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# Welcome

**O**n behalf of the Association and the Council, I would like to extend a very warm welcome to you at this our 33rd EACTS Annual Meeting. Our Annual Meeting is the greatest and largest cardiothoracic congress in the world and we are delighted that so many of you are joining us this year. Lisbon promises to be a terrific event and thank you for taking the time to be a part of it.

Your work is vital. It matters – to patients and their families – and I know many of you are making personal sacrifices and travelling long distances to be here. So, thank you. But I also say well done for choosing to be here in Lisbon because we have an excellent conference for you. For the second year running we are packing a year's worth of education into three days. Your time in Lisbon will be time well spent: a time to learn, deepen your understanding, refresh your skills, and develop and extend your network.

### A packed programme

Over the next three days you can look forward to exploring new scientific insights, learning about the latest innovations in cardio-thoracic surgery and, importantly, taking part in topical debates alongside global experts. We have a packed programme full of learning opportunities.

#### Did you know?

- You will have several opportunities to learn more about advances in areas such as imaging, next-generation robots and the future of LVAD technology. And don't miss the Techno-College sessions where the latest innovation, technology, equipment and devices will be shown during live surgery.

- A series of surgical cases, live-in-a-box broadcasts and the ever-popular 'Lion's Den' competition are all unmissable.

- This year we are working with other associations to offer more joint sessions on coronary surgery and provide a more in-depth programme to educate clinicians on how to interpret data properly.

- We also have more than 18 sessions focused on TAVI including our stand-out session on Saturday. Analysing new data on longer-term outcomes for patients

Looking ahead to Saturday, I'd like to highlight our 'Trial Update and Evidence Review' session at 11:45 in Auditorium 1, which will consider the long-term outcomes for patients who have surgery, as well as those who opt for heart stents or transcatheter aortic valve implantation (TAVI). Do not miss this debate. I am thrilled that Dr Rita Redberg, the Editor of *JAMA Internal Medicine* from the University of California will co-chair this session. She will be joined by a world-class panel of contributors to present the very latest in international studies. Their analysis of five-year survival rates will focus minds and challenge some conventional thinking.



### A world class networking opportunity

But we're not just here to learn. Just as important is the opportunity to form new relationships and reacquaint with existing colleagues from around the world. With this in mind, don't forget that there is a fantastic social and cultural programme that is not to be missed. You will also have the opportunity to meet EACTS' Council members and expand your professional network.

### Da Vinci

This year marks the 500th anniversary since the death of Leonardo da Vinci. I am delighted that at this year's meeting we will be celebrating the life and legacy of this genius and exploring how his work influenced many aspects of cardiothoracic surgery. I am thrilled that we will be joined by an array of international historians and clinicians for these sessions. To whet your appetite, make sure you pick up a copy of Friday's *EACTS Daily News* for a preview of Mr Francis Wells' lecture on 'Leonardo's Heart'. Leonardo da Vinci's drawings on human physiology and anatomy are truly remarkable so do take a moment to enjoy the exhibition of his work.

### Social media

Throughout all of this we encourage you to post and Tweet via your social networks. We're using the hashtag #EACTS2019 and the best Tweets will be visible on our Twitter wall. In addition, those interested in social media will be interested in the #SoMe session being run by Dr Patrick Myers at 09.00.

### Here's to a tremendous event

Once again, it is an honour to share the 33rd Annual Meeting with all of you and I do hope you find the time to enjoy this magnificent city and take in its culture, food, architecture and warm spirit. As the great Leonardo said, 'The noblest pleasure is the joy of understanding', but just as important is to have fun, and on that note I look forward to meeting as many of you as possible on Saturday evening at the party to celebrate what is sure to be another exceptional Annual Meeting.

Have a great stay in the wonderful city of Lisbon.

**Domenico Pagano**

*EACTS Secretary General*

## New

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## Techno-College | Thursday / Friday

## Techno-College showcases the 'latest and greatest' in cardiac practice

**H**endrik Treede, Director, Department of Cardiac Surgery, University Hospital Bonn, Germany, spoke to *EACTS Daily News* to highlight the Techno-College sessions at this year's Annual Meeting.

The importance of the Techno-College sessions, began Professor Treede, is reflected in their prime-time slots this year. "The Techno-College is really very important as it gives surgeons the chance to have taster talks on the 'latest and the greatest' treatments and techniques for their daily practice, all in one place," he said.

"The Techno-College is becoming even more important because of the increasing rate in which innovations and advances are now emerging. Each session, held Thursday and Friday morning, will be the showroom window for what's new in surgery and interventional techniques at EACTS. The Techno-College is not so much data based; it's about presenting ideas to solve problems."

Professor Treede added: "The talks and live surgery broadcasts are designed to provide a mixture of developments that might shape practice in the future, but they will also include the sort of new techniques and innovations you could go home from the Meeting and use right away."

While it is difficult to choose from the many highlights of this year's sessions, Professor Treede did stress that the live surgery elements are always the fundamental pillars of the Techno-College programme: "This morning, we have two transcatheter-based live cases which are being broadcast from Hamburg, Germany," he said.

One of the cases involves a TAVI patient with aortic regurgitation – a special indication in itself that will be made all the more special given that it will be treated entirely by surgeons.

"The other case involves the 'cracking'

technique, where a balloon is opened up inside the bioprosthesis in such a forceful way that the prosthetic ring is fractured," continued Professor Treede. "It's a pretty new approach which has been around for less than two years, but until recently has only been used in small numbers. This will be the first time it has been shown live, anywhere."

Friday's Techno-College includes a minimally invasive aortic valve replacement with a newly developed pericardial bioprosthesis that is combined with automated suturing technology – another brand-new innovation about to emerge on the market. "This allows for smaller access, faster operations and (possibly) more reproducible suturing," explained Professor Treede. "This is something delegates might find particularly useful to hear about – something practical they might be able to use pretty soon."

"The second live case on Friday from Leipzig, Germany, will showcase a new type of MitraClip – somewhat different from the one we have known and have used for many years. Again, what's interesting is that the team who will implant this are all cardiac surgeons, thereby proving that surgeons are very capable of doing interventional mitral-valve work."

Professor Treede is also looking forward to the 'Live-in-a-box' broadcasts, including Friday's from Freiburg, Germany, during which two aortic arch cases will be shown at the same time, both with similar pathologies. One will be treated surgically, and the other with TEVAR, the comparison serving to highlight the differences between the two treatment strategies, and who should receive them. The hope is that it will help other surgeons make decisions about which approach to use, noted Professor Treede.

"I'm also expecting a debate on Friday about the



*"If you want to see what's coming up in the next few years in regular cardiac surgery, transcatheter techniques and minimally invasive surgery, come along and see them all in one place."*

Hendrik Treede

techniques in a patient population that are very good candidates for surgery. In these situations, I think we should say, 'No, we already have a great treatment available here'."

The 'Lion's Den' format for the Techno-College Awards, introduced in 2018, will also return this year. Here, applicants present their case in front of a panel of not only experts in the field, but also venture capitalists and CEOs of companies too.

"Applicants are grilled, asked for ideas and have to make a business case," said Professor Treede. "In addition, the audience gets to vote and controls a third of the final outcome. It was very popular and good fun last year, so we've decided to stick with this format."

As he underlined, Professor Treede's main message is to encourage as many surgeons as possible to attend the Techno-College sessions to pick up ideas, advice, tips and insights that they might be able to use in their own practice to improve outcomes. "The Techno-College lives through its audience; we need you there. There are so many new techniques and procedures now, and these sessions will give you an overview of what's interesting, and what might help your daily practice," he said.

"If you want to see what's coming up in the next few years in regular cardiac surgery, transcatheter techniques and minimally invasive surgery, come along and see them all in one place."

## Focus Session | Cardiac | 3rd International EACTS VAD Coordinator Symposium

## The 3rd International EACTS VAD Coordinator Symposium

Thursday, 09:45–13:00, Room 3C, Pav 3

**Katrien Vandersmissen;**  
on behalf of the VAD Coordinator Symposium moderators

**T**he growing number of ventricular assist device (VAD) patients requires a dedicated team of health care professionals to bridge specific needs from ambulatory to hospital care. Consequently, the role of VAD coordinators is expanding. With this in mind, EACTS had founded a European association of VAD coordinators, and is actively supporting the development of this new profession.

The annual EACTS VAD Coordinator Symposium is a great opportunity to bring together the knowledge and experience of mechanical circulatory support (MCS) clinicians dedicated to caring for end-stage heart failure patients. Held this morning at 09:45 in Room 3C (Pav 3), the meeting will focus on the long-term management of VAD patients.

While VAD therapy started as a bridge to transplant, many patients are implanted with an alternative strategy. The experience of the Leiden University Medical Center (the Netherlands) is exceptional as the programme is dedicated to destination therapy only. During the session, Meindert Palmen will explain how his team has built up a



Keynote speaker Sarah Schettle (Rochester, USA)

destination programme and created a referral base.

Chronic heart-failure patients are faced with frailty, and decision making on VAD therapy is often troubled by the assessment of this frailty and its reversibility. The keynote speaker of this meeting, Sarah Schettle, (Rochester, USA), addresses this challenge to provide insight in how to deal with frail patients.

Other topics to be discussed today include improvement the management and quality of life of patients with VADs, the power of data, device innovations and infection control, shared by a number of esteemed European VAD coordinators.

We hope to see you there!

### Programme

#### Moderators:

A. M. Oppelaar, Utrecht, K. Vandersmissen, Leuven, D. Roefe, Bad Oeynhausen

#### 09:45

##### Frailty in LVAD patients

S. Schettle, Rochester

#### 10:15

##### How to build a DT program

M. Palmen, Leiden

#### 10:35

##### Daily life and Self-care in LVAD patients

G. Soerensen, Oslo

#### 10:55

##### Cold Atmospheric Plasm for Driveline infections

F. Mueller, Heidelberg

#### 11:15

##### The Power of Data: Waveforms and logfiles

T. Schlöglhofer, Vienna

#### 11:35

##### EUROMACS PRESENTATION

S. Antonides, Rotterdam

#### 11:55

##### HVAD and the future of Left Ventricular Assist Devices

K. Grudkovska, Framingham

#### 12:10

##### Latest advantages in the HeartMate 3(tm)

M. Muller, Eschborn, Germany

#### 12:25

##### Hands – on HeartMate and HeartWare



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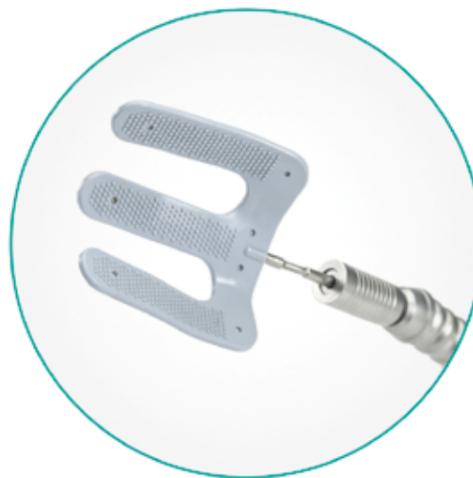
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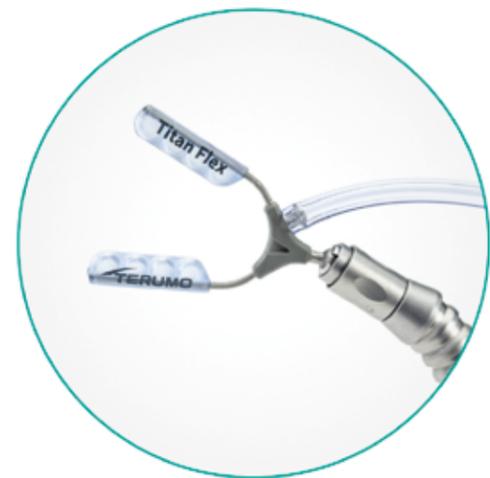
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## The Francis Fontan Fund

## Francis Fontan Fund: Attracting high-calibre applicants from all over the world



## FRANCIS FONTAN FUND



Rafael Sádaba

The Francis Fontan Fund for Education was setup by EACTS to support educational opportunities, foster professional development and promote lifelong relationships in cardiac and thoracic surgery for its members.

The Fund bears the name of the great Francis Fontan, the pioneering French cardiothoracic surgeon best known for his signature operation for tricuspid atresia, the Fontan procedure, who sadly passed away in January 2018. Professor Fontan was the first president of our Association, and remains a guiding light to this day.

In his honour, the Francis Fontan Fund offers several fellowships to young surgeons – exciting opportunities which offer the chance to learn new techniques and procedures via placement in cardiac surgery centres of excellence across the world.

To find out more about the latest activities within the Fund, and its growing success, *EACTS Daily News* spoke to its Chair, Rafael Sádaba, Associate Clinical Professor at the University of Navarra, and Head of the Research and Innovation Directorate for Diseases of the Heart at Complejo Hospitalario de Navarra in Pamplona, Spain.

"We now have six categories of fellowships available through the Fund," said Professor Sádaba. "We only set up the Fund two years ago, but we are now being inundated with applications

*"Each fellow has the chance of working with leading experts in a particular field and spends time in highly specialised centres."*

Rafael Sádaba

from high-calibre applicants. It's very encouraging and we plan to expand the number of fellowships we can offer even further in the future."

Most applications for fellowship are from young surgeons who have genuine reasons for wanting to study at centres with expertise in particular techniques, noted Professor Sádaba. "In deciding who we award them to, we consider how much that individual will potentially learn from the fellowship and how they will make use of their learning in day-to-day practice."

Applications for fellowships are received from all over the world including Brazil, India, Malaysia and China, and this international spirit extends into the lasting relationships that develop. "Each fellow has the chance of working with leading experts in a particular field and spends

## FFF Fellowships

Professor Sádaba outlined details of the Francis Fontan Fund for Education fellowships (some of which are closed for this current year but will be open again in 2020).

**The Postoperative Critical Care Fellowship in Adult Cardiovascular Surgery 2020**

This is a four-month fellowship at the Department of Cardiovascular Surgery at the Hospital Clinic Barcelona, Spain, running from January to May 2020. Applications close in a few days on October 6. This fellowship has been designed to provide knowledge and competences required in postoperative care of cardiovascular surgery patients.

The successful trainee will engage in perioperative management of patients undergoing cardiovascular surgery under the supervision of the department and fellowship programme director. There will be a special focus on post-operative care, and fellows will be expected to acquire all of the knowledge, training and skills necessary to be able to adhere to the European Board of Cardiothoracic Surgery (Membership and Cardiac subspecialty) during or after completion of the fellowship.

In January 2019, two surgeons from Italy and Kenya started their fellowship at the Hospital Clinic Barcelona.

**The Atrial Fibrillation Fellowship in co-operation with AtriCure**

There are six fellowships available in this category. Fellows get the chance to stay in a high-volume AF ablation centre in Stuttgart (Germany), Warsaw (Poland), Nieuwegein (the Netherlands), Brescia (Italy) or Brussels (Belgium) and attend two AtriCure events including a one-day course called 'Navigating the Maze', alongside the 'Maze IV training course'.

**The EACTS-MSTCVS Quality and Outcomes in Cardiac Surgery Training Fellowship**

This fellowship focuses on quality collaborative activities and data analysis.

This includes the chance to spend four months with the MSTCVS in Ann Arbor, Michigan, USA. Milan Milojevic from the Department of Cardiothoracic surgery at Erasmus University, Rotterdam, the Netherlands, completed the fellowship in 2018 and Chris Bond, a surgeon from the Heart of England NHS Foundation Trust, Birmingham, UK, took up a fellowship in 2019.

time in highly specialised centres," said Professor Sádaba. "As such, the peer-to-peer relationships that are established often continue long after the fellowship has ended."

As he underlined, some of the newer fellowships are being run in collaboration with industry, securing a valuable source of revenue to help run the programme.

The six categories of fellowships on offer cover a wide range of specialities including: advanced postoperative care in cardiovascular surgery, atrial fibrillation (in partnership with AtriCure), off-pump coronary artery bypass (OPCAB; in partnership with Medtronic), uniportal Video-assisted thoracoscopic surgery (VATS), aortic root and valve repair

**OPCAB Fellowship**

Here the goal is to provide newly graduated cardiothoracic surgeons from around the world (especially those with an interest in off-pump and minimal invasive techniques) with an educational opportunity to enhance their clinical understanding and to acquire theoretical and practical knowledge in the surgical management of patients with coronary artery disease.

The fellowship is under the guidance of leading surgeon-educators in this field.

The specific learning objectives are to provide surgeons with the foundational knowledge of the pathophysiology of coronary artery disease, the rationale for its surgical treatment and first-hand experience in OPCAB and minimally invasive cardiac surgery (MICS) coronary artery bypass grafting (CABG).

As a result of this training, fellows may ascend to leadership roles and set up their own OPCAB/MICS CABG programmes in their own centres.

**Uniportal VATS Fellowship in General Thoracic Surgery**

This is a three-month fellowship in uniportal access to lobectomy at Shanghai Pulmonary Hospital and Tongji University in China – a high-volume centre performing the highest number of lung cancer resections in the world.

The successful fellow will be involved in acquiring hands-on experience in a mentor- and surgeon-led environment, which could eventually lead to performing procedures either under remote supervision or no supervision.

**Aortic Root and Valve Repair Fellowship**

The purpose of this fellowship is to acquire knowledge on the disease of the aortic valve and the aortic root, understand the basis for current recommendations for management and learn about optimal management.

It consists of a two EACTS organised courses, one in Windsor, UK, and another in Brussels, plus a two-week internship in a high-volume centre (one week in Paris, France or Brussels, and one week in Homburg, Germany or Rome, Italy).

and the EACTS MSTCVS (Michigan Society of Thoracic and Cardiovascular Surgeons) Quality and outcomes in Cardiac Fellowship.

For more details of the Francis Fontan Fund for Education please head to: <https://www.eacts.org/the-association/franciscfontanfund/>

## Training Village

## Come visit the TAVI Training Village

**Enrico Ferrari** Cardiovascular Surgery, Cardiocentro Ticino Foundation, Lugano, Switzerland

During the last 10 years, cardiovascular surgery has rapidly changed, with new transcatheter devices for valve replacement or repair becoming more and more familiar to a new generation of cardiac surgeons, earning them a more consistent role in daily clinical practice. The implementation of new transcatheter devices together with the rapid innovation of hybrid and minimally invasive cardiovascular procedures has led to the creation of multidisciplinary Heart Teams in the majority of cardiovascular centres worldwide, thereby modifying the perception of what the modern cardiovascular surgeon looks like.

In this new era, skills for the manipulation of wires and transcatheter devices are required, however these skills are not always integrated in the postgraduate cardiovascular surgical training programme of countries in and outside of Europe. As such, the EACTS Academy has gradually introduced the



concept of advanced specialised education for young cardiovascular surgeons, with course-led teaching of the guidewire skills required to perform both minimally invasive and transcatheter heart-valve procedures.

For Heart Teams, knowledge of the technical details surrounding new transcatheter technologies such as valve devices or new low-profile delivery catheters is strongly associated with the possibility



of performing successful transcatheter valve implantations or repairs in complex high-risk cases or in selected intermediate-risk patients.

To that end, the TAVI Training Village hosted here at the 33rd Annual Meeting is a great opportunity for all cardiovascular surgeons to touch and play with guidewires, valves, delivery systems and simulators. In partnership with Industry, we have been able to

organise a fascinating journey through the latest transcatheter valve devices and technologies where self-expanding valves, balloon-expanding valves, valve clips and guidewires are at disposal of all cardiovascular surgeons who understand the need and desire of the modern Heart Team to maintain a key role in the modern cardiovascular domain.

The Training Village is a place where the virtual introduction of guidewires together with the implantation of valve devices is performed in modern simulators. Both transapical delivery systems and transfemoral devices are available at EACTS TAVI Training Village for manipulation and simulation. We strongly believe that the cardiac surgeon, as part of the Heart Team, has to be able to actively participate in trans-vascular procedures in partnership with cardiologist colleagues.

We look forward to welcoming you to the TAVI Training Village, and we look forward to discussing the indications and the technical details underpinning modern transcatheter heart valve therapies.

The TAVI Training Village takes place 14:30–17:45 today

# CryoLife enters into distribution agreement with Endospan

CryoLife, Inc., a leading cardiac and vascular surgery company focused on aortic disease, announced that it has entered into distribution and credit facility agreements with Endospan, as well as an option agreement to purchase Endospan. Endospan is an Israeli-based, privately-held developer of NEXUS™, the only endovascular stent graft system approved for the repair of both aneurysms and dissections in the aortic arch. The addition of NEXUS™ to CryoLife's highly differentiated branched aortic stent graft portfolio further strengthens the Company's position as a leader in the growing aortic repair market. By this CryoLife will be able to offer an even more comprehensive and differentiated portfolio of products and technologies for the endovascular treatment of the entire aorta, from the ascending aorta to the iliac arteries - all from a single source.

NEXUS™, the first approved branched endovascular system to treat aortic arch disease, transforming a complex surgical aortic arch repair into a standard endovascular procedure. It is designed for enhanced intra-procedural and long-term stability attributable to its proprietary geometrical design, which reduces arch manipulation and, hence, stroke risks.

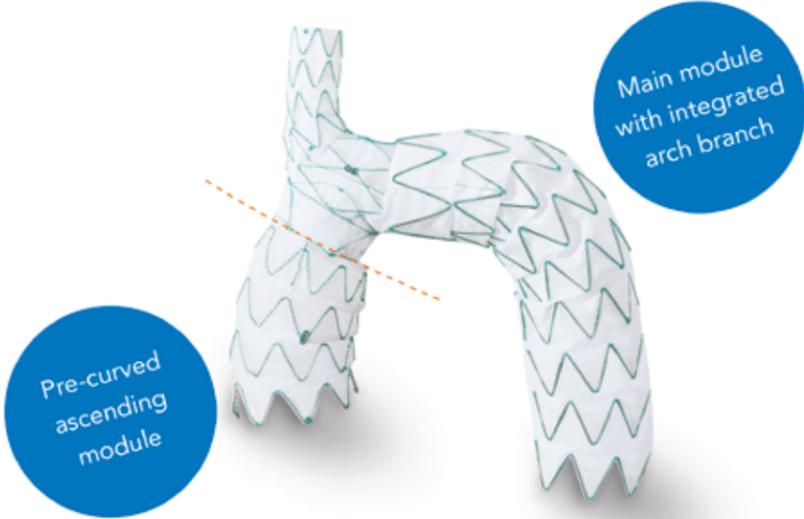
Prof. Dr. Nicolas Doll, Sana Cardiac Surgery, Stuttgart, Germany, commented, "NEXUS is a highly differentiated stent graft system that allows physicians to repair aneurysms and dissections in the aortic arch through an endovascular approach. NEXUS is especially important for elderly patients who are not suited for open surgery, and for patients with a prior Type A dissection that was repaired in an open surgical approach."

Univ. Prof. Dr. Hubert Schelzig, Clinic for Vascular and Endovascular Surgery, University Clinic Düsseldorf, Germany, commented. "The NEXUS system has the potential to cross the next frontier in aortic surgery, namely a safe, therapeutic, minimally invasive procedure in aortic arch pathology. Not only does it provide a platform to treat the aortic arch, but it is a perfect fit with CryoLife's highly differentiated and comprehensive portfolio of products that treat the entire aorta."



## NEXUS™ Stent Graft System

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## Annual Meeting

## This year's Congenital Domain

**Lorenzo Galletti** 'Bambino Gesù' Paediatric Hospital, Rome, Italy; Chair, Congenital Heart Disease Domain

The Congenital Domain will feature a roster of 14 sessions.

We think that the Annual Meeting should honour presentation of original work, thus all but one of the sessions has been assembled from abstract presentations and featured lectures by experts. Among the abstracts received, 36 have been selected for oral presentation, 18 of which will be held in Rapid-Response sessions. This format has been particularly appreciated in the last few years due to the animated discussion that is often generated.

This year we have two sessions dedicated to adult congenital heart disease, a topic more and more prevalent in congenital meetings. Two invited lectures will address fundamental aspects



that include the status of adult congenital management in Europe, and the long-term neuro-psychological, social and working aspects that patients face after correction of their heart disease.

Two sessions will be dedicated to single ventricle lesions – one to hypoplastic left heart syndrome (HLHS) and the other to the complex problem of atrioventricular valve regurgitation in single ventricle reconstruction. Another session is dedicated to

updates on mechanical circulatory assist devices in children – a field of continuous evolution. Other topics that will be touched upon include coronary disease in children, valve surgery in children and Ebstein's anomaly.

This year, as a novelty, we wanted to include the presentation of clinical scenarios with interactive discussion of possible therapeutic options. These will take place during two sessions ('Ebstein Disease' and 'AVV Regurgitation in SV'; see session listings for details). The underlying idea is to mimic what normally happens in our surgical units when patients are presented and discuss, in an interdisciplinary manner, how we can establish a pathway for treatment. We will also host a session dedicated to innovative surgical techniques, illustrated by eight video presentations.

Finally, an important session entitled 'Knowledge Generation in Congenital Heart Surgery' is

dedicated to the analysis and discussion of evidence derived from the latest guidelines and trials in congenital heart disease. Two invited lectures will address topics from the EACTS-AEPC existing guidelines on transposition of the great arteries (TGA) and truncus arteriosus, and a third lecture will be dedicated to expert consensus related to management of anomalous aortic origin of coronary arteries.

We also know that existing guidelines for the management of valvular and aortic diseases do not accurately fit the young and/or congenital patient. Keeping this in mind, two lectures will discuss management of aortic dilation in the congenital patient and the role of the Ross operation in aortic valve replacement. The final lecture of this session will be dedicated to evidence generated by a single-ventricle reconstruction trial – an important prospective multicentric study dedicated to HLHS.

## Congenital Domain sessions at the 33rd Annual Meeting

Date	Session	Time
Thu 3 Oct	Mechanical Circulatory Support	08:30–09:30
	Congenital Rapid Response 1	09:45–11:15
	Knowledge Generation in CH Surgery	11:15–12:45
	Management of ACHD 1	14:30–16:00
	Management of ACHD 2	16:15–17:45
Fri 4 Oct	Coronary arteries in CHD	08:00–09:30
	Training Suite: Congenital – Ross and the Reinforced Ross	08:00–11:15
	Congenital Rapid Response 2	09:45–11:15
	Management of HLHS	14:00–15:30
	AVV Regurgitation in SV	15:45–17:15
Sat 5 Oct	Congenital Video	08:00–09:30
	Ebstein Disease	11:45–13:15
	Congenital Valve	13:30–15:00
	Congenital Miscellaneous	15:15–16:45

## A great year for the Vascular Domain

**Davide Pacini** S.Orsola-Malpighi Hospital, University of Bologna, Italy; Chair, Vascular Disease Domain

The Vascular Domain programme over the next three days will include several focus sessions that will alternate with Abstract and Rapid Response sessions. All the aspects of aortic disease treatment – from the valve to the abdominal aorta – will be covered and discussed. Masters in aortic surgery from all over the world will make their contributions, underlining the Annual Meeting as a unique event.

This year started as a great success for the Vascular Domain thanks to the traditional appointment of the 'Introduction to Aortic Surgery' course (pictured), held 14–16 March in Windsor, UK, about which participants gave extremely positive feedback – better than ever before. Aimed at residents and young surgeons wishing to broaden their experience in the aortic pathologies, this year's highly interactive course covered major aspects of the aortic valve, ascending aorta and arch, all the way to the descending thoracic aorta.

Invited experts supported delegates with keynote presentations and supervision during wet labs, dry labs and hands-on simulations of valve sparing procedures, arch repair and aortic root enlargement techniques. Live-in-the-box cases gave the opportunity to engage in practical training during the course. Delegates were also trained in the basics of thoracic endovascular

aortic aneurysm repair (TEVAR) via a dedicated simulation session.

We then had two Academic Courses on Aortic Valve Repair: the EACTS Aortic Valve Repair Summit in Brussels on June and the Advanced Skills Course 'Reconstruction of the Aortic Valve and Root: A practical approach' taking place 18 to 20 September in Homburg Saar, Germany. During these two courses, knowledge and concepts spanning all aspects of the management of the proximal aorta were shared. They were specially designed in a didactic way to allow participants to reproduce the content.

The Vascular Domain is also working hard to offer an educational programme on TEVAR via multi-stage courses. The aim is to join the Hybrid Surgeon Educational Programme, thereby offering proof and certification of an acquired skill competence. Two fellowships will be provided to support and encourage this programme. The objectives of the endovascular courses will range from the basic principles of imaging and transcatheter skills to the management of more complex thoracic and thoraco-abdominal aortic pathologies. Participants will be able to work in a hybrid room and practice on C-arm; they will also be actively involved in the use of simulators and animal models.

The Vascular Domain continues to spread aortic knowledge and promote research and education on vascular pathologies. We hope you stay tuned for future events!



Davide Pacini



The 'Introduction to Aortic Surgery' course held in March.



Thomas Walther

## The EACTS Acquired Cardiac Disease Domain

**Thomas Walther** University Hospital, Frankfurt, Germany; Chair, Acquired Cardiac Disease Domain

Thank you very much for your interest in adult cardiac surgery and for your participation at this year's EACTS Annual Meeting. This year's Acquired Cardiac Disease Domain programme features many interesting sessions, including didactic state-of-the-art lectures, abstract sessions, live-in-box video presentations and training courses. Topics to be covered include the

latest evidence in coronary artery bypass grafting, aortic valve repair and aortic valve replacement, indications and technical aspects as well as longer-term outcomes of transcatheter aortic valve implantation, mitral valve repair or replacement, transcatheter techniques to treat mitral valve disease, therapy for heart failure and new ideas in the miscellaneous sessions. Experts in different fields will provide structured overviews in order to summarise session content and provide perfect learning experiences.

Additionally, two major Techno-College sessions

– featuring live surgery and the latest technical developments – will focus on topics including endoscopic mitral valve therapies, new ablation strategies, updates on the latest TAVI technologies, minimally invasive access options and tricuspid valve therapies. We are confident that, as in previous years, these sessions will generate some of the true highlights of the Meeting.

We hope that by raising your interest in the new developments and medical advances in adult cardiac surgery, you will be encouraged to participate in one of the

different Task Forces of the Acquired Cardiac Disease Domain within EACTS. These Task Forces are made up of international colleagues who have an interest in developing our speciality further. Currently the following Task Forces exist: New Technology, Coronaries, Arrhythmia, Heart Failure, Mitral and Tricuspid therapies, Imaging, Transcatheter Techniques, Aortic Valve Surgery, and Aviation Medicine.

If you are an EACTS member and wish to participate in one of the above Task Forces please apply via your EACTS user account in the Self Nomination area.

Annual Meeting

# The 2019 Thoracic programme

**Eric Rössner** University Hospital Mannheim, Germany; Chair, Thoracic Disease Domain

**T**horacic topics here in Lisbon will cover a broad range of specialist areas, ensuring full immersion in cutting-edge techniques, guidelines and best practises. Some of the highlights from the expansive programme include: Techno-College sessions on new technologies beyond robots, complex sleeve resections, 'how to' teaching and very advanced surgery with live-in-a-box videos; a joint session with the European Respiratory Society (ERS) on mesothelioma, including presentation of the new joint guidelines; a joint EACTS-STS-ASCVTS session on international perspectives on lung cancer screening; and other great, high-level abstracts across all fields of thoracic surgery.

