EACTS European Association For Cardio-Thoracic Surgery

# Daily News

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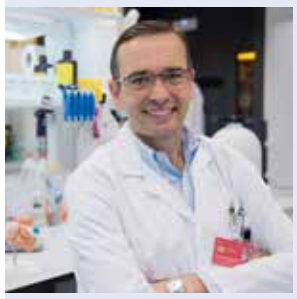
## In this issue













# Benvenuti a Milano!

## Welcome to the 32nd EACTS Annual Meeting

I welcome all of you to this outstanding meeting and to this fashionable city. This is the first time for our new three-day Annual Meeting format, but rest assured we have not compromised on quality and content: you will find more than 160 sessions featured throughout the invigorating schedule. What's more, the Techno-College sessions are now scheduled on each day of the Meeting, marking their place as a truly integral part of the proceedings.

This year's programme is packed with interesting sessions, including 'How to become a hybrid surgeon' as part of the EACTS Hybrid Surgeon Programme, and a Trial Update session in association with the newly established EACTS Analytical Support Unit. This is a collaboration with the Institute of Clinical Trials and Methodologies of the University College London, UK and is part of the quest to educate surgeons on how to interpret clinical trials.

The ART trial 10-year results and the IMPAG, COAPT and MITRA-FR trials will be presented and analysed for the first time in a surgical meeting, and three sessions will be streamed live through our website, through CTS-net and at #eactslive, with a dedicated Twitter feed for truly global interaction.

In order to cater for all in attendance, the programme is very varied, including several sessions on coronary surgery, valve surgery, innovative techniques and even a session on rare and uncommon diseases. I encourage you to download the EACTS App so you can create your own personalised schedule, and we can keep you up to date throughout the meeting.

I do hope that in addition to the educational opportunities, you will spend three wonderful days in this vibrant city. I wish you an enjoyable and enlightening Annual Meeting, and I look forward to seeing you at the party on Saturday evening at the Alfa Romeo museum in Arese.

**Domenico Pagano**
Secretary General
EACTS

**EACTS**

# Interview: **Marian Zembala**

Ahead of the Annual Meeting, Marian Zembala (Silesian Center for Heart Diseases, and Medical University of Silesia, Zabrze, Poland) joined *EACTS Daily News* to discuss the landmarks of his life and the importance of partnership in his mission as EACTS President.

The author of nearly 700 papers and 92 book chapters, Professor Zembala was involved in numerous clinical firsts in Poland, including arterial revascularisation with the use of both internal thoracic arteries, the surgical treatment of arrhythmias (including ventricular tachycardia and atrial fibrillation), procedures in chronic pulmonary embolism, endocardial ablation, and heart and lung transplantation.

After receiving his training at Poland's historically renowned Medical Academy of Wrocław, he built his experience in Belgium, the Netherlands, the US and UK, as well as in Poland. Immediately after graduating from medical school he spent time at the Catholic University of Leuven (Belgium), before beginning a residency position at St Antonius Hospital Utrecht (the Netherlands). Here he developed, amongst other things, an interest in arrhythmia surgery. "In St Antonius I learned very modern coronary surgery," he explained. "And I also learned organisation – this was very important for me. During this time I had very many duties."

This period in Utrecht, he explained, also delivered a lesson on the impact of cross-border collaboration in raising international standards: "During my work at St Antonius hospital, I was fortunate to meet cardiac surgeon Professor Francois Hitchcock. At that time, we regularly (about once a week) operated on children from abroad for charity. I asked them to consider operating on some Polish children – we had a lot of Polish children with congenital defects which could not be operated on at that time [due to lack of local experience]. Dr Hitchcock responded positively. So, between 1983 and 1990, 427 Polish children with congenital malformation were operated on in Utrecht's Wilhelmina Children's Hospital. My Dutch colleagues also accepted 16 people from Poland on training programmes – mainly cardiac surgeons, cardiologists, perfusionists. It was fascinating."

The charitable project undertaken by the cardiology and cardiac surgery community in Utrecht was honoured in 2013 when over 90 cardiologists and cardiac surgeons from all over Poland sailed to Amsterdam on "Dar Mlodziezy" (Gift of the Youth), the Polish tall ship of the Gdynia Maritime University, on behalf of the hundreds of children whose congenital heart defects were surgically treated free of charge. "On an national level, this is very special and highly respected.

*"My dream is much greater integration of the EACTS with other European organisations."*

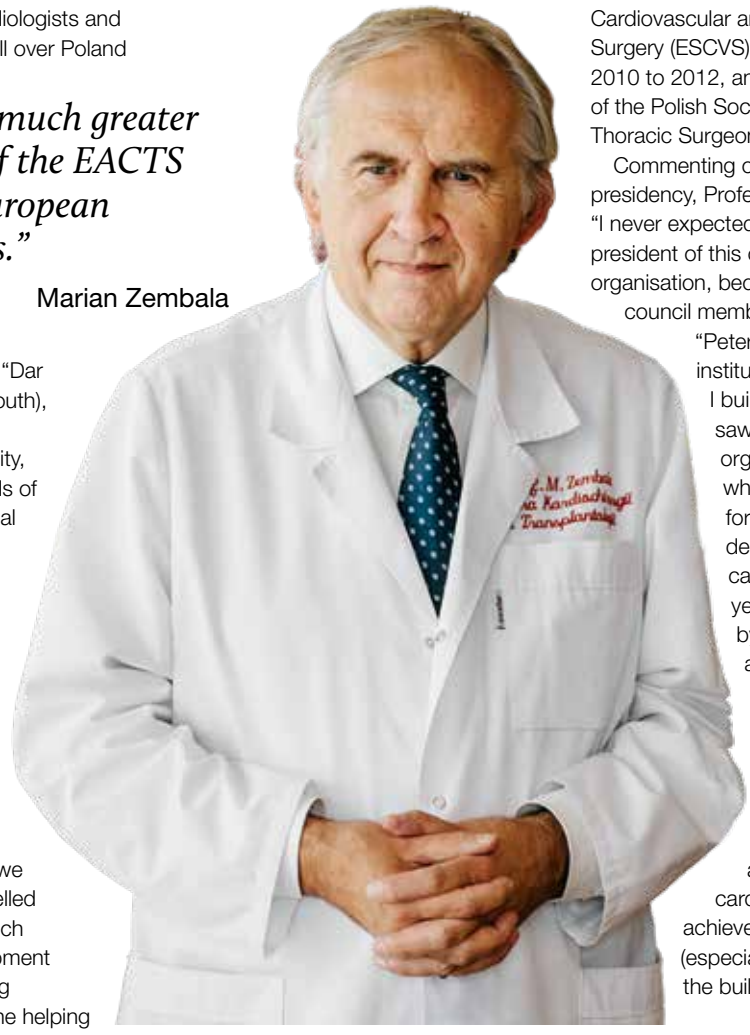
Marian Zembala

"This [project] was the reason that, in Zabrze, we started to operate on children from Poland, Bosnia, Peru, Kosovo, Ukraine, and Bolivia as much as we could. And we also travelled to these countries to teach and support the development of training. We have a big programme in the Ukraine helping cardiologists and cardiac surgeons there. That is important, because they need this kind of friendly cooperation – and we do the same in Russia, Belarus, and other countries."

After St Antonius, Professor Zembala moved back to Poland, to the Silesian Medical Academy in Zabrze. Alongside mentor Zbigniew Religa, in 1985 he conducted the first successful heart transplantation in Poland. More than 1,500 heart transplantations have been carried out since. He also carried out the country's first successful heart-lung transplantation (this patient remains alive today), as well as the first lung transplantation for chronic pulmonary embolism, and pioneering methods in arterial revascularisation, transcatheter aortic valve implantation (TAVI) and extracorporeal membrane oxygenation (ECMO).

As well as his clinical achievements, Professor Zembala has served as the Polish National Consultant in Cardiac Surgery and as Minister of Health in 2015. He was European Society of Cardiovascular and Endovascular Surgery (ESCVS) President from 2010 to 2012, and is President-elect of the Polish Society of Cardiac and Thoracic Surgeons.

Commenting on his EACTS presidency, Professor Zembala said: "I never expected that I could be a president of this outstanding, important organisation, because I was not a council member.



"Peter Kappetein visited my institution and he saw how I built a new hospital. He saw a very modern, well organised department, which I have chaired for many years. At this department we do 2,000 cardiac operations a year. He was impressed by the quality of work and organisation.

"Then, I received a call from Friedrich Mohr informing me [of my candidacy]. The reasons were three-fold – my achievements as a cardiac surgeon, my achievements as a leader (especially focussing on the building of bridges

*Continued on page 2*

EACTS

# Interview: **Marian Zembala**

*Continued from page 1*

between different peoples), and the training programme I established. I was speechless."

Describing how his ambitions for the role have taken shape, he continued: "We try step by step to make new achievements. My dream is much greater integration of the EACTS with other European organisations, such as the ESCVS but also the European Society of Cardiology (ESC).

"Why? Because in the global world, you need to make a strong voice and partnership. War is devastating; we need peace and pragmatism. That is my message – peace and pragmatism."

A key working example of partnership and pragmatism in the clinical sphere, explained Professor Zembala, is described in the recently published consensus statement on TAVI by the Association of Cardiovascular Interventions of the Polish Cardiac Society and the Polish Society of Cardio-Thoracic surgeons, which legitimise the active participation of cardiac surgeons in TAVI procedures, from any approach, as an operator. The paper also highlights the importance of the multidisciplinary TAVI team in facilitating optimal patient selection, organisation and treatment.[1] This notion is underscored by recent evidence published by Zembala and colleagues, demonstrating the feasibility and efficaciousness of a hybrid approach to revascularisation in selected patients with multivessel coronary disease[2,3].

