nine (63%) patients required peripheral or central ECMO support to treat severe EGF, and 17 (37%) required IABP for moderate EGF. Results revealed that absence of GD correlated strongly with better survival: 94% at 1 year and 81% at 5 years without EGF versus 76% and 36% at 1 year, and 70% and 28% at 5 years with EGF requiring IABP or ECMO support, respectively. However, weaned and/or survived patients after IABP and/or ECMO treatment appeared to have a similar 5-year conditional survival rate as those transplant patients not having suffered EGF: 88% without EGF versus 84% with EGF treated with MCS devices (p=0.08). The analysis also underlined some predictive risk factors for moderate-to-severe EGF occurrence. Risk factors included preoperative transpulmonary gradient >12 mmHg (OR: 5.2; p=0.029), inotropic score >10 (OR: 8.5; p=0.001), and ECMO support before transplant (OR: 4.2; p=0.012); while for the donor, a Eurotransplant donor score >17 (OR: 8.3; p=0.006).

In summary, while confirming that EGF, either primary or secondary, is a major risk factor for in-hospital graft loss, our results showed that MCS appears to be a reliable strategy for treating both moderate and severe forms. It also confirmed that the occurrence of this syndrome is often multifactorial, and dependent on both donor and recipient profiles. Since parameters and characteristics are not readily modifiable, optimisation of donor/recipient matching is crucial to reduce the risk of EGF. Additionally, changes in strategies of myocardial protection for marginal donors should be evaluated to further protect allograft function, and the adoption of ex-vivo perfusion for donor hearts may become a routine option in the near future.3

References

Vascular – Professional Challenge: Arch involvement in acute aortic dissection: a surgical challenge

Systolic flow displacement using 3D cardiac magnetic resonance imaging in an experimental model of ascending aortic aneurysm: are we underestimating rheology?

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Bicuspid aortic valve (BAV) is the most common congenital heart disease, with a prevalence of 1–2%. Up to 80% of patients with BAV will develop ascending aortic aneurysm. There is considerable debate on the pathogenesis of the aortic dilatation in BAV. The two main theories explaining the aortopathy in BAV are: 1) the haemodynamic theory, in which the abnormal haemodynamic stress on the aortic wall, induced by eccentric turbulent flow through the BAV, leads to subsequent aortopathy.1 The presence and type of BAV is associated with changes in regional wall shear stress distribution and systolic flow eccentricity, assessed with 4D cardiac magnetic resonance (CMR). Haemodynamic markers suggest a physiological mechanism, by which valve morphology phenotype can influence phenotypes of BAV aortopathy.2 Moreover, systolic flow displacement has been shown to be a good predictor of ascending aortic growth.3 4 However, experimental studies in this regard are lacking; therefore, the pure influence that rheological stimulus has in aortopathy development is unknown.

Figure 1. Sagittal view of 3D cardiac Magnetic resonance. The arrow shows the jet of the aortic stenosis.

The objectives of this study are: first, to demonstrate that rheological stimulus per se induces aortic aneurysm; second, to assess the predictive value of systolic flow displacement, measured by 3D phase contrast CMR for aortopathy in an experimental ascending aortic aneurysm animal model, where BAV phenotype is absent but flow eccentricity is present. Animals were randomly allocated to either restrictive ascending aortic banding (n=14) or sham operation (n=6). 3D phase contrast CMR was performed at 6 weeks and 18 weeks after the banding procedure, and systolic flow displacement and aortic diameter were assessed.

At 6 weeks, aortic diameter growth was evident. Dilatation was mainly distal to the aortic banding (Figure 1). Mean aortic diameter was 29.8±8.4 mm versus 21.4±2.7 mm in sham-operated controls (p<0.001). At 18 weeks, mean aortic diameter was 50±8.4 mm versus 38±8.3 mm (p=0.001). There are significant statistical differences at 6 weeks and 18 weeks.