Throughout the year we also feature three Thoracic Surgery courses, the first of which took place from 4 to 6 April at the EACTS Headquarters in Windsor, UK. Part I of the series (pictured) offered greater insight and up-to-date knowledge on different aspects of thoracic surgery related to lung diseases with emphasis on lung cancer, infectious diseases, lung resection and transplantation. There was also a hands-on dry-lab session on bronchoscopy placement of double lumen tubes and bronchial blockers. Thoracic Surgery: Part II was held 5-7 September in its new location of Mannheim, Germany, featuring fantastic international speakers who are experts in their field. The main topics and sessions showcased included: Chest wall, surgery for metastasis and mediastinum; hands-on sessions on chest wall repair; energy devices, lasers and the latest DaVinci XI dual console system.

Part III will be hosted in Porto, from 28 to 30 November. There we will focus on extended resections, hands-on sessions on sleeve resections, and much more. Final-year trainees, junior consultants and anyone preparing for EBCTS or EBTS are encouraged to attend.



EACTS Residents

# Highlights for residents at the 33rd EACTS Annual Meeting



**Miia Lehtinen** Kymenlaakso Central Hospital, Finland

**S**ince trainees are the future of our specialty, each year, EACTS organises numerous Annual Meeting sessions targeted especially at residents. These sessions are designed by residents for residents. Over time, many of these sessions have become real classics, but every year the EACTS Residents Committee tries its best to come up with new sessions that provide education across 'hot topics' in the field.

This year, we will start the Meeting by organising a tour for residents. The aim of this tour is to get the most out of the conference. The EACTS Annual Meeting has grown into a huge event with multiple sessions at the same time – as well as interesting sessions in the Exhibition Hall, which hosts numerous activities provided by our collaborators. Thus, **during the tour held at 14:00 this afternoon**, we will start from the EACTS Residents Lounge and take a stroll through everything that this year's fantastic venue has to offer over the next three days.

As we begin the first day of the Meeting, residents will get a chance to hear some alternative career paths. In the 'Outside the Box of Cardiothoracic Surgery' session (Thursday, 11:15, Room



Miia Lehtinen (third from left) with fellow members of the Resident's Committee

108) we will hear presentations by senior colleagues who have chosen to work in crisis areas. If you are interested, you will have a chance to ask how to participate in this kind of international work yourself. And, to end the session with on a lighter note, we will hear an inspiring presentation by a surgeon who balances his successful surgical career with something completely different: winemaking!

The EACTS Residents Committee has a strong belief in collaboration. Thus, this year we will feature two

*“In conjunction with our growing collaboration with national resident societies, the Residents Committee launched a survey on current training practices in Europe.”*

Miia Lehtinen

special sessions: one organised in cooperation with the Young Community of the European Society of Cardiology (ESC), called 'The Team is the Key' (Thursday, 14:30, Room 5C, Pav 5); and another called 'Help! Trainee in Trouble' (Saturday, 15:15, Room 108) which we will organise with great help from national resident societies in France, Germany, the UK, Switzerland, Portugal and the Netherlands. Both of these sessions will provide interesting food for thought via complex case examples, all presented by residents.

In conjunction with our growing collaboration with national resident societies, the Residents Committee launched a survey on current training practices in Europe. We have finally gathered all the responses from trainees in numerous European countries and will present the results in our 'Career Development' session (Saturday, 11:45, Room 108). In this session, we have also invited successful surgeons to share some tips from their own career path, ranging from how to fit family life into an academic- and clinical work schedule, to publishing in high-impact journals.

And of course, like in the previous years, we will once again hold on to our traditions and organise our three popular staples: the 'Work in Progress' session (Saturday, 08:00, Room 108), bringing future research talents to the stage; 'Nightmares in CT Surgery' (Friday, 14:00, Room 108), where well-known surgeons will reveal their most palm-sweating cases; and 'How to do it – Live in a box' (Friday, 15:45, Room 108), during which refined surgical techniques will be introduced by top-talents in the field.

To end the Annual Meeting in style, we will host the Residents Luncheon on Saturday. Please remember to book your seat at your favourite table in good time – the seats always sell out fast!

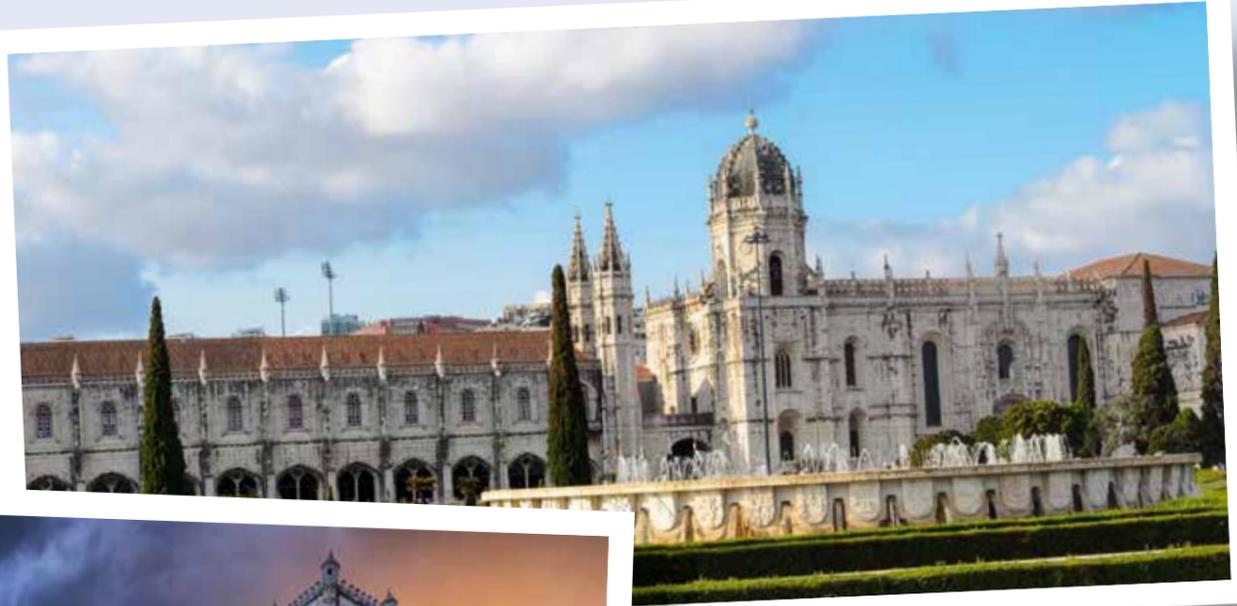
# INSIDE LISBON

Where to go? What to do?

## BEST OF BELÉM

### MOSTEIRO DOS JERÓNIMOS

Lisbon's original story of one-upmanship, this breathtaking Unesco-listed monastery was commissioned by Manuel I at the end of the 15th Century to lord it over Vasco da Gama, the Portuguese explorer who was the first European to reach India by sea. That's one beautiful act of jealousy...



### TORRE DE BELÉM

The Tower of Belém is an intricate yet powerful fortress built in the early 16th century to protect Lisbon's harbour from would-be attackers. Resembling a giant chess piece, its design includes meringue-like cupulas and even rhinoceros-inspired stonework. The views from the top are stunning, but be warned it gets very busy on Sundays.



### MUSEUM OF ART, ARCHITECTURE AND TECHNOLOGY

Rising out of the ground like a majestic wave, the MAAT museum showcases art, architecture and technology right on the waterfront. Its exhibitions often reflect its location, with displays on ocean pollution being particularly poignant.



### PASTÉIS DE NATA

The famous (and delicious) Portuguese tart filled with custard cream and dusted with cinnamon originated in Belém back in the early 1800s. If you want the most authentic, *Antiga Confeitaria de Belém* is the place to go.



## ALFAMA

### CASTELO DE SÃO JORGE

Lisbon's oldest quarter, Alfama, is about as picture-perfect as it gets. Its most visited attraction is this seemingly well-preserved castle dating back to around 200 BC which, over generations, has served as everything from a barracks and prison to a theatre and even a children's home.

In reality, what you see has been largely restored since 1938, but its magnificence is still timeless.



### TAKE A TRAM

Far from being a quaint tourist attraction, the little yellow trams of Lisbon are still used by hundreds of locals every day. But, for that true out-of-towner experience, hop onto the number 28 tram for a more scenic journey through Alfama's rustic streets.

### FABULOUS FADO

The soulful sound of Alfama is Fado, a centuries-old traditional music that rose out of Lisbon's poorest classes. If you want to learn more about it, the nearby Fado museum charges a small fee to fill your head with historical context. Or, you could take a seat in almost any restaurant or bar to hear it first-hand.

Abstract | Congenital | Management of ACHD

# Outcomes of aortic coarctation surgical repair in adolescents and adults: the efficacy of left subclavian artery to descending aorta bypass grafting

**Sungkyu Cho<sup>1</sup>, Chang-Ha Lee<sup>2</sup>, Eung Rae Kim<sup>2</sup>, Jae Hong Lim<sup>2</sup>** 1. Department of Thoracic and Cardiovascular Surgery, Seoul National University Children's Hospital, Seoul, South Korea; 2. Department of Cardiovascular Surgery, Sejong General Hospital, Bucheon, South Korea

## Introduction

**T**reatment of adult coarctation of the aorta (CoA) is challenging due to complications with other cardiac diseases, vascular abnormalities (such as aneurysms) and possible CoA recurrence. Therefore, adult CoA patients may require a different surgical method than that for children – of which several operative techniques exist.

Surgical strategy was determined based on the coarctation site, length of the coarctation segment, collaterals, concomitant lesions, and surgeon preference. A variety of surgical techniques are available to manage CoA which can be classified as either *in situ* management or extra-anatomical bypass.

*In situ* techniques have been used in patients as follows: In patients with an aortic aneurysm, we preferred aneurysmal resection and graft interposition; end-to-end anastomosis was primarily used in patients with very short coarctation segments.

Extra-anatomical bypass was often used in patients with long coarctation segments, and those with high-risk of recurrent laryngeal nerve injuries due to severe adhesion of the coarctation segment. Left subclavian artery to descending aorta bypass was performed without cardiopulmonary bypass. This technique was performed via left thoracotomy through the third or fourth intercostal space, and a graft was interposed under partial aortic clamping. The patients who underwent left subclavian artery to descending aorta bypass required a smaller dissection and did not have compromised arterial blood flow to the spinal cord.

## Methods

From November 1994 to July 2018, 24 adolescents and adults



Sungkyu Cho (left) and Chang-Ha Lee

underwent CoA repair. The mean age at operation was  $29.9 \pm 15.1$ ; 19 (79%) were older than 18 years; 16 (67%) patients had hypertension; 5 (21%) had bicuspid aortic valves; 4 (17%) had descending aneurysms; 2 (8%) had ascending aneurysms; 2 (8%) had patent ductus arteriosus; and 1 (4%) had an atrial septal defect. There were three patients who had prior surgery (two CoA repair, one ventricular septal defect repair).

## Results

Surgical correction included extra-anatomical bypass in 12 (50%) patients (9 left subclavian artery to descending aorta bypass, 2 proximal-to-distal coarctation bypass, 1 ascending-to-descending bypass), an end-to-end anastomosis in 6 (25%), resection and interposition of the graft in 5 (21%), and 1 (4%) arch augmentation with a patch. Mean follow-up duration was  $6.2 \pm 5.1$  years. No mortality was observed. No patients required reoperation or re-intervention. Mean upper extremity systolic pressure significantly decreased from  $142.4 \pm 30.3$  mmHg preoperatively to  $121.1 \pm 15.9$  mmHg postoperatively ( $p = 0.002$ ). Arterial pressure gradient between the upper and lower extremities significantly decreased from  $50.0 \pm 21.8$  mmHg preoperatively to  $9.7 \pm 13.5$  mmHg postoperatively ( $p = 0.000$ ).

The postoperative mean upper extremity systolic pressure of nine patients who underwent left subclavian artery to descending aorta bypass also significantly decreased from  $141.2 \pm 34.5$  mmHg to  $117.9 \pm 13.5$  mmHg ( $p = 0.036$ ). Postoperatively, the mean right- and left-sided ankle-brachial pressure index of patients who had a left subclavian artery to descending aorta bypass were  $0.96 \pm 0.16$  and  $0.94 \pm 0.11$ . All grafts were patent at the last follow-up. Postoperative course was uneventful with no morbidity.



Figure 1. Postoperative CT image

## Conclusions

CoA surgical repair in adolescents and adults showed good outcomes. Left subclavian artery to descending aorta bypass is a safe and reliable approach that is recommended for complex CoA with long stenotic segments. Re-coarctation, following previous transcatheter or surgical therapy and calcification of the aorta, is another indication for this kind of bypass. This procedure avoids total cross-clamping of the aorta and extensive dissection through the hard adhesions between the CoA and surrounding organs. Compared to other surgical techniques, it is easy to perform, tension free, and the collateral vessels can be preserved.

Rapid Response | Cardiac | Review of the latest tendencies and improvements in cardiac surgery

# Contemporary Valve Heart Team: Indications and decision-making in 500 consecutive cases

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Alberto Pozzoli

**E**valuation of patients with valvular heart disease aims to diagnose, quantify and assess the mechanism of disease, as well as its consequences. Decision making for intervention should be made by a dedicated 'Heart Team' with specific expertise in valve diseases ('Valve Team'). It comprises cardiologists and cardiac surgeons, imaging specialists and anaesthetists. General practitioners, geriatricians, heart failure specialists, electrophysiologists or intensive care specialists should be also involved whenever needed.

The Heart Team approach is particularly advisable in the management of high-risk patients, but is also important for other subsets, such as asymptomatic patients, or when the evaluation of valve reparability is a key component in decision making. The futility of interventions in patients unlikely to benefit from the treatment should always be taken into consideration.

Therefore, the Valve Heart Team is currently considered as a standard of care to guarantee a tailored therapy for patients with valvular heart diseases<sup>1</sup>. However, little is known about patient profiles, treatment delays and adherence to guidelines with this approach. The aim of this study was to determine the feasibility of a multidisciplinary Valve Team that could drive decision making for patients with valvular heart disease.

In this retrospective analysis, we analysed consecutive cases of valvular heart disease discussed by our institutional Heart Team. Assessments were made concerning the distribution and characterisation of patients according to the aetiologies of their disease, the decision-making process used during the Valve-Team meeting and the final indications.

The results uncovered that between July 2018 and April 2019, 500 case discussions occurred (15 were repeat cases, resulting in a cohort of 485 patients, or 48.5 patients/month). The mean age was  $72 \pm 12$

years, 63% were men, and 35% had concomitant ischaemic cardiomyopathy. The Society of Thoracic Surgeons score was 1.7 vs 5.9% for surgery and catheter-based procedures, respectively. Aortic valve disease was present in 305 patients (combined with aortic vascular disease in 27% of patients and mitral disease in 5%), of whom 103 patients (34%) received surgical treatment and 202 patients (66%) received TAVI (15% valve-in-valve).

Mitral valve disease was discussed in 164 patients (97% degenerative aetiology), of whom 125 patients (76%) were treated surgically and 33 patients were referred to transcatheter treatment (85% MitraClip). Isolated tricuspid valve disease was present in 13 patients (2.6%), of whom seven were percutaneously treated. Treatment decisions were postponed in 35 patients (5.5% of cases) due to a need for additional diagnostic information (angio-CT or stress echocardiography in all the cases). Conservative treatment was chosen in 12 patients (2.4%) due to absence of treatment indication stemming from optimisable medical therapy and a lack of symptoms. Every patient was discussed within one week from referral and treated in less than four weeks from Valve Team evaluation. Indications were adherent to ESC Valve Guidelines in 483 cases (99.6% of patients) and proposed treatment

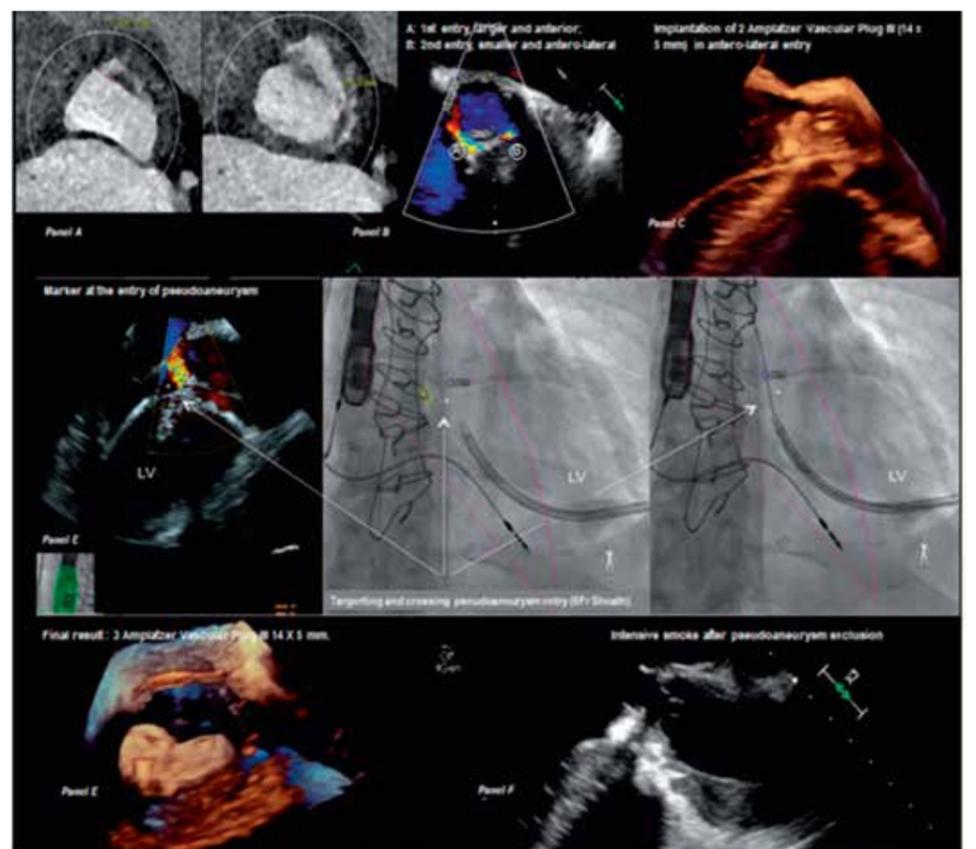


Figure 1. Example of complex multidisciplinary case discussed. A rare case of transcatheter exclusion of a huge aortic pseudo-aneurysm following aortic bio prosthetic endocarditis: key role of multimodality imaging and 3D echo-fluoro fusion imaging.

by referring physicians was confirmed in all but 27 patients (94% of patients).

To conclude, in our single-centre analysis, the Heart Team approach for valve heart disease was feasible, with multidisciplinary decision-making and consecutive treatment within a short time after referral. The timing of treatment could be further optimised if adequate information and imaging could be available at the time of the Heart Team

discussion. The Valve Team is currently an integrated part in the treatment of cardiovascular valve disease according to European Guidelines, and it is standard of care at our institution.

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## Abstract | Cardiac | Re-directing blood flow with mechanical circulatory support

## Fibonacci's Golden Ratio

## An innovative approach to the design and management of extracorporeal circulation

**Ignazio Condello<sup>1</sup>, Giuseppe Nasso<sup>1</sup>, Flavio Fiore<sup>1</sup>, Seanne Azzolina<sup>1</sup>, Bonifazi Raffaele<sup>1</sup>, Nicola Di Bari<sup>1</sup>, Fabrizia Massaro<sup>1</sup>, Francesco Bartolomucci<sup>2</sup>, Giuseppe Speziale<sup>1</sup>** 1. GVM Care & Research, Department of Cardiovascular Surgery, Anthea Hospital, Bari, Italy; 2. ASL BAT, Department of Cardiology, Andria, Italy

**T**echnological advances in the field of extracorporeal circulation (ECC) over the past decade have led to numerous methods for monitoring metabolism and coagulation during cardiopulmonary bypass (CPB), as well as to the development of materials with improved biocompatibility, thereby reducing the risks associated with CPB. However, ECC is still predominantly based on a traditional design that involves the use of roller pumps. This exposes the patient to a variety of pathophysiological consequences, both intra- and postoperative, such as cognitive disorders, haemolysis and haemodilution, systemic inflammation and changes in coagulation.

Here we describe the advantages of an ECC circuit inspired by the Fibonacci Golden Ratio<sup>1</sup>, which does not use a roller pump, in a prospective study of patients undergoing elective cardiac surgery. Comparing to conventional ECC, this prospective cohort study of superiority was carried out between August and mid-November 2018 at Anthea Hospital, GVM Care & Research (Bari, Italy). The study consisted of 60 adult patients (aged 49–75 years) who were scheduled for elective isolated aortic valve replacement (AVR; n = 30) or ascending aortic replacement (AAR; n = 30) with ECC for CPB. Patients were randomly assigned to either the Fibonacci circuit or conventional circuit (Figure 1).

The Fibonacci ECC includes a serial impeller pump along with vacuum-assisted venous drainage (VAVD) for intracavitary aspiration into a venous reservoir and a further VAVD for another hardshell reservoir. The Conventional ECC circuit takes advantage of a VAVD master pump<sup>2</sup>. Intracavitary aspiration into the venous reservoir is achieved via



Ignazio Condello



Giuseppe Speziale operating

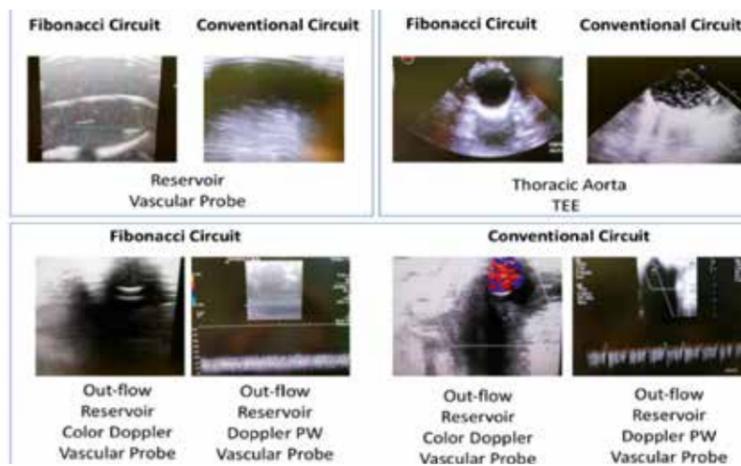


Figure 2. Measurement of fluid dynamics – with ultrasound in the circuit components and thoracic aorta – during cross-clamp.

a roller pump, and extracavitary aspiration is achieved via a roller pump in a second chamber of the reservoir<sup>3</sup>.

During CPB, echocardiography was used to estimate the quality of fluid dynamics in the extracorporeal circuit and the patient's arterial vessels (Figure 2). A DO<sub>2</sub> management system was used to evaluate metabolism, and an electronic system was used to determine gaseous microemboli (GME) counts.

Statistically significant differences between the Fibonacci and conventional groups were found in the average value of DO<sub>2</sub>, the cardiac index and the volume of fluids administered. The average absolute free haemoglobin (fHb) concentration at 10 min after CPB in the Fibonacci group was significantly less than that in the conventional group (12.7

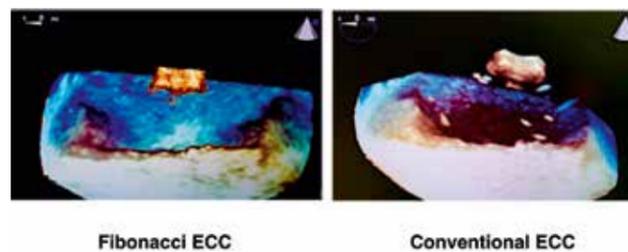


Figure 3. Transoesophageal echocardiography for evaluation of fluid dynamics in the ascending aorta during cross-clamp. Fibonacci EEC (left) and Conventional EEC

± 0.7 vs 38.9 ± 0.4 mg/l; p = 0.003). Furthermore, on average, the Fibonacci group required significantly fewer red blood cell (RBC) units per patient (p = 0.003).

The rates of major and minor postoperative morbidity were comparable between the groups, except for agitation upon discontinuation of anaesthesia (1 patient in the Fibonacci group vs

7 in the conventional group, p = 0.004), and postoperative delirium (0 vs 5 patients; p = 0.005). This increased postoperative cognitive dysfunction was also associated with a longer ICU stay (16.9 vs 43.4 hours, p = 0.04).

Fibonacci ECC offered superior intraoperative fluid dynamics, reduced the production of – and improved

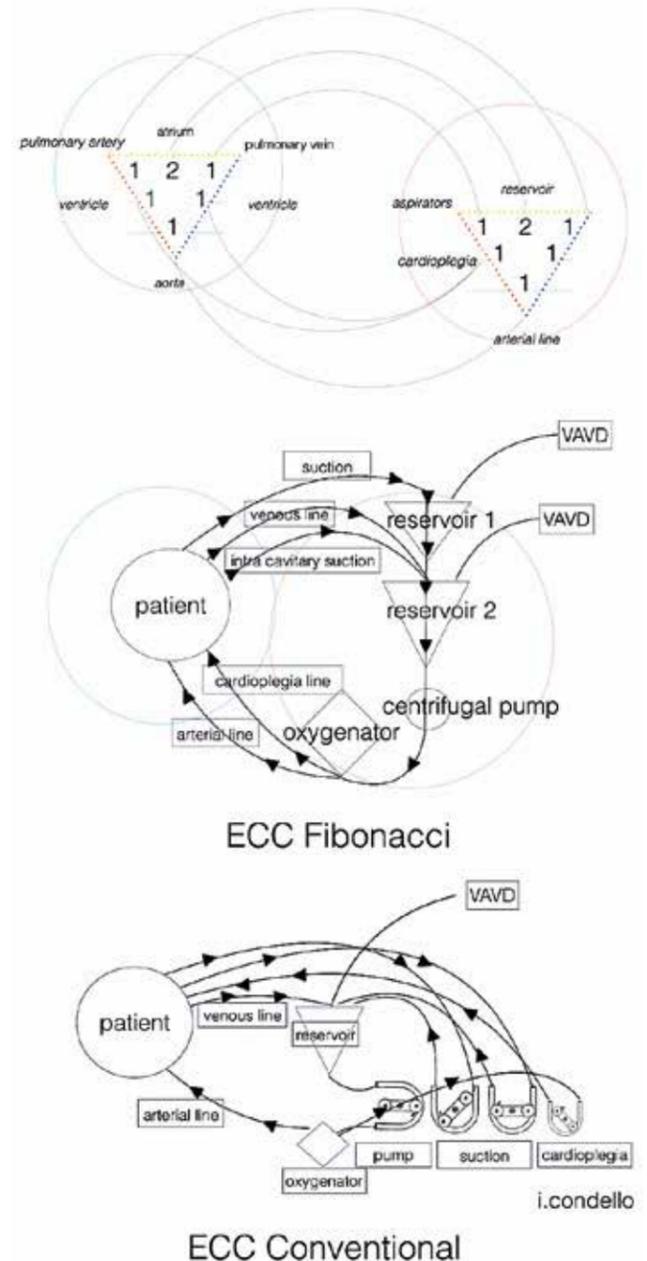


Figure 1. Differences in the structure and design of Fibonacci ECC and conventional ECC.

elimination – of GME (Figure 3), and improved intraoperative metabolism, particularly with regards to oxygen delivery and extraction. The improvements in fluid dynamics and metabolic variables were associated with a reduction in the incidence of pathophysiological events compared to the conventional system, particularly regarding transitory cognitive disorders<sup>4</sup>, and a shorter stay in intensive care.

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## Abstract | Thoracic | Non Oncology

## Wartime cardiothoracic injuries: characteristics of those who sustained an injury – a Yemen War casualties report

**Hysam Abdelmohty, Sameh Sersar** Cardiothoracic Surgery Department, Mansoura University, Egypt

## Background

**D**uring the Yemen war, the atrocity produced several penetrating thoracic injuries and blunt traumas, ranging from major to minor, the most common to the rarest. Strategies to prevent death or decrease late sequelae by medical professionals were confronted with controversies or opinions from different war casualty reports questioning best management practice.

## Methods

We analysed the 159 patients who sustained cardiothoracic war wounds received at our hospital between January 2016 to June 2016.

## Results

There were 46 (28.9%) patients with pure lung injuries, 4 (2.51%) with pure cardiac injuries and 109 (68.5%) with mixed injuries. The scope of management of the presented cases ranged from chest drainage only in 63 (39.62%) patients, thoracotomy, evacuation of haemothorax and suture of the lung tear in 5 (3.14%) patients, lobectomy in 2 (1.25%) patients, decortication in 4 (2.51%) patients



Hysam Abdelmohty (left) and Sameh Sersar

and in 1 (0.63%) patient we encountered a pleurobiliary fistula. The more commonly injured cardiac chamber was the right ventricle in 2

(1.25%) patients, the left ventricular in 1 (0.63%) patients, the right atrium in two (1.25%) patients and there was one (0.63%) patient with left-sided injury of the internal thoracic artery. The primary procedure consisted of exploratory thoracotomy, evacuation of haemothorax and cardiac sutures with pericardial pledgets, undertaken in three (1.88%) patients.

## Conclusions

Cardiothoracic wounds are the most serious injuries seen in wartime. However, despite their nature, patients who sustained such injuries could be managed with low mortality or morbidity.

## Abstract | Cardiac | Tissue is the issue: collaborative insights from translational science

# Toll-like receptor 3 mediates ischemia/reperfusion injury after cardiac transplantation

Can Gollmann-Tepeköylü<sup>1\*</sup>, Michael Graber<sup>1\*</sup>, Leo Pözl<sup>1</sup>, Felix Nägele<sup>1</sup>, Rafael Moling<sup>2</sup>, Hanna Esser<sup>2</sup>, Bianca Summerer<sup>2</sup>, Vanessa Mellitzer<sup>2</sup>, Susanne Ebner<sup>2</sup>, Jakob Hirsch<sup>1</sup>, Georg Schäfer<sup>3</sup>, Hubert Hackl<sup>4</sup>, Benno Cardini<sup>2</sup>, Rupert Oberhuber<sup>2</sup>, Florian Primavesi<sup>2</sup>, Dietmar Öfner<sup>2</sup>, Nikolaos Bonaros<sup>1</sup>, Jakob Troppmair<sup>2</sup>, Michael Grimm<sup>1</sup>, Stefan Schneeberger<sup>2</sup>, Johannes Holfeld<sup>1</sup>, Thomas Resch<sup>2</sup>

1. Department of Cardiac Surgery; 2. Department of Visceral, Transplant and Thoracic Surgery; 3. Department of Pathology; 4. Division of Bioinformatics, Biocenter, Medical University of Innsbruck, Innsbruck, Austria; \*Authors contributed equally



Can Gollmann-Tepeköylü

More than 5,000 heart transplantations per year are performed worldwide, offering a lifesaving option for patients with end-stage heart failure.<sup>1</sup> Ischaemia during organ harvesting and subsequent restoration of blood flow inevitably results in ischaemia/reperfusion injury (IRI). IRI is associated with rejection and impaired outcomes, thus strategies for prevention of IRI are much needed.<sup>2</sup>

Organ ischaemia and consecutive restoration of blood flow initiates excessive inflammatory response resulting in tissue damage and graft dysfunction. However, it remains unknown how the initial inflammatory response is orchestrated.