"When you have experienced cardiac surgeons, you have a much better result in TAVI than without them," explained Professor Zembala. "The focus is on partnership, with an active role by cardiac surgeons. This is a very fresh, very new idea crucial for the development of our specialty and its future."

Professor Zembala also spoke of the importance of transatlantic partnership, as epitomised by Hans Borst's 1985 paper, 'Hands across the ocean'[4]: "I very much like cooperation with the American societies," he commented. "They are very dynamic, and very focused on new research and new technology, and working together with companies. We adopted many American methods for education and training programmes, and vice versa. In a global world we need standardisation, because then our quality of work gets better."

*"When you have experienced cardiac surgeons, you have a much better result in TAVI than without them. The focus is on partnership, with an active role by cardiac surgeons. This is a very fresh, very new idea crucial for the development of our specialty and its future."*

Marian Zembala

Steps to strengthen bonds within Europe recently took shape at a meeting of the European Commissioner for Health and Food Safety and representatives of the ESC, EACTS, and ESCVS in May of this year. These parties discussed strengthening the role of the European medical registries, to improve the monitoring of the availability and effectiveness of treatments as well as to improve scientific and clinical data. Also addressed was the importance and value of multicentre, European, non-commercial scientific and clinical research and its role in the further development of modern evidence-based European cardiovascular medicine. Lastly, prevention was discussed, including the need for an EU structural framework for cardiovascular disease prevention, to parallel those already in place for cancer prevention.

The cooperation of the ESC, EACTS and ESCVS underscored the importance of EU Commission support in conducting and funding such research, explained Professor Zembala. "We have many opportunities from this meeting – the Commissioner told us that he appreciates tremendously this kind of power from the societies. If we work together, in a strong voice, forces from the societal side have a big influence on the outcome. This is the pragmatic approach."

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**Cardiac | Professional Challenge | A practical approach to aortic valve repair**

# Aortic valve repair, "let's standardise it"

Today's Professional Challenge session on a practical approach to aortic valve repair will feature presentations from some of the most well-known experts in this very challenging field. "There are not many experts in aortic valve repair around the world, but most of them are here," session co-moderator J. Rafael Sádaba – a cardiac surgeon at the Complejo Hospitalario de Navarra and Clinical Associate Professor at the University of Navarra in Pamplona, Spain – told *EACTS Daily News*. "This is a very high-profile session with regards to its speakers."

The aim of the session is to demystify the technique that many believe is so tricky they usually opt for replacement instead of repair, explained Dr Sádaba. "Aortic valve repair has been perceived by most surgeons as something that is more difficult, more technically demanding," he said. "Some would say that there has been a fair amount of art to this technique rather than anything else. That's probably why it has been limited to a few capable surgeons," he explained.

Because aortic valves have traditionally been replaced rather than repaired, knowledge and expertise on the procedure is much thinner on the ground compared with the repair of other valves, said Dr Sádaba. "For example, mitral valve repair has been performed for a long time now, and has been standardised over the years."

In contrast, literature on aortic valve repair has been sparse. "The results have not been as solid or as robust as the mitral valve," he added. "The argument for aortic valve repair over replacement has not been made that clear until recently."

*"There are not many experts in aortic valve repair around the world, but most of them are here."*

J. Rafael Sádaba

However, times are changing, noted Dr Sádaba, adding that in recent years, aortic valve repair has become more and more popular, with increasing uptake. "There are more papers coming out reporting on the results of aortic valve repair, so this is why it is an important subject," he said.

Today's session will deal with some of the most important issues surrounding aortic valve repair, including what the clinical guidelines say regarding the treatment of patients, the different techniques that can be used, what we understand about the indications for aortic valve repair in patients with aortic regurgitation, and a closer look at annuloplasty and when it's appropriate.

Critically, said Dr Sádaba, the session will include several step-by-step accounts of different techniques that can be used. The presentation 'Standard surgical steps to repair an aortic valve – liveinabox' by Munir Boodhwani (Associate Professor in the Division of Cardiac Surgery at the University of Ottawa Heart Institute, Canada) is but one example. "In these presentations the objective is to standardise the technique, step-by-step, rather than leaving it more to art," explained Dr Sádaba. "It's about establishing a proper technique.

*"We will take a comprehensive look at all of the technical aspects of aortic valve repair for those surgeons who may be interested in developing a programme in their centres, and would like to start performing this technique."*

J. Rafael Sádaba

"We will take a comprehensive look at all of the technical aspects of aortic valve repair for those surgeons who may be interested in developing a programme in their centres, and would like to start performing this technique. And it will interest those who may have some experience but want to reinforce their knowledge and see what others do. I think this will attract a fair amount of people."

The presentations will also look at how to identify the right patients for this procedure, the pitfalls and how to deal with complications. For example, Joseph Bavaria (Philadelphia, PA, USA) will give a presentation that raises some important questions, noted Dr Sádaba: "In particular, he will talk about when not to attempt a repair, and how to identify those patients where the repair will fail," he said. "That is a very interesting presentation. I think we are not used to this kind of discussion: how to deal with the complications of aortic valve repair. That is something that we usually don't hear about at meetings."

Patient selection will be one of the most important aspects of the discussion, commented Dr Sádaba, noting that he tends to limit repair procedures to younger patients with specific types of aortic valve disease, such as aortic valve regurgitation. By definition, that too limits the numbers of procedures he performs. "It's really not that common to find young patients who have this kind of problem," he explained. "This is completely different from mitral valve, where a huge proportion of patients are repairable, but very much depends on the experience and expertise of the surgeon."

It follows that even if a surgeon is willing, there is a vicious circle at play in terms of garnering expertise: "Because there are not many patients, surgeons don't get the opportunity to do many aortic valve repairs, so you don't get as much experience as with other procedures," said Dr Sádaba.

Despite this fact, he stressed that surgeons increasingly want to circumvent the need for prosthetic valves because of the inherent disadvantages, so it's vital that aortic valve repair finds its footing. "With replacement, you have to take medications and anticoagulants and those impose significant risks. Patients are more likely to have splits or have problems with thrombosis," he said.

That's why the session will be full of practical tips for those willing to see this technique as a viable alternative to replacement. "It will be useful because the audience will learn a lot of very important things that they can use on a daily basis," Dr Sádaba concluded.

**The session 'A practical approach to aortic valve repair' takes place 14:15–17:30 today in the Auditorium.**

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Techno-College

# New technology meets common practice, how to enhance your surgical portfolio

Hendrik Treede, Director of Cardiac Surgery at the Mid German Heart Centre at University Hospital, Halle, Germany, spoke to *EACTS Daily News* to offer some of the highlights of the Techno-College sessions at this year's meeting.

This year's Techno-College programme has a new format, spanning all three days of the Meeting, but with the same clear message: learn new techniques to develop your skills portfolio. "New approaches can make your life even easier and maybe achieve similar results to complex surgery," noted Professor Treede.

One of the Techno-College sessions held this morning, beginning at 9.30 am in the Auditorium, will focus on how new technology can enhance your surgical portfolio: "The Techno-College is in contrast to the rest of the very scientific EACTS meeting; it's more liberal, more future-centric, where we show the newest ideas and data," explained Professor Treede. "It should allow us a glimpse into the future of our profession, so we can see what's coming up next, and where we are heading.

"It's also educational – a chance for younger surgeons to learn tips and tricks from experienced surgeons about performing particular techniques, and for experienced surgeons to learn about the latest developments. There is something for everyone, whatever their level of experience.

"Overall, it is all about showing that as surgeons of the future, we should look towards minimally invasive technology and understand that minimally-invasive techniques are as safe, simple and do-able as more complex surgical procedures. These new approaches can make your life even easier and maybe achieve comparable results to complex surgery."

He cautioned, however, that new techniques can still take a long time to get into common practice: "For example, we have performed minimally invasive mitral valve repair surgery for 20 years now, but it is not being offered by every centre. There is a clear need to get information out there. Of course, the numbers are increasing – but you can't go to every hospital and get this done.

*"The Techno-College is in contrast to the rest of the very scientific EACTS meeting; it's more liberal, more future-centric, where we show the newest ideas and data."*

Hendrik Treede

"The same applies for aortic valve replacement [AVR] – it's a technique that

is very easily doable from a minimally invasive approach, but it is not very often done. In some centres it is absolutely routine, and others don't do it at all, and the Techno-College wants to facilitate interested operators to find their way into this new field."

Indeed, over the course of three days, the Techno-College sessions will showcase new minimally invasive techniques, including some eagerly anticipated live cases: "One of the highlights will be a live transmission of transcatheter mitral valve replacement – this is only the second time in the world this has been transmitted live to an audience," said Professor Treede.

"Other highlights include a live transmission of a new surgical technique for mitral valve repair. It is a clip-like device that is being surgically implanted by live transmission from a surgeon in Hamburg via a minimally invasive technique. And we also have a live case showing lead extraction using the Excimer laser, it's been around for many years but is still not widely used in the community and we want to enhance it by showing how easy it is to do by demonstrating it live.

"The idea is to give surgeons advice on how to enhance their portfolio, and pass on the tips and tricks to help them get started if they haven't done this before. For example, there is a session of talks given by experts in the field who will explain how you can start a minimally invasive AVR programme. They will explain what the pitfalls are and what to look for and what else has to be taken into account to make AVR more modern using less-invasive techniques."

He added that less-invasive techniques including upper partial sternotomy and lateral mini thoracotomy will also be placed under the spotlight, including when to choose the techniques, and for which patients.

Additional highlights, continued Professor Treede, include a session tackling valve choices available to younger patients, bearing in mind the need for valve-in-valve procedures, as well as other procedures such as how to close the left atrial appendage in minimally invasive endoscopic surgery and internal annuloplasty for complex aortic valve repair.