In banded animals (n=14), no significant differences between systolic flow parameters for quantification of flow eccentricity in the ascending aorta. Animal were randomly allocated to either restrictive ascending aortic banding (n=14) or sham operation (n=6). 3D phase contrast CMR was performed at 6 weeks and 18 weeks after the banding procedure, and systolic flow displacement and aortic diameter were assessed.

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Shock wave therapy causes increased macrophage recruitment and enhances M2 polarisation in ischaemic muscle

Can Topkapıkkaya and Johannes Holfeld

Ischaemic heart disease still represents a major socioeconomic health burden in Western countries, with significant impairment of quality of life for affected patients. Ischaemia leads to a loss of viable myocytes, resulting in remodelling of the myocardium and the formation of scar tissue. Experimental regenerative approaches of recent years mainly include (stem) cell-based therapies. Although favourable results have been reported, none of these therapies has reached broad clinical use due to distinct limitations.1 Low energy shock wave therapy (SWT) developed for tissue regeneration was based on the incidental finding of haembone thickening in patients undergoing shock wave lithotripsy.2 Since then, low energy SWT has developed as a standard of care or alternative therapy for a variety of orthopaedic and soft tissue diseases, including ischaemic heart disease.3 Percutaneous cardiac: SWT was reported to induce angiogenesis and vasculogenesis, reduction of infarction size and improvement of ventricular function in animal models of ischaemic heart failure. Additionally, patients suffering from coronary heart disease were shown to experience relief of symptoms after treatment.4,5 Although the results are encouraging, the working mechanism remains largely unknown.

Macrophages have a crucial role in post-infarction remodelling. In the first hours after the infarction, macrophages are responsible for the phagocytosis of necrotic tissue and loosening of the collagen network by metalloproteinases to enable cell migration. At the same time, macrophages enhance angiogenesis by the secretion of pivotal growth factors, like vascular endothelial growth factor (VEGF) and fibroblast growth factor (FGF) (Figure 1A).6 In our current work, we aimed to investigate whether the regenerative effect of SWT is at least partly a result of enhanced macrophage recruitment. Therefore, mice were subjected to unilateral hind limb ischaemia with subsequent SWT sham treatment. Tissue was analysed for macrophage markers via RT-PCR and immunofluorescence staining. To evaluate the functional outcome, animals were subjected to Laser Doppler perfusion imaging of the ischaemic limb. In addition, the number of vessels was evaluated via immunofluorescence staining. Treated muscles showed increased expression of the pivotal macrophage recruiting factor monocyte chemotactic protein 1 (MCP-1). Indeed, we found increased numbers of macrophages in treated muscles confirmed by increased expression of the macrophage marker CD14, as well as by immunostaining. Analysis of the scavenger receptor CD163 revealed that mainly the number of the regenerative M2 macrophages was increased in SWT animals.

In line with these findings, treated mice showed improved limb perfusion when analysed by Laser Doppler perfusion imaging. In addition, analysis of tissue sections revealed a higher number of capillaries (CD31) as well as arterioles (CD31 and aSMα), clearly indicating induction of angiogenesis. Interestingly, macrophages were found in close proximity to newly formed vessels. With this work, we could show for the first time that the recruitment of macrophages has a major role in the angiogenic effect of SWT. We believe that SWT will become a promising tool for the regeneration of ischaemic myocardium and will be used as an adjunct to coronary artery bypass graft (CABG).