Toll-Like receptor 3 is a pattern recognition receptor of the innate immune system and as such, essential for the initiation of inflammation. It detects both viral RNA and endogenous RNA released from injured cells. Thus, it functions as stress sensor, initiating inflammatory response upon tissue injury.<sup>3</sup> In this study we hypothesised that IRI leads to RNA release from injured cells and to subsequent TLR3 activation,

inflammation and graft damage during cardiac transplantation.

To assess the role of TLR3 in IRI *in vitro*, human endothelial cells were subjected to IRI. IRI of human endothelial cells caused upregulation of TLR3 and the subsequent expression of inflammatory cytokines. Moreover, reporter cells treated with supernatant from hypoxic endothelial cells displayed TLR3 activation. To identify the very nature of the released molecule activating TLR3, preconditioned supernatant was incubated with RNase prior to the transfer to reporter cells.

Importantly, pre-treatment of IRI supernatant with RNase abolished TLR3 activation, underlining that the observed TLR3 activation is due to RNA release. Gene expression profiling showed similar gene expression of cells exposed to IRI or treated with TLR3 agonist Poly(I:C), whereas inflammatory gene expression upon IRI could be alleviated using a specific TLR3 inhibitor. Thus, TLR3 seems to have a key role in orchestrating the inflammatory response upon IRI.

Neutrophils are the primary responding leucocytes following ischaemia.<sup>4</sup> IRI injury of endothelial

cells caused increased adhesion of neutrophils. However, we could prevent neutrophil adhesion using a TLR3 inhibitor.

In a second set of experiments we performed a heterotopic cardiac transplantation model, transplanting either Tlr3<sup>-/-</sup> or WT mice. Tlr3 deficiency resulted in a significantly reduced expression of pro-inflammatory chemokines in the graft, whereas the expression of the anti-inflammatory peptides IL10 and TGFβ increased. Moreover, splenic expression of adhesion molecules was downregulated, including ICAM1, VCAM1 and P-selectin.

To substantiate whether the altered inflammatory cytokine expression in Tlr3<sup>-/-</sup> might protect from organ damage, cardiac allografts were analysed for histomorphologic integrity 48 hours after transplantation.

Grafts from Tlr3<sup>-/-</sup> were protected from damage upon IRI. Further dissecting the nature of the injury, we found reduction of epicardial and myocardial damage, whereas there was no difference in endocardial damage. In line with these findings, the rate of cardiac apoptosis was

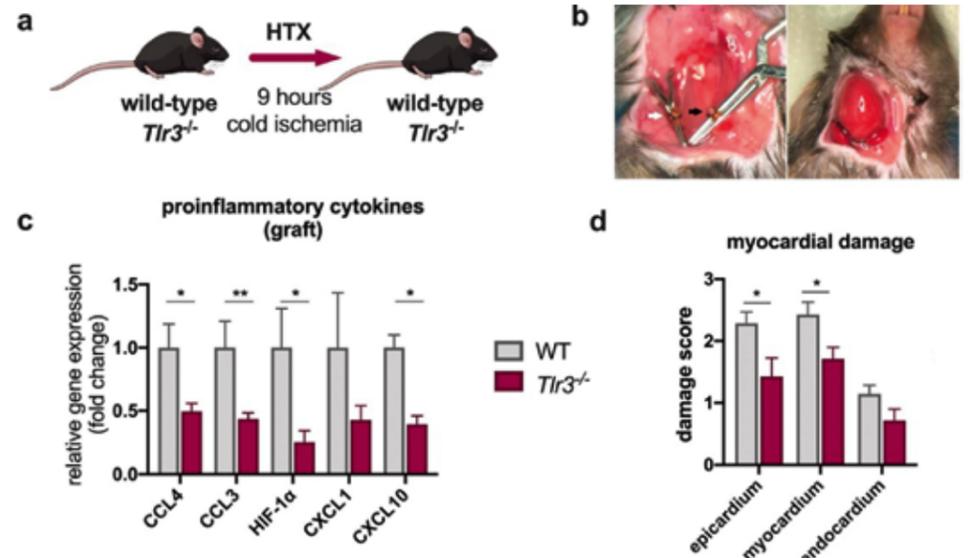


Figure 1: Tlr3 deficiency protects from cardiac inflammation and damage upon transplantation: a) To evaluate the role of Tlr3 in IRI *in vivo*, we performed syngeneic heart transplantation (HTX) of wild-type (WT) to WT or Tlr3 knockout (Tlr3<sup>-/-</sup>) mice to Tlr3<sup>-/-</sup> mice, following 9 hours of cold ischaemia; b) A cervical heart transplantation model using the modified cuff technique was applied. The images on the right show the situs in the recipient before and after successful heterotopic (cervical) cardiac transplantation; c) Cardiac allografts were analysed 48 hours post-transplantation via RT-PCR for cytokine expression. Tlr3<sup>-/-</sup> animals showed markedly decreased intragraft expression of CCL3, CCL4, HIF-1α, CXCL1 and CXCL10 (\*p < 0.05, \*\*p < 0.01); d) Both epicardial and myocardial damage were reduced in Tlr3<sup>-/-</sup> animals (\*p < 0.05).

markedly reduced in Tlr3<sup>-/-</sup> animals. Most prominently, reflecting our *in vitro* findings, Tlr3 deficiency affected the attraction of inflammatory cells, as displayed by a significant reduction of intragraft cell infiltrates.

In conclusion, we uncover a novel pathomechanism of IRI providing evidence that TLR3 plays a crucial role in the orchestration of inflammation. Injured cells release RNA and activate TLR3, which in turn promotes the development of IRI after cardiac transplantation. We reveal TLR3 as novel target for future pharmacologic

therapies to prevent IRI and thus, improve outcome in solid organ transplantation.

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## Abstract | Cardiac | TAVI – New approaches and data from the real world

# Fitness-tracker assisted Frailty-Assessment before transcatheter aortic valve implantation

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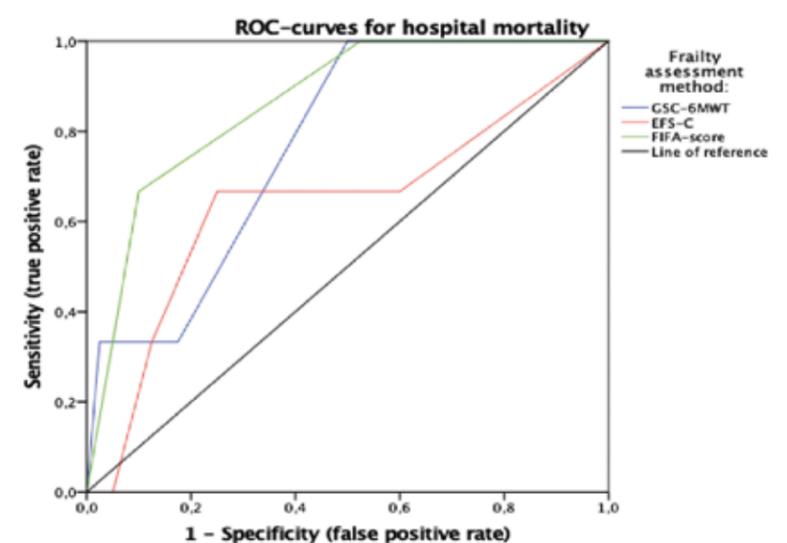
Markus Mach

perform preoperative assessments.

The principal objective was to leverage parameters already measured by a wearable health-monitoring devices into a simple, efficient, and economical tool for preprocedural frailty assessment.

The prospective study analysed data of 50 consecutive patients (77.5 ± 5.1 years, EuroSCORE II of 3.3 ± 4.1%) undergoing either a transfemoral or transapical TAVI procedure between 2017 and 2018. Every patient was fitted with a wrist-worn health-monitoring device (Garmin Vivosmart 3) for one week prior to the procedure. Twenty different parameters were measured, and threshold levels for the three most predictive categories (step count, heart rate, preprocedural stress) were calculated. The patients were assigned one point per category when exceeding the cut-off value and then classified in four stages (no, borderline, moderate, severe frailty). The FIFA-score was then compared to preprocedural gait speed category derived from 6-minute-walking-test (GSC-6MWT) and the Edmonton Frailty Scale classification (EFS-C). The primary study endpoint was hospital mortality.

Overall preprocedural stress level (p



= 0.017), minutes of high stress per day (p = 0.019), minutes of rest per day (p = 0.045) and daily maximum heart rate (p = 0.048) as single parameters were the strongest predictors of hospital mortality. When comparing the different frailty scores, the FIFA-score demonstrated the greatest predictive power for hospital mortality (FIFA area under curve [AUC] = 0.844 (0.656–1.000), p = 0.048; GSC-6MWT AUC = 0.671 (0.487–0.855), p = 0.416; EFS-C AUC = 0.636 (0.254–1.000), p = 0.436).

This proof-of-concept study demonstrates the strong predictive performance of the FIFA score compared to conventional frailty assessment and the potential of wearable technology to be integrated into the surgical pathway. The minimal infrastructure required combined with the fitness trackers ease of use frees up resources and staff previously allocated to frailty assessment, whilst simultaneously serving as a less disruptive measure for preoperative evaluation.

Wearable devices have the potential to transform modern healthcare and the FIFA-trial showcases an innovative new way in which their use can completely overhaul preoperative assessment.

Traditional methods of preoperative assessment are both labour- and resource intensive, providing only a glimpse into a patient's status. To meet the increasing demands in healthcare and obtain a more holistic view of patient baseline, new approaches are required. Harnessing technology in the operating room has yielded paradigm-shifting procedures, yet utilising existing

consumer hardware has remained a largely untapped area. The surge in the popularity of smartwatches and fitness bands provides doctors with an unprecedented opportunity to easily evaluate a patient's frailty outside the vacuum of an isolated clinical assessment. Findings from the FIFA trial highlight how this concept can be translated into clinical practice, providing a more accurate and intuitive way to

## Academy

## Endoscopic Port-Access Mitral Valve Repair Drylab Training

Peyman Sardari Nia

Maastricht University Medical Center,  
the Netherlands

Endoscopic mitral valve repair is one of the most difficult procedures to learn. The learning curve is steep, which is partially linked to the fact that the operation is conducted with long-shafted instruments, with the surgeon looking at a monitor rather than into the wound. Acquiring endoscopic skills with long-shafted instruments is a process that no one can escape from.

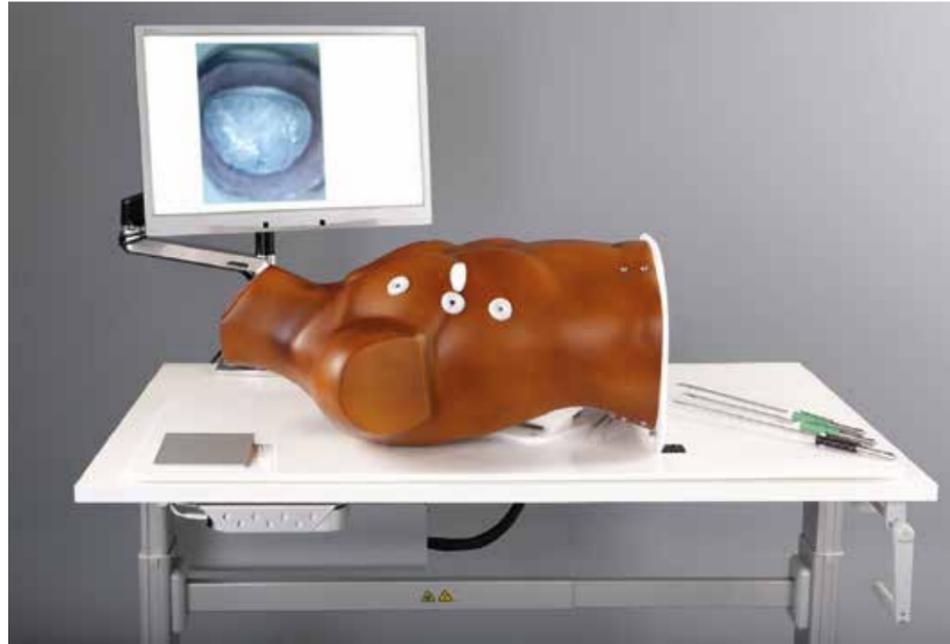
However, acquiring these skills in patients is not logical or efficient, thus in 2012 I initiated a project to develop a high-fidelity minimally invasive mitral valve simulator (MIMVS). Fidelity in simulation has traditionally been defined as "the degree to which the simulator replicates reality"<sup>1</sup>. Obviously, a simulation platform should be realistic and mimic the procedure setup.

In addition to this, and fundamental to learning, is feedback. There is no efficient learning without feedback, and indeed it has been shown that if the feedback is provided in an objective and reproducible manner, the learning process is more efficient<sup>2</sup>. Therefore, the aim of the project was to create a platform that was realistic and could provide feedback regarding the skills that one would like to develop, namely, a platform that could be used to train oneself objectively, repeatedly, and in a reproducible manner.

In 2013 we developed a prototype which I used to start the endoscopic mitral valve programme myself, and to refine my skills. Because of the success of the platform, we received funding from Maastricht University Medical Center to develop an industrialised platform. We assembled an engineering group that I worked with to actualise my ideas. We were able to create a high-fidelity simulator that provides a platform on which to train endoscopic skills repeatedly and objectively.

Additionally, the simulator we created provides the objective assessment and feedback essential in any simulator-based training. What's more, the disposable mitral valve is made of special silicone, developed by us, that provides a true suturing experience.

We were awarded the EACTS Techno-College



Innovation Award in 2014. At that time, we envisioned using this platform to train surgeons, as well as for pre-operative planning. Ever since, we have striven to bring this innovation from bench to reality. We published the process involved in development of this simulator in the *Journal of Thoracic and Cardiovascular Surgery* to stimulate the development of this field. During various educational programmes, 99 senior surgeons validated the platform for use in training of minimally invasive mitral valve surgery.<sup>3</sup>

Furthermore, we developed a process for modelling and 3-dimensional (3D) printing of different mitral valve diseases for procedural planning and simulation, based on 3D transoesophageal echocardiography (TOE). We published the results recently in the *European Journal of Cardio-Thoracic Surgery*. Disposable 3D-printed pathological silicone replicas can be mounted into the simulator so that one can also be trained in any repair technique on any pathology of the mitral valve.<sup>4</sup> We also provided proof of concept of the use of 3D printing and simulation in prospective patients for procedural planning.<sup>5</sup>

In 2015, we founded the EACTS Endoscopic Port-Access Mitral Valve Repair Drylab Training course using the high-fidelity simulators. This course has since been organised almost 20 times in Maastricht. The course was designed based on the latest educational science and is structured like an air-pilot-training concept course, starting with technical and theoretical pre-assessment and two subsequent days of intensive training on simulators, mixed with interactive presentations and videos regarding all aspects of the endoscopic mitral repair programme. The course ends with technical and theoretical post-assessment.

The aim of the course is to provide a formula for success for those who would like to start an endoscopic programme, and provide standardised education. For example, we used the high-fidelity mitral valve simulator to develop a suturing map for placement of the annuloplasty ring with minimal tissue manipulation and maximal visual exposure. The suturing map could be helpful for less-experienced surgeons who are starting to learn the techniques of minimally invasive mitral valve surgery.<sup>6</sup>

We have already trained around 200 surgeons, and our preliminary analyses show very promising results for skill development using the simulator. We presented the results of the endoscopic mitral course during the AATS annual meeting in Toronto. The majority of participants were senior surgeons. Theoretical pre- and post-assessment showed that participants scored significantly higher on post-assessment. Pre- and post-assessment of skills on the simulator showed that participants could work with long-shafted instruments more accurately and faster. Follow-up of the participants based on course evaluation and a survey showed that over 30% of participants had started the endoscopic mitral programme successfully, while 70% had yet to start due to the right conditions not being in place. The course is a continuous EACTS educational



programme taking place four times a year in Maastricht. The next course will take place 9–10 December. For more future dates, head to the EACTS Academy website at [www.eacts.org/educational-events/academy/](http://www.eacts.org/educational-events/academy/).

I am looking forward to welcoming all those interested in taking part in Maastricht.

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## Conflict of Interest Statement

Peyman Sardari Nia is the inventor of the simulator that is commercialised by Maastricht University Medical Center, Maastricht, the Netherlands.

## Acknowledgements

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For support of the whole project: Jos Maessen (Head of Department of cardiothoracic surgery in Maastricht), Samuel Heuts, Jean Daemen and Jules Olsthoorn (residents and researchers at Maastricht University Medical Center).

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Invited faculty during the years: Friedrich Mohr, Randolph Chitwood, Patrick Perier, Martin Misteled, Robert Klautz, Ludwig Muller, Thomas De Kroon, Mohammad Bentala, Wolfgang Buhre, Sebastiaan Streukens and Yuri Ganushchak.

Theoretical part	Hands-on part	Course attributes
<b>General</b>	<b>General</b>	<b>Two days</b>
<ul style="list-style-type: none"> <li>How to start a programme</li> <li>Repair techniques</li> <li>Perfusion techniques</li> <li>Anesthesiology techniques</li> <li>Operative planning</li> </ul>	<ul style="list-style-type: none"> <li>Instrument handling</li> <li>Suture placement of annulus</li> <li>Suture placement on papillary muscles/leaflets</li> <li>Knot pusher training</li> </ul>	<ul style="list-style-type: none"> <li>Air-pilot training concept</li> <li>Theoretical pre-assessment</li> <li>Technical pre-assessment</li> <li>Objective feedback from simulator</li> <li>Formative feedback from expert</li> <li>Theoretical post-assessment</li> <li>Technical post-assessment</li> <li>Course evaluation and follow-up</li> </ul>
<b>Specific</b>	<b>Specific</b>	
<ul style="list-style-type: none"> <li>Setup</li> <li>Groin Cannulation</li> <li>Port access</li> <li>Steps of operation</li> <li>Complications</li> <li>Troubleshooting</li> </ul>	<ul style="list-style-type: none"> <li>Annuloplasty ring replacement</li> <li>Full repair on 3D-printed pathological valve</li> </ul>	

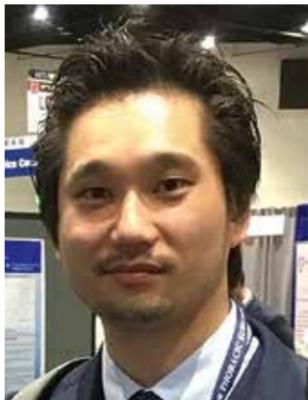


Rapid Response | Cardiac | Outcome prediction in patients treated by endovascular, minimally invasive and conventional aortic valve surgery

# Quantitative evaluation of superior mesenteric artery calcification in haemodialysis patients undergoing aortic valve replacement

**Shuhei Miura, Yoshihiko Kurimoto, Takahiko Masuda, Yohsuke Yanase, Yutaka Iba, Ryushi Maruyama, Eiichiro Hatta, Akira Yamada** Department of Cardiovascular Surgery, Teine Keijinkai Hospital, Sapporo, Japan

The number of patients with end-stage renal disease requiring haemodialysis (HD) has been increasing. As the prognosis of HD patients improves, the number of patients with major comorbidities typified by calcified vascular and valvular disease is expected to inevitably increase. Specifically, aortic valve stenosis (AS) is a well-recognised complication of long-term HD.

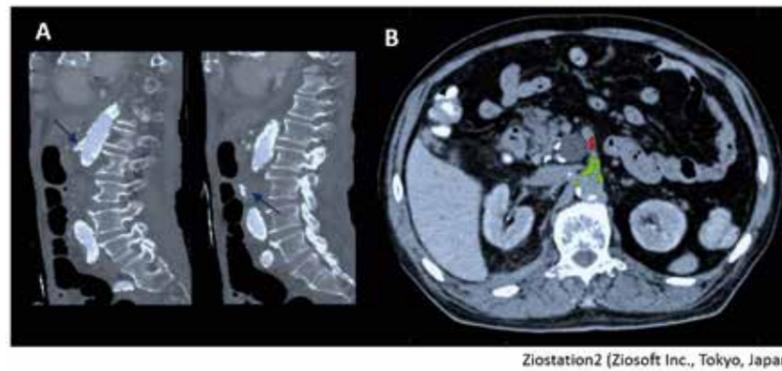


Shuhei Miura

In Japan, aortic valve replacement (AVR) still remains the gold standard treatment in HD patients with severe AS because transcatheter aortic valve replacement (TAVR) in HD patients is not reimbursed. However, previous publications have illustrated adverse outcomes including higher mortality and morbidity after surgical AVR in HD patients. One of the reasons for extreme poor outcomes after AVR may be associated with acute mesenteric ischaemia (AMI). This is a life-threatening complication

which frequently occurs in HD patients. Therefore, the occurrence of AMI must be prevented to ensure the safety of surgical AVR in HD patients.

The objective of this study is to evaluate the association between the presence of superior mesenteric artery calcification (SMAC) and early and late outcomes after AVR in HD patients with severe AS. Between April



Calcium score parameters

Score = 1	130 [HU]	19%
Score = 2	200 [HU]	29%
Score = 3	300 [HU]	39%
Score = 4	400 [HU]	-
Max CT value (HU)		

Figure 1. SMAC Evaluation by Agaston Score

2003 and December 2018, of the 58 haemodialysis patients who underwent AVR for severe AS, 46 patients (19 women; mean age 72 years) were retrospectively reviewed. Twenty-five patients (54.3%) who had hyper calcification from the ostium until distal branches of superior mesenteric artery (SMA) were defined as the SMAC group, and the calcification extent of SMA and related arterial branches including thoracic aorta, celiac artery and abdominal aorta were evaluated quantitatively

on preoperative non contrast-enhanced CT using the Agaston calcium score (calcification area [cm<sup>2</sup>] × max CT value [HU]; Figure 1). The operative outcomes were compared with those of the non-SMAC group, comprising 21 consecutive patients (45.7%). In this study, the incidence of AMI (24.0%) in the SMAC group was significantly higher than that (4.7%) of the non-SMAC group (p < 0.001). The presence of SMAC was an independent risk factor for the incidence of AMI (OR = 3.8, p = 0.05) and hospital mortality (OR = 2.4, p = 0.02) following AVR. Furthermore, the calcium score of SMA in those complicated with AMI was significantly higher levels compared with those without AMI

(815.7 ± 300.5 vs 366.9 ± 351.2 cm<sup>2</sup> × HU; p < 0.01; Figure 2).

In conclusion, the presence of SMAC was significantly associated with the risk factor for AMI. SMA hypoperfusion-related to perioperative hypotension must be avoided in HD patients with high calcium score of SMA to prevent the incidence of AMI. Quantitative evaluation of SMAC could be a new predictive marker of postoperative AMI and improve the prognosis after AVR in HD patients.

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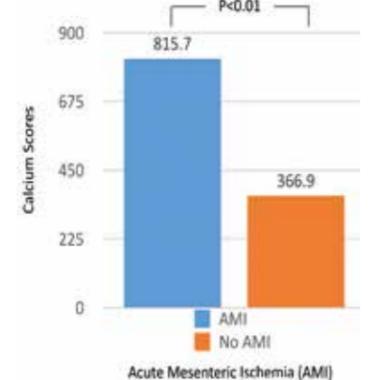


Figure 2. Mesenteric ischaemia influenced by calcium scores of SMA

Abstract | Congenital | Management of ACHD

# Surgical repair of aortic coarctation in adults: half a century of a single centre clinical experience

**Djamila Abjigitova<sup>1</sup>, Mostafa M Mokhles<sup>1</sup>, Maarten Witsenburg<sup>2</sup>, Pieter C van de Woestijne<sup>1</sup>, Jos A Bekkers<sup>1</sup>, Ad JJC Bogers<sup>1</sup>** 1. Department of Cardiothoracic Surgery; 2. Department of Cardiology, Erasmus University Medical Center, Rotterdam, the Netherlands.

Coarctation of the aorta (CoA) accounts for 5–8% of all congenital heart defects and the estimated prevalence is 3 per 10,000 live births. However, adolescents as well as adults can also be diagnosed with primary CoA of the native aorta as a first-time diagnosis. In this untreated, older age group, primary adult CoA should be considered as a complex composite of cardiovascular disorders.

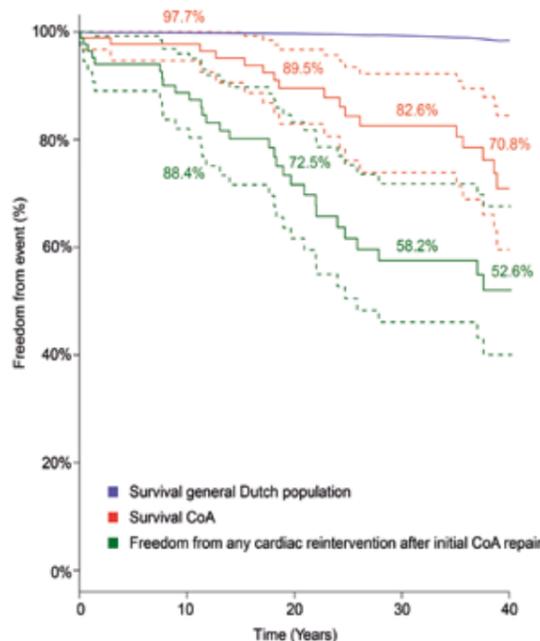


Djamila Abjigitova

Current reports on adult coarctation presenting during adult life most frequently represent cases of re-coarctation, following previous transcatheter or surgical therapy. Moreover, endovascular treatment of coarctation with balloon angioplasty and stenting is used increasingly therefore leading to a paucity of current surgical data.

In this regard, the aim of this study was to report our unique consecutive clinical experience over a period of more than five decades treating patients with primary adult CoA with open surgical repair and to provide data that will allow benchmarking for percutaneous treatment.

Between July 1961 and October 2008, 90 consecutive adult patients underwent isolated primary open repair of CoA. Median age at surgery was 24 years (interquartile range (IQR): 20–36 years) and 53 (59%) were male. Thirty-nine (43%) patients were asymptomatic and the CoA was incidentally discovered during workup for cardiac murmur or military medical examination by measuring hypertension. Upper body hypertension was present in all patients (100%) and 40 (44%) patients were already treated with antihypertensive drugs. Other comorbid conditions included bicuspid aortic valve in 39 (43%) and ventricular septal defect in 5 (6%) patients. The CoA was noted paraduactally in most patients (64%).



Number at risk after CoA repair:

Mortality	90	81	58	41	21
Reintervention	90	67	41	26	12

Figure 1. Cumulative survival (red line) and cumulative freedom from any cardiac reintervention (green line) after surgical repair of primary coarctation of 90 patients. The blue line represents the survival of the normal population (matched for age and gender). Red dashed lines represent 95% confidence intervals of cumulative survival. Green dashed lines represent 95% confidence intervals of freedom from reintervention.

Most patients (57%) underwent reconstruction with an end-to-end anastomosis, followed by extended end-to-end anastomosis in 13% of patients. In-hospital mortality was 1% (1 patient). Twenty-one patients (23.3%) died during the follow-up period. The cumulative survival was 97.7%, 89.5%, 82.6%, 70.9% and 61.4% at 10, 20, 30, 40 and 50 years, respectively. Compared to age- and gender matched Dutch population norms, the survival of patients with CoA undergoing open surgical repair was significantly impaired (Figure 1). Reintervention due to re-coarctation was necessary in 4 (4%) of

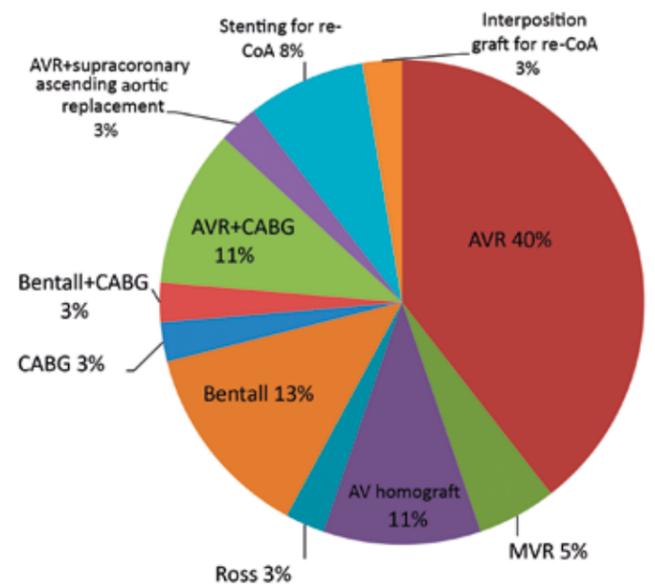


Figure 2: Distribution of cardiac reinterventions (N =38) after initial coarctation repair.

all in-hospital survivors. There were 15 (40%) cases of subsequent aortic valve replacement (AVR) due to aortic valve disease (Figure 2). The long-term follow-up showed that 69 (77%) patients still suffered from hypertension. The quality-of-life (QoL) assessment using the Short Form 36-Item Health Survey showed that compared with an age- and gender-matched Dutch population, male and female patients rated social functioning (p < 0.001), mental health (p < 0.001), vitality (p < 0.001) and general health (p < 0.001) significantly lower. Furthermore, they reported higher bodily pain (p < 0.001).

This is the largest adult cohort featuring very long-term outcomes of surgical correction of primary CoA. The findings of the present study suggest that patients presenting later in life with CoA can successfully undergo complete resection, resulting in long-term durability. However, the perception that surgically repaired coarctation in young adults is a benign condition should be met with caution as shown by our findings since the QoL of these patients is significantly impaired compared with the general population. Life-long careful clinical follow-up and better adherence to secondary prevention are warranted for all patients after CoA repair. These findings may serve benchmarking with percutaneous treatment for adult CoA.

## Abstract | Cardiac | What's new in endocarditis?

# Endocarditis-related stroke is not a contraindication for early cardiac surgery – an investigation among 440 patients with left-sided endocarditis

**Elfriede Ruttmann<sup>1</sup>, Hannes Abfaltrer<sup>1</sup>, Julian Wagner<sup>1</sup>, Michael Grimm<sup>1</sup>, Ludwig Müller<sup>1</sup>, Katie Bates<sup>2</sup>, Hanno Ulmer<sup>2</sup>, Nikolaos Bonaros<sup>1</sup>** 1. Department of Cardiac Surgery; 2. Department of Medical Statistics, Informatics and Health Economics, Innsbruck Medical University, Austria

A treatment dilemma arises when surgery has to be performed in patients with infective endocarditis (IE) complicated by cardio-embolic stroke.

In such an event, neurologists recommend surgery to be postponed for at least one month if possible. The aim of this study was to investigate the rate of perioperative neurologic complications and the long-term neurologic recovery potential in patients with IE-related stroke and indication for early cardiac surgery.

A total of 440 patients with left-sided IE undergoing urgent or emergent surgery were investigated. One-hundred and thirty-five patients (30.7%) suffered cardio-embolic strokes prior to cardiac surgery. Surgery was performed within 72 hours after stroke onset in 38% of IE patients and in 70% of patients the cardiac procedure was performed within the first week after the index neurologic event.

Among 28 patients (20.7%), cardio-embolic stroke occurred while under antibiotic treatment. In 107 patients (79.3%) stroke was the index clinical event for hospitalisation.