On Saturday, there will be a new 'Lion's Den' format for the Techno-College Awards, where applicants will present their case in front of a panel of not only experts in the field, but also venture capitalists and CEOs of companies too.

"They will each be grilled, asked for ideas and will have to make a business case," said Professor Treede. "In addition, the audience gets to vote and controls 33% of the final outcome, so that should be interesting in deciding who will ultimately receive the Techno-College Award."

Investigator Meeting

# The road to ROMA

Enrolment continues in the ROMA trial (Randomized Comparison of the Clinical Outcome of Single Versus Multiple Arterial Grafts)[1], with the hope that it will outstrip its predecessors in terms of clarity of findings. Co-principal investigator Mario Gaudino (Weill Cornell Medicine | NewYork – Presbyterian Hospital, USA) will be presenting an update on ROMA at the Annual Meeting.

The prospective, unblinded, randomised event-driven multicentre ROMA trial will include at least 4,300 subjects, with the primary hypothesis that in patients undergoing primary isolated non-emergent coronary artery bypass grafting (CABG), the use of two or more arterial grafts compared with a single arterial graft is associated with a reduction in the composite outcome of death from any cause, any stroke, post-discharge myocardial infarction and/or repeat revascularisation. Commencing in January 2018, its pilot phase (which included 430 patients) was completed in early September. In the continuing full trial phase, the number of participating centres will be expanded from 22 to more than 50.[2]

A summary of current evidence on the clinical outcome associated with the use of single and multiple arterial grafts for CABG was recently published by Gaudino et al. in 2018.[3] The paper underscores the need for the ROMA trial, given the inconclusiveness of randomised trial data to date – including the most recent, the ART trial[4], where possible methodological limitations may explain neutral findings to date – and the difficulty in interpreting findings from observational studies. Gaudino et al. contrast ART and ROMA, noting differences in important aspects such as: primary outcome, which was overall survival in ART, and major adverse cardiovascular and cerebral events in ROMA; age cut-off, of which there was none in ART, and 70 years in ROMA; and pilot phase assessment of crossover and protocol adherence, which was carried out in ROMA but not in ART.[3]

In conversation with *EACTS Daily News*, Dr Gaudino commented: "Even though it is probably a bold statement, I think ART has served as a proof-of-concept or a preliminary trial in order to design ROMA. Not only that, but the analysis of the ART trial (which was presented at the European Society of Cardiology in August by David Taggart and will be presented again in Milan) gives even more support to the rationale of ROMA by showing that the second arterial graft can be either the radial artery or the right internal thoracic artery (ITA)."

One other prominent difference between ART and ROMA is with respect to operator

*"ROMA is the first trial I have ever seen where the observed enrolment rate was higher than the expected rate."*

Mario Gaudino

experience, which was posited as an influence on the results of ART. Indeed, a subgroup analysis is planned within the ROMA trial to examine how this variable interacts with other factors. "In ROMA, we have strict criteria for surgeon experience," said Dr Gaudino. "A surgeon can participate in the trial if they have experience of at least 250 multiple arterial graft operations. The bar is much higher than in ART – five times higher, because of the operator experience to treatment effect correlation that was evident in ART. In ART, that number was 50."

Dr Gaudino acknowledged that this type of

## Investigator Meeting

issue is a general one in surgical trials, given that efficacy of intervention is by its nature entangled with the effectiveness with which that intervention is delivered. So-called expertise-based randomised trials, where operators are recruited based on their expertise in one of the compared interventions rather than both, endeavour to remove such interactions[5,6]. And while ROMA is not precisely an expertise-based trial, Dr Gaudino explained, participating surgeons have been selected such that all are highly confident in multiple arterial grafting.

Returning to explain why permittance of the use of the radial artery as an alternative to the right ITA is such an important aspect of ROMA, Dr Gaudino said: "One of the problems with ART was the per-protocol use of bilateral ITA, which is not ideal in every patient. There are patients in which it is just much easier if the second arterial graft is the radial artery. I think that by doing these things – the combination of the higher bar for participation, and allowing the use of radial artery – we will probably address the issue of surgeon experience."

ROMA also invites the use of more than two arterial grafts where required, explained Dr Gaudino, based on evidence that more arterial grafts should provide a greater benefit to some patients[6-12]. "By multiple arterial grafts, we mean the use of as many arterial grafts as are appropriate for the surgeon and patient. So if you are experienced you could do three arterial

*"The analysis of the ART trial ... gives even more support to the rationale of ROMA."*

Mario Gaudino

grafts, or even four. But if you are starting out on the learning curve, or if your patient is not so fit, you can just use two. Individualisation to the patient and the surgeon is the key."

In his concluding remarks Dr Gaudino noted the rapidity with which patients have so far been recruited into ROMA, reflecting on the mood of anticipation surrounding its progress. "As you know, in randomised trials, one of the most important problems is enrolment – there is the constant problem that the enrolment rate is low. ROMA is the first trial I have ever seen where the observed enrolment rate was higher than the expected rate, even higher than our liberal estimate. I think this tells you a lot about the enthusiasm in the surgical community for this trial: the fact that it addresses an important question that every cardiac surgeon feels needs to be answered."

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## Vascular | Focus Session | Challenging the guidelines in thoracic aortic surgery

# The quiet TEVAR revolution

There's a slow revolution in endovascular solutions for proximal thoracic aortic disease according to Joseph E. Bavaria, a surgeon at Penn Medicine, Philadelphia, PA, USA who will be speaking in a presentation dedicated to the role of open and endovascular techniques in the future. Dr Bavaria has 25 years of experience in the classic aortic surgical space, extensive endovascular experience and is a past president of the Society of Thoracic Surgeons (STS) and an EACTS Vascular Domain member. He told *EACTS Daily News* that an enormous amount of investment has been made in new devices; between 80 and 90% of funding by industry is focused on proximal thoracic aortic conditions at the moment. That is what's fueling the revolution. Classic surgery, therefore, is under siege, he said. "This has been the domain of cardiovascular surgery forever," said Dr Bavaria. "So the big picture is that cardiovascular surgeons need to be a major part of this. They need to be aware of this revolution that is beginning."

Traditionally, endovascular solutions have not successfully reached the proximal aorta, so the two techniques have been separated, he said. "There was kind of a divide between open surgery and endovascular surgery," said Dr Bavaria, but with these newer devices there is a sea change. "Now for the first time we are able to treat the aorta closer to the heart in the aortic arch and the ascending aorta."

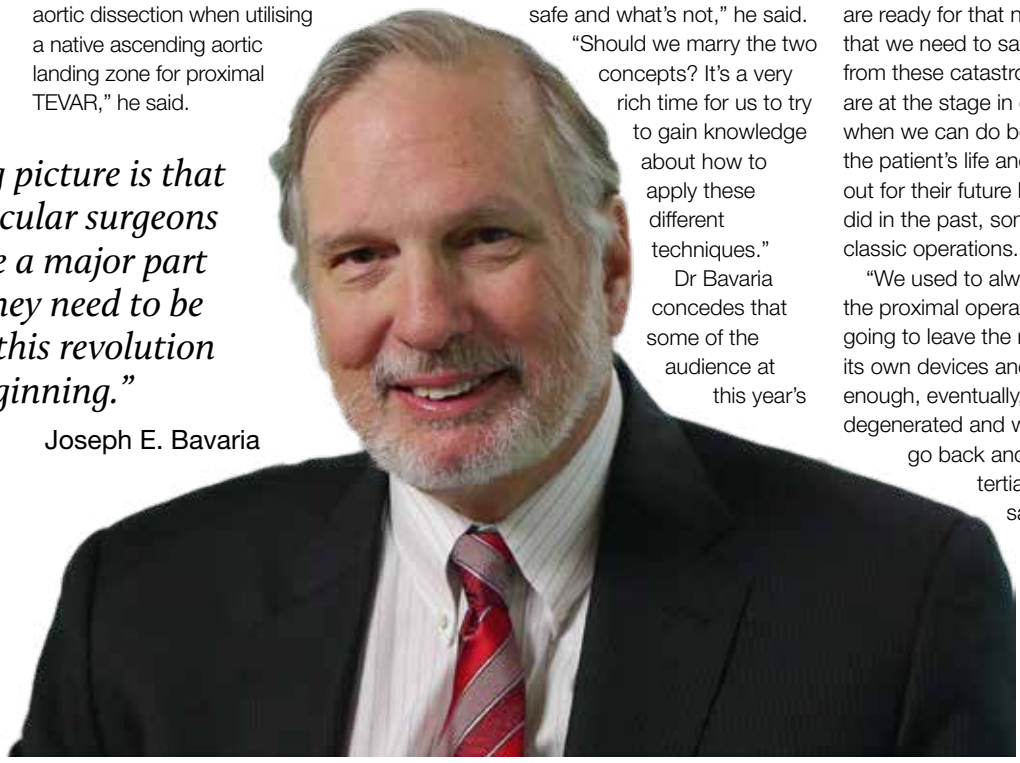
Dr Bavaria will explain how thoracic endovascular aortic repair (TEVAR) devices are improving matters. "We will talk about classic proximal aorta repair, which allows you to use TEVAR distally. We also have new branched aortic arch TEVAR devices that are now becoming more widely available, and achieving approval for clinical use in both North America and Europe," he explained. "This is going to change the way we think about open thoracic aortic surgery for both dissections and aneurysms."

Early emerging devices and the treatment of isolated ascending aortic disease, including Type A aortic dissection will also be discussed. "So it is not just important to have a landing zone in the ascending aorta, but actually to treat ascending aortic conditions that are primary to the ascending aorta," he explained. "This is really a very big difference."