Open surgery for chronic aortic dissection: examination of 371 elective cases

Takuya Fujikawa

Open surgery of chronic aortic dissection (ChAD) have been mentioned in many previous reports. However, results are improving. We evaluated contemporary outcomes of open repair of chronic aortic dissections (ChAD). From January 2008 to December 2014, 371 patients had elective open repair of ChAD. Mean age was 60.2 years and 79.0% were male. In total, 100 (27.0%) patients were chronic type A dissection; 64 patients had undergone hemi-arch replacement, and 23 total arch replacement emergently. Thirteen patients had received other treatment. A total of 271 (73.0%) patients were chronic type B dissection, and the majority received optimal medical treatment initially. Descending thoracic aortic repair (DTAR) was performed in 220 cases (59.3%) and thoracoabdominal aortic open repair have been mentioned in many previous reports. However, results are improving. We evaluated contemporary outcomes of open repair of chronic aortic dissections (ChAD). From January 2008 to December 2014, 371 patients had elective open repair of ChAD. Mean age was 60.2 years and 79.0% were male. In total, 100 (27.0%) patients were chronic type A dissection; 64 patients had undergone hemi-arch replacement, and 23 total arch replacement emergently. Thirteen patients had received other treatment. A total of 271 (73.0%) patients were chronic type B dissection, and the majority received optimal medical treatment initially. Descending thoracic aortic repair (DTAR) was performed in 220 cases (59.3%) and thoracoabdominal aortic open repair have been mentioned in many previous reports. However, results are improving.
Dilatation of the proximal aorta does not progress after isolated aortic valve replacement for bicuspid aortic valve stenosis: magnetic resonance imaging follow-up study

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Mitrail valve repair (MVR) represents the gold standard therapy for patients with mitral regurgitation, enabling preservation of the entire native valvular structure and allowing patients to enjoy good quality of life. Over the past decade, the substantial positive impact of annuloplasty on long-term durability of MVR has been gradually recognized. However, to date the choice of the “most appropriate” annuloplastic ring still largely relies on individual surgeon’s personal preference. In particular, recent experimental and clinical researches highlighted the potential advantage of a saddle-shaped annuloplasty in diminishing mitral annular and leaflet strain, as well as improving leaflet coaptation geometry. Nonetheless, it remains controversial whether we should apply saddle-shaped annuloplasty ring in every patient. In our own practice, we have adopted a tailored selection principle following the guidance of preoperative 3-dimensional transeosophageal echocardiography (3D TEE). We routinely measure the annular height to commissural width ratio (ACHWR) prior to every mitral valve repair operation for an individualized selection of the proper annuloplastic ring type. By using this approach we have found that a semi-rigid ring rather than a saddle-shaped ring may provide more reliable repair results in patients whose ACHWR remains within the normal range (i.e., ACHWR ≥15%). Whenever such condition is confirmed we would select the MEMO 3D ring (Sorin SpA, Milan, Italy) as the ring of choice, due to its unique structural characteristics that help to achieve satisfactory repair results. Postoperative 3D TEE showed that mitral annular saddle shape could be well preserved in these patients. In fact, the MEMO 3D ring’s innovative design and laser-cut alloy cell structure provide a progressive degree of flexibility from anterior to posterior, mimicking the heart’s complex yet natural anatomy and therefore preserving truly physiologic annular dynamics. In addition, the bio- and hemocompatible properties of the unique Carbofilm coating allows complete ring endothelialization while preventing inflammatory reaction and scar tissue formation, leading to physiological dynamics preservation in the long term. Latest advances in annuloplasty technology have provided additional opportunity to address the challenges in MVR presented by the dynamic physiology of the heart. One particularly interesting breakthrough is the MEMO 3D ReChord™ mitral annuloplasty ring which, in addition to the unique Memo 3D design, provides an innovative chordal guiding system that allows a correct implantation of PTFE neochordae without the need for chordal measurement, thus improving the accuracy of artificial chordae replacement technique while streamlining the procedure. The temporary chordal guiding system, placed at the level of the posterior annulus, acts as a reference point for the reconstruction of the neochordae, relying on the principle of basal marginal chordae equivalence, where the height of a marginal (primary) chorda is always equal to that of the corresponding basal (tertiary) chorda. Once the PTFE chordae are passed through the loops of the guiding system, the free margin of the anterior or posterior leaflet is brought to the posterior annulus, the PTFE are tied and the temporary loops system is removed. The length of the neochordae obtained with this system exactly matches the plane of the native annulus at the coaptation point. Artificial chordae implantation guided by the MEMO 3D ReChord results in a simple and reproducible technique suitable for both anterior and posterior leaflet prolapse. In particular, it restores leaflet motion and ensures a large surface of coaptation while shortening the procedure duration effectively.