Uncomplicated ischaemic stroke was found among 93 patients (68.9%), and 42 patients (31.1%) presented with complicated cerebral lesions such as concomitant abscess formation, secondary cerebral haemorrhage, meningitis, or mycotic aneurysms.

During follow-up, neurologic recovery was assessed by the modified Rankin scale and the Barthel index. A Rankin scale of  $\leq 1$  and a Barthel index of 20 points defined complete neurologic recovery. The hospital- and long-term mortality risk was calculated by Cox regression models, adjusting for age.

Among stroke patients, the age-adjusted hospital mortality risk was 1.4-fold higher (95% CI 0.74–2.57;  $p = 0.31$ ), as was the long-term mortality risk (95% CI 1.003–2.001,  $p = 0.048$ ) compared to IE patients without previous stroke.

However, age-adjusted mortality risk was increased among patients with complicated ischaemic lesions (HR: 2.1; 1.24–3.54;  $p = 0.005$ ) but not in patients with uncomplicated ischaemic strokes (HR: 1.18; 0.79–1.77;  $p = 0.41$ ). The observed risk for intraoperative haemorrhage was 2.3% among patients with complicated strokes and 0% among patients with uncomplicated ischaemic strokes.

In long-term follow-up, full neurological recovery could be achieved in 84 survivors (62.2%) and partial recovery in 32 patients (23.7%). Aggravation of neurologic injury was found in two patients only (1.5%).

Contrarily to common clinical practice and neurologic recommendations, early surgery in IE is safe and is associated with a very low intraoperative neurologic complication rate. In patients undergoing



Elfriede Ruttmann

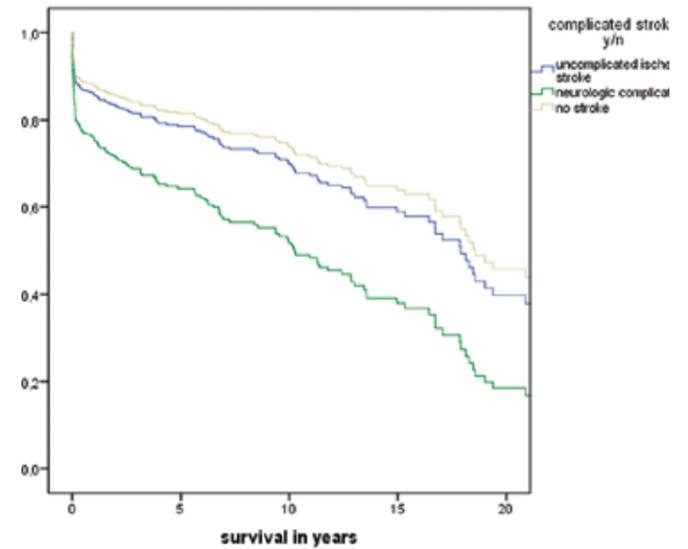


Figure 1, above: Kaplan-Meier survival analysis of patients with and without infective endocarditis-related cardio-embolic stroke.



Figure 2: Staphylococcus aureus endocarditis in a patient with partial middle cerebral artery stroke. Left: large vegetation of the posterior mitral leaflet. Middle: replacement of a large defect of the posterior mitral leaflet by autologous pericardium. Right: result of the mitral repair.

early surgery for IE, intraoperative cerebral haemorrhage risk is extremely low in both uncomplicated-ischaemic and

complicated IE-related strokes. As hospital- and long-term outcome was convincing – together with the high

neurological recovery potential – we recommend early surgery in all patients with IE-related strokes.

## Rapid Response | Thoracic | Non oncology

# Epidural versus local – a long-term study on pain management in an enhanced recovery program after thoracic surgery

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The treatment of postoperative pain with multimodal analgesia is a key component of 'Enhanced Recovery After Surgery' (ERAS). In this prospective study we examined whether the mode of analgesia has an influence on ERAS in thoracic surgical patients. We compared the efficacy of pain therapy with an epidural catheter (EDC) and with a local wound infiltration catheter (WIC) that was placed intercostally at the end of surgery. Short-term effects and long-term outcome up to one year were assessed. Besides the assessment of pain, we examined impairment in patients' daily activities.

We prospectively recruited patients between June 2015 and November 2017. The one-year follow-up was finalised in November 2018. Patients with chronic pain were excluded a priori. A total of 67 patients included in this study completed the one-year follow-up. All patients were randomly allocated either to the EDC ( $n = 34$ ) or to the WIC ( $n = 33$ ) group. Patients in both groups had similar age, gender and physical status according to ASA classification and were in similar UICC stages of non-small cell lung cancer (NSCLC). The mean age of the patients was  $59.3 \pm 14.6$  years; 57% of the patients were men.

All patients were interviewed for pain on the 3rd and 10th postoperative day (POD) and at 6 and 12 months after surgery using a numeric rating scale (0–10). Possible daily impairments were assessed at POD 3 and 10, and 6 months after surgery. The start of continuous analgesia either through EDC or WIC was 20 minutes before the end of surgery. We terminated continuous analgesia within 12



Fabian Doerr

hours after the removal of the chest tube. Patients with EDC received on average 5 ml/h ropivacaine (1.5 mg/ml) plus sufentanil (0.75 ug/ml). Patients with WIC were given a constant rate of 8 ml/h ropivacaine (2 mg/ml). During hospitalisation both groups received identical oral pain therapy.

Both groups had a comparable amount of video-assisted surgery (EDC: 47%; WIC: 45%). We performed a similar rate of lobectomies due to NSCLC in both groups (EDC: 65%; WIC:

63%). Operations such as wedge resections and mediastinal tumour resections were equally distributed between the two groups. The mean duration of surgery was comparable in both groups

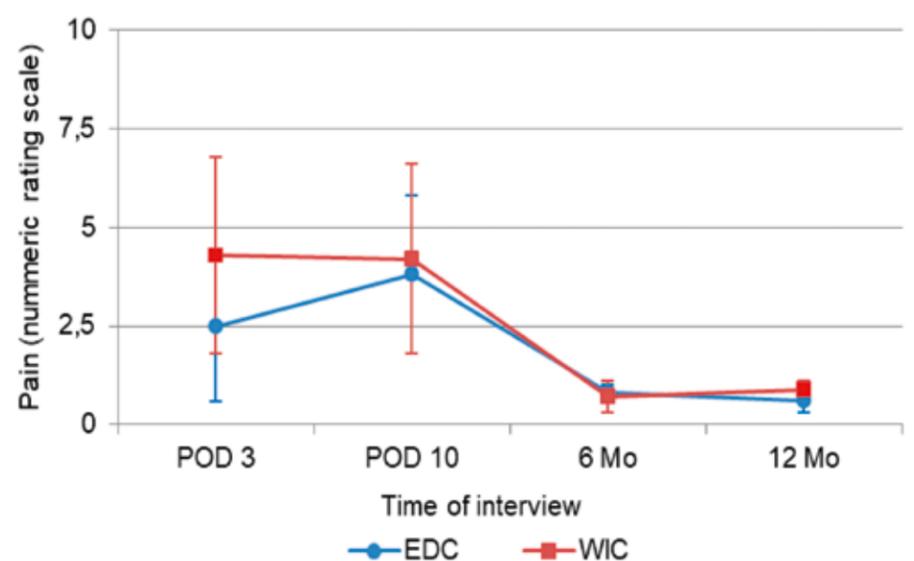


Figure 1. Comparison of stress pain in EDC and WIC groups within one year after surgery

(EDC:  $134 \pm 62$  min; WIC:  $121 \pm 59$  min;  $p = 0.38$ ). Total length of stay in hospital was identical in both groups (EDC:  $9.4 \pm 6.2$  days; WIC:  $8.2 \pm 3.9$  days;  $p = 0.41$ ). All patients had only one chest tube. The mean duration of chest drainage was similar in both groups (EDC:  $3.2 \pm 2.4$  days; WIC:  $3.4 \pm 2.1$  days;  $p = 0.26$ ).

On POD 3, patients with EDC experienced significantly lower stress pain than patients in the WIC group (EDC:  $2.5 \pm 1.9$ ; WIC  $4.3 \pm 2.5$ ;  $p = 0.001$ ). Stress pain on POD 10 showed no significant difference between both groups (EDC:  $3.8 \pm 2.0$ ; WIC:  $4.2 \pm 2.4$ ;  $p = 0.39$ ). None of the patients reported pain after 6 and 12 months.

These results are displayed in Figure 1. Regarding impairments in everyday tasks, we detected a non-significant trend at POD 3 and 10 in favour of the EDC group. Patients in this group reported reduced sleep (EDC: 15%; WIC: 19%) and deep breathing impairments (EDC: 22%; WIC: 26%).

Patients with epidural catheter experience less pain during the first 72 hours after surgery. Both the EDC and the local WIC effectively prevent chronic pain. There is no significant superiority of epidural pain therapy in regard of impairment in daily activities. As part of an ERAS program, successful pain management may either be based on an epidural or a local approach with intercostal catheter.

## Abstract | Cardiac | Does the coronary outcome data speak for itself?

# Individualised and precise dual antiplatelet therapy based on CYP2C19 genotype and platelet function improves the patency of coronary endarterectomy

Tianxiang Gu, Enyi Shi Department of Cardiac Surgery, v First Hospital, China Medical University, Shenyang, China

Coronary endarterectomy (CE) with coronary artery bypass grafting (CABG) may be a method to revascularise otherwise un-graftable vessels with controversial outcomes. Early graft closure with reduced long-term graft patency is the common concern after CE combined with CABG. The current study retrospectively evaluated the mid-term results of closed CE adjunct to off-pump CABG with precise dual antiplatelet therapy (DAT) based on CYP2C19 genotype and platelet function for at least one year. The graft patency of CE was highlighted.

Sixty-one patients underwent closed CE with off-pump CABG for diffuse coronary artery disease. The principal indications for CE were as follows: 1) total or subtotal occluded major coronary arteries caused by diffuse coronary artery disease with viable myocardium; 2) revascularisation that could not be performed with routine methods; 3) diameter of the target vessel >1.0–1.5 mm. CYP2C19 genotype was tested for all the patients before the operation.

Clopidogrel is a prodrug, and its

antiplatelet activity is dependent on its conversion to an active metabolite by the cytochrome P450 (CYP) system, principally CYP2C19. Ticagrelor is a direct-acting inhibitor of the ADP receptor P2Y12. DAT with aspirin (100 mg) and clopidogrel (75 mg) or ticagrelor started six hours after the operation and lasted for 12 months followed by administration of aspirin only. Clopidogrel was used in patients who were ultrarapid metabolisers (CYP2C19 \*1/\*17, \*17/\*17) or extensive metabolisers (CYP2C19 \*1/\*1), while ticagrelor was used in patients who were intermediate metabolisers (CYP2C19 \*1/\*2, \*1/\*3, \*2/\*17, \*3/\*17) or poor metabolisers (CYP2C19 \*2/\*2, \*3/\*3, \*2/\*3). The adenosine diphosphate (ADP) induced platelet aggregation function was measured and the value was controlled between 10–30%.

The dose of ticagrelor was individualised and adjusted according to the platelet aggregation rate. Graft patency was evaluated by a computer tomography angiogram or coronary angiography.

Twenty-nine patients (47.5%) were intermediate or poor metabolisers. All



Tianxiang Gu



Figure 1. Embolus taken out from the endarterectomised coronary arteries.

patients underwent off-pump CABG with 3–5 bypass grafts per patient. CE was performed in one coronary vessel in 56 patients and in two coronary vessels in the other five patients. One patient died from multiple organ failure 23 days after the operation. Ticagrelor was adjusted from 15 to 45 mg twice a day. No severe bleeding complications were detected during the protocol of DAT. Rates of graft patency in endarterectomised vessels were 93.8% and 89.1% at discharge and one year after the operation. Clinical follow-up of 42.1 ± 11.5 months reported a one-, three-, and five-year survival of 98.4%, 94.3% and 83.9%, respectively.

In selected patients with diffuse coronary artery disease, CE with off-pump CABG can be used for complete myocardial revascularisation with acceptable graft patency and mid-term survival. Individualised and precise DAT based on CYP2C19 genotype and platelet function may improve the patency of endarterectomised vessels with low bleeding risks.

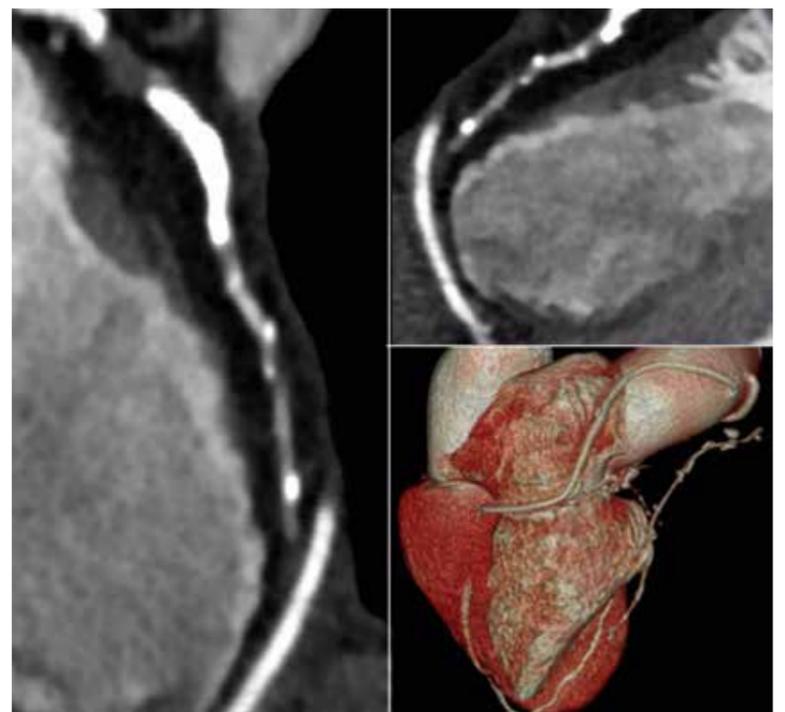


Figure 2. The endarterectomised right coronary artery is still patent four years after the operation.

Table 1. CYP2C19 genotype of patients in the current cohort.

	Clopidogrel resistance	Strategy of antiplatelet therapy	Patients (n = 61)
CYP2C19 *1/*1	-	Aspirin+Clopidogrel	16
CYP2C19 *1/*2	+	Aspirin+Ticagrelor	7
CYP2C19 *1/*3	+	Aspirin+Ticagrelor	4
CYP2C19 *2/*2	+	Aspirin+Ticagrelor	5
CYP2C19 *3/*3	+	Aspirin+Ticagrelor	4
CYP2C19 *2/*3	+	Aspirin+Ticagrelor	5
CYP2C19 *1/*17	-	Aspirin+Clopidogrel	9
CYP2C19 *2/*17	+	Aspirin+Ticagrelor	2
CYP2C19 *3/*17	+	Aspirin+Ticagrelor	2
CYP2C19 *17/*17	-	Aspirin+Clopidogrel	7

## Focus Session | Cardiac | Aortic Valve Stenosis: not just a wear and tear issue; the valve, the heart and the organs

# Comparative analysis of mechanical and bioprosthetic tricuspid valve replacement over a 20-year period

Yoonjin Kang, Ho Young Hwang, Suk Ho Sohn, Jae Woong Choi, Kyung Hwan Kim, Ki-Bong Kim

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The optimal prosthesis for tricuspid valve replacement (TVR) is the subject of ongoing debate due to the fact that clinical outcomes of TVR have generally been suboptimal, and the life expectancy of patients undergoing TVR is

poor. Previous studies, including ours<sup>1,2</sup> suggest that the long-term outcomes of bioprosthetic TVR might be comparable to those of mechanical valves when considering life expectancy.

In this retrospective cohort study, 226 TVR patients were enrolled; 120 patients underwent bioprosthetic TVR (BTV group) and 106 underwent mechanical TVR (MTV group). Early results and long-term clinical outcomes were compared. The median follow-up duration was 73 (1–235) months. Propensity score (PS) analyses including PS-

adjusted Cox regression models and 1:1 PS matching were performed.

The mean age of the MTV and BTV groups was 53.9 ± 8.9 and 55.9 ± 12.2 years, respectively. There were no significant differences

in early mortality (9.2%) and postoperative complications between the two groups. The overall survival and freedom from cardiac death in the BTV group was similar to the MTV group (hazard ratio [95% confidence interval] = 0.840 [0.476–1.482] and 1.004 [0.517–1.951], respectively). The rate of freedom from a composite of thromboembolism and bleeding was significantly higher in the BTV group (2.353 [1.162–4.768], p = 0.018). However, freedom from tricuspid valve reoperation was significantly lower in the BTV group (0.106 [0.021–0.532]).

Overall, TV-related event rates in the BTV group were similar with those in the MTV group (0.891 [0.558–1.424]). The PS matching extracted 69 pairs. Comparative analyses of early and long-term outcomes from the matched groups yielded similar findings with those from the complete patient groups.

In summary, the outcomes of bioprosthetic TVR were comparable with those of mechanical TVR in terms of long-term survival and tricuspid valve-related events over a 15-year postoperative follow-up. Although reoperation rates were higher in the BTV group, overall survival, freedom from cardiac death and freedom from TVRE were not significantly different between the two groups in multivariable models, and the composite of thromboembolism and bleeding rate was lower in the BTV group.



Yoonjin Kang (left) and Ho Young Hwang

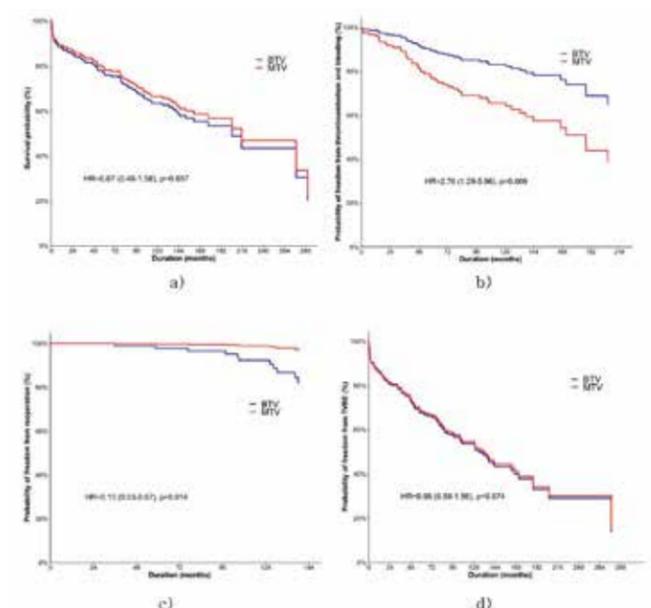


Figure 1. Cox proportional hazard curves for a) overall survival, b) composite of thromboembolism and bleeding, c) TV reoperation and d) TV-related events.

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## Rapid Response | Congenital | Congenital Rapid Response 1

# Intrapulmonary-artery septation: Does it overcome cases of pulmonary vein obstruction?

Motonori Ishido, Kazuyoshi Kanno, Masaya Murata, Keiichi Hirose, Akio Ikai, Kisaburo Sakamoto Department of Cardiovascular Surgery, Mt. Fuji Shizuoka Children's Hospital, Japan

Patients with unbalanced pulmonary artery (PA) growth and decreased unilateral pulmonary circulation are not considered suitable candidates for the Fontan procedure. Following our previous study on the utility of intrapulmonary-artery septation (IPAS) for patients with PA hypoplasia<sup>1</sup> (Figure 1), we investigated the use of IPAS in patients with pulmonary venous obstruction (PVO).

We recruited 42 patients who

underwent IPAS for unilateral PA hypoplasia and/or PVO between 1998 and 2018 and classified them into those without PVO (group N) or with PVO (group P). We calculated the affected PA index (PAI) to assess growth of affected PA.

Functional significance of the PVO segments was evaluated using lung perfusion scanning, and the percentage of defective segments in the affected lung was calculated. We defined the percentage of the effective

pulmonary vein (PV) segment in the affected lung divided by total PV segments in both lungs. We evaluated PV segments before the Fontan procedure, as well as the relevance of this parameter to operative outcomes.

Groups P and N included 24 and 18 patients, respectively. One patient in group N and six in group P died during follow-up; this difference was statistically significant (log rank  $p = 0.05$ ). In group N, 15 patients (83%) achieved two-lung Fontan circulation. In group P, all patients with  $\geq 25\%$  effective PV segments underwent the two-lung Fontan procedure. In patients with  $\geq 25\%$  effective PV segments, the percentage of the effective PV segments increased after IPAS (Figure 2A, B). The shunt size was significantly larger in patients with  $\geq 25\%$  effective PV segments (median 4.0 mm [range 4–5 mm]) than others in group P (median 3.5 mm [range 3–4 mm];  $p = 0.04$ ).

Figure 3A shows the Kaplan-Meier survival curve of patients with or without  $\geq 25\%$  effective PV segments. There was a significant difference in survival (log rank  $p = 0.04$ ). Poorer PA growth was observed in patients with  $< 25\%$  effective PV segments than in patients with  $\geq 25\%$  (Figure 3B).

Our surgical approach primarily aims to release PVO and allow the affected lung to receive pulmonary blood flow. However, the recurrence rate of PVO is high. We considered that more continuous antegrade blood flow from the systemic pulmonary artery shunt (SPS) could achieve growth of the affected PA and prevent PVO recurrence, thus we consciously increased the shunt size over time as we adapted IPAS to PVO.

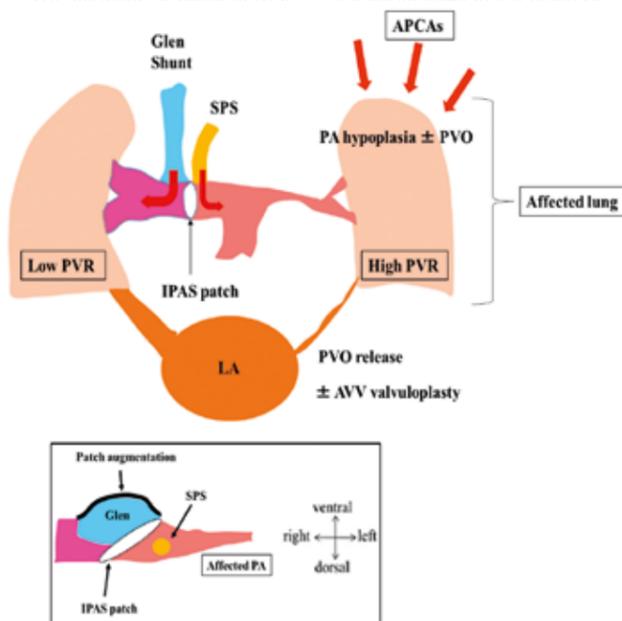


Figure 1. Intrapulmonary-artery septation concept. A Glenn shunt and systemic pulmonary artery shunt (SPS) are adjoining in an unaffected pulmonary artery (PA). A septation patch was obliquely placed between the unaffected PA connected to the SPS and affected PA connected to the Glenn shunt. Abbreviations: APAC – aorto-pulmonary collateral artery; AVV – atrioventricular valve; LA – left atrium; PVO – pulmonary vein obstruction; PVR – pulmonary vascular resistance.

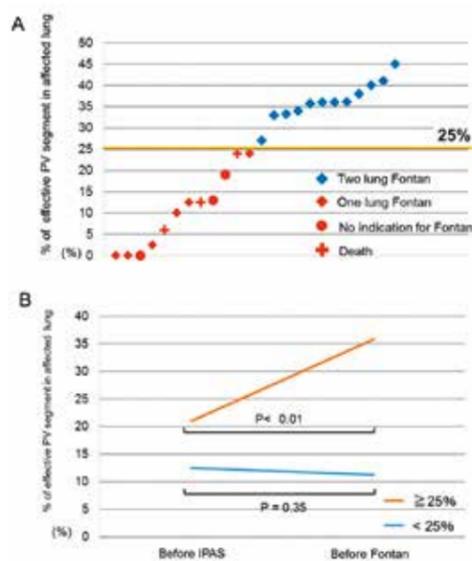


Figure 2. (A) Percentage effective pulmonary vein (PV) segments in group P at the time of evaluating indications for Fontan procedure after intrapulmonary-artery septation. Twelve patients maintained  $\geq 25\%$  effective PV segments in affected lungs; all underwent successful two-lung Fontan procedure. (B) Changes in median percentage of the effective PV segments in the affected lung in patients with or without  $\geq 25\%$  effective PV segments. The effective PV segments increased significantly in patients with  $\geq 25\%$  effective PV segments after IPAS. Abbreviations: PV – pulmonary vein; IPAS – intrapulmonary-artery septation.

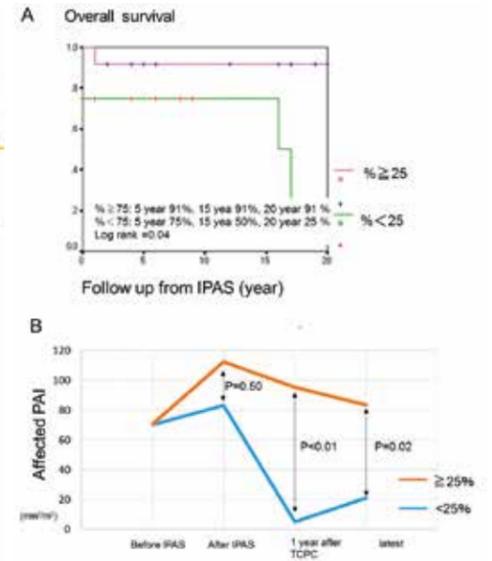


Figure 3. (A) Kaplan-Meier survival curve of patients with or without  $\geq 25\%$  effective pulmonary vein (PV) segments. Survival differed significantly. (B) Changes in median affected pulmonary artery index (PAI) in patients with or without  $\geq 25\%$  effective PV segments. Poor pulmonary artery growth was observed in patients with  $< 25\%$  effective PV segments compared with patients with  $\geq 25\%$ . Abbreviations: IPAS – intrapulmonary-artery septation; PAI – pulmonary artery index; PV – pulmonary vein; TCPC – total cavopulmonary connection.

The severity of atrioventricular valve regurgitation (AVVR) with single-ventricle physiology influences mortality and achievement of two-lung Fontan circulation. Although we speculate that ventricular volume overload after IPAS with SPS contributes to the deterioration of AVVR and ventricular dysfunction, we did not identify strong relationships between AVVR, mortality, and success of the two-lung Fontan procedure. We performed

aggressive valvuloplasty using various techniques such as the inter-annular bridge technique<sup>2</sup> at IPAS which could maintain atrioventricular valve function and ventricular function, allowing larger shunts into the affected PA.

In conclusion, larger shunt use in the affected lung at IPAS increased the percentage of the effective PV segments in patients with PVO. Maintenance of  $\geq 25\%$  effective PV segments in the affected lung, along with

comprehensive treatment, is key for a successful two-lung Fontan procedure.

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## Rapid Response | Congenital | Congenital Rapid Response 1

# Blood flow analysis of Fontan pathway using computational fluid dynamics in apicocaval juxtaposition

Aiko Sonobe, Muneaki Matsubara, Hideyuki Kato, Yuji Hiramatsu Department of Cardiovascular Surgery, University of Tsukuba, Japan

Malpositioned heart with apicocaval juxtaposition (ACJ) complicates the selection of conduit route in children with a functional single ventricle during the extracardiac Fontan procedure (eTCPC). Conduit placement ipsilateral to the cardiac apex (ipsilateral route) carries the risk of conduit compression by the ventricle while a route contralateral to the cardiac apex (contralateral route) requires a long and curved conduit that risks energy losses and conduit kinking.<sup>1</sup>

Computational fluid dynamics (CFD) has identified a design characteristic of eTCPC pathways that can cause flow disturbances and energy dissipation.<sup>2</sup>

Our objective is to use CFD models based on flow stagnation and energy loss to determine optimal Fontan routes in patients with ACJ.

Based on CT data before and after eTCPC in ACJ patients, a virtual simulation of two viable Fontan routes (ipsilateral and contralateral routes) was created with 3D computer graphics and blood flow analysis.

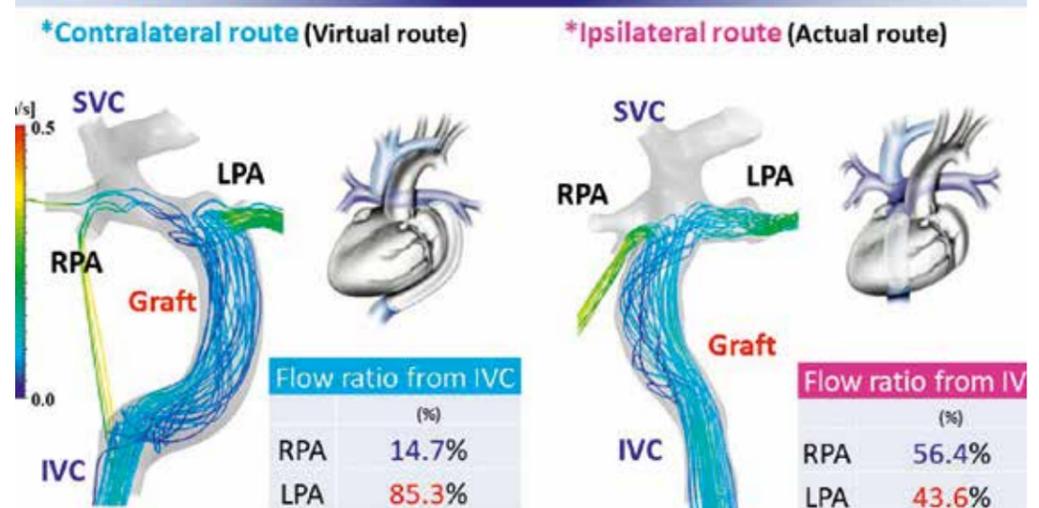
With this advanced CFD, valuable insights into



Aiko Sonobe

the proper Fontan route selection for ACJ were revealed. We found that a virtual Fontan route opposite to the actual route caused significant left-right imbalance in pulmonary blood flow from the inferior vena cava, increasing future pulmonary arteriovenous fistula risk (Figure 1).

## Prediction of postoperative blood flow (A Case)



#### References

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Abstract | Congenital | Mechanical Circulatory Support

# Bridge to recovery with Berlin Heart EXCOR in children < 10 kg with dilated cardiomyopathy – clinical and histological analysis



(From left) Yuji Tominaga, Yoshiki Sawa and Takayoshi Ueno

**Yuji Tominaga, Takayoshi Ueno, Takashi Kido, Tomomitsu Kanaya, Naoki Okuda, Kanta Araki, Takuji Watanabe, Koichi Toda, Toru Kuratani, Yoshiki Sawa** Department of Cardiovascular Surgery, Osaka University Graduate School of Medicine, Suita, Osaka, Japan

### Background

Berlin Heart EXCOR® (BHE) has significantly improved survival. However, the management of paediatric patients < 10 kg with dilated cardiomyopathy (DCM) remains a challenging issue because of the high incidence of morbidity including stroke, bleeding, and infection. Therefore, minimising morbidities associated with BHE support is becoming increasingly important. In adult patients with DCM, the left ventricular (LV) myocardial histology is

reported to predict the recovery of myocardial function after mechanical unloading with VAD support, however the predictive factors for myocardial recovery with BHE in paediatric patients with DCM is unclear. This study aimed to identify the histological characteristics associated with bridge to recovery using BHE in paediatric patients < 10 kg with DCM.