But although so much innovation is ongoing within the endovascular proximal aortic arena, Dr Bavaria said it is still preferable to have hybrid solutions of both open aortic and endovascular surgery for the proximal aortic disease in both aneurysms and dissection. "Despite the advances in endovascular surgery, there are significant hurdles that need to still be overcome. They include stroke risk associated with aortic arch repair of aortic arch branched TEVAR, and also the spectre of retrograde Type A aortic dissection when utilising a native ascending aortic landing zone for proximal TEVAR," he said.

*"So the big picture is that cardiovascular surgeons need to be a major part of this. They need to be aware of this revolution that is beginning."*

Joseph E. Bavaria



Importantly, noted Dr Bavaria, surgeons will have to design new operations and new approaches from an open aortic standpoint, based on the availability of new TEVAR devices. "This is a big step," he cautioned. "Before, we never designed operations based on the availability of new devices. We just designed operations based on disease process and our knowledge of that disease process.

"We are moving towards Zone One and Zone Two arch procedures in all directions. In other words, we are doing less hemi- and Zone Three arches and more Zone One and Zone Two arches. We are coalescing towards this concept," he added. These relatively straightforward operations also allow for what Dr Bavaria terms exquisite TEVAR solutions in the future. "It is really a conceptual change in the way we look at and think about how we and why we do proximal thoracic aortic procedures," he said.

Such possibilities make for an exciting period, said Dr Bavaria. "This is a very rich and creative time where we are trying to figure out what we can do, how far we can take it, what's safe and what's not," he said. "Should we marry the two concepts? It's a very rich time for us to try to gain knowledge about how to apply these different techniques."

Dr Bavaria concedes that some of the audience at this year's Annual Meeting may believe this concept to be slightly controversial. "There is one camp that says our main job is to save the patient's life and not worry about anything else. And you know what? That is a very, very reasonable approach. There's a certain truth to that," he said. "But I maintain that we are now good enough to both save the patient's life, and think about the patient's future interventions – the patient's future residual aortic disease."

*"This is a very rich and creative time where we are trying to figure out what we can do, how far we can take it, what's safe and what's not."*

Joseph E. Bavaria

Dr Bavaria believes better index operations can be done with no change in mortality and morbidity rates in the older operation: "My thesis is that we are ready for that now. While it is true that we need to save the patient's life from these catastrophic events, we are at the stage in our development when we can do both. We can save the patient's life and we can look out for their future better than we did in the past, sometimes without classic operations.

"We used to always say we are doing the proximal operation and we are just going to leave the rest of the aorta to its own devices and fate. And sure enough, eventually, it would become degenerated and we would have to go back and do a secondary or tertiary operation," he said. "But that's not necessarily the way we should be doing it now." He instead recommended safe and sophisticated index procedures with an algorithm that allows for earlier treatment – an ability to use a TEVAR solution at the second stage, or downstream, instead of another big operation.

"Type A Aortic dissection is a total catastrophic event, not just a catastrophic ascending aortic event. It needs a more robust and more definitive solution than the present index procedure," he said. "So the way forward is a good open operation as an emergency, but also to prepare that patient so that early endovascular downstream treatment is possible. That way the aorta will properly remodel early and this will have a massive effect on the patient's lifespan and the patient's future re-operation."

The approach requires a change in attitude from surgeons, suggested Dr Bavaria. "We have to be self-critical and realise that many of the open operations that we've done in the past and are doing presently are simply inadequate for allowing the next procedure," he said. "And so what's happening is that if we continue the way we have in the past, we're just doing a second and third operation as the disease progresses."

So, predicting the future for Type A aortic dissection treatments, Dr Bavaria concluded that there will be a choice of three different approaches. For patients older than then 65 or 70 – with less than 10 or 15-year life expectancy – there will be the classic hemi-arch procedure; for those with a significant arch tear, or distal mal-perfusion that is clinically significant, the frozen elephant technique might be done at the time of the index procedure. "And for everybody else, which is the majority of patients who are less than 65 or 70 and stable, we will probably go to a Zone One or Two arch procedure with sequential arch branched TEVAR solutions for the residual aorta within the first eight weeks," he explained. "This will allow us to more definitively treat these patients for their long-term health. The controversy has been the idea that you go back and do an operation eight weeks later. Now it's possible, but it wasn't before."

Cardiac | Rapid Response | Pulmonary thrombosis and hypertension and ventricular complications of MI

# Cardiac Surgeons should be involved in the management of large pulmonary embolism

**Mark Newman, Jurgen Passage, Lucas Sanders, Pragnesh Joshi and Kaushal Rathore** Sir Charles Gairdner Hospital, Perth, Western Australia

Pulmonary embolism (PE) is a common condition estimated to cause 100,000–180,000 deaths per year in the US alone.

The mortality from pulmonary embolism varies from 1% for small emboli to 50% for those with a massive PE. The intermediate or submassive group – defined as those who are haemodynamically stable but have evidence of right ventricular strain – has a mortality of about 8%.

The treatment of PE always involves anticoagulation. The addition of thrombolytic agents is recommended in massive PE, but it is still debated in submassive PE. The downside of thrombolytic agents is the significant incidence of major haemorrhagic complications – up to 20% with a 2–4% incidence of intracranial haemorrhage. The efficacy of thrombolytic agents in PE is also dubious, with no trial showing an improvement in mortality. This is not surprising due to the large size of pulmonary thromboemboli; restricted access of the agents to the thrombus in obstructed pulmonary arteries results in the relatively slow action (hours) of thrombolytic agents.

The major cause of morbidity and death from pulmonary embolism is the mechanical obstruction of the pulmonary arteries. The right ventricle (RV) is a good volume pump, but it does not adapt well to an acute pressure load. In the case of a PE it fails, and inflow to the left heart is decreased, leading to cardiogenic shock.

Traditionally, the management of PE has been led by respiratory physicians and haematologists. Cardiac surgeons have only been called upon when treatment with anticoagulation and thrombolysis has failed. Not surprisingly, the results of surgical embolectomy in these extremely sick patients have not been good, with mortalities often greater than 50% being reported. However, a number of reports in more recent times have indicated much improved results when embolectomy is performed earlier in the course of the condition.

Mark Newman

At the Sir Charles Gairdner Hospital in Perth, Western Australia, we have been offering a surgical embolectomy service for selected patients with a large PE since 1997. We have performed 65 cases since, averaging around 10 cases per annum over the last four years. We have a well-trained team of surgeons, anaesthetists, perfusionists and nurses and have been able to even rescue patients undergoing CPR.

We use a technique of beating heart on normothermic cardiopulmonary bypass. Our results have included five deaths (8%) overall, with all deaths occurring in those that required CPR (mainly due to hypoxic cerebral injury).

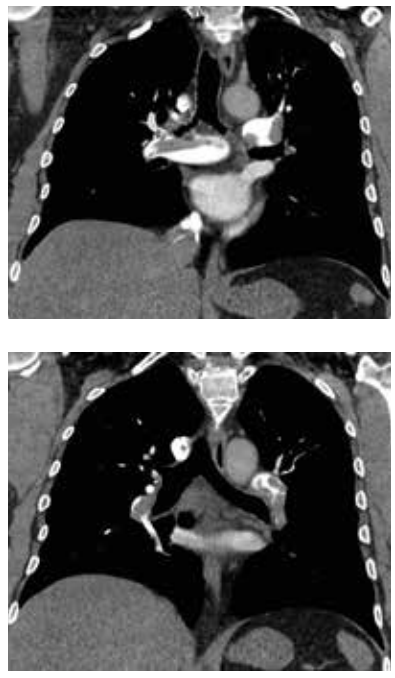


Figure 1. CT pulmonary angiogram showing large central pulmonary emboli

There were no deaths in patients not requiring CPR, but two patients required 2–3 days of ECMO support in this group.

The positive results we achieved were not expected by our respiratory and emergency physician colleagues (as there are so few centres providing this service). We now form a multidisciplinary team that assess all patients with large PE that present to our hospital.

Surgical embolectomy is now this hospital's preferred method of treatment for massive PE, and submassive PE when thrombolysis is contemplated. We rely heavily on the echocardiographic appearance of the RV in determining which of the submassive PE patients should have embolectomy.

We have followed up a group of 37 patients after surgical embolectomy and showed that at 2–3 months, pulmonary artery pressure and RV function returned to normal, with no instances of late death or recurrent PE.

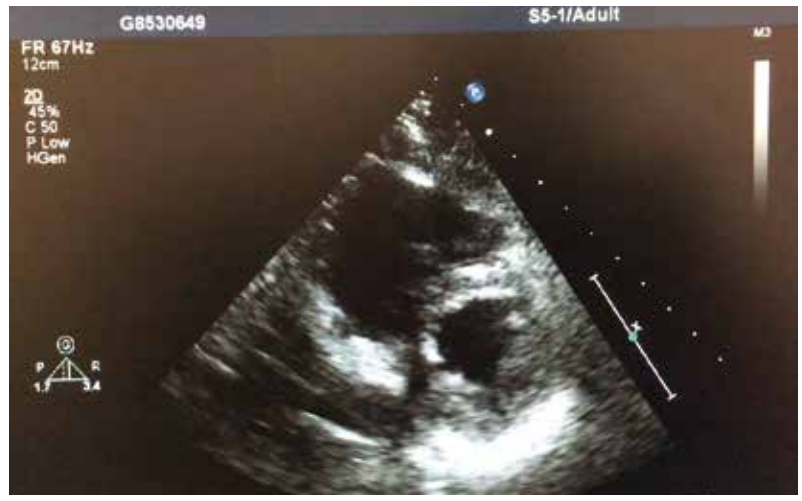



Figure 2. Echocardiography showing severe right ventricular enlargement and dysfunction, and a small left ventricle

Figure 3. Large clots removed from the pulmonary arteries

In conclusion, we believe that as the cause of death in PE patients is an acute mechanical obstruction to the RV outflow, the best treatment is expeditious removal of this obstruction. This requires cardiac surgeons to be involved in the management of patients to appropriately select and treat patients who present with a large PE.