Over the past 8 months, we have implanted the MEMO 3D ReChord ring in 12 patients (male/female=9/3, age range: 37-82 years), including 2 semi-urgent cases with preoperative IABP and/or mechanical ventilatory support. Concomitant aortic valve replacement (n=1), tricuspid repair (n=3), or coronary artery bypass grafting (n=2) were carried out. Mitral valve lesions involved anterior leaflet (n=9), bi-leaflet (n=2), and posterior leaflet (n=1). Within the same period of time we have also implanted the MEMO 3D rings in another group of 12 patients with posterior leaflet lesions (n=11) or ischemic mitral regurgitation (n=1). There was no 30-day mortality in all 24 patients. Pre- and post-operative 3D TEE was completed in all patients, with subsequent 6-month (and yearly thereafter) transesophageal echocardiography follow-up. So far, in the MEMO 3D ReChord ring group, none of the patients had greater-than-trivial postoperative mitral regurgitation upon follow-up. This series represents the first Asian clinical experience using the MEMO 3D ReChord ring. Whereas the long-term durability of mitral valve repair with the MEMO 3D ReChord ring warrants further validation, our current clinical observation and short-term echocardiography data following this type of mitral annuloplasty appeared extremely encouraging.

Find out more at Sorin Group Booth # 3.15

References
Decortication of empyema thoracis in children: a large single-centre perspective

Muhammad Izanee Mydin
Freeman Hospital, Newcastle-upon-Tyne, UK

The Freeman Hospital’s Cardiothoracic Centre was established with two surgeons in a purpose built facility in 1977 and has since expanded to a team of 14 surgeons. The Freeman Hospital is the only hospital in the country to provide the full range of cardiothoracic surgery for adults and children, including heart and lung transplantation under one roof. Mr Asif Hasan, Senior Consultant Congenital Cardiothoracic Surgeon, alongside his colleagues Mr Massimo Grisselli and Mr Bari Murtuza, as a team, have extensive experience of operating on paediatric patients with empyema thoracis.

Empyema thoracis can cause significant morbidity and mortality in children. Various treatment modalities have been employed including tube thoracostomy, video-assisted thoracoscopic surgery (VATS) and decortication. However, the evidence base is limited and practice varies widely within the UK. We reviewed the outcomes from primary surgical management in our unit for later comparison with a national audit – the UK-ESPE study.

Our team studied a total of 194 children who were selected between 2007 and the present day for this prospectively-recruited observational study. All patients underwent muscle sparing thoracotomy and decortication of empyema. The outcomes reviewed included: chest drain duration, total hospital and paediatric intensive care unit (PICU) length of stay (LOS), need for ventilation and readmission rates, complications (including recurrence and repeat procedures) and mortality.

Within the study population, there were 84 females and 110 males. Median age was 3 years (1–16 years). Our results compared favourably with published series with a median duration of chest drainage of 2 days (0–10 days). Post-procedure complications occurred in 21 patients (10.8%) (pneumothorax 7, recurrence 6, lung abscess/necrosis 4, infection 2, renal failure 1, veno-venous extracorporeal membrane oxygenation (ECMO) 1). Reoperations were performed in eight patients (4.1%) (redo decortication 6, wound debridement 2). Forty-two patients (21.6%) were admitted to PICU. 31/194 patients (15.9%) required ventilation postoperatively (nine patients were ventilated >24 hours; one patient required veno-venous ECMO). Median PICU LOS was 2 days (1–40 days). Median hospital LOS was 6 days (0–64 days). Nine patients (4.6%) were re-admitted post discharge; four required a repeat surgical procedure. Mortality was 2/194 patients (1%) (non-surgical: co-morbidity related).