### Methods

Of the 10 consecutive patients < 10 kg with DCM who underwent BHE implantation

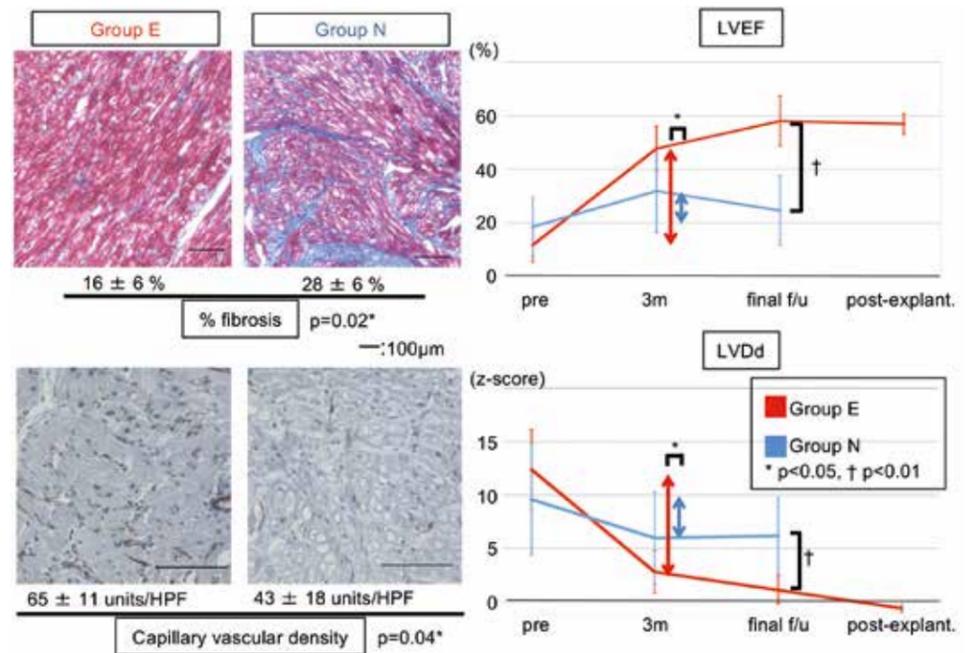
between 2013 and 2018, four showed improvement in LV function resulted in successful BHE explantation (Group E). The remaining six patients showed persistent LV dysfunction and underwent heart transplantation (Group N). The following variables were compared between the two groups: (1) Histological findings in LV myocardium obtained at BHE implantation; and (2) LV function after BHE implantation assessed with echocardiography and cardiac catheterisation.

### Results

The degree of myocardial fibrosis was significantly lower and the capillary vascular density was significantly higher in Group E than in Group N ( $16 \pm 6\%$  vs  $28 \pm 6\%$ ,  $p = 0.02$  and  $65 \pm 11$  vs  $43 \pm 18$  units/high-power field  $p = 0.04$ ). The changes during the three months after BHE implantation in LV diastolic dimension (z-score) and ejection fraction were significantly greater in Group E than in Group N ( $-9.6 \pm 3.5$  vs  $-3.6 \pm 4.5$ ,  $p = 0.045$  and  $36 \pm 13\%$  vs  $13 \pm 13\%$ ,  $p = 0.03$ ).

### Conclusions

In paediatric patients < 10 kg



Histological findings at BHE implantation and changes in LVDd and LVEF over time after BHE implantation.

with DCM, the degree of LV myocardial fibrosis and capillary vascular density at Berlin Heart EXCOR® implantation were found to be predictive factors for bridge to recovery.

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Abstract | Cardiac | Outcomes and controversies in mitral repair

# Re-repair after previous mitral valve reconstruction: handle with care!

**Cinzia Trumello, Ilaria Giambuzzi, Benedetto Del Forno, Marta Bargagna, Stefania Ruggeri, Alessandro Castiglioni, Ottavio Alfieri, Michele De Bonis** Department of Cardiac Surgery, IRCCS San Raffaele Hospital, Vita-Salute San Raffaele University, Milan, Italy

Mitral valve repair is the gold standard for the treatment of mitral regurgitation (MR), and the rate of repair for degenerative disease has progressively increased over the years, whether in high- or low-volume centres. Yet despite significant improvements in surgical techniques and results, failure to repair remains an issue both early and late after surgery. The reasons are essentially related to failure of the previous procedure (such as length misjudgement of artificial chordae, ring prosthesis or suture dehiscence), progression of the original disease (new valve prolapse or further annular enlargement) or onset of a new pathology (such as endocarditis).

The optimal surgical strategy for repair failure is still under debate. In this study, we retrospectively evaluate our series of patients with recurrent mitral disease after mitral repair and compare short- and long-term outcomes of those who underwent a re-repair versus replacement. A total of 81 patients, admitted in our institution for mitral valve re-surgery from 2003 to 2017 were

selected and divided in two groups: Group A (patients who underwent a re-repair) and Group B (patients who underwent mitral valve replacement: MVR). Each group had inevitable baseline differences thus patients were matched to create comparable distributions of the covariates that were significantly different.

The degree of MR was measured semi-quantitatively by Doppler colour flow imaging using a four-grade scale: mild (1+/4+), moderate (2+/4+), moderate-to-severe (3+/4+) and severe (4+/4+). The mean follow-up was  $7.4 \pm 3.26$  years (max 14.4). Despite the mixed aetiology of initial mitral disease, a re-repair was feasible in 48.1% of the patients (39/81). No differences were found in cardiopulmonary bypass (CPB) and cross-clamp times in the re-repair vs replacement groups: 81 (72–88) vs 76 (63–87),  $p = 0.577$ ; and  $51.8 \pm 15.38$  vs  $60.0 \pm 18.37$ ,  $p = 0.061$ .

A greater number of concomitant procedures were necessary in the MVR group (43% vs 12.8%) and, at hospital discharge, 5 patients (12.8%) of the re-repair group showed residual moderate MR. There was no residual MR in the



Cinzia Trumello

replacement group. This suggests that in a valve which has already been repaired, the re-repair procedure is technically more cumbersome and time consuming, carrying a higher risk of immediate, suboptimal results. There were no in-hospital deaths in either group.

The paired overall survival at 8 years was 100% in the re-repair group and  $96.6 \pm 3.20\%$  (95% CI 88.15–99.06) in the replacement group ( $p = 0.051$ ). The cumulative incidence function (CIF) of cardiac death – with non-cardiac death as competitive event – at 8 years was 0% in the re-repair group and  $3.3 \pm 2.2\%$  (95%

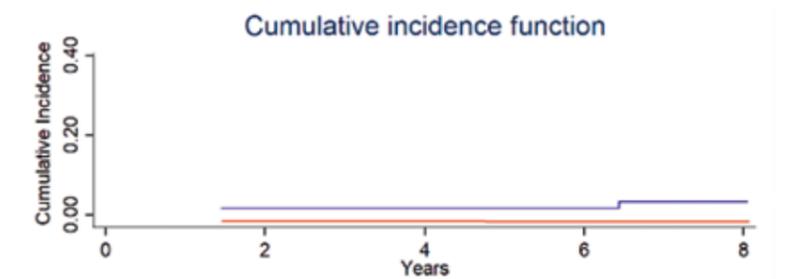


Figure 1. The cumulative incidence function (CIF) of cardiac death with non-cardiac death as competitive event.

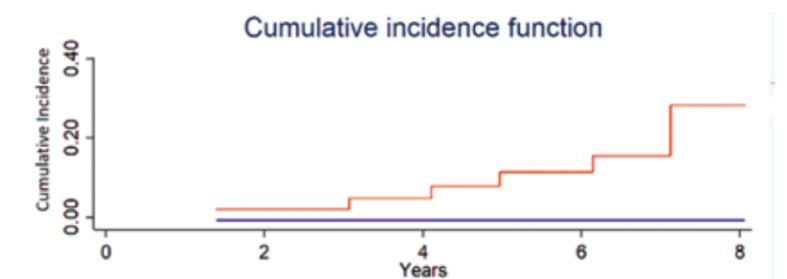


Figure 2. The cumulative incidence function (CIF) of mitral regurgitation (MR) ≥ 3+ with death as competitive event.

CI 0.72–9.81) in the replacement group ( $p = 0.057$ ; Figure 1). The CIF of MR ≥ 3+ at 8 years, with death as competitive event, was  $23.7 \pm 7.43\%$  in the re-repair and 0% in the replacement group ( $p < 0.001$ ; Figure 2).

In summary, survival seems to be worse

with mitral valve replacement, however recurrent significant MR after re-repair is not rare at 8 years, which mandates for a careful balance when deciding whether a re-repair is a worthy alternative to replacement for each individual.



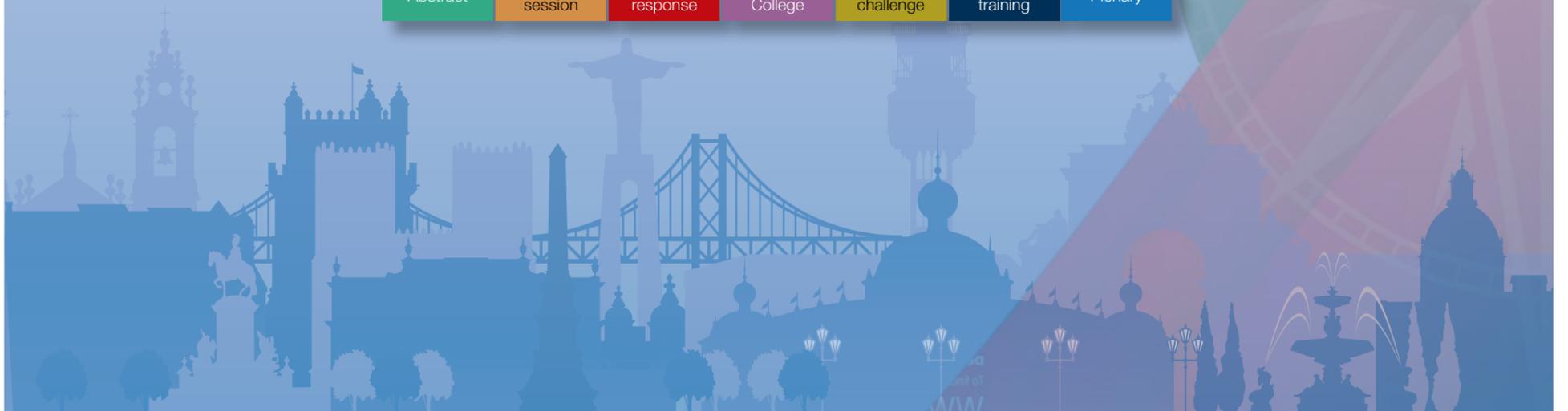
# EACTS 2019 Agenda

Thursday 3 October			
08:30	Does the coronary outcome data speak for itself?	Room 3C, Pav 3	Adult Cardiac
08:30	Re-directing blood flow with mechanical circulatory support	Room 3A, Pav 3	Adult Cardiac
08:30	TAVI – New approaches and data from the real world.	Auditorium 8	Adult Cardiac
08:30	Using data management to further improve cardiac surgery outcomes	Room 3B, Pav 3	Adult Cardiac
08:30	What's new in endocarditis?	Auditorium 7	Adult Cardiac
08:30	Mechanical Circulatory Support	Auditorium 2	Congenital Disease
08:30	Doubt and controversies in managing acute type A aortic dissection	Auditorium 6	Vascular Disease
08:30	Innovations	Room 5A, Pav 5	Thoracic Disease
08:30	MMCTS video session–Challenging aortic cases	Room 108	Vascular Disease
<b>Break</b>			
09:45	Non Oncology	Room 3B, Pav 3	Thoracic Disease
09:45	Complex resections	Room 5A, Pav 5	Thoracic Disease
09:45	Surgery on the left ventricle – resect, repair and support	Auditorium 3+4	Adult Cardiac
09:45	Congenital Rapid Response 1	Room 5B, Pav 5	Congenital Disease
09:45	3rd International EACTS VAD Coordinator Symposium – Long-term management of VAD patients	Room 3C, Pav 3	Adult Cardiac
09:45	Techno-College	Auditorium 1	Adult Cardiac
11:15	Mediastinum and oesophagus	Room 3B, Pav 3	Thoracic Disease
11:15	Outside the Box of Cardiothoracic Surgery	Room 108	Annual Meeting
11:15	Observational studies in the practice	Auditorium 6	Adult Cardiac
11:15	Knowledge Generation in Congenital Heart Surgery	Auditorium 2	Congenital Disease
11:15	SAVR-new concepts and ideas you have not heard about before ...	Auditorium 3+4	Adult Cardiac
11:15	Embracing the aortic arch	Room 5B, Pav 5	Vascular Disease
11:15	Sleeve resections	Room 5A, Pav 5	Thoracic Disease
<b>Break</b>			
13:00	Jeopardy – Semi Finals	Room 5B, Pav 5	Annual Meeting
14:30	Current challenges in heart transplantation	Auditorium 8	Adult Cardiac
14:30	Outcomes and controversies in mitral repair	Room 3B, Pav 3	Adult Cardiac
14:30	Management of ACHD	Auditorium 2	Congenital Disease
14:30	Transplant abstract and focus session	Room 5B, Pav 5	Thoracic Disease

14:30	The Team is the Key	Room 5C, Pav 5	Annual Meeting
14:30	EU Medical Device Directive: consequences for novel device application	Room 108	Adult Cardiac
14:30	MiECC	Room 3C, Pav 3	Adult Cardiac
14:30	Practical approach to challenging aortic valve surgery	Auditorium 1	Adult Cardiac
14:30	Visualizing the heart – future aspects	Room 3A, Pav 3	Adult Cardiac
14:30	Value in thoracic Surgery	Room 5A, Pav 5	Thoracic Disease
14:30	EACTS-STs: Acute type A aortic dissection: can we bring mortality down to single digits? Part 1	Auditorium 6	Vascular Disease
14:30	Review of the latest tendencies and improvements in cardiac surgery	Auditorium 3+4	Adult Cardiac
14:30	Training Suite- TAVI Training	Training Village	Annual Meeting
14:30	How to build a specialized coronary program	Auditorium 7	Adult Cardiac
<b>Break</b>			
16:15	Minimally invasive and transcatheter approaches to the mitral valve	Room 3B, Pav 3	Adult Cardiac
16:15	Tissue is the issue: collaborative insights from translational science	Room 108	Adult Cardiac
16:15	Management of ACHD 2	Auditorium 2	Congenital Disease
16:15	Aortic Valve Stenosis: not just a wear and tear issue; The Valve, the Heart and the Organs	Room 3A, Pav 3	Adult Cardiac
16:15	EACTS-ESC Joint Session – Valvular heart disease in the 21st Century: a team approach	Room 5C, Pav 5	Adult Cardiac
16:15	ECMO/ ECLS	Room 3C, Pav 3	Adult Cardiac
16:15	The difficult choice of a prosthetic valve in the 21st century	Auditorium 1	Adult Cardiac
16:15	The transeptal approach to the mitral valve	Auditorium 8	Adult Cardiac
16:15	Joint session ERS: Mesothelioma guidelines	Room 5A, Pav 5	Thoracic Disease
16:15	EACTS-STs: Acute type A aortic dissection: can we bring mortality down to single digits? Part 2	Auditorium 6	Vascular Disease
16:15	Outcome prediction in patients treated by endovascular, minimally invasive and conventional aortic valve surgery	Auditorium 3+4	Adult Cardiac
16:15	Non oncology	Room 5B, Pav 5	Thoracic Disease

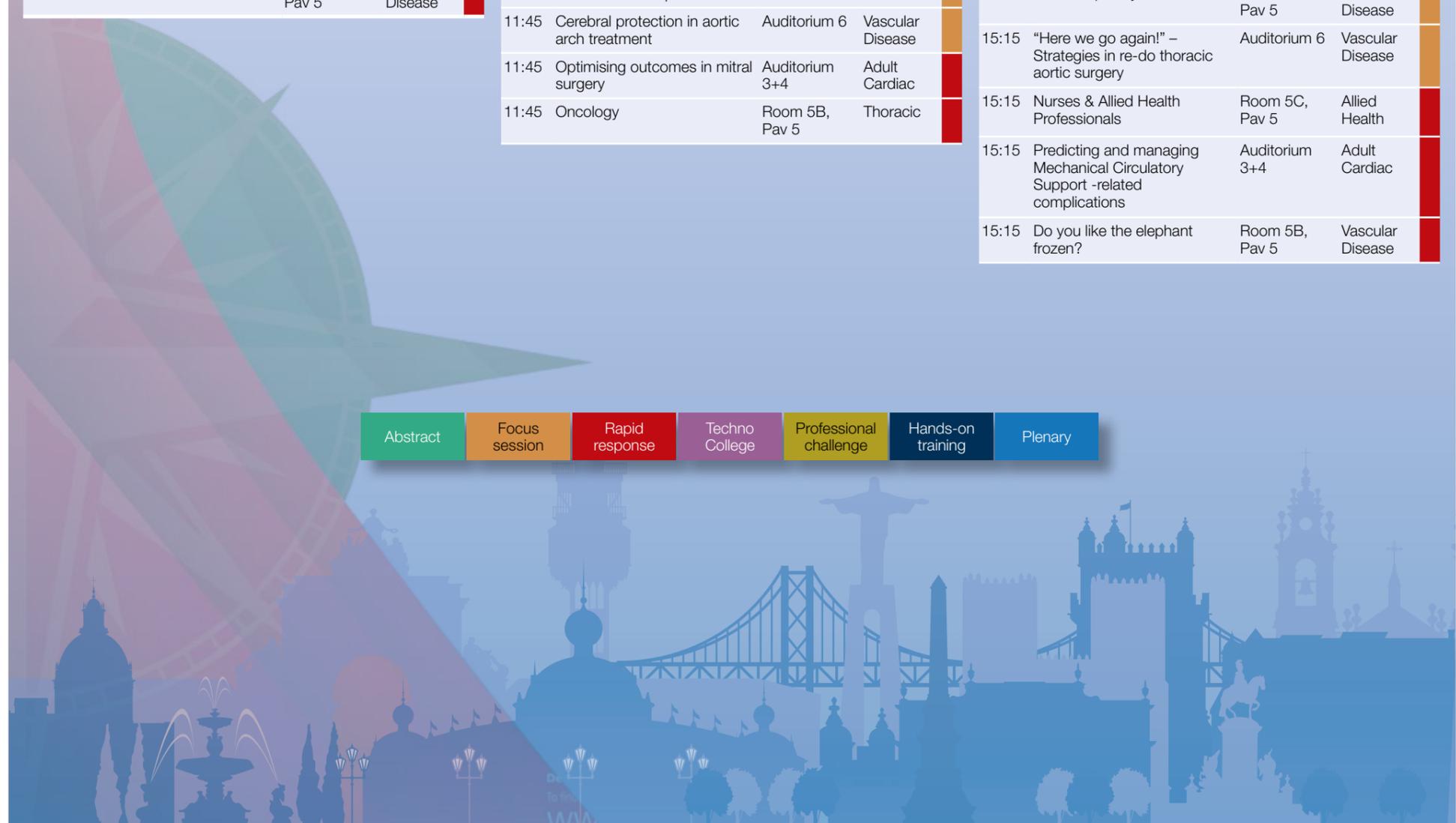
Friday 4 October			
08:00	Late Breaking Clinical Trials – Part 1	Auditorium 7	Adult Cardiac
08:00	Techno-College	Auditorium 1	Techno College
08:00	Coronary arteries in CHD	Auditorium 2	Congenital Disease
08:00	Clinical Trials in the practice. Focus on TAVI versus SAVR RCT	Room 3C, Pav 3	Adult Cardiac
08:00	TB and friends	Room 108	Thoracic Disease
08:00	Complexity in Brief: Translational Research in Cardiac Surgery	Auditorium 3+4	Adult Cardiac
08:00	TEVAR: Guns and Roses	Room 5B, Pav 5	Vascular Disease
08:00	Update Thymic Surgery	Room 5A, Pav 5	Thoracic Disease
08:00	Training Suite: Congenital – Ross and the Reinforced Ross	Training Village	Congenital Disease
<b>Break</b>			
09:45	Late Breaking Clinical Trials – Part 2	Auditorium 7	Adult Cardiac
09:45	Oncology	Room 108	Thoracic Disease
09:45	Thoracoabdominal surgery: Spying on the spinal chord	Auditorium 6	Vascular Disease
09:45	Controversies in valve repair vs replacement for congenital and rheumatic heart diseases in LMICs.	Room 3C, Pav 3	Adult Cardiac
09:45	Esophageal Surgery	Room 5A, Pav 5	Thoracic Disease
09:45	EUROMACS	Room 3B, Pav 3	Annual Meeting
09:45	Dilemmas in mitral repair, tricuspid surgery and endocarditis	Auditorium 3+4	Adult Cardiac
09:45	Congenital Rapid Response 2	Room 5B, Pav 5	Congenital Disease
<b>Break</b>			
14:00	Potentially modifiable preoperative factors to improve outcomes in cardiac surgery	Room 3C, Pav 3	Adult Cardiac
14:00	SAVR and TAVI – are we comparing apples to oranges?	Room 3A, Pav 3	Adult Cardiac
14:00	The evolution of cardiopulmonary bypass strategies in modern cardiac surgery	Room 3B, Pav 3	Adult Cardiac
14:00	The evolving challenges of coronary surgery	Auditorium 8	Adult Cardiac

Abstract	Focus session	Rapid response	Techno College	Professional challenge	Hands-on training	Plenary
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14:00	Management of HLHS	Auditorium 2	Congenital Disease	<b>Saturday 5 October</b> 08:00 Congenital Videos Auditorium 2 Congenital Disease 08:00 Work in Progress Room 108 Annual Meeting 08:00 Aviation medicine and high hazard occupational medicine Room 3C, Pav 3 Adult Cardiac 08:00 Minimally Invasive Mitral Valve Surgery parade. Auditorium 8 Adult Cardiac 08:00 Physiology for the cardiac surgeon Room 3A, Pav 3 Adult Cardiac 08:00 Stroke in TAVI; Prediction, Prevention and Treatment Auditorium 1 Adult Cardiac 08:00 Systematic Reviews and Meta-Analyses: at the top of the evidence? Room 3B, Pav 3 Adult Cardiac 08:00 Nurses & Allied Health Professionals Room 5C, Pav 5 Allied Health 08:00 Lung Failure (Transplantation, ECMO and pulmonary endarterectomy) Room 5A, Pav 5 Thoracic Disease 08:00 Thoracic aortic surgery in the young (DA VINCI SESSION) Auditorium 6 Vascular Disease 08:00 Approaches to minimise stroke and improve survival in atrial fibrillation patients Auditorium 3+4 Adult Cardiac 08:00 Thoracic Mixed Room 5B, Pav 5 Thoracic Disease Break 09:45 Leonardo Da Vinci: 500 years of genius Auditorium 1 Annual Meeting Break 11:45 Career Development Room 108 Annual Meeting 11:45 A further step ahead: minimally invasive and Hybrid CABG Room 3B, Pav 3 Adult Cardiac 11:45 BAV Repair Auditorium 8 Adult Cardiac 11:45 Heart transplantation in 2019 Room 3A, Pav 3 Adult Cardiac 11:45 ERAS Cardiac Surgery: First International Presentation of Guidelines Room 5C, Pav 5 Allied Health 11:45 Ebstein Disease Auditorium 2 Congenital Disease 11:45 Joint session ERS: MDT COPD and transplant Room 5A, Pav 5 Thoracic Disease 11:45 Cerebral protection in aortic arch treatment Auditorium 6 Vascular Disease 11:45 Optimising outcomes in mitral surgery Auditorium 3+4 Adult Cardiac 11:45 Oncology Room 5B, Pav 5 Thoracic
14:00	Nightmares in CT	Room 108	Annual Meeting	
14:00	Controversies and new findings in the treatment of tricuspid regurgitation	Auditorium 7	Adult Cardiac	
14:00	Guidelines	Auditorium 1	Adult Cardiac	
14:00	Thoracic surgery and basic science	Room 5A, Pav 5	Thoracic Disease	
14:00	Acute Type B Dissection	Auditorium 6	Vascular Disease	
14:00	Jeopardy – Final	Room 5B, Pav 5	Annual Meeting	
14:00	Thoracic Miscellaneous	Auditorium 3+4	Thoracic Disease	
14:00	Controversies and catastrophes in adult cardiac surgery	Room 5C, Pav 5	Adult Cardiac	
14:00	Training Suite – Coronary	Training Village	Adult Cardiac	
Break				
15:45	AVV Regurgitation in Single Ventricle Reconstruction Pathway	Auditorium 2	Congenital Disease	
15:45	How to do it – Live in a box	Room 108	Annual Meeting	
15:45	New evidence for secondary MR: really game changer?	Room 3A, Pav 3	Adult Cardiac	
15:45	TAVI Basics	Auditorium 7	Adult Cardiac	
15:45	The developing and changing field of surgical and hybrid treatment of atrial fibrillation	Room 3C, Pav 3	Adult Cardiac	
15:45	The evidence that every CABG surgeon should know	Auditorium 8	Adult Cardiac	
15:45	VAD surgery – state of the art	Room 3B, Pav 3	Adult Cardiac	
15:45	Joint EACTS-STAS-ASCVTS session: International perspectives on lung cancer screening	Room 5A, Pav 5	Thoracic Disease	
15:45	Thoracoabdominal aortic disease – patient tailored approaches	Auditorium 6	Vascular Disease	
15:45	Coronary outcomes: Did you know this?	Auditorium 3+4	Adult Cardiac	
15:45	Transplant and Mediastinum	Room 5B, Pav 5	Thoracic Disease	
11:45	Trial Update and Evidence Review	Auditorium 1	Adult Cardiac	
11:45	Training suite: Introduction to mitral and tricuspid valve repair	Training Village	Adult Cardiac	
12:00	Residents Luncheon	Terrace	Annual Meeting	
Break				
13:30	Congenital Valve	Auditorium 2	Congenital Disease	
13:30	Strategy and long-term results in aortic valve repair	Room 3C, Pav 3	Vascular Disease	
13:30	Cardiac Surgery and translational basic science	Room 108	Adult Cardiac	
13:30	Choosing conduits for CABG: strategy is the secret for success	Room 3B, Pav 3	Adult Cardiac	
13:30	Heart failure surgeon at the cutting edge	Room 3A, Pav 3	Adult Cardiac	
13:30	TAVI vs. SAVR in low-risk patients	Auditorium 1	Adult Cardiac	
13:30	Lung Ultrasound workshop	Room 5C, Pav 5	Allied Health	
13:30	Advances in management of thoracic malignancies	Room 5A, Pav 5	Thoracic Disease	
13:30	Late complications of TEVAR	Auditorium 6	Vascular Disease	
13:30	TAVI – interesting new data will influence your practice ...	Auditorium 3+4	Adult Cardiac	
13:30	Dissecting aortic dissection	Room 5B, Pav 5	Vascular Disease	
13:30	EACTS-EACTA Joint Session: Repair of a regurgitant aortic valve	Auditorium 8	Adult Cardiac	
Break				
15:15	Improving outcomes by a perioperative personalized blood management	Room 3B, Pav 3	Adult Cardiac	
15:15	SAVR – long-term results, emphasis on particular sub-groups	Room 3A, Pav 3	Adult Cardiac	
15:15	Congenital Miscellaneous	Auditorium 2	Congenital Disease	
15:15	Help! Trainee in Trouble	Room 108	Annual Meeting	
15:15	Technical pearls in mitral valve repair: artificial chordae adjustment	Auditorium 1	Adult Cardiac	
15:15	Multidisciplinary tumour board	Room 5A, Pav 5	Thoracic Disease	
15:15	"Here we go again!" – Strategies in re-do thoracic aortic surgery	Auditorium 6	Vascular Disease	
15:15	Nurses & Allied Health Professionals	Room 5C, Pav 5	Allied Health	
15:15	Predicting and managing Mechanical Circulatory Support -related complications	Auditorium 3+4	Adult Cardiac	
15:15	Do you like the elephant frozen?	Room 5B, Pav 5	Vascular Disease	

Abstract	Focus session	Rapid response	Techno College	Professional challenge	Hands-on training	Plenary
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Academy

# Minimally Invasive Techniques in Adult Cardiac Surgery (MITACS)

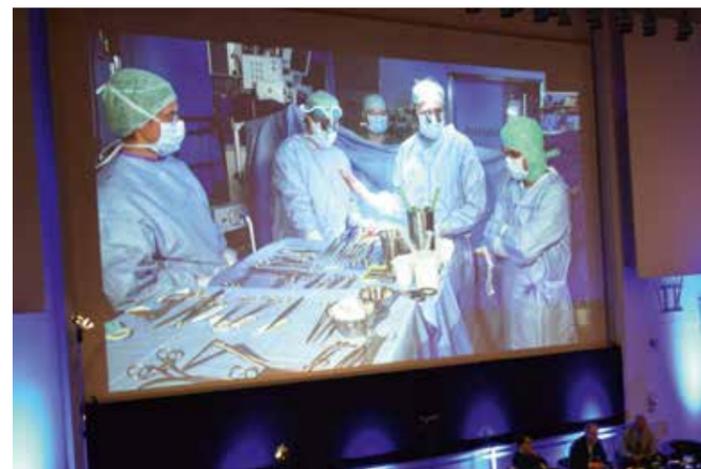
**Michael A Borger** University Department for Cardiac Surgery, Leipzig Heart Center, Germany

Please come and join us June 18–19, 2020 for the EACTS Minimally Invasive Techniques in Adult Cardiac Surgery (MITACS) meeting in Leipzig, Germany. I have the great privilege of joining Peyman Sardari Nia, Thomas Walther, and Volkmar Falk as a MITACS Course Director, and together we'll give our best efforts to make next year's meeting a memorable one.

As in years before, the course will be structured primarily as an educational event with several live operations interspersed with didactic practical lectures and live-in-a-box videos. The course will be of value to cardiac surgeons, cardiologists, cardiac anesthetists, fellows, residents, perfusionists and nurses who are interested in minimal invasive cardiac surgery. Live surgical procedures will be broadcast from the operating room and hybrid suites within the Leipzig Heart Center, with plenty of opportunity for interaction and discussion between expert faculty and course attendees. We will continue to focus on contemporary approaches to minimal invasive aortic valve, mitral valve, tricuspid valve, aortic, and atrial ablation surgery, as well as showing detailed tips and tricks necessary to perform MICS CABG surgery.

Next year's MITACS meeting promises to be another excellent educational opportunity for clinicians interested in establishing or mastering minimal invasive techniques at their institution. We look forward to seeing you in Leipzig!

Snapshots from this year's MITACS Course in Frankfurt, Germany



Awards

## Young Investigator Award programme

EACTS is grateful to Edwards Lifesciences SA for their generous support of this year's Young Investigator Award programme.