Congenital | Rapid Response | Rapid Response – Congential

# European study on decellularised homografts for pulmonary valve replacement: The prospective ESPOIR Trial initial results and ESPOIR Registry data

**Samir Sarikouch** Department for Cardio-Thoracic Surgery, Hannover Medical School, Hannover, Germany

Decellularised pulmonary homografts (DPH) have shown promising early- to mid-term results when used for pulmonary valve replacement in congenital heart disease. Several groups using different decellularisation protocols have described superior results of DPH to standard cryopreserved homografts (CH) and bovine jugular vein (BJV) conduits.

However, to date, controlled prospective multicentre studies are lacking. The ESPOIR trial is the first prospective study worldwide evaluating cell-free homografts for pulmonary valve replacement.

The study was performed at seven centres for congenital heart surgery in Europe (Hannover, Leiden, Leuven, Padua, Chisinau, London and Zurich) between August 2014 and December 2016, with support by the European Commission (Grant Agreement No. 278453). Indication for pulmonary valve replacement according to current clinical guidelines was the key inclusion criterion, with no age limit. Patients with active endocarditis were not included.

Early follow-up data of 121 patients presented here at the 2018 EACTS Annual Meeting in Milan proves cell-free homografts as safe and effective in a multicentre setting. The mean age of the study participants was 21.3 ± 14.4 years, and the mean implanted DPH diameter was 24.4 ± 2.8 mm.

After a mean of 2.2 ± 0.6 years, the primary efficacy endpoints of mean peak gradient (16.1 ± 12.1 mmHg) and mean regurgitation grade (0.25 ± 0.48; Grade 0-3) were excellent. One DPH without degenerative signs was explanted after 23 months for technical reasons during re-operation for recurrent subvalvular stenosis caused by a pericardial patch. Furthermore, one balloon dilatation was performed on a previously stented LPA, leading to a freedom from explantation and re-intervention of 98.3t.

The early ESPOIR Trial data were combined with data from the ESPOIR Registry, which has a 100% follow-up of all DPH patients operated on since January 2005. A direct matched comparison to the most frequent alternative options for PVR – CH and BJV conduits (Contegra®) – was performed. Matching was performed on the basis of the patient's age at implantation, diagnosis, number of previous operations and number of previous PVRs.

The combined DPH cohort (n = 235), when matched to CH (n = 235) and BJV (n = 235), showed significantly better freedom from explantation (DPH 96.7 ± 2.1%, CH 84.4 ± 3.2%, p = 0.029; BJV 82.7 ± 3.2%, p = 0.012) and reduced structural valve degeneration at 10 years (DPH 61.4 ± 6.6%, CH 39.9 ± 4.4%, BJV 47.5 ± 4.5%).

In conclusion, the initial results of the prospective European ESPOIR Trial up to three years proved DPH as safe and efficient in a multicentre setting with excellent short-term haemodynamics. Follow-up over a period of at least 10–20 years is planned.

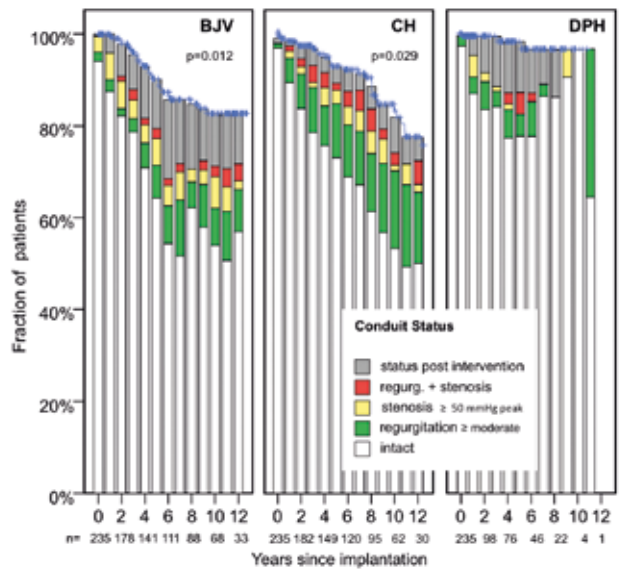



Figure 1. Freedom from explantation and functional conduit status for decellularised pulmonary homografts (DPH), cryopreserved homografts (CH) and bovine jugular vein (BJV) conduits.

Analysis of more than 700 patients following PVR showed superior DPH performance to other widely used options, such as BJV conduits (Contegra®) and standard CH in cohorts matched for age, type of congenital heart defect and number of previous procedures.

**More information is available at: www.espoir-clinicaltrial.eu**

Vascular | Focus Session | EACTS-STS – Treatment of type B aortic dissection in the era of stent-grafting – Acute dissection

# How to intervene in type B aortic dissection with arch involvement:
## The European point of view

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

The treatment of an acute type B aortic dissection (DeBakey Type III), characterised by an entry tear distal to the left subclavian artery, is well investigated, having been evaluated in several studies and registries. After the principal discrimination between uncomplicated and complicated type B dissection, a decision between different treatment strategies has to be made. According to the ESC-Aortic Disease Guidelines, a conservative approach with optimal medical therapy is a class I indication for uncomplicated type B dissections. However, based on the results of the INSTEAD XL trial, an endovascular treatment should also be considered for so-called uncomplicated dissections.[1] This recommendation is based on superior five-year results with respect to re-intervention and mortality in the endovascular group.

Complicated type B dissections should be treated by endovascular stent-graft placement in order to cover the primary entry tear, which is commonly located close to the offspring of the left subclavian artery. This class I recommendation is based on several studies which showed significant mortality and morbidity rates for open surgery via posterolateral thoracotomy.

However, retrograde Type A aortic dissection following stent-graft placement in the proximal descending aorta or in the distal aortic arch remains a significant and substantial problem. Perforation of the intima-media layer of the aortic wall by the bare springs of the stent-graft, oversizing of the endovascular prosthesis, an increase in aortic wall shear stress in front of the rigid endovascular stent graft, and/or a non "healthy" proximal landing zone are several factors that will be discussed as potential causes of this serious complication. Weiss et al. demonstrated that for an ascending aortic diameter of more than 4 cm, the location of the primary entry tear at the concavity of the aortic arch and a haematoma within the arch are associated with an increased risk for a complicated course of the disease.[2]

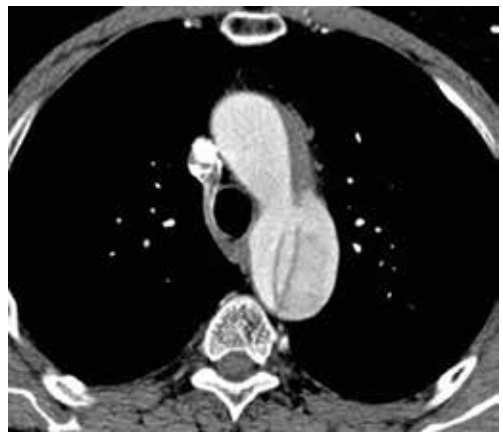


Figure 1: CT-scan showed a haematoma within the aortic arch

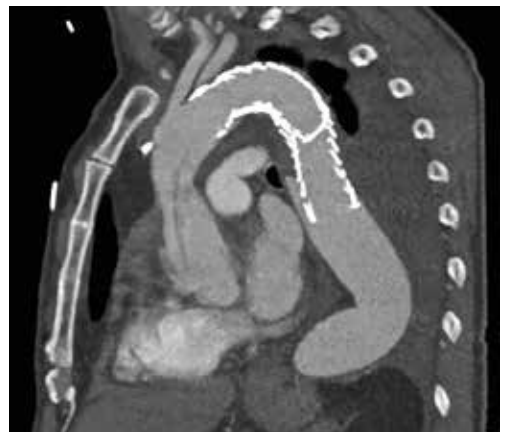


Figure 2: Retrograde type A aortic dissection after endovascular treatment for complicated type B aortic dissection

In patients with a haematoma propagating into the aortic arch, or those with a small dissection flap between the left common carotid and subclavian artery, endovascular treatment should not be performed. One should discuss whether this type of dissection should be called "non A, non B" aortic dissection, with the consequence of an open surgical treatment strategy.

The European point of view favours the frozen elephant trunk operation as an excellent operative strategy to successfully treat patients with this specific pathology. Coverage of the entry tear with an endoprosthesis as well as replacement of the aortic arch is possible in a one-stage procedure using moderate hypothermic circulatory arrest and antegrade cerebral perfusion. Indeed, promising results are published, demonstrating low mortality and morbidity rates using this hybrid technique.[3]

In conclusion, patients suffering from an acute type B dissection with a retrogradely affected aortic arch should not be treated by an endovascular approach due to the high risk of retrograde type A dissection. The antegrade approach using a hybrid prosthesis offers a reliable and effective treatment option for acute complicated type B dissections with aortic arch involvement.

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# INSIDE MILAN

## Where to go? What to do?

### CATHEDRALS

#### THE DUOMO

This sublime Gothic cathedral is the prima donna of Milan, reflecting the beauty and ambition of the city. Six-hundred years in the making, 3,400 statues adorn its façade, with 135 spires reaching from its pink Candoglia marble construction. Inside it is no less impressive, with a vast and ornate space peppered with the largest stained-glass windows in Christendom.