In conclusion, we present our results of a large cohort of paediatric empyema patients managed with thoracotomy and decortication. A median LOS of 6 days, 4.1% reoperation rate and 1% mortality compare very favourably with other published series.

Hypertrophic obstructive cardiomyopathy (HOCM) is the most common monogenic cardiac disease and is characterised by left ventricular outflow tract (LVOT) obstruction, mitral valve systolic anterior motion (SAM), and can produce symptoms of heart failure and sudden cardiac death. Mitral regurgitation (MR) in HOCM patients is induced by SAM and subvalvular apparatus pathology. Myectomy of LVOT described by Morrow is considered the gold standard of surgical correction in symptomatic patients.

Comparison of septal myectomy with and without mitral subvalvular apparatus intervention in patients with obstructive hypertrophic cardiomyopathy: a prospective randomised study

There were no early deaths in either group. Immediately following the procedure, the residual MR ≥2+ was 14.7% (5 patients) in the no-MSA group and none in the MSA group (p=0.023); residual SAM was shown in eight patients (23.5%) and one patient (2.7%), respectively (p=0.001). Peak LVOT gradient was 12.2±6.3 mmHg in the no-MSA group and 8.7±4.5 mmHg in the MSA group (p=0.009). Two patients (5.6% and 5.9%) in both groups required pacemaker implantation before discharge, owing to complete atrioventricular block, and one patient (2.8%) had septal defect in the MSA group (p=0.514).

Impact of new generation TAVI technologies in choice and evaluation of surgical and transcatheter aortic valves

An interview with Mr. Neil Moat, Royal Brompton Hospital, London, United Kingdom

Latest clinical trials show that TAVI is a beneficial option for very high and extreme risk patients. What key insights do latest trials like the CoreValve US IDE provide?

It is clear that in the recent trials of AVR vs TAVI that the forward flow haemodynamics of transcatheter valves were superior to standard stented bioprostheses and more akin to the favourable forward flow characteristics of stentless surgical bioprostheses. For example, in the US CoreValve trial the effective orifice area after a CoreValve implant was approximately 1.9 cm², compared to about 1.3 to 1.4 cm² for valves implanted in the surgical arm. In the surgical community we must aim to implant surgical valves with a larger EOA!!

In terms of hospital stay, TAVI was superior to surgery in the very high/extreme-risk patient cohort.

Based on your experience, what advance do you think new generation TAVI technologies such as Evolut R provide?

The 1:1 response and self-centering of Evolut R provides increased stability making it more precise and predictable. There is also the option to fully recapture and reposition the valve. It is easier to obtain an optimal implant depth and position with the prosthetist thus reducing the risk for PVL and pacemaker implantation. For the implanter, this means more control and confidence especially with the safety net provided by the recapturability. Finally, the system has the lowest profile, 14Fr-equivalent across all sizes with the InLine sheath, and is indicated for transarterial access vessel diameters ≥5.0 mm. This and its excellent trackability will likely reduce the risk of vascular complications. Evolut R is a game changer.

With Evolut R lower delivery profile, is there still room for alternative access?

The number of eligible patients for transfemoral access will certainly increase with the lower profile of Evolut R. That’s a good thing as the TF alternative access?

With Evolut R lower delivery profile, is there still room for alternative access? The number of eligible patients for transfemoral access will certainly increase with the lower profile of Evolut R. That’s a good thing as the TF approach is undoubtedly less invasive. However, some patients will still represent a real challenge for the TF approach. Surgeons will need to master alternative accesses to offer the highest safety and best possible outcomes for those patients. Subclavian seems to offer the least invasive alternative (compared to TA and DA) but carotid and transcervical approaches are also of interest.
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