**Thursday 3 October**

Time	Presentation	Room	Session Title	Presenter
08:30-09:30	The FIFA-trial: Fitness-tracker assisted Frailty-Assessment before transcatheter aortic valve implantation	Auditorium 8	TAVI – New approaches and data from the real world.	Markus Mach
09:45-11:15	Safety and Efficiency of Continuing Aspirin during the Perioperative Period of Lung Resection – A Propensity Score-matched Analysis	Room 3B, Pav 3	Non Oncology	Takashi Sakai
11:15-12:45	Acute Aortic Dissection Complicated by Cerebral Malperfusion: Complete Vascular Remodelling Utilizing the AMDS Arch Remodelling Device	Room 5B, Pav 5	Embracing the aortic arch	Sabin Bozso
11:15-12:45	Mapping Pre-Dissection Aortic Growth: a multiparametric assessment	Room 5B, Pav 5	Embracing the aortic arch	Ignas Houben
11:15-12:45	Native versus prosthetic ascending aorta as proximal landing zone for endovascular aortic arch repair: clinical and imaging outcomes	Room 5B, Pav 5	Embracing the aortic arch	Chuan Tian
11:15-12:45	Shortcomings of Indexed Effective Orifice Area charts	Auditorium 3+4	SAVR-new concepts and ideas you have not heard about before ...	Michiel Vriesendorp
14:30-16:00	Surgical Repair of Aortic Coarctation in Adults: Half a Century of a Single Center Clinical Experience	Auditorium 2	Management of ACHD	Djamila Abjigitova
16:15-17:45	Twenty-year follow-up of Bentall procedure using the Perimount bioprosthesis and the Valsalva graft	Auditorium 1	The difficult choice of a prosthetic valve in the 21st century	Ilaria Chirichilli
16:15-17:45	Mitochondrial Transplantation for Myocardial Protection following Warm Global Ischemia-Reperfusion Injury in ex-vivo Perfused Diabetic Hearts	Room 108	Tissue is the issue: collaborative insights from translational science	Alvise Guariento
16:15-17:45	Toll-like receptor 3 mediates ischemia/reperfusion injury after cardiac transplantation	Room 108	Tissue is the issue: collaborative insights from translational science	Can Gollmann-Tepeköylü

**Friday 4 October**

08:00-09:30	Atrial fibrillation, increased EURO SCOREII, low calcium-induced contractility and high pentraxin-3 serum levels independently predict reduced right heart function in elective CABG patients	Auditorium 3+4	Complexity in Brief: Translational Research in Cardiac Surgery	Constanze Bening
08:00-09:30	The genetics of cardiac energy metabolism in diabetic patients undergoing cardiac surgery	Auditorium 3+4	Complexity in Brief: Translational Research in Cardiac Surgery	Yama Haqzad
08:00-09:30	In vivo evaluation of third generation hybrid aortic graft using SPIDER technique for thoracoabdominal aortic repair	Auditorium 3+4	Complexity in Brief: Translational Research in Cardiac Surgery	Sabine Wipper

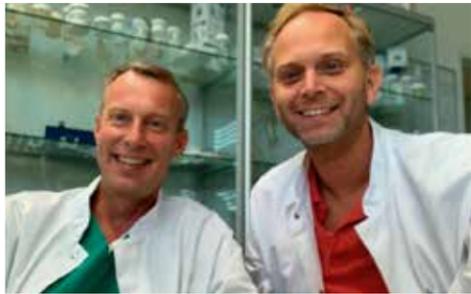
08:00-09:30	Predictors of 30-Day Readmission and Resource Utilization after Thoracic Endovascular Aortic Repair (TEVAR)	Room 5B, Pav 5	TEVAR: Guns and Roses	Amit Iyengar
09:45-11:15	Surgical treatment of pleural recurrence of thymoma: Is hyperthermic intrathoracic chemotherapy worthwhile?	Room 108	Oncology	Diana Bacchin
09:45-11:15	Effects of cerebrospinal fluid pressure increase on spinal cord perfusion – First-time direct detection in a large animal model	Auditorium 6	Thoracoabdominal surgery: Spying on the spinal chord	Josephina Haunschild
09:45-11:15	Detecting Spinal Cord Ischaemia during Aortic Repair by Microdialysis Rapid Bed-Side Detection of Ischaemia Markers in Cerebrospinal Fluid	Auditorium 6	Thoracoabdominal surgery: Spying on the spinal chord	Urszula Simoniuk
09:45-11:15	Mapping the Collateral Network	Auditorium 6	Thoracoabdominal surgery: Spying on the spinal chord	Konstantin Von Aspern
14:00-15:30	Improved inter-stage outcomes following Norwood operation with hybrid management of right ventricle to pulmonary artery shunt flow	Auditorium 2	Management of HLHS	Takashi Yasukawa

**Saturday 5 October**

08:00-09:30	Survival after surgical ablation for atrial fibrillation in heart surgery: Propensity score matched analysis from the Polish National Registry of Cardiac Surgery Procedures (KROK)	Auditorium 3+4	Approaches to minimise stroke and improve survival in atrial fibrillation patients	Mariusz Kowalewski
08:00-09:30	Coagulation factors and fibrinolytic activity in heart chambers and effect on left atrial appendage closure on peripheral blood hemostasis and fibrinolysis in patients with atrial fibrillation	Auditorium 3+4	Approaches to minimise stroke and improve survival in atrial fibrillation patients	Radoslaw Litwinowicz
08:00-09:30	Identifying Risk factors for Respiratory Infection in Non-Small Cell Lung Cancer: A Comparative Analysis	Room 5B, Pav 5	Mixed	Akshay Patel
13:30-15:00	Iliofemoral tortuosity score predicting access and bleeding complications during transfemoral transcatheter aortic valve implantation	Auditorium 3+4	TAVI – interesting new data will influence your practice ...	Markus Mach
13:30-16:45	Aortic Valve-sparing Root Replacement in Patients with Bicuspid Aortic Valve: Long-term outcome with David I Procedure over 20 Years	Auditorium 8	EACTS-EACTA Joint Session: Repair of a regurgitant aortic valve	Erik Beckmann
13:30-16:45	A direct correlation between Commissural Orientation and annular shape in aortic valves: a new anatomical and Computed Tomography classification	Auditorium 8	EACTS-EACTA Joint Session: Repair of a regurgitant aortic valve	Ilaria Chirichilli
15:15-16:45	Aortic Valve-sparing Root Replacement (David): Learning Curve and Impact on Outcome	Auditorium 2	Congenital Miscellaneous	Erik Beckmann
15:15-16:45	Malperfusion Syndrome after Frozen Elephant Trunk procedure in chronic aortic dissection: risk factor analysis	Room 5B, Pav 5	Do you like the elephant frozen?	Carlo Mariani
15:15-16:45	Japan made frozen elephant trunk Multi-center trial of total arch replacement in patients with aortic arch aneurysm and dissection: J-ORCHESTRA study	Room 5B, Pav 5	Do you like the elephant frozen?	Yukata Okita

Rapid Response | Cardiac | SAVR-new concepts and ideas you have not heard about before ...

# Minimally invasive aortic valve replacement without visible scars – the next evolutionary step in aortic valve surgery



Utz Kappert (left) and Manuel Wilbring



Figure 1. Postoperative aspect of patient's thorax after minimally invasive aortic valve replacement.

**Manuel Wilbring, Konstantin Alexiou, Klaus Matschke, Utz Kappert** Center for Minimally Invasive Cardiac Surgery, University Heart Center, Dresden, Germany

Conventional aortic valve surgery by full sternotomy is an extremely controlled and safe approach. It has been the gold-standard procedure for addressing aortic valve disease since Harken and Soroff performed first surgical aortic valve replacement in 1960. Nonetheless, surgical aortic valve replacement is continuously challenged by catheter-based procedures and their ever-expanding indications. Indeed, the FDA expanded TAVR indications to low-risk patients just weeks ago. There is increasing patient demand for improved quality of life, reduced pain, quicker recovery and better cosmetic outcome. To meet these issues, surgery consequently has to implement minimally invasive techniques. For upper partial sternotomy and right anterolateral thoracotomy, two well-established minimally invasive access routes already exist, but they both have their limitations, including sternal instability, rib luxation, lung herniation and loss of the right mammary artery.

By surveying the experience of more than 1,000 minimally invasive aortic valve surgeries at our centre, we wanted to address these limitations by

refining the present techniques to a completely new access route. The access presented is simple, reproducible, safe and provides superior cosmesis (Figure 1).

Herein we present an initial series of surgical aortic valve replacements using a right lateral mini-thoracotomy in the anterior axillary line through the third intercostal space. This access route leaves the osseous thorax and the ribs completely untouched and achieves a surgical result without any visible scars from the front view. Additionally, no fancy and expensive equipment is needed – standard minimally invasive cardiac surgery instruments and a headlight suffice. After a short learning curve, the technique becomes reproducible for more than one surgeon per institution. All kinds of prosthesis – whether biologic, mechanic, sutured or a rapid deployment valve – can be implanted by this access route.

For detailed planning, and to rule out unsuitable patients, a preoperative 3D-reconstructed computed-tomography scan of the chest and heart is necessary (Figure 2). Through a small skin incision in the right anterior axillary line, the third intercostal space is opened. Extracorporeal circulation is established by femoral cannulation. After placing the soft tissue retractor and pericardial stay sutures, an impressive exposure of the aortic valve can be achieved (Figure

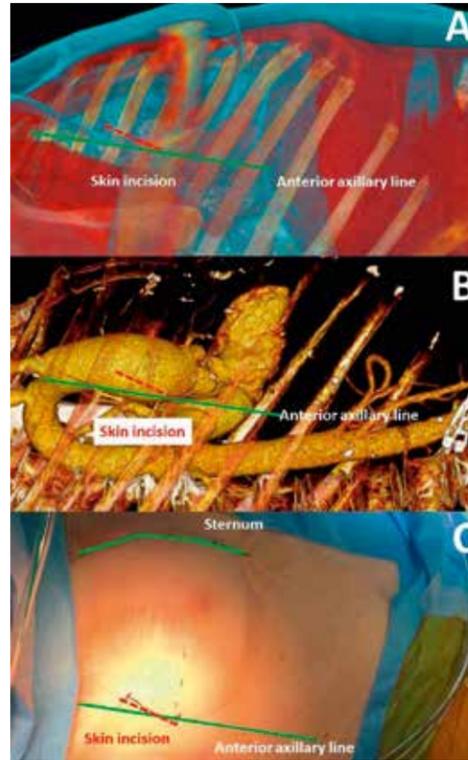


Figure 2. Depiction of anatomical settings and transfer to the operative field.

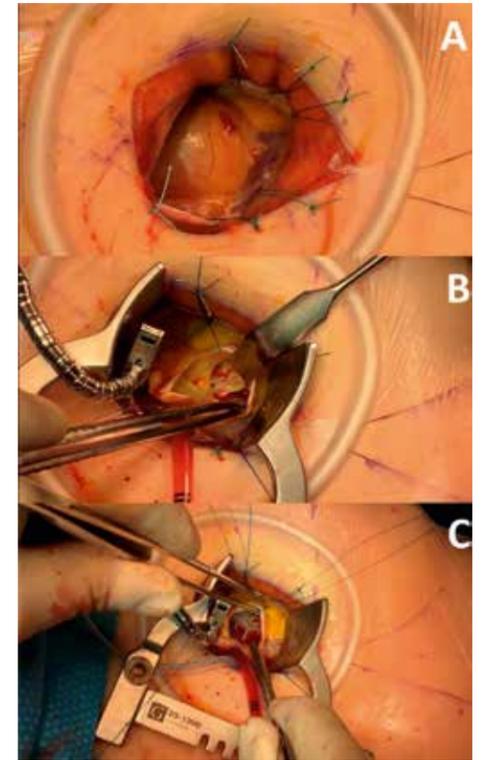


Figure 3. Exposition of the aortic valve through the right lateral access.

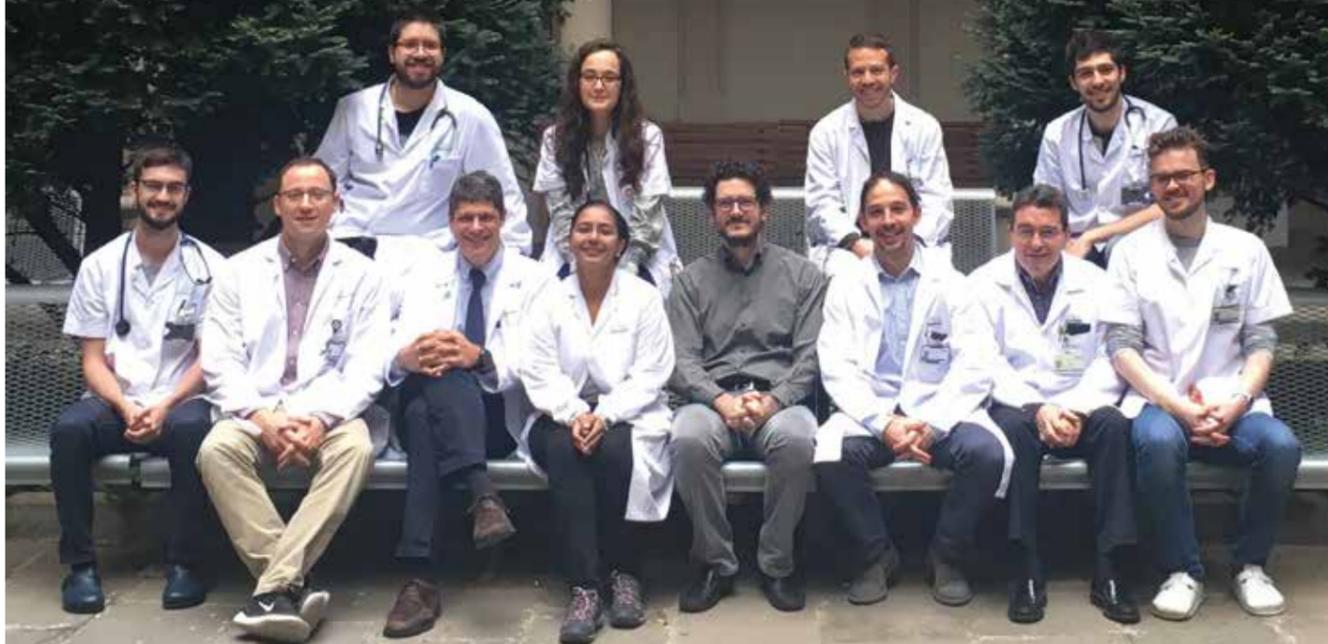
3). Through a transverse or longitudinal aortotomy, the aortic valve replacement is performed as usual. After the procedure, no traces of surgery are visible from the front view (Figure 1). To unsheath the scar, the patient has to lift his arm above 90°.

The results of our initial series of more than 50 patients are promising. There were no deaths, no strokes, no coronary obstructions and we did not observe any impaired wound healing. The simplicity of the technique translated into short procedural

times (median 1-hour 55 min) and short cross-clamp times (median 45 min). All patients were discharged successfully from hospital without peri-procedural morbidity, and follow-up until now has been uneventful.

Of course, "one size does not fit all", but this complementary technique can easily be established and, together with the other access routes and TAVR, brings us one step closer to the aim of an individualised and tailor-made therapeutic concept.

## Postoperative Critical Care Fellowship in Adult Cardiovascular Surgery 2020



Department of Cardiovascular Surgery at Hospital Clinic de Barcelona (University of Barcelona, Spain)

January - May 2020

The goal of this fellowship is to obtain appropriate training in advanced intensive postoperative care in cardiovascular surgery.

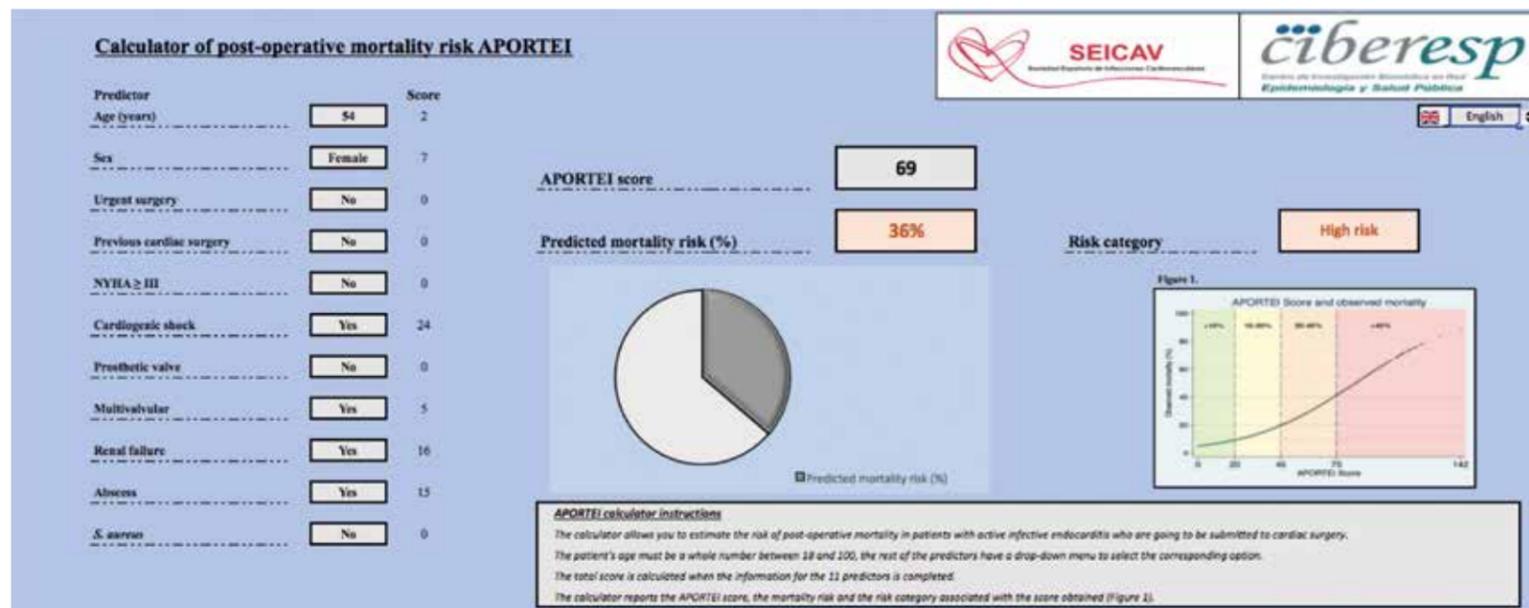
During this four-month fellowship, the trainee will engage in perioperative management of patients undergoing cardiovascular surgery. The trainee will be under the supervision of a staff member from the department, the Fellowship Program Director as well as the Chief of Department. The fellowship will assist in the management of patients with special focus in the postoperative care of patients following cardiovascular operations.

The fellow should acquire all necessary knowledge and competences to lead the postoperative care of his/her patients; compile the necessary training in this aspect to be able to achieve the European Board of Cardiothoracic Surgery (Membership and Cardiac subspecialty) during or after completion of the fellowship.

**Application Deadline: 6 October 2019**

## Abstract | Cardiac | What's new in endocarditis?

## Prognostic assessment of valvular surgery in active infective endocarditis: Multicentric nationwide validation of a new score developed from meta-analysis



Laura Varela Barca<sup>1,2</sup>, Borja M. Fernández-Felix<sup>2,3</sup>, Enrique Navas Elorza<sup>4</sup>, Carlos A. Mestres<sup>5</sup>, Patricia Muñoz<sup>6</sup>, Gregorio Cuerpo-Caballero<sup>7</sup>, Hugo Rodríguez-Abella<sup>7</sup>, Miguel Montejo-Baranda<sup>8</sup>, Regino Rodríguez-Álvarez<sup>9</sup>, Francisco Gutiérrez Díez<sup>10</sup>, Miguel Angel Goenaga<sup>10</sup>, Eduard Quintana<sup>11</sup>, Guillermo Ojeda-Burgos<sup>12</sup>, Aristides de Alarcón<sup>13</sup>, Laura Vidal-Bonet<sup>1</sup>, Tomasa Centella Hernández<sup>14,2</sup> and Jose López-Menéndez<sup>14,2</sup> on behalf of the Spanish Collaboration on Endocarditis – Grupo de Apoyo al Manejo de la Endocarditis Infecciosa en España (GAMES) 1.

Department of Cardiovascular Surgery, University Hospital Son Espases, Palma de Mallorca, Spain; 2. University of Alcalá de Henares, Madrid, Spain; 3. CIBER Epidemiology and Public Health (CIBERESP), Clinical Biostatistics Unit, Hospital Ramon y Cajal (IRYCIS), Madrid, Spain; 4. Department of Infectology, University Hospital Ramon y Cajal, Madrid, Spain; 5. Department of Cardiovascular Surgery, University Hospital Zurich, Zurich, Switzerland; 6. Department of Clinical Microbiology and Infectious Diseases, University Hospital Gregorio Marañón, Madrid, Spain; 7. Department of Cardiovascular Surgery, University Hospital Gregorio Marañón, Madrid, Spain; 8. Department of Infectology, University Hospital Cruces, Bilbao, Spain; 9. Department of Cardiovascular Surgery, University Hospital Marques de Valdecilla, Santander, Spain; 10. Department of Infectology, University Hospital Donosti, San Sebastian, Spain; 11. Department of Cardiovascular Surgery, Hospital Clínic de Barcelona, University of Barcelona, Barcelona, Spain; 12. Department of Infectology, University Hospital Virgen de la Victoria, Malaga, Spain; 13. Clinical Unit of Infectious Diseases, Microbiology, and Preventive Medicine Infectious Diseases Research Group, Institute of Biomedicine of Seville (IBiS), University of Seville/CSIC/University Hospital Virgen del Rocío, Seville, Spain; 14. Department of Cardiovascular Surgery, University Hospital Ramon y Cajal, Madrid, Spain

A large proportion of patients with active infective endocarditis (IE) are at high risk of mortality if not treated with cardiovascular surgery. In the recent years, some new IE-specific scores have been published with the aim of improving prognostic accuracy in the surgical treatment of IE. However, the utility of these risk models in clinical practice has been debated, and few external validations have been conducted to assess their accuracy. We have previously developed an evidence-based specific score, and the aim of the present study was the assessment of its prognostic accuracy in a nationwide cohort.

We developed a systematic review and meta-analysis following the PRISMA Guidelines and the obtained pooled estimates were used as the basis for the development of a new specific-IE score (APORTEI). We analysed the prognostic utility of APORTEI using patient-level data from the Spanish multicentric national cohort (GAMES cohort). We assessed the performance of the model through



Laura Varela Barca

the calculation of its discrimination and calibration over postoperative mortality and, afterwards, we assessed the agreement between estimated mortality of APORTEI score and EuroSCORE I.

The meta-analysis identified 11 variables with significant impact on

mortality: cardiogenic shock, urgent or emergency surgery, paravalvular abscess, preoperative renal failure, previous cardiac surgery, S. aureus, female sex, age, NYHA class ≥III, prosthetic valve IE and multivalvular involvement. Their pooled estimations were used to construct the new score.

Predicted risk of mortality associated with individual scores was calculated in 1,338 patients according to the presence and scoring of each of the variables included. Overall observed surgical mortality was 25.56%. The score demonstrated an optimal discrimination (area under the ROC curve = 0.75; 95% CI 0.72–0.77) and calibration (calibration slope = 1.03, Hosmer-Lemeshow test p = 0.389).

In addition, we analysed the agreement between APORTEI score and Logistic EuroSCORE I. EuroSCORE I underestimated mortality in low-risk patients, whereas it overestimated mortality in high-risk patients. The absolute agreement between both scores was low (CCC = 0.55); there was a clear trend of lack of agreement between both scores in Bland-Altman analysis: the higher the expected mortality was, the lower the agreement.

Specific IE scores have shown a better mortality risk prediction, however, some of them are very complex to calculate and, as a consequence, there is a lack of application of these scores in routine clinical practice. We developed an online free calculation system to facilitate the use of APORTEI in daily practice.

To conclude, a new specific endocarditis score (APORTEI score), developed from a systematic review and meta-analysis, showed an accurate estimation of the risk of mortality in the surgical treatment of active infective endocarditis. The external validation of this score in a multicentric nationwide cohort confirmed an optimal calibration and discrimination, therefore, it could be a useful tool for preoperative risk prediction in surgically treated patients affected with infective endocarditis.

## Abstract | Thoracic | Non Oncology

## Safety and efficiency of continuing aspirin during the perioperative period of lung resection — a propensity score-matched analysis

Takashi Sakai, Keiju Aokage, Shinya Katsumata, Shoko Nakasone, Satoshi Okada, Kenta Tane, Tomohiro Miyoshi, Masahiro Tsuboi Department of Thoracic Surgery, National Cancer Center Hospital East, Kashiwa, Japan

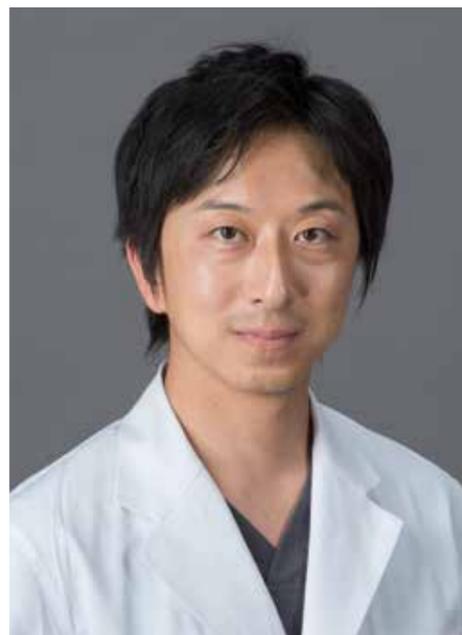
Today, many patients who require lung resection for their pulmonary disease have cardiovascular and cerebrovascular comorbidities. Patients with cerebrovascular disease, peripheral vascular disease or ischaemic heart disease who are treated by coronary artery stent all require anti-platelet therapy (APT). The American and European guidelines recommend that continuation of single and dual APT is feasible in patients with comorbidities requiring APT and non-cardiac surgery, unless the risk of bleeding is significant<sup>1-3</sup>, because discontinuing anti-platelet agents increases major adverse cardiovascular events (MACE). Similarly, discontinuation of anti-platelet agents in patients with a history of brain ischaemic stroke (BIS) or transient ischaemic attack is a risk factor for recurrence<sup>4</sup>.

As an increased incidence of complications related to bleeding was the main concern in the continuation of anti-platelet agents, until recently, anti-platelet agents were usually discontinued during the perioperative period of non-cardiac surgery. In recent years, several studies and

meta-analyses have shown that single APT continuation during the perioperative period of non-cardiac surgery including lung resection does not increase bleeding complications<sup>5,6</sup>. Thus, in some institutions, lung resection has already performed with continuation of anti-platelet agents perioperatively. However, guidelines on non-cardiac surgery also recommended APT discontinuation if the non-cardiac surgery has a high bleeding risk, or the bleeding risk outweighs the advantages of thrombotic complication prevention, and they concluded that continuation or discontinuation of APT depends on the individual decision.

On the other hands, the efficiency of continuing anti-platelet agents during the perioperative period is rarely reported in lung resection. As MACE is a severe complication but is relatively rare in lung resection, it was difficult to elucidate the effect of continuing APT during the perioperative period.

Thus, the safety and efficiency of aspirin continuation is still a controversial issue. We investigated the patients who underwent lung resection in our hospital, and clarified the safety and efficiency of aspirin continuation during



Takashi Sakai

perioperative period of lung resection through a detailed propensity matching analysis. As the result, complications related to bleeding did not increase,

and MACE decreased by continuing aspirin during the perioperative period of lung resection. We concluded that aspirin continuation is desirable for patients requiring aspirin during the perioperative period of lung resection, if there is no prohibitive bleeding risk.

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## Abstract | Thoracic | Mediastinum and oesophagus

# Video-assisted thoracoscopic thymectomy is feasible for large thymomas: a propensity matched comparison

Wenhan Weng<sup>1</sup>, Xiao Li<sup>1</sup>, Shushi Meng<sup>2</sup>, Xianping Liu<sup>2</sup>, Peng Peng<sup>2</sup>, Zhenfan Wang<sup>2</sup>, Jianfeng Li<sup>1</sup>, Jun Wang<sup>1</sup> <sup>1</sup>. Department of Thoracic Surgery, Peking University People's Hospital, Beijing, China; <sup>2</sup> Peking University Health Science Center, Beijing, China

Video-assisted thoracoscopic thymectomy (VATT) is becoming the preferred approach for early-stage thymoma. However, large thymomas are still recognised as a relative contraindication due to the possible risk of incomplete resection or capsular disruption. Thus, the aim of this study is to evaluate the feasibility of VATT for large thymomas.

Patients diagnosed with Masaoka Stage I-IV thymoma between April 2001 and December 2018 were retrospectively reviewed. All patients were divided into two groups: thymoma < 5.0 cm (group A) and thymoma ≥ 5.0 cm (group B). Propensity score matching (PSM) was performed to compare postoperative results. Recurrence-free survival (RFS) and overall survival (OS) were compared for oncological evaluation.

A total of 346 patients were included in this study. In the PSM analysis, 126 patients were included both in group A and group B. There was no significant difference between these two groups in terms of the R0 resection rate (95.2% vs 94.4%,  $p = 1.000$ ), conversion rate (1.6% vs 3.2%,  $p = 0.684$ ), operation time ( $119.4 \pm 48.4$  min vs  $139.1 \pm 46.6$  min,  $p = 0.955$ ), blood loss ( $93.2 \pm 231.7$  ml vs  $100.5 \pm 149.3$  ml,  $p = 0.649$ ), duration of chest drainage

( $2.7 \pm 1.6$  days vs  $2.8 \pm 2.0$  days,  $p = 0.184$ ), duration of hospitalisation ( $5.0 \pm 3.9$  days vs  $5.2 \pm 2.9$  days,  $p = 0.628$ ) or postoperative complications (5.9% vs 8.5%,  $p = 0.068$ ). There was no significant difference between these two groups in terms of the OS ( $p = 0.271$ ) and RFS ( $p = 0.288$ ).

Tumour size is not a prognostic factor for thymoma and does not influence stage<sup>1</sup>, but the appropriate tumour size for VATT still remains debatable. In the present study, there was no significant difference found between smaller and larger thymomas in any perioperative outcome. In addition, tumour size was not a predictive factor for OS and RFS. Thus, from our perspective, large thymomas should not be contraindicated for VATT. During actual clinical practice, we prefer VATT for almost every thymoma condition (including vascular involvement), except for invasion of the SVC, aorta and pulmonary artery trunk.

Furthermore, the reality of an operation may sometimes not be in accordance with the imaging which is evaluated preoperatively. Therefore, we wanted to attempt VATT for almost every patient with thymomas, converting to open thymectomy (OT) if complete resection could not be achieved by VATT during the operation. We suggest that the decision between VATT and OT be



Wenhan Weng

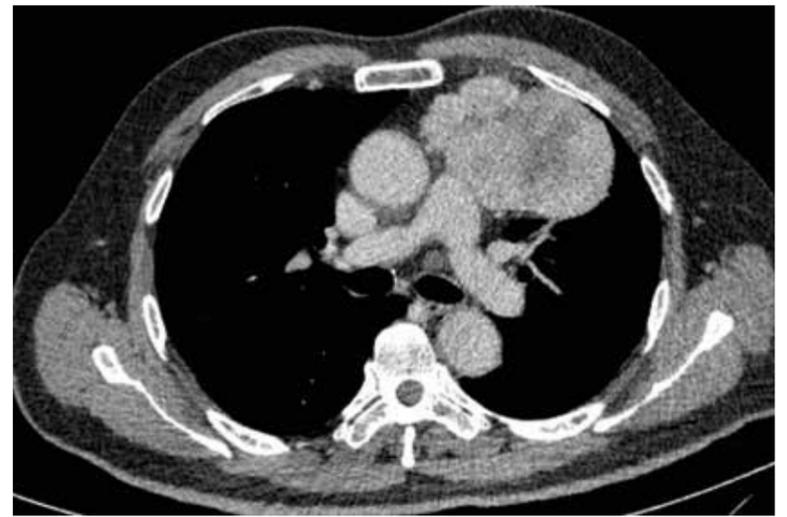


Figure 1. A large thymoma successfully and completely resected by video-assisted thoracoscopic thymectomy.

made during surgery rather than before surgery as it is beneficial for patients. Generally, conversion to OT seems mainly dependent on tumour invasion into the great vessels, regardless of the tumour size<sup>2</sup>. Of course, VATT should never compromise oncological principles at any time<sup>3</sup>.