### GALLERIES

#### THE LAST SUPPER

One of the famous artworks in the world, Leonardi da Vinci's *The Last Supper* is at home on the wall of the refectory adjoining the Basilica di Santa Maria delle Grazie. Booking in advance is mandatory, or you can sign up to one of the guided tours on offer.

#### PINACOTECA DI BRERA

This modest-sized gallery started out as a study collection of drawings and plaster cases for students at the Accademia di Belle Arti. Now it houses some of the region's finest collections – some apparently "borrowed" from Venice by famous scoundrels such as Napoleon – from as far back as the 13th century. Its most famous residents include Piero della Francesca's *The Virgin with Child* and Gentile Bellini's *St Mark Preaching in Alexandria*.

### SHOPPING

#### GRAND GALLERIA VITTORIO EMANUELE II

Take your eyes, and your wallet, out for a stroll in the Grand Galleria and you won't be disappointed. Located just opposite the Duomo, this extraordinary feat or architecture combines beauty, art and luxury shopping all under one sprawling and ornate glass roof.

### OUTDOORS

#### PARCO SEMPIONE

The large park grounds were established in the late 1800s, offering the busy inhabitants of Milan the chance to relax in the lushly-kept green spaces. Within its extended borders are several must-see structures such as Acquario Civico Milano aquarium, the Arena Civica amphitheatre and the Arco della Pace archway.

### OPERA

#### LA SCALA

The Teatro alla Scala opera house opened in 1778, replacing its fire-damaged predecessor, the Teatro Regio Ducale. Sit for an opera within the beautifully opulent 3,000-seat hall and you will see why the owners of this second incarnation wanted to keep it safe from fire, apparently placing 1,000 buckets of water on standby in the days when it was lit entirely by candlelight.

If opera isn't your thing, or you left it too late to get tickets, try one of the guided tours instead which definitely do not disappoint.

# Time for surgeons to tackle ‘our most lethal human attachment’ with new surgical techniques for LAA closure in AF

New data has shown that surgical left atrial appendage (LAA) clip closure techniques can significantly lower stroke risk in atrial fibrillation (AF), delegates will hear today in a session held in room Amber 3 from 12:45 to 14:00.

AF patients are at higher risk of stroke and around 95% of clots originate in the LAA – sometimes referred to as “our most lethal human attachment.”[1]

Speaking to *EACTS Daily News*, Thorsten Hanke (Department for Cardiac Surgery, Asklepios Klinik, Harburg-Hamburg, Germany), said that although LAA surgical closure techniques have been slow to take off, important new research published this year suggests that the time has now come for more surgeons to start using new techniques shown to reduce stroke risk. He added that key papers have been published in the past year showing a stroke risk reduction for patients undergoing surgical LAA-occlusion (S-LAAO).

“Three papers looked at mortality, neurological events and readmission rates,” said Professor Hanke. “All three papers showed a benefit for LAA when it comes mortality, and showed reductions in readmissions due to neurological complications and reduced the neurological events after the procedure compared to those not treated for the LAA.”

These papers include one study[2] by Friedman et al., which showed that in older patients with AF undergoing concomitant S-LAAO compared with no S-LAAO, the former had an association with lower risk of thromboembolism over three years. The authors concluded that the findings supported the use of S-LAAO but stressed that randomised trials are needed for further clarification. A second paper by Yao et al.[3] published in JAMA in May 2018 comparing surgical LAAO to no surgical LAAO during cardiac surgery found that LAAO was associated with a reduced risk of stroke and all-cause mortality. The third study by Elbadawi et al.[4] in patients undergoing coronary artery bypass grafting (CABG) found that patients having LAAO had a lower risk of hospital cerebrovascular events (although the authors said this benefit was outweighed by a higher risk of bleeding, pericardial effusion, cardiac tamponade, post-operative shock and in-house mortality).

“The stroke reduction risk of surgical LAAO is significant and cannot be ignored,” continued Professor Hanke. “Surgeons are still very reluctant to treat atrial fibrillation in the first place, and even more reluctant to treat the LAA. We now have a class I indication in the US to treat atrial fibrillation concomitantly but now we strongly believe that we have to address the LAA too.”

He went on: “If you treat AF in the OR and you don’t address the LAA by either clipping or excising it, you reduce your chance of a successful sinus rhythm restoration by up to 10%, because we know that – especially in patients with persistent AF – there is a source of AF within the orificium of the LAA. So, by clipping it or excising it, you eliminate those triggers that support AF. Therefore, it’s not only the neurological benefit from LAA – you also have an electrical benefit that translates into a higher success of sinus rhythm restoration in patients with persistent AF.”

*“We have seen great improvements in the data available showing that LAAO is an effective method for stroke protection.”*

Martin Bergmann

*“Our study concluded that LAA clipping during thoracoscopic ablation is a feasible and safe technique for the closure of LAAs in patients with atrial fibrillation. One of the most important findings was the low stroke risk in follow-up …This is really the first paper that shows thoracoscopic AA closure reduces ischaemic stroke risk.”*

Bart P. van Putte

Various surgical techniques for S-LAAO have been developed including suture ligation, stapling and surgical excision, but the closure rate is only 40–60% using these techniques, thus clot risk is still high.[5,6] On the other hand, LAA clipping has a demonstrated success rate of 95%.

Bart P. van Putte – a cardiac surgeon at the St Antonius Hospital, Nieuwegein, the Netherlands – will describe his latest research, published in ACC using thoracoscopic left atrial appendage clips. His study set out to document the closure rate, safety and stroke rate after thoracoscopic left atrial appendage clipping and followed 222 consecutive patients from the Netherlands and the US from 2012 to 2016.

The results showed complete LAA closure was achieved in 95% of cases, with no intraoperative or clip-related complications, and an overall 30-day freedom from complications of 96.4%. The freedom from cerebrovascular events after surgery was 99.1%. Median follow-up of 20 months and overall survival was 98.6%. The observed rate of cerebrovascular events after clipping was low (0.5 per 100 patient years).

“Our study concluded that LAA clipping during thoracoscopic ablation is a feasible and safe technique for the closure of LAAs in patients with atrial fibrillation,” said Dr van Putte.

“One of the most important findings was the low stroke risk in follow-up. This may be due to a combination of LAAO, rhythm control therapy and 43% anticoagulation use. This is really the first paper that shows thoracoscopic AA closure reduces ischaemic stroke risk.”

He added that randomised trials are required to compare this approach directly with and without cessation of NOAC therapy to assess the place of thoracoscopic LAA clipping for stroke prevention in AF.

“At the moment it is recommended (class 1) to continue anticoagulation [2016 AF guidelines] after ablation for AF – this will probably change in the 2020 ESC guidelines,” continued Dr van Putte.

“We know that anticoagulation therapy is responsible for an annual major event rate of about 10%. Anticoagulation medications that are meant to prevent embolic events are actually quite dangerous drugs, which we would like to stop prescribing them after the procedure – but we need evidence that it is safe to discontinue.”

Martin Bergmann interventional cardiologist at Cardiologicum, Hamburg, Germany, will stress that there is good evidence from his speciality in support of LAAO procedures for reducing stroke risk. “We have seen great improvements in the data available showing that LAAO is an effective method for stroke protection. This is more the case in interventional closures than surgical closures, but I would regard this as transferable if surgical closure is proven to be effective, which has not been the case in the past.”

What’s more, Professor Bergmann said he was encouraged by the research papers published this year on LAAO surgical techniques with clips, saying they added to the understanding of the procedure.

“At the moment some of the LAAO procedures used in interventional procedures are used in patients who are contraindicated for warfarin and NOACs most of the time. These are patients who are at increased risk of bleeding, especially the elderly aged 80 years or even older,” he explained.

“For the surgical LAAO approach, the benefit lies in not using it as a standalone procedure but as part of other surgery, such as with ablation for AF.”

*“We now have a class I indication in the US to treat atrial fibrillation concomitantly but now we strongly believe that we have to address the LAA too.”*

Thorsten Hanke

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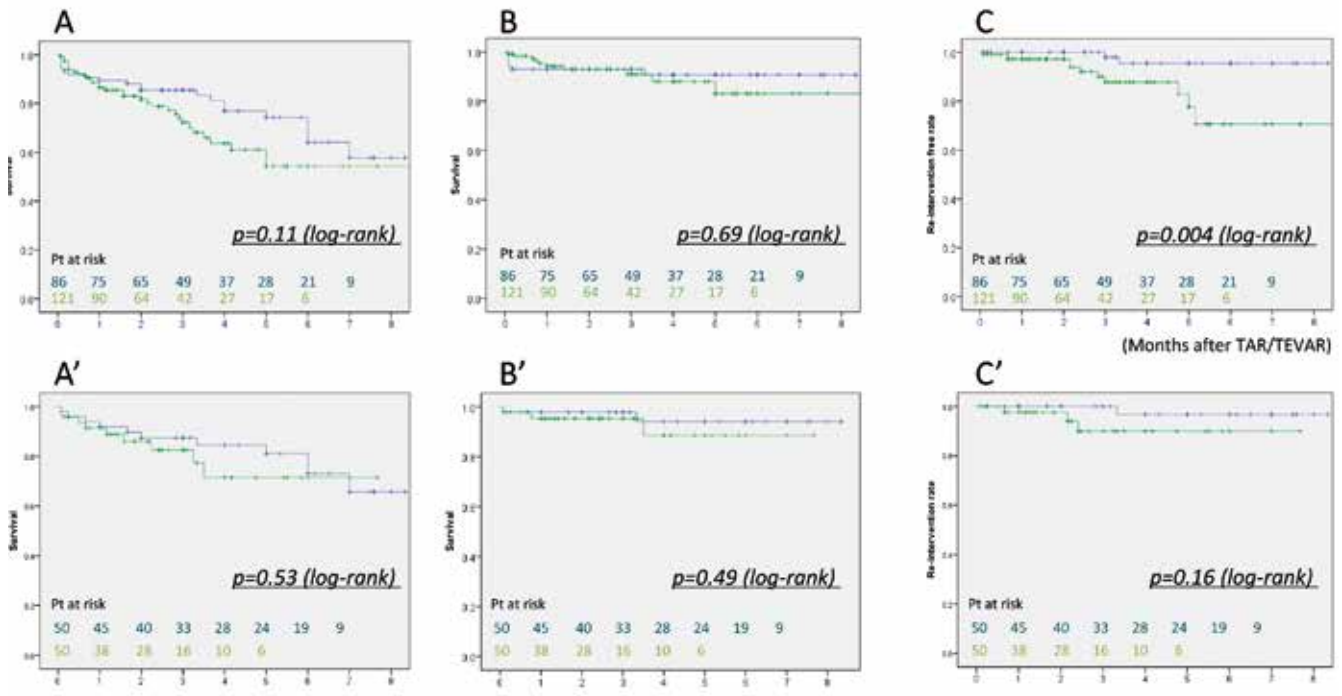
Vascular | Abstract | Working from inside the aorta with surgical input

# Is debranching thoracic endovascular aortic repair acceptable as the first choice for aortic arch aneurysm in the elderly (>75-years-old)?