Since thymectomy may be efficient for early-stage thymoma<sup>4</sup>, we still recommend total thymectomy for thymomas without MG. According to our experience, total resection of the thymus gland did not increase any postoperative or long-term complications, nor did it increase difficulty during the operation. In addition, a thorough removal of the

thymus gland may reduce relapse of thymomas. However, part of the normal thymus gland is reserved in younger patients, especially in teenagers due to its potential immune function. For patients with MG, we suggest VATS-extended thymectomy to remove residual thymic cells that are invisibly distributed in the anterior mediastinal fat tissue to improve the remission rates of MG.

In conclusion, VATT is a safe and effective approach for large thymomas (≥ 5 cm) with comparable surgical and oncological outcomes. The size of the thymoma should not be a contraindication for VATT.

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## Rapid Response | Congenital | Congenital Rapid Response 1

## Critical tetralogy of Fallot: right ventricle to pulmonary connection vs systemic to pulmonary artery shunt for first-stage palliation

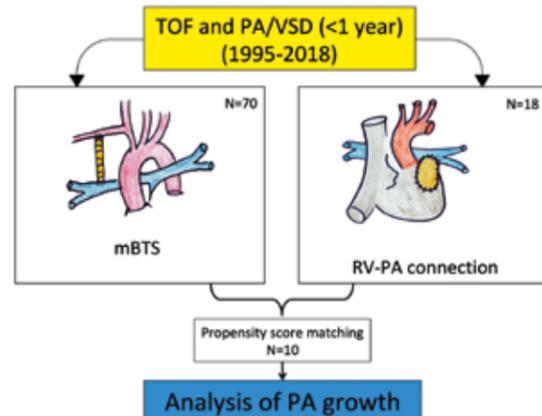


Figure 1. Flowchart of 88 patients (PA/VSD and TOF) with first palliation.

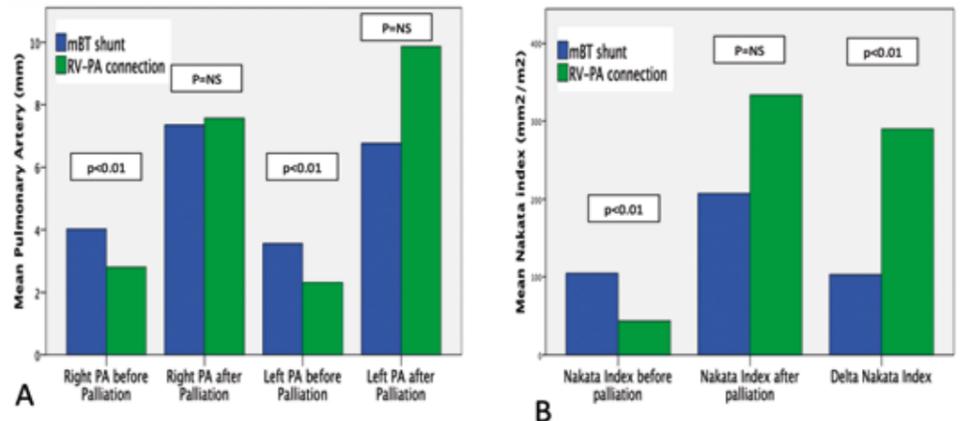


Figure 2. A) Mean pulmonary artery diameter before and after palliation for 2 groups. B) Mean Nakata index before and after palliation and Delta Nakata index for 2 groups. (mBTS, blue bar ; RVPA connection, green bar).

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## Introduction

The management of newborns with extreme tetralogy of Fallot (TOF) or pulmonary atresia with ventricular septal defect (PA/VSD) is multifaceted. Use of a Blalock-Taussig shunt has two main complications, namely acute thrombosis and significant mortality. Thus, Delaval et al.<sup>1</sup> modified the Blalock-Taussig shunt (mBTS) by interposing a PTFE tube, while other options have been proposed as alternatives to mBTS: RVPA connection<sup>2</sup>, central systemic-pulmonary shunts<sup>3</sup> and more recently stenting of the right ventricular outflow

tract (RVOT)<sup>4</sup> and stents in the arterial canal<sup>5</sup>. Various studies show that the RVPA connection allows a growth of the arterial tree with a decrease in the risk of thrombosis and a good ratio of biventricular repair. The ideal palliation is still debated, especially for newborns. Choi et al.<sup>6</sup> reported their initial experience of the RVPA connection, warning of complications, especially RVOT pseudoaneurysm.

Numerous studies have suggested improved pulmonary arterial growth after the Norwood procedure in hypoplastic left heart syndrome using Sano (ventricle to PA connection).

The purpose of this report is to outline the short- and mid-term outcomes of RVPA connection compared to mBTS in infants with TOF or PA/VSD.

## Methods

From 1995 to 2018, 88 patients needed palliation (PA/VSD n = 47; TOF n = 41).

Among these patients, 70 mBTS and 18 RVPA connections were performed before six months of age. Using a 1:1 propensity-score matched analysis, 20 patients were included in the study (n = 10 in each group). The primary outcome was in-hospital mortality and PA growth (Figure 1).

## Results

After matching, the preoperative Nakata index was smaller in the RVPA group ( $54 \pm 24 \text{ mm}^2/\text{m}^2$ ) than the mBTS group ( $109 \pm 31 \text{ mm}^2/\text{m}^2$ ;  $p < 0.001$ ). The age and weight were similar (RVPA,  $63 \pm 40$  days,  $3.5 \pm 1$  kg; mBTS,  $43 \pm 51$  days,  $3.5 \pm 1$  kg;  $p = 0.31$  and  $p = 0.9$ , respectively). There was no difference in in-hospital mortality (RVPA, n = 1 (10%); mBTS, n = 0;  $p = 0.3$ ). Duration of mechanical ventilation was similar in both groups ( $p = 0.21$ ). The left and right PA diameter at time of biventricular repair were similar (RVPA,  $9.9 \pm 5.7/7.4 \pm 0.9$  mm; mBTS,

$6.8 \pm 2.2/7.3 \pm 2.6$  mm in mBTS;  $p = 0.48$  and  $p = 0.8$ , respectively; Figure 2). On the contrary, the Nakata index and delta Nakata were smaller in the mBTS group ( $206 \pm 80 \text{ mm}^2/\text{m}^2$ ,  $75 \pm 103 \text{ mm}^2/\text{m}^2$ ) than the RVPA group ( $365 \pm 170 \text{ mm}^2/\text{m}^2$ ,  $214 \pm 165 \text{ mm}^2/\text{m}^2$ ;  $p = 0.03$ ;  $p < 0.001$ ). Median time to biventricular repair was similar in the RVPA (11.4 [7.8–39] months) and mBTS (8.9 [5.7–89] months) groups ( $p = 0.46$ ). The rate of interstage reintervention was similar (40% in RVPA, 30% in mBTS;  $p = 0.63$ ).

## Conclusions

Despite a smaller pulmonary artery, RVPA connection is equivalent to mBTS shunt in terms of the rate of biventricular repair, time to biventricular repair, and morbidity (re-intervention for restrictive pulmonary blood flow). The RVPA connection is better for the rehabilitation of the native pulmonary artery.

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## Abstract | Congenital | Management of ACHD 2

## More than 40 years' experience of tetralogy of Fallot repair: Impact of preserving pulmonary valve annulus and minimizing right ventriculotomy

**Yoshikazu Ono<sup>1</sup>, Takaya Hoashi<sup>1</sup>, Masatoshi Shimada<sup>1</sup>, Kenta Imai<sup>1</sup>, Motoki Komori<sup>1</sup>, Kenichi Kurosaki<sup>2</sup>, Hajime Ichikawa<sup>1</sup>** 1. Department Pediatric Cardiovascular Surgery; 2. Department of Pediatric Cardiology, National Cerebral and Cardiovascular Center, Suita, Osaka, Japan

Right ventricular outflow tract reconstruction (RVOTR) is problematic during the repair of tetralogy of Fallot (TOF) compared with the closure of a large and malaligned ventricular septal defect (VSD) through the tricuspid valve via the right atriotomy. While RVOT obstruction must be relieved without right ventriculotomy (RVtomy) if possible<sup>1,2,3</sup>, there is no choice except the transannular patch (TAP) augmentation in RVOT in patients whose pulmonary valve annulus is too small, whose right ventricular infundibulum has long segmental stenosis, or when VSD is of the total conus defect type.

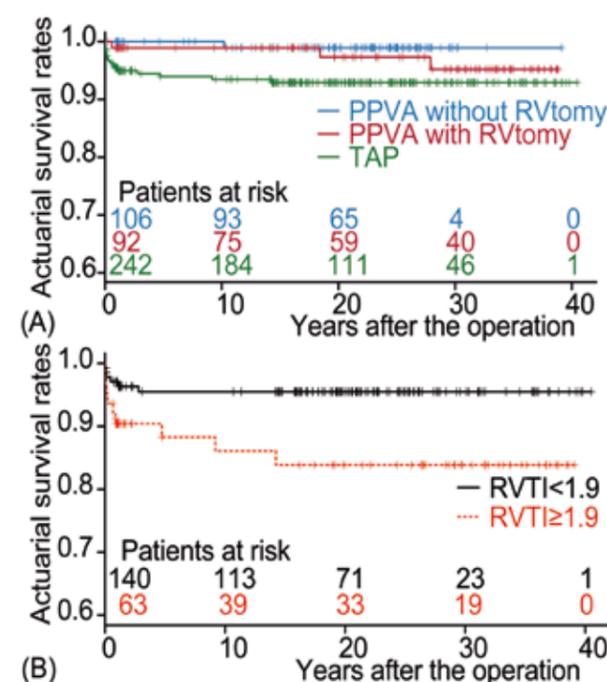
Starting from the idea that right ventriculotomy adversely affects long-term outcomes after TOF repair, we compared the clinical courses of TOF repair of three different surgical procedures: preserving pulmonary valve annulus (PPVA) without right ventriculotomy (RVtomy), PPVA



Yoshikazu Ono

with RVtomy, and transannular patch (TAP). Additionally, the effect of the length of RVtomy at TAP was analysed.

Four-hundred and forty consecutive patients were enrolled, aged less than 10 years, who underwent TOF repair from



1978 to 2003; 242 patients (55.0%) underwent TAP, 92 patients (20.9%) underwent PPVA with RVtomy, and 106 patients (24.1%) underwent PPVA without RVtomy. The "right ventriculotomy index (RVTI)" was defined as the length of RVtomy (mm) divided

by body weight (kg). PPVA with RVtomy was no longer performed after 1991, and it was replaced by PPVA without RVtomy. Patients who underwent PPVA with RVtomy were the oldest patients. Shunt palliation was most frequently performed in TAP.

The median follow-up period was 20.3 (inter-quartile range: 10.7–27.6) years. Actuarial survival rate at 20 years was 95.3% in all patients. In patients who underwent TAP, actuarial survival rate tended to be worse ( $p = 0.05$ , Figure A), atrial arrhythmia-free survival rate was worse ( $p = 0.02$ ), and ventricular arrhythmia-free survival rate tended to be worse ( $p = 0.08$ ) compared to patients who underwent PPVA without RVtomy. For TAP, the actuarial survival rate ( $p < 0.01$ , Figure B), atrial arrhythmia-free survival rate ( $p = 0.017$ ), and ventricular arrhythmia-free survival rate ( $p = 0.046$ ) were worse in patients whose RVTI was 1.9 or greater. Cox proportional hazard analysis showed that RVTI was the independent risk factor for mortality, adjusted for any considerable preoperative variables.

Although patients who underwent TAP tended to show worse long-term life prognosis and freedom from both atrial and ventricular arrhythmia compared with patients who underwent PPVA without RVtomy, no significant differences were identified between the outcomes in patients who underwent TAP

and PPVA with RVtomy. This finding suggests that avoiding RVtomy was more advantageous than preserving the native pulmonary valve leaflets and annulus in providing long-term arrhythmia-free survival. For TAP, avoiding too much RVtomy must be beneficial for better long-term arrhythmia-free survival. However, this study demonstrated that excessive minimisation of the RVtomy was not required. Appropriately sized RVtomy during TAP is, therefore, thought to provide necessary and sufficient relief of the RV outflow tract obstruction.

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## Rapid Response | Congenital | Congenital Rapid Response 2

## Is long duration of cardiopulmonary bypass a contraindication for on-table extubation after paediatric cardiac surgery?

**Rajnish Garg** Al Jalila Children's Hospital, Dubai

In the last few years, there has been an increasing trend towards the practice of on-table extubation after corrective or palliative paediatric cardiac surgery. A number of authors have reported successful on-table extubation in children undergoing complex congenital repairs – even in the neonatal age group. Long duration of cardiopulmonary bypass (CPB) time is often cited as one of the main reasons for failing to practice on-table extubation in paediatric patients. Since we have practiced on-table extubation for the last six years without considering CPB duration, per se, as a contraindication, the aim of the study was to retrospectively analyse data of all the patients who had long CPB (> 180 minutes) and to find out how many of them were extubated on-table.



Rajnish Garg

The data were reviewed for age, complexity of the procedure, duration of CPB, haematocrit, use of conventional and modified ultrafiltration and requirement of additional fluid in the reservoir. Patients were categorised with respect to age and duration of CPB. The total number of patients extubated on-table in each category was recorded. Reason for failure to extubate was noted. Data was also analysed for reintubation, morbidity and mortality in extubated patients.

A total of 63 patients had CPB duration > 180 minutes, anaesthetised with standardised protocols. The number of patients who had CPB duration of 180–300/300–400/> 400 minutes were 48/7/8, respectively. Age-wise there were 15/32/16 neonates/infants/children, respectively. All patients underwent pre-bypass, conventional and modified ultrafiltration. Haematocrit was always kept above

27% in infants/children and above 30% in neonates during CPB, and above 35% and 45%, respectively, after weaning from CPB, with the help of conventional and modified ultrafiltration. Fifty-six patients (88%) were extubated on-table. None of these patients had mortality or required re-intubation in the intensive care unit.

CPB is associated with several cascade activations with consequent pro-inflammatory mediators released into the circulation, leading to systemic inflammation response syndrome (SIRS) which is exaggerated in prolonged CPB. A number of pharmacological and non-pharmacological interventions are postulated to minimise CPB-triggered SIRS, such as corticosteroids, ultrafiltration, heparin coated circuits, aprotinin, leukofiltration, optimal haematocrit and miniaturisation of circuits. However, there is not enough evidence for most of these strategies as

the choice of treatment.

We used corticosteroids, ultrafiltration, optimal haematocrit and miniaturisation of circuits as our strategies to minimise CPB-triggered SIRS. One of our criteria for on-table extubation is not to have any surgical concerns which can lead to surgical reintervention. So, complete structural repair, without correctable residual defects, was our goal as it is more important than CPB time or worrying about a second-run CPB.

We conclude that long duration of CPB is not a contraindication for on-table extubation. Complete structural repair, strategies to minimise SIRS, avoidance of haemodilution, ensuring adequate venous drainage to prevent addition of extra volume and consequent interstitial oedema along with proper anaesthetic management potentially help in achieving on-table extubation.

## Rapid Response | Cardiac | SAVR-new concepts and ideas you have not heard about before ...

## Prevalence of permanent pacemaker implantation after conventional aortic valve replacement – a propensity-matched analysis in patients with a bicuspid or tricuspid aortic valve: A benchmark for TAVR

**Josephina Haunschild<sup>1</sup>, Martin Misfeld<sup>1</sup>, Thomas Schroeter<sup>1</sup>, Frank Lindemann<sup>2</sup>, Piroze Davierwala<sup>1</sup>, Ricardo A. Spampinato<sup>1</sup>, Stefan Weiss<sup>1</sup>, Michael A. Borger<sup>1</sup>, Christian D. Etz<sup>1</sup>** 1. University Department for Cardiac Surgery; 2. Department of Electrophysiology, Leipzig Heart Center, Germany

Over the past years the indication for transcatheter aortic valve replacement (TAVR) has expanded from predominately elderly, multimorbid, high-risk patients to young, low- and intermediate-risk patients<sup>1</sup> who are equally eligible for conventional or possibly minimally invasive surgical aortic valve replacement (SAVR). These younger patients with early aortic valve dysfunction frequently carry a bicuspid aortic valve (BAV; up to 30% in contemporary series), even though this abnormality typically affects between 0.5–2% of the general population<sup>2</sup>. Despite improvements in valve prostheses and deployment systems, conduction disturbances remain the most common – and frequently understated – complication after TAVR, especially high-degree atrioventricular block or complete heart block<sup>3</sup>, with a potentially significant impact on longevity and quality of life. In contemporary clinical studies, BAV patients – although frequently younger – are affected by the highest pacemaker implantation (PMI) rates (up to 14%) when compared to their tricuspid peers<sup>4,5</sup>.

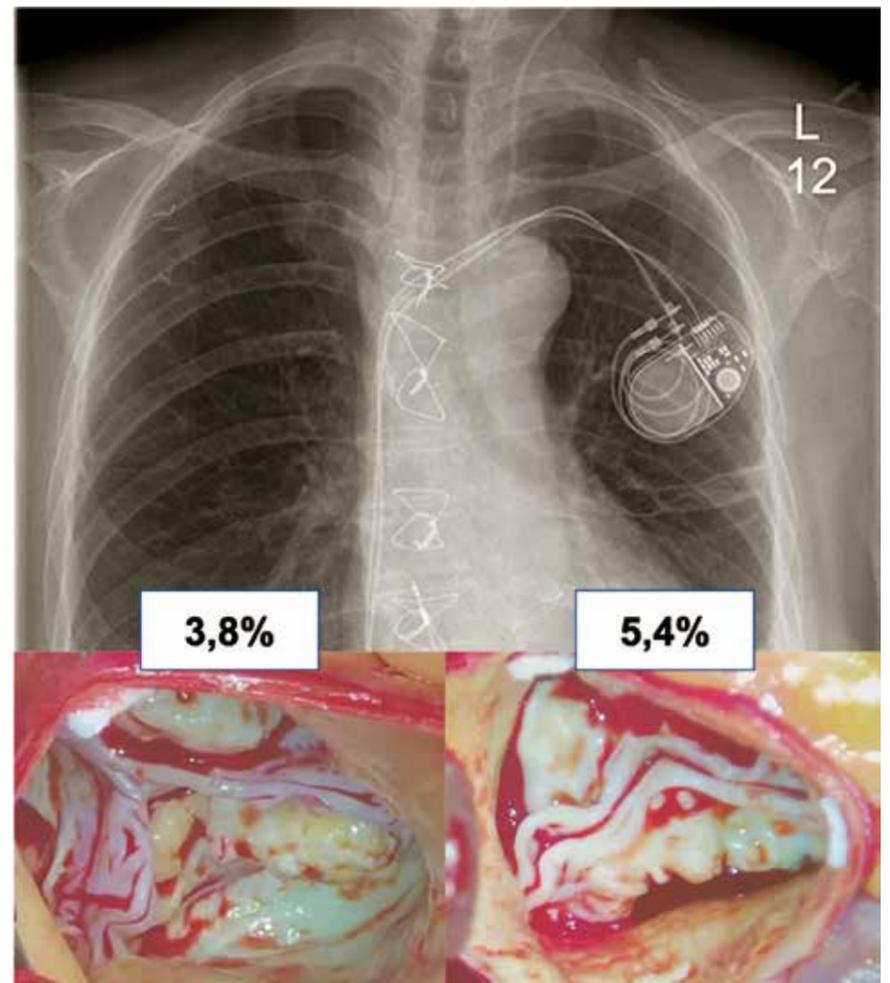
We performed a retrospective single-centre analysis of 4,154 patients receiving isolated SAVRs (w/o concomitant procedures), between 2000 and 2019, of whom 1,108 had a BAV (27%). PMI rate, early- and long-term outcomes were analysed. For better comparability of these demographically unequal cohorts, 1:1 nearest neighbour matching was performed. At time of SAVR, BAV patients were on average 10 years younger than their TAV peers (59.7 ± 12 vs 69.3 ± 9 years; p < 0.001) and had less comorbidities; all relevant characteristics were equally balanced after statistical matching. Overall PMI rate was significantly higher in BAV patients (5.4 vs 3.8%; p = 0.03). BAV required PMI exclusively (100%) and TAV predominately (96%) for persistent postoperative high-degree atrioventricular block



Josephina Haunschild

(AV<sup>0</sup>/III). After matching, PMI rate was similar (5.1 vs 4.4%, p = 0.5). In-hospital mortality in the matched cohort was 1% in both groups. Long-term survival was more favourable in BAV patients (94 vs 90% in TAV at 5 years; 89 vs 82% in TAV at 9 years; p = 0.013).

With SAVR, the overall incidence of PMI among BAV-patients seems significantly higher, however after propensity matching no difference in PMI rates between BAV and TAV is evident. The PMI rate was remarkably lower among BAV patients after SAVR compared to reported incidence after TAVR. This large retrospective single-centre analysis suggests contemporarily reported PMI rates to be two-fold higher in TAV and three-fold higher in BAV patients undergoing TAVR, as compared to conventional SAVR.



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## Annuloplasty for aortic valve repair: A practical approach

Indications for surgery in (A) severe aortic regurgitation and (B) aortic root disease (irrespective of the severity of aortic regurgitation)

Indications for surgery	Class <sup>a</sup>	Level <sup>b</sup>
<b>A. Severe aortic regurgitation</b>		
Surgery is indicated in symptomatic patients [57, 58, 66, 67]	I	B
Surgery is indicated in asymptomatic patients with resting LVEF <50% [57, 58]	I	B
Surgery is indicated in patients undergoing CABG or surgery of the ascending aorta or of another valve.	I	C
Heart Team discussion is recommended in selected patients <sup>c</sup> in whom aortic valve repair may be a feasible alternative to valve replacement.	I	C
Surgery should be considered in asymptomatic patients with resting ejection fraction >50% with severe LV dilatation: LVEDD >70 mm or LVESD >50 mm (or LVESD >25 mm/m <sup>2</sup> BSA in patients with small body size) [58, 66]	IIa	B
<b>B. Aortic root or tubular ascending aortic aneurysm<sup>d</sup> (irrespective of the severity of aortic regurgitation)</b>		
Aortic valve repair, using the reimplantation or remodeling with aortic annuloplasty technique, is recommended in young patients with aortic root dilation and tricuspid aortic valves, when performed by experienced surgeons.	I	C
Surgery is indicated in patients with Marfan syndrome who have aortic root disease with a maximal ascending aortic diameter ≥50 mm.	I	C
Surgery should be considered in patients who have aortic root disease with maximal ascending aortic diameter: <ul style="list-style-type: none"> <li>• ≥45 mm in the presence of Marfan syndrome and additional risk factors<sup>e</sup> or patients with a TGFBR1 or TGFBR2 mutation (including Loeys-Dietz syndrome).<sup>f</sup></li> <li>• ≥50 mm in the presence of a bicuspid valve with additional risk factors<sup>e</sup> or coarctation.</li> <li>• ≥55 mm for all other patients.</li> </ul>	IIa	C
When surgery is primarily indicated for the aortic valve, replacement of the aortic root or tubular ascending aorta should be considered when ≥45 mm, particularly in the presence of a bicuspid valve. <sup>g</sup>	IIa	C

BSA: body surface area; CABG: coronary artery bypass grafting; CT: computed tomography; ECG: electrocardiogram; LV: left ventricular; LVEDD: left ventricular end-diastolic diameter; LVEF: left ventricular ejection fraction; LVESD: left ventricular end-systolic diameter.

<sup>a</sup>Class of recommendation.

<sup>b</sup>Level of evidence.

<sup>c</sup>Patients with pliable non-calcified tricuspid or bicuspid valves who have a type I (enlargement of the aortic root with normal cusp motion) or type II (cusp prolapse) mechanism of aortic regurgitation [6, 48, 49].

<sup>d</sup>For clinical decision making, dimensions of the aorta should be confirmed by ECG-gated CT measurement.

<sup>e</sup>Family history of aortic dissection (or personal history of spontaneous vascular dissection), severe aortic regurgitation or mitral regurgitation, desire for pregnancy, systemic hypertension and/or aortic size increase >3 mm/year (on repeated measurements using the same ECG-gated imaging technique measured at the same level of the aorta with side-by-side comparison and confirmed by another technique).

<sup>f</sup>A lower threshold of 40 mm may be considered in women with low BSA, in patients with a TGFBR2 mutation or in patients with severe extra-aortic features [60].

<sup>g</sup>Considering age, BSA, aetiology of the valvular disease, presence of a bicuspid aortic valve and intraoperative shape and thickness of the ascending aorta.

Figure 1. From the 2017 ESC/EACTS Guidelines for the management of valvular heart disease.<sup>1</sup>

## Annuloplasty for aortic valve repair: A practical approach

### An EACTS technical course on aortic valve repair; March 9-11, 2020: Paris, France

**Emmanuel Lansac** Course Director; Institut Mutualiste Montsouris, Paris, France

Recent ESC/EACTS guidelines for heart valve diseases recommend a heart-team discussion to evaluate aortic valve reparability and “aortic valve repair using the re-implantation or remodelling with aortic annuloplasty technique, in young patients with aortic root dilation and tricuspid aortic valves,” (Figure 1).<sup>1</sup> However, despite an increased level of evidence that aortic valve repair – when compared to the use of a prosthesis – leads to fewer valve-related complications, as well as a better quality of life, it is still rarely performed. This fact brings into question the lack of technical standardisation of valve-sparing / repair procedures aimed at improving reproducibility and reducing the risk of reoperation. The Level 3 EACTS technical course on aortic valve repair offers, for a limited number of attendees, an in-depth 2.5-day training course on standardised approaches to aortic valve repair with external aortic ring annuloplasty.

Good candidates for aortic valve repair are patients with pliable, non-calcified tricuspid or bicuspid valves who have type I (enlargement of the aortic root with normal cusp motion) or type II (cusp prolapse) mechanisms of aortic insufficiency. Depending on whether the sinuses of Valsalva and/or the tubular ascending aorta are dilated, three phenotypes can be individualised: 1) Dilated root aneurysms (sinuses of Valsalva 45 mm); 2) dilated tubular ascending aortic aneurysms (sinuses of Valsalva 40–45 mm); 3) isolated aortic insufficiency (all diameters < 40–45 mm).

According to each phenotype, a



standardised approach to valve repair was developed, based on: 1) dynamic preservation or reconstruction of the aortic root; 2) cusp geometry and effective height assessment of the valve; and 3) an external aortic ring annuloplasty to increase the surface of coaptation and protect the repair (Figure 2).<sup>2</sup>

The objective of this Level 3 EACTS technical course is to offer a standardised approach for aortic valve repair with external aortic ring annuloplasty, providing a step-by-step process including patient selection, echo valve analysis and technical standardisation for a reproducible repair, according to each phenotype of the aorta. As this course reflects the multi-disciplinary aspect of aortic valve repair, course delegates could include cardiac surgeons and echocardiographers (cardiologists and anaesthetists) who are willing to start, or are already part of, a valve-sparing aortic root replacement and aortic valve repair programme. Advanced residents

interested in the field of valve repair are also welcomed.

The course will provide in-depth training of aortic valve repair from valve-sparing root replacement to isolated aortic valve repair for tricuspid, bicuspid and unicuspid valves. The aim is to integrate state-of-the-art into daily practice, as well as to challenge current knowledge via lectures from international faculty. Presentations will address anatomical issues, the indications and limitations of guidelines, the selection of patients as well as detailed surgical techniques in aortic valve repair and their current outcomes.

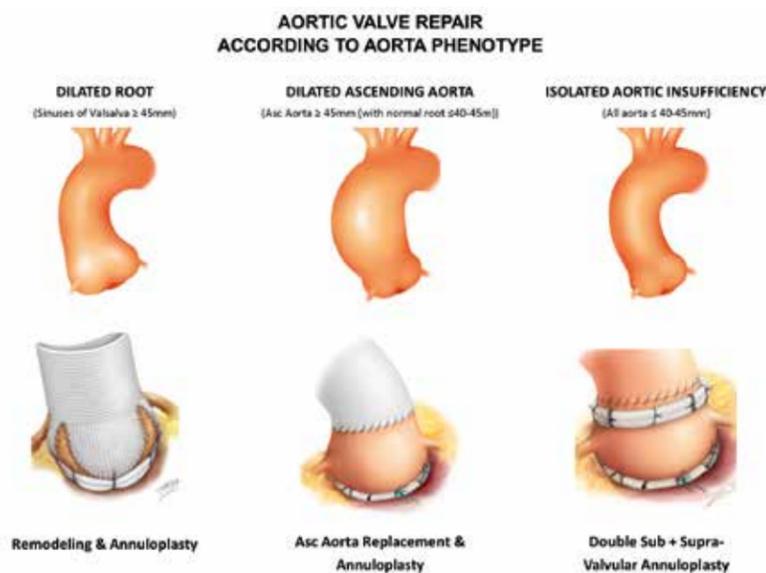
The course will also feature live surgeries, offering a fascinating overview of the whole procedure which will be combined with a short video session illustrating specific lesions related to the type of case. Technical issues will be addressed in detailed step-by-step fashion, including standardised management of the valve with assessment of cusp geometry and effective height, as well as aortic annuloplasty techniques to protect the repair. Specific facets of aortic dissections as well as the paediatric population will be addressed. In addition, the surgical strategy of valve replacement for non-elderly patients will be addressed including the Ross procedure and Ozaki type procedure with decellularised patches.

The programme will also include a ‘failure session’, in which attendees will discuss cases all the way from echo analysis to surgical repair, learning how to identify predictors of repair failure as well as the bailout techniques available to them when such situations arise. The course will end with a wet lab which will bring together the theoretical knowledge with a practical application on anatomical heart in the historical laboratory of anatomy, du Fer à Moulin in Paris.

This Level 3 EACTS Aortic valve repair technical course, ‘Annuloplasty for aortic valve repair: A practical approach’ will take place 9–11 March, 2020 in Paris, France. For registration (of a limited number of attendees), the programme and other details, head to the course website at: <http://www.eacts.org/academy/courses/master-class-on-aortic-valve-repair/>.