**Yoshimasa Seike[1], Hitoshi Matsuda[1], Tetsuya Fukuda[2], Yoshiro Hori[2], Yosuke Inoue[1], Atsushi Omura[1], Kyokun Uehara[1], Hiroaki Sasaki[1] and Junjiro Kobayashi[1]**
1. Department of Cardiovascular Surgery, National Cerebral and Cardiovascular Center, Osaka, Japan; 2. Department of Radiology, National Cerebral and Cardiovascular Center, Osaka, Japan

The Hybrid Team in the OR, including Yosuke Inoue, Nana Kawano, Yoshimasa Seike, Kyokun Uehara, Sakiko Matsuo, Atsushi Omura, Hitoshi Matsuda, Natsumi Yasunaga, Erika Abe, Naoko Matsumoto, Miki Kuroki, Hiroaki Sasaki and Aya Kawamura




(TOP) Survival curve, entire cohort: (A) Freedom from all causes of mortality, (B) Freedom from aortic death. (C) Freedom from aortic re-intervention.
(BOTTOM) Survival curve, score-matched cohort: (A') Freedom from all causes of mortality, (B') Freedom from aortic death. (C') Freedom from aortic re-intervention.

In patients of advanced age, total arch replacement (TAR) or debranching thoracic endovascular aortic repair (d-TEVAR) should be selected in accordance with the risk for open surgery and the anatomical features of the aorta. Advanced age is generally a powerful independent predictor for early postoperative complications after conventional TAR.[1] In contrast, there is increasing evidence that TEVAR can provide acceptable early results in patients deemed to have a high risk for open surgery.[2] Since 2008, we have applied d-TEVAR for treating aortic arch aneurysms mainly for selected elderly patients aged >75 years. However, of whom we should select is still a challenging issue when both techniques are equally available, especially in patients with poor vascular condition and/or the anatomical difficulty of a short landing zone for d-TEVAR.[3]

The aim of this study was to reveal the differences of mid-term outcomes between TAR and d-TEVAR, and to assess the validity of d-TEVAR as a first choice for aortic arch aneurysms in the elderly. In general, comparable study in these two groups is difficult due to the dissimilarity of patients' backgrounds and biased surgical decision. In the present study, we compared propensity score-matched (PSM) groups to compensate for this insufficiency.

We reviewed 86 patients with TAR (64 men; age 78 ± 2.9 years) and 121 with d-TEVAR (90 men; age 82 ± 4.5 years) between 2007 and 2017. A total of 50 patients from each group were matched by their propensity scores.

Freedom from all-cause mortality at two- and four-years was similar between both groups (88% and 77% in TAR, 82% and 64% in d-TEVAR, p = 0.11). The rate of freedom from reintervention at 2- and 4 years was significantly higher in TAR (100/96%) than d-TEVAR (97/88%; p = 0.006). PSM yielded similar survival (88%/85% in TAR vs 86%/71% in d-TEVAR, p = 0.53) and comparable freedom from reintervention rates (100% and 97% in TAR, 98% and 90% in d-TEVAR, p = 0.16; Figure). Using Cox regression analysis, cerebral infarction (HR, 3.9; p = 0.005 in TAR/ HR, 3.1; p = 0.002 in d-TEVAR) was identified as an independent positive predictor of overall mortality in the both groups.

In conclusion, mid-term outcomes after both TAR and d-TEVAR were satisfactory, and evaluation using PSM revealed no differences. D-TEVAR is acceptable as the first-choice procedure for aortic arch aneurysms in patients older than 75 years.

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Cardiac | Abstract | Surgical aortic valve replacement from bench to bedside

# The effect of surgical versus transcatheter aortic valve replacement on endothelial function

**Marco Moscarelli[1,5], Fiorella Devito[1], Khalil Fattouch[2], Patrizio Lancellotti[3], Marco Matteo Ciccone[4], Paola Rizzo[5], Francesco Viceli Dalla Sega Francesco[5], Alfredo Marchese[1], Gianni Angelini[6] and Giuseppe Speziale[1]** 1. GVM Care & Research, Department of Cardiovascular Surgery, Anthea Hospital, Bari, Italy; 2. GVM Care & Research, Department of Cardiovascular Surgery, Villa Maria, Palermo, Italy; 3. University of Liege, GIGA Institute, Belgium; 4. Department of Cardiology, University of Bari, Italy; 5. Department of Morphology, Surgery and Experimental Medicine, University of Ferrara, Italy; 6. Bristol Heart Institute, University of Bristol, UK

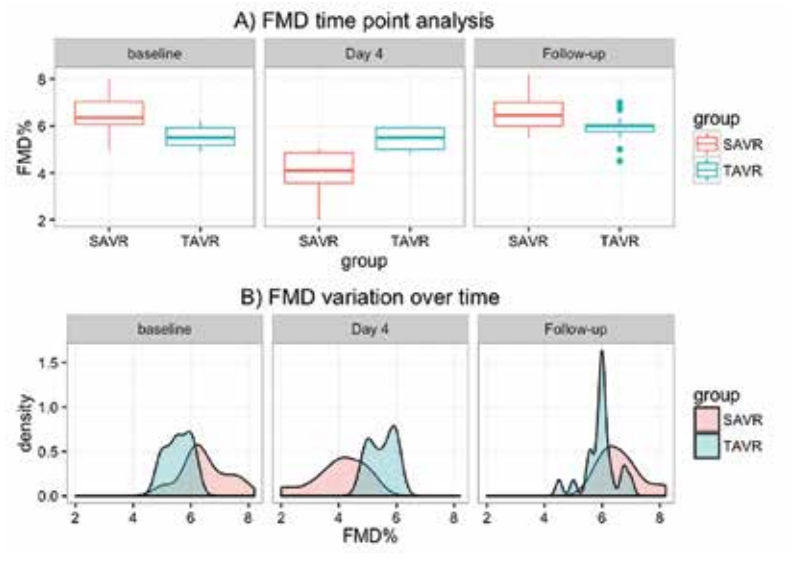
Aortic stenosis (AS) affects not only the left ventricle but also vascular and endothelial function. Patients with endothelial dysfunction have an increased risk of cardiovascular events, yet the influence of conventional surgical aortic valve surgery (SAVR) with the aid of cardiopulmonary bypass (CPB) and cardioplegic myocardial protection versus transcatheter aortic valve replacement (TAVR) on endothelial function is unknown. TAVR is indicated in high-risk patients, but growing evidence suggests that a percutaneous approach may be equally beneficial for intermediate-risk patients. Technique superiority is judged based on standard outcomes such as mortality, morbidity, and long-term freedom from reintervention; however, novel markers of hemodynamic performance such as flow-mediated dilation (FMD) and apoptotic rate in human umbilical vein endothelial cells (HUVECs) as a measure of endothelial dysfunction are increasing in popularity.

Marco Moscarelli

Giuseppe Speziale

We investigated the effects of surgical and transcatheter aortic valve replacement on early and 90-day endothelial function measured by brachial FMD and apoptotic rate in HUVECs in patients with significant aortic stenosis, intermediate risk of surgery, and no coronary artery disease.

We conducted a prospective, observational case-control single-blind study at a single tertiary centre. Endothelial function was measured at baseline, early post-procedure (four days), and follow-up (90 days). A blood pressure cuff was used to elicit reactive hyperaemia for measuring brachial wall shear stress and FMD. The apoptosis rate was observed in the HUVECs after a 48-hour incubation with 20% serum (derived from the patient). The rate of apoptosis was assessed by determining the number of annexin V and propidium iodide positive cells by flow cytometry.




Early post-procedure flow dilation was significantly lower in the surgical group ($p < 0.003$). At follow-up, both groups showed incremental increases in FMD. The surgical group's apoptotic rate did not significantly change, while the transcatheter apoptotic rate steadily decreased, suggesting a trend toward improved endothelial function.

The data suggest that conventional surgical aortic valve replacement may be associated with an early and transient decrease in endothelial function, likely due to the use of CPB.

Congenital | Abstract | Surgical videos

# Combined Ross-Konno procedure and coronary ostial plasty for the treatment of hypercholesterolaemia aortic valvulopathy in three patients

**Mehmet Salih Bilal** Cardiovascular Surgery Department, Medicana International Istanbul Hospital, Turkey

Welcome to the 32nd EACTS Annual Meeting in this charming city of Milan, a quintessential melting pot of civilization, culture and history. It is a great honour and privilege for me to be invited to this meeting to share our surgical experiences related to the treatment of hypercholesterolaemic aortic valvulopathy encountered in patients with homozygous familial hyperlipidaemia syndromes (HFHS).