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## Abstract | Cardiac | Minimally invasive and transcatheter approaches to the mitral valve

# European multicentre assessment of mitral repair strategies using patient-specific valve replicas

**Gabriele Romano<sup>1</sup>, Raffaele De Simone<sup>1</sup>, Lalith Sharan<sup>2</sup>, Sven Koehler<sup>2</sup>, Ivo Wolf<sup>2</sup>, Matthias Karck<sup>1</sup>, Sandy Engelhardt<sup>2</sup>**

1. Department of Cardiac Surgery, University of Heidelberg, Heidelberg, Germany; 2. Department of Computer Sciences, Mannheim University of Applied Sciences, Mannheim, Germany

**S**urgical repair of the mitral valve (MVR) remains the preferred approach for mitral pathology<sup>1</sup>. However, the empiricism of MVR influences the outcome of the surgical procedure and is a roadblock to achieving a standardised approach. Even annuloplasty ring sizing is considered non-reproducible among different surgeons<sup>2</sup>. The aim of this study was to investigate different surgical approaches to MVR on the same valve pathology.

For this purpose, our research group created silicone replicas of patient-specific mitral valves (Figure 1)<sup>3,4</sup>. Using one of our models, we questioned surgeons from different cardiac surgery centres in Europe about repair strategies, reproducing the paradigm of degenerative pathology of the posterior leaflet due to a scallop in the P2 segment.

We recruited 22 surgeons, among them nine experts and 11 non-experts in MVR. They were asked to comply to the following tasks: identify the pathology of the valve replica; suggest which repair strategies they would approach to repair it; and indicate which



Gabriele Romano



Figure 1. Patient-specific mitral valve replica.

of the nine ring sizes they would choose from the Carpentier-Edwards Physio II Annuloplasty mitral ring catalogue.

The valve pathology was accurately identified by 20 out of 22 surgeons. Surgeons tend either to resect the prolapsed segment (10 of 22) or prefer the implantation of neochordae (9 of 22). Three of 22 would perform both. The ring sizing results show that this task is highly disparate among different experts on the same pathological valve model. All ring sizes between 24- and 40 mm were proposed. The mean ring size across all suggestions was  $36.5 \pm 2.1$  mm. Correlation analysis between the suggested ring size, the diagnostic assessment, the proposed repair strategy or the expert level found no correlation between the studied variables.

Interestingly, there was a systematic and significant oversizing of the prosthesis implanted during surgery (average suggested ring size +4.5 sizes) in our model, despite the fact that intraoperatively, a triangular P2 resection and a Physio II ring of size 32 mm was implanted. It has to be noted that models are obtained using a 'snapshot' of valves in the beating heart (end-systolic phase), and are endowed with the shape and structure of such a situation, while traditional ring sizing is carried out on the flaccid cardioplegic heart. We mainly attribute the differences in functional state of the model and the intraoperative cardioplegic heart to this fact, since there are only minor manufacture errors on the models when compared to the echo image<sup>5</sup>.

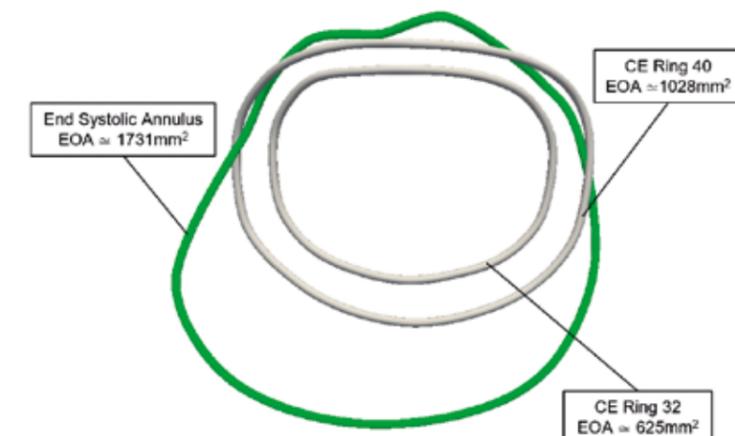


Figure 2. Illustration of the the valve model together with the intraoperatively chosen ring size and the maximally commercially available ring size (40 mm).

Furthermore, we calculated the effective orifice area (EOA) of the end-systolic valve and Physio II ring models. The difference between end-systolic EOA ( $1731.44 \text{ mm}^2$ ) and the EOA of the 32-mm ring size (implanted during surgery,  $\sim 625.45 \text{ mm}^2$ ) was 64%. The difference with the 36-mm ring size (EOA  $\sim 796.55 \text{ mm}^2$ ; the mean size implanted by surgeons in our study) is 54% (Figure 2). We believe that this difference of EOA could lead to a functional increase in transvalvular diastolic gradients with possible clinical consequences, above all, during exercise.

Our study confirms that sizing technique is strictly dependent on the surgeon and should be considered with care to avoid underestimation of the annulus size. We believe that a broader

reflection regarding the subjectivity of mitral repair strategies is needed in order to move this technique towards greater standardisation.

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## STS/EACTS Latin America Cardiovascular Surgery Conference

November 22 - 24, 2019 | ICC | Cancun, Mexico



### Programme Information

The programme will concentrate on the multidisciplinary approach to coronary artery disease, valvular heart disease, thoracic aortic disease, atrial fibrillation, and the surgical management of heart failure as well as a additional tracks covering congenital heart disease, research, database, leadership and fellowships.

Sessions will incorporate invited lectures from a world-class international faculty, including experts from Europe, Latin America, and North America, on traditional and new technology procedures, plus technical videos and original scientific abstracts. New this year, we have introduced a number of wetlab and simulator sessions on Sunday 24 November, providing participants with an opportunity to hone their skills in small supervised training groups.

### Programme Directors

José Luis Pomar, (Barcelona, Spain)  
Joseph E Bavaria (Philadelphia, USA)  
Lorenzo Galletti (Rome, Italy)  
Patrick Perier (Bad Neustadt, Germany)  
Nestor Sandoval (Bogotá, Columbia)  
Vinod H Thourani (Washington DC, USA)  
Juan P Umaña (Bogotá, Columbia)

### National Co-ordinators

Alejandro Rey (Mexico City, Mexico)  
José Antonio Heredia (Monterrey, Mexico)  
Edgar Samuel Ramirez-Marroquin (Tlalpan, Mexico)

### Learning Objectives

Upon completion, participants should be able to:

- Evaluate the impact and the application of new knowledge and technology on the treatment of cardiovascular diseases
- Discuss surgical techniques in order to improve the standard of care for cardiovascular patients
- Review the results of clinical and laboratory investigations designed to reveal new knowledge of cardiovascular disease
- Describe the multidisciplinary approach to coronary artery disease, valvular heart disease, thoracic aorta disease, atrial fibrillation, and the surgical management of heart failure
- Discuss quality improvement as it pertains to pediatric cardiac surgery
- Describe new surgical strategies in neonates and children with congenital heart disease.

### Target Audience

This conference is intended for:

- Cardiothoracic surgeons
- Cardiovascular surgeons
- Cardiologists
- Anesthesiologists
- Perfusionists
- Physician assistants
- Nurses
- Other health care professionals interested in the topic

## Abstract | Cardiac | Current challenges in heart transplantation

# The association between psychiatric problems and parental coping strategies in adolescents with left ventricular assist devices and heart transplantations

Helin Yilmaz Kafali<sup>1</sup>, Tugba Kalyoncu<sup>2</sup>, Burcu Ozbaran<sup>3</sup>, Emir Kalyoncu<sup>4</sup>, Pelin Ozturk<sup>4</sup>, Cagatay Engin<sup>4</sup>, Tahir Yagdi<sup>4</sup>, Zual Ulger<sup>5</sup>, Mustafa Ozbaran<sup>4</sup>

1. Ankara Children's Hematology and Oncology Training and Research Hospital, Department of Child and Adolescent Psychiatry, Ankara, Turkey; 2. Tepecik Training and Research Hospital, Department of Child and Adolescent Psychiatry, Izmir, Turkey; 3. Ege University School of Medicine, Department of Child and Adolescent Psychiatry, Izmir, Turkey; 4. Ege University School of Medicine, Department of Cardiovascular Surgery, Izmir, Turkey; 5. Ege University School of Medicine, Department of Pediatric Cardiology, Izmir Turkey

Psychological impairment and problems in social support influence treatment adherence, morbidity, and mortality in both heart transplant recipients and heart transplant candidates<sup>1</sup>. However, to the best of our knowledge, there is no study evaluating the association between parental coping strategies and the psychological impairment in adolescents with left ventricular assist devices (LVAD) and adolescents who underwent heart transplantation (HTx). The current study aimed to investigate this association.

A total of 25 patients with end-stage cardiac failure were reviewed for this study. Twelve of them were recruited (HTx [n = 8], LVAD [n = 4]). K-SADS (Schedule for Affective Disorders and Schizophrenia for School-Aged Children) was administered to detect the psychiatric diagnosis of the patients. The Children's Depression Inventory (CDI), State-Trait Anxiety Inventory (STAI), Childhood Sleep Habits Questionnaire (CSHQ), and Pediatric Quality of Life Inventory were filled by the participants. To evaluate the coping styles of the parents, participants' mothers completed the Brief Coping

Styles Inventory.

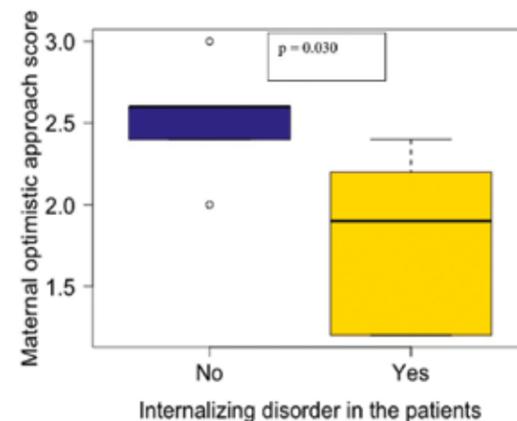
All of the LVAD cases and 25% of the HTx cases had an internalising disorder (depressive and anxiety disorders). Compared to the HTx group, the LVAD group had significantly higher depressive symptom scores ( $p = 0.048$ ). When we allocate the groups according to the presence of an internalising disorder, as a way of coping strategy the 'optimistic approach' scores were significantly higher in the mothers of the cases without an internalising disorder ( $p = 0.030$ ).

Although both the LVAD and the HTx cases were at risk for internalising disorders, the LVAD cases were more inclined to have psychiatric symptoms. This result may be explained by the fact that the LVAD cases have to admit a life that is far from normal and their caregivers and themselves have to adapt their lifestyles to these changes<sup>2</sup>. Besides, the long waiting period for HTx and low possibility of HTx are other factors that increase the psychological stress of patients with LVAD.

However, the caregivers' optimistic coping strategy may be a protective factor against



Helin Yilmaz Kafali



internalising disorders for these patient groups. Optimism is described as an individual's tendency to expect positive results in potentially negative situations<sup>3</sup>. Optimistic individuals mentalise problems as external and temporary, and they can more easily cope with serious health threats, admit reality, and take actions to reduce health risks<sup>3</sup>. Thus, it seems that the caregiver's coping strategies may be better examined in each case, and families supported by psychiatrists, cardiologists, and coordinators.

Furthermore, cognitive restructuring and problem-solving training techniques can be used by psychiatrists to enhance the active-monitoring-

optimistic approach in the caregivers. A future multi-centred, prospective, large-scale longitudinal study should be planned to assess the effect of parents' coping strategies on the psychopathology of the cases.

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## Focus Session | Congenital | Knowledge Generation in Congenital Heart Surgery

# Late arterial switch and the pursuit of left ventricular fitness: limits and "hopes"

Roberto M Di Donato Al Jalila Children's Hospital, Dubai, UAE

In transposition of the great arteries with intact ventricular septum (TGA/IVS), the left ventricle (LV) – with a mass at birth equivalent to that of the right ventricle – undergoes a process of early "deconditioning", eventually losing the ability to function against a systemic afterload. At a cellular level, this involution corresponds to the transition from an early hyperplastic phase of both myocytes and capillaries to a myocyte hypertrophic phase within few post-natal weeks.

Therefore, an arterial switch operation (ASO) for TGA/IVS is advisable within the first month of life, ideally at one week. Nevertheless, a primary ASO has been safely accomplished up to 6–8 weeks



after birth with occasional requirement for temporary mechanical circulatory support to manage postoperative LV failure. Beyond the neonatal period, a patient

with TGA/IVS becomes a "late presenter" with an increasingly age-dependent unsuitability of the LV for systemic work, though it differs from patient to patient.

Hence, there is a need for a period of LV "retraining" to regain adequate myocardial mass and qualify for ASO. For this purpose, two methods have been adopted: 1) Pulmonary artery banding combined with a Blalock-Taussig shunt, capable of eliciting an increase in LV myocardial mass by virtue of combined pressure/volume overload (hypoxic retraining). Here, the subsequent staged ASO becomes feasible as early as 1–2 weeks in infants (later with aging); 2) Secondary mechanical circulatory support (ECMO, VAD) in the (rare) cases of LV failure following a "late" primary ASO (normoxic retraining).

As specified in the guidelines, there are

strict criteria governing both indications and their timing. Unfortunately, in older infants and children, there is no clear-cut evidence that a normal myocardium will develop. Indeed, despite being anatomically adequate, the increase in LV mass mostly depends on myocyte hypertrophy with a pattern of concentric (± eccentric) hypertrophy. From a functional point of view, the initially compensated "physiologic hypertrophy" may evolve into "pathologic hypertrophy", commonly associated with upregulation of foetal genes, fibrosis, cardiac dysfunction and increased mortality. In fact, experience with pulmonary artery banding in late TGA/IVS presenters is disappointing overall, with slower development of adequate LV mass, less satisfactory LV function and even leads to unfeasibility for secondary ASO.

A realistic upper age limit for a successful staged ASO is unknown, but based on the scant available information, any attempt at LV retraining in TGA/IVS beyond two years of age is likely doomed to failure. Therefore, an atrial switch may still have a role in the older population, yet with many limitations.

In conclusion, the current quest for LV "fitness" in late TGA/IVS presenters relies only on physical methods, i.e. by increased afterload/preload challenges, and cannot confer adequate and durable LV endurance. Is there an alternative? Recent research advances in cell therapy, aimed at enhancing ventricular function in congenital heart anomalies (particularly single ventricle), might suggest new paths of treatment of this group of patients based on increased cellularity.

**DON'T MISS!**  
**THE JEOPARDY SEMI FINALS**  
 Today at 13:00–14:15  
 Room 5B (Pav 5)

Abstract | Thoracic | Mediastinum and oesophagus

# Real-world cost-effectiveness of thoracoscopic versus open oesophagectomy for oesophageal cancer: a nationwide population-based study



Yin-Kai Chao

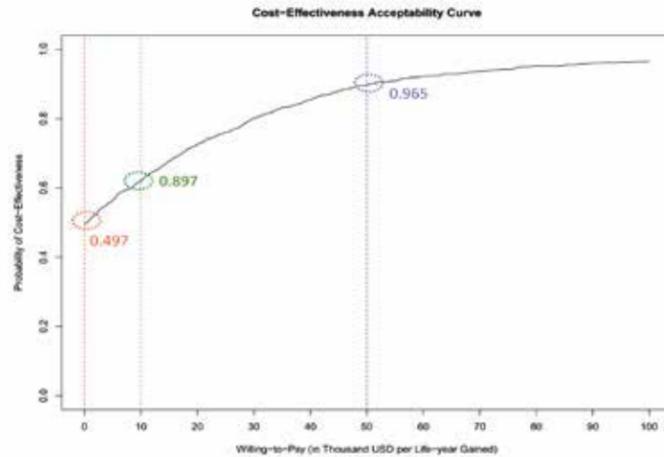


Figure 1. Cost-effectiveness plane, the numbers in the graph represent the percentage of points in each quadrant.

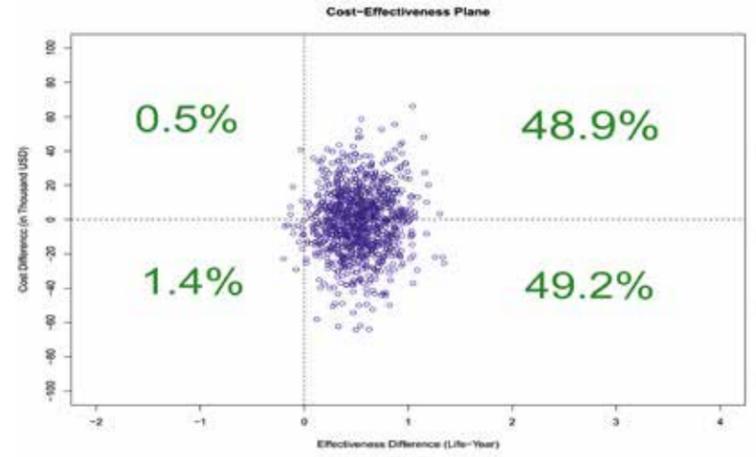


Figure 2. Cost-effectiveness acceptability curve. Vertical axis: probability of VATE to be cost-effective; Transverse axis: willingness-to-pay (unit: 1,000 US dollars/ life-year).

Yin-Kai Chao<sup>1</sup> Yu-Wen Wen<sup>2</sup>

1. Division of Thoracic Surgery, Chang Gung Memorial Hospital-Linkou, College of Medicine; 2. Clinical Informatics and Medical Statistics Research Center, Chang Gung University, Taoyuan, Taiwan

**S**urgery remains the cornerstone of curative treatment for oesophageal cancer. However, oesophagectomy is a highly complex procedure, and despite advances in perioperative management, morbidity and mortality after oesophagectomy remains high. Over the last two decades, video-assisted thoracoscopic oesophagectomy (VATE) has gained increasing popularity owing to its capacity to provide an improved magnification and precise tissue dissection. In several randomised clinical trials, VATE has been shown to result in a significant reduction of postoperative mortality and morbidity compared with open oesophagectomy (OE).

However, VATE is known to incur an increased surgical expense due to the endoscopic system, specialised instruments, and disposable surgical materials, and it is unknown whether the benefits associated with VATE outweigh the increased costs. As health care budgets are

becoming increasingly constrained, the cost-effectiveness of new medical technologies and surgical techniques should be established before widespread adoption. To our knowledge, the real-world cost-effectiveness of VATE versus OE has rarely been reported. In the current study, we aimed to estimate the cost-effectiveness of VATE versus OE for oesophageal cancer patients at a population level.

We identified 3304 oesophageal cancer patients who received transthoracic oesophagectomy and gastric tube reconstruction between 2008 and 2015 through a comprehensive population-based database containing cancer and death registries, and reimbursement data. To reduce the selection bias, we included eight potential confounding covariables (age, gender, comorbidity, histology subtype, clinical stage, tumour location, use of preoperative therapy, pathology stage) and used propensity scoring (PS) to construct a 1:1 match sample. The duration of interest was three years after surgery. Effectiveness was measured by the life expectancy after surgery and cost was measured by direct costs including medical expenditures paid by the National Health Insurance Program and co-pay of patients in Taiwan. Life expectancy

was projected by a Weibull model. We took the societal perspective and converted the cost to 2017 United States dollars (USD).

Our population consisted of 942 PS-matched subjects. VATE was associated with a significantly higher numbers of lymph-node dissections (25.79 vs 19.39,  $p < 0.001$ ) and lower 30-day mortality rate (2% vs 3.7%,  $p = 0.027$ ) compared with OE. VATE had higher index-hospitalisation cost (13,447 USD vs 11,831 USD,  $p < 0.001$ ) while the difference diminished and became insignificant for the long term. The survival was higher for VATE compared with OE (three-year overall survival: 45% vs 40%). The life expectancy was 3.78 years for VATE and 3.26 years for OE, respectively. Cost-effectiveness showed that that 49.2% of VATE was less costly but more effective, while only 0.5% of VATE was more costly and less effective than OE (Figure 1). The probability of VATE being cost-effective was 0.497, 0.897 and 0.965 at willingness-to-pay (WTP) thresholds of 0, 50,000 and 100,000 USD/ life-year, respectively (Figure 2).

In the current study, we provided empirical evidence that when compared to OE, VATE was cost-effective within common WTP levels.

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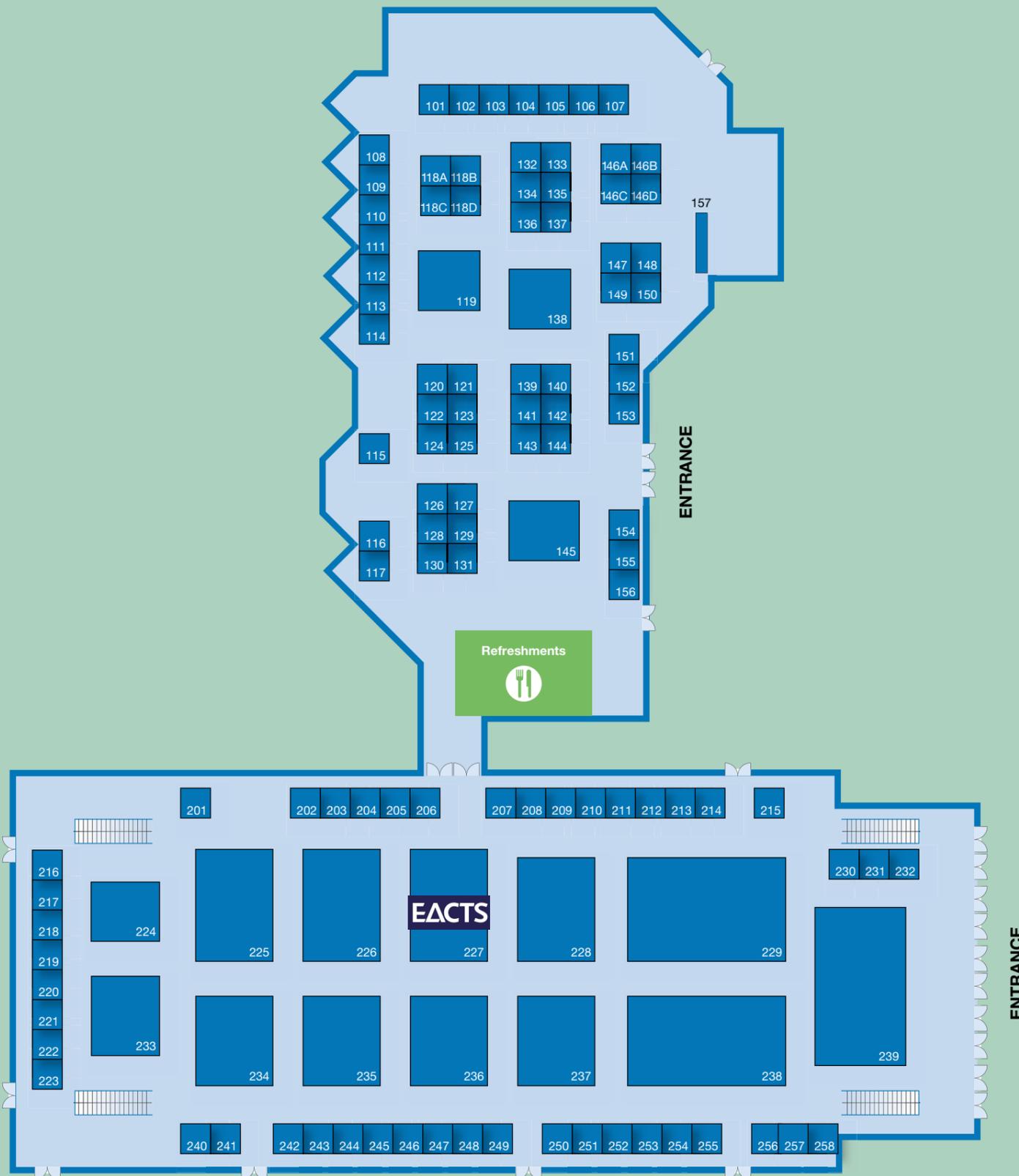
**Techno-College,  
Auditorium 1**

# Exhibition Floor Plan 2019

## Exhibition opening times:

Thursday 3 October 14:00–19:00  
 Friday 4 October 09:00–17:00  
 Saturday 5 October 09:00–17:00

101	3-D Matrix UK Limited
121 & 123	A&E Medical Corporation
225	Abbott
106 & 107	ABIOMED Europe GmbH
111	Admedus
253	Advancis Surgical
218	American Association for Thoracic Surgery (AATS)
230	Andocor NV
248	AngioDynamics
118b	Ansabere Surgical, S.L.
244	Ascyrus Medical LLC
237	AtriCure BV
148	Aziyo Biologics, Inc.
235	B Braun Aesculap
138	Berlin Heart GmbH
142	BFW, Inc.
131	BioCer Entwicklungs-GmbH
246	Biointegral Surgical, Inc
132	Biom'up SA
110	BIOMED
252	BioStable Science & Engineering, Inc
245	Cardia Innovation AB
116 & 117	CardiaMed B.V.
120	Cardio Medical GmbH
220 & 221 & 222 & 223	Chalice Medical Ltd
103	ClearFlow, Inc.
211	CORONEO Inc
233	Cryolife Inc. / Jotec GmbH
109	Cardiac Surgery Intersociety Alliance (CSIA)
217	CTSNet
212 & 213 & 214	CytoSorbents Europe GmbH
136	De Soutter Medical Limited
143 & 144	Delacroix-Chevalier
247	Dendrite Clinical Systems Ltd
126 & 128	Dr. Franz Koehler Chemie GmbH
227	The European Association For Cardio-Thoracic Surgery (EACTS)
238	Edwards Lifesciences
122	em-tec GmbH
202 & 203	Ethicon, Johnson & Johnson Medical Devices Companies
234	Eurosets s.r.l.
215	Exstent Limited
231 & 232	Fehling Instruments GmbH & Co KG
140	Fuji Systems
145	GEISTER Medizintechnik GmbH
125	General Cardiac Technology/Heart Hugger
255	Genesee BioMedical Inc
239	Getinge
146d	Heart Valve Society
137	HeProCalc AB
135	International Society for Minimally Invasive Cardiothoracic Surgery (ISMICS)
133	Jarvik Heart Inc
118a	JOMDD Inc – Japanese Organization for Medical Device Development
240	Karl Storz SE & Co. KG



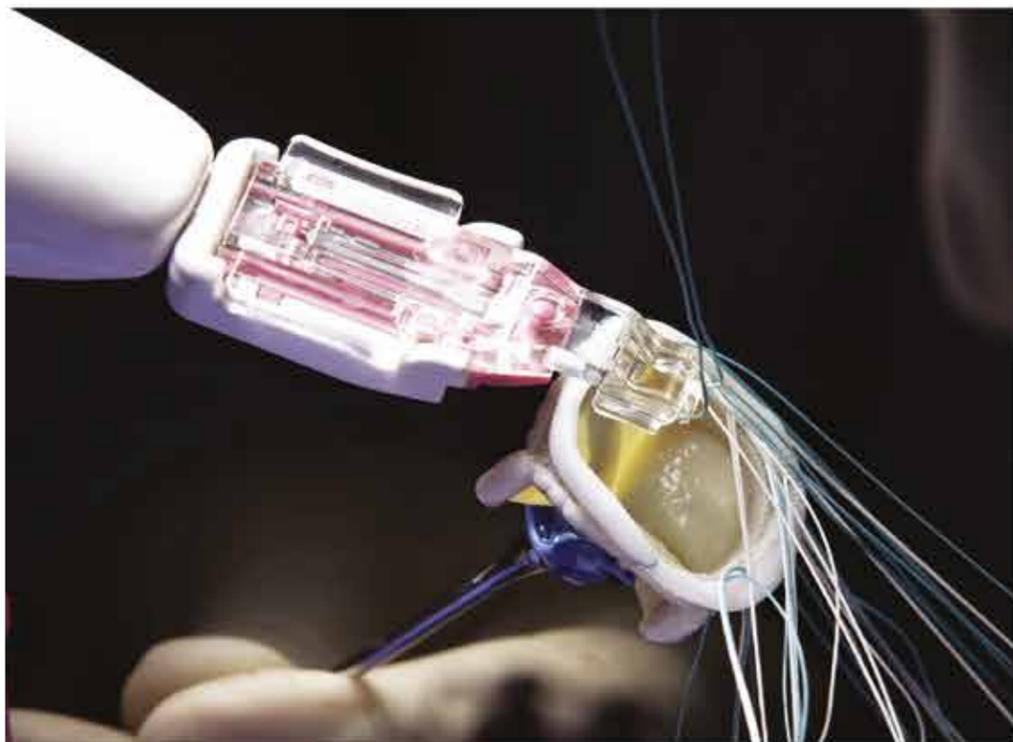
113 & 114	KLS Martin Group
236	LSI Solutions
250&251	Medela AG
224	Medistim ASA
229	Medtronic International Trading SÀRL
104 & 105	Meril Life Sciences Pvt Ltd
256	NeoChord, Inc.
146c	New Valve Technology (NVT)
124	Nordic Pharma
139	NSE North-Southern Electronics Limited
241	OmniGuide Surgical
209 & 210	Oplnstruments GmbH
112	Osypka AG
219	Oxford University Press
134	Paragonix Technologies, Inc.

207 & 208	Peters Surgical
249	Qualiteam Group Ltd.
149 & 150	Redax Spa
141	Rumex International Co.
151 & 152 & 153	Scanlan International Inc
119	Siemens Healthcare GmbH
204	Portuguese Society of Cardiothoracic and Vascular Surgery (SPCCTV)
228	Spectrum Medical
115	Stille AB
216	The Society Of Thoracic Surgeons (STS)
147	Sunoptic Technologies
257 & 258	SynCardia Systems LLC
226	Terumo Aortic + Terumo Europe NV

118c & 118d	Tianjin Plastics Research Institute Co Ltd (TPRI)
201	Tianjin Welcome Medical Equipment Co., Ltd.
127 & 129	Transonic Europe B.V.
205 & 206	Vascular Graft Solutions
130	Vygon
254	Waston Medical Appliance Co., Ltd
154 & 155 & 156	Wexler Surgical, Inc. & TeDan Surgical Innovations & Designs for Vision
157	Wisepress Online Bookshop
242 & 243	Xenosys Co Ltd
108	Zeon Medical Inc
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with more than 18,000 implants worldwide and clinical evidence to prove its safety and effectiveness when used in a less-invasive thoracotomy approach.<sup>1,2</sup>

HeartWare™  
HVAD™ System



#### References:

1. McGee E, Danter M, et al. Evaluation of a lateral thoracotomy implant approach for a centrifugal-flow left ventricular assist device: The LATERAL clinical trial. *JHLT*. 2019;38(4):344-351.
2. Medtronic data on file as of July 2019, and data extrapolated based on source data from: HVAD System Instructions for Use. HeartWare Inc., Framingham, MA, USA 07/18. HeartMate 3 Left Ventricular Assist System, Instructions for Use. Thoratec Corporation, Pleasanton, CA, USA 08/17.

#### Brief Statement: HeartWare™ HVAD™ System

##### Indications for Use

The HVAD™ System is intended for use in patients at risk of death from refractory end-stage heart failure. The HVAD™ System is designed for in-hospital and out-of-hospital settings, including transportation via fixed wing aircraft or helicopter.

##### Contraindications

The HVAD™ System is contraindicated:

- In patients with a body surface area (BSA) less than 1.2m<sup>2</sup>
- In patients who cannot tolerate anticoagulation therapy
- During pregnancy

Refer to the "Instructions for Use" for detailed information regarding the implant procedure, indications, contraindications, warnings, precautions and potential adverse events prior to using this device.