We have operated on three patients (serum LDL levels: 897 mg/dl, 719 mg/dl and 421 mg/dl, respectively) with significant aortic stenosis with small aortic roots in association with coronary ostial stenosis related to HFHS in the last two decades (in 2000, 2006, and 2017). All patients were young females. We performed the Ross-Konno procedure for aortic valve replacement in this patient population at child bearing age. We augmented the coronary ostial stenosis with autologous or heterologous pericardial patches, which were fixed with glutaraldehyde.

Two of the patients had left main coronary ostial stenosis, however our last patient had significant stenosis of both the left main and right coronary arteries. Pulmonary valved conduits were implanted at a pulmonary position in all cases, and all patients are being followed up without any symptoms. Our first patient had a de novo right coronary artery stenosis 15 years after the surgery, which was treated with percutaneous intervention. Our second patient who was operated in 2006 had two subsequent childbirths without any cardiac or perinatal complications.

This indication for the Ross-Konno procedure with concomitant coronary ostial plasty is a rare surgical intervention, which has only been reported by our group in the English literature. Unsurprisingly, cardiovascular aetiology is the single most important cause of mortality in familial hyperlipidaemia (FHL) patients, since the underlying hyperlipidaemia leads to a malignant premature atherosclerosis.

Therefore, follow-up for development of recent coronary artery lesions is deemed mandatory, along with strict and effective anti-hyperlipidaemia therapy and plasmapheresis, if needed. The long-term function of pulmonary autografts at the aortic position in this patient population is an important issue of concern, however our experience supports encouraging results.

Important to note is that the dilatation of the autograft may resist the development of premature atherosclerosis. Moreover, the Ross-Konno procedure may be suitable with this indication even when the patients have Marfan syndrome or any other connective tissue disorder, which are traditionally contraindications for pulmonary autograft implantation at the aortic position. However, obtaining a pulmonary homograft is not mandatory for pulmonary reconstruction, since valved conduits have satisfactory function at the pulmonary position in these patients.

Once again, I would like to welcome my colleagues from all over the world to this fascinating event, which will give us a priceless opportunity to share our experiences.

Thoracic | Rapid Response | Oncology 1

# Risk factors and effects of conversion from VATS to open lobectomy: analysis from a national database

**Stefano Bongiolatti** Thoracic Surgery Unit, Careggi University Hospital, Florence, Italy

Video-assisted thoracoscopic surgery lobectomy (VATS-L) has become a safe and effective alternative to conventional thoracotomy, associated with a shorter length of stay, reduced postoperative pain, preserved pulmonary function, fewer postoperative complications and better compliance with adjuvant chemotherapy.

VATS-L is still considered a demanding procedure with potentially serious intra-operative complications that will require thoracotomy. Analysing the literature, the unexpected conversion rate ranges from 2.5–23%, while the rate of emergent conversion is under 1%. However, there are a lack of multicentre studies investigating the risk factors, causes and effects of conversion on early post-operative outcomes.

We performed a retrospective study using the Italian VATS Group Database – a multicentre, web-based data system for collecting and reporting clinical characteristics, patterns of care and outcomes on patients treated with a VATS-L procedure. The Italian VATS Group has maintained this prospective database since January 2014. At the time of the latest report, there were more than 50 participating centres (general thoracic surgery units or services, not individual surgeons) and about 6,000 collected cases.

Our study population consisted of patients who received VATS-L as the primary procedure for non-small-cell lung cancer (NSCLC) at VATS Group participating centres between 1 January 2014 and 31 December 2017. After exclusions, we identified 4,629 patients who underwent planned VATS-L for NSCLC, and of these 432 (9.3%) required conversion to thoracotomy. Comparing the causes of conversion with the VALT classification system[1] (V: vascular, A: anatomic, L: lymph nodes, T: technical), we observed that the higher percentage of conversions were due to anatomical reasons (45.1%) such as adhesions, fused fissure, anatomical anomalies and oncological findings. VATS uncontrollable bleeding was the second reason of conversion in about a third of cases, and in 23.9% the thoracotomy was due to the presence of fibro-calcified hilar lymph nodes.

Although conversion is often unexpected, some studies have identified risk factors including older age, impaired lung function, male sex, presence of fibro-calcified lymph nodes, clinically node-positive disease, larger tumour size and use of induction therapy. In our study, the multivariable analysis clearly demonstrated the association of conversion with the male gender, reduced FEV1 and clinical lymphatic involvement. Furthermore, these results demonstrated that patients with large tumours or those undergoing induction treatment had similar risks of conversion, thereby demonstrating the feasibility of VATS-L. Thus, the minimally invasive approach should not be denied to these groups of patients.

The second consideration is the impact of unexpected thoracotomy on early post-operative outcomes. After an extensive analysis on post-operative outcomes we detected worse results in converted patients – especially in terms of a higher incidence of complications, more extensive blood loss and longer hospital stay. These results, while seemingly obvious, are corroborated and validated using an expansive data set collected via a national database.

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Cardiac | Rapid Response | Atrial fibrillation surgery: room for improvement

# Complete left-atrial lesion set vs PVI only in patients with paroxysmal AF undergoing CABG or AVR

**Simon Pecha** University Heart Center Hamburg, Germany

## Introduction

In patients with paroxysmal atrial fibrillation (AF) undergoing coronary artery bypass grafting (CABG) or aortic valve replacement (AVR), many surgeons are reluctant to open the left atrium to perform a complete left-sided Cox-Maze lesion set. Pulmonary vein isolation (PVI) is often preferred in those patients. Here we analysed rhythm course and outcome of patients with PVI compared to those receiving an extended left atrial (LA) lesion set.

## Methods

Between 2003 and 2016, 817 patients underwent concomitant surgical AF ablation in our institution, with 294 patients with paroxysmal AF treated by surgical ablation concomitant to AVR or CABG. Ninety-eight patients received a complete Cox-Maze left atrial lesion set, while 196 patients were treated with an isolated PVI. The primary endpoint of the study was freedom from AF at 12 months follow-up.

## Results

There were no statistically significant differences regarding baseline patient characteristics. No major ablation-related complications occurred in any of the groups. In the PVI group, two patients (2.0%) experienced intraoperative stroke, while three (1.5%) patients had a stroke in the extended LA ablation group. In patients receiving an extended LA lesion set, mean cross clamp time was 21 ± 8.6 min longer when compared to the PVI group. In-hospital mortality was 3.3% in the PVI group, versus 2.7% in the extended LA group (p = 0.34). Freedom from AF at 12 months follow-up was 77% in the extended LA ablation group vs 70% in the PVI group, showing no statistically significant difference (p = 0.27).

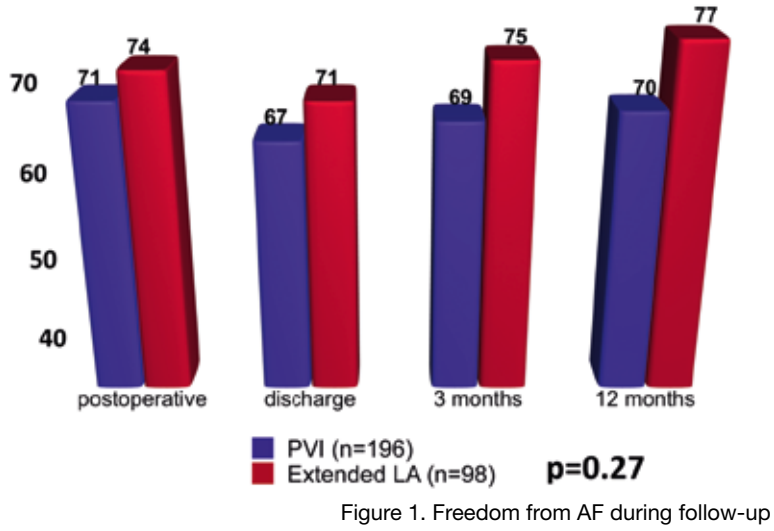


Figure 1. Freedom from AF during follow-up

## Conclusions

Surgical AF ablation concomitant to CABG or AVR in patients with paroxysmal AF is safe and effective. There was no statistically significant difference between PVI and an extended LA lesion set in terms of freedom from AF after 12 months. Besides a longer cross-clamp time for patients in the extended LA group, there were no other differences between groups. Thus, PVI may be sufficient in this special patient population.

Thoracic | Focus Session | Innovations in thoracic surgery

# Artificial intelligence and machine learning

**Shanda H. Blackmon**
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The very technology that is used to drive healthcare, personalised marketing campaigns, analyse complex genomic and patient data, predict the likelihood of disease, interpret radiology tests and make clinical decisions already exists in our world. "Artificial intelligence (AI) – also referred to as augmented human intelligence at the Mayo Clinic – has been utilised in healthcare to develop software and algorithms that approximate human cognition, facilitating the analysis of complex medical data, and machine learning utilises natural language processing and cognitive computing to drive innovative healthcare.

Company initiatives such as IBM Watson, Microsoft Azure Machine Learning, and Health Catalyst have well-developed neural networks that are utilised for such use. People use AI any time they ask Siri, Alexa, or Google to help them find something.

The Mayo Clinic has utilised AI in the development of rapid diagnosis tools for stroke, complex analysis of ECG data to predict underlying disease, analysis of pulmonary nodules, management of oesophagectomy patients, and to predict changing patterns in the lung after surgery, to ultimately predict function. Each of these novel technologies will be reviewed when I speak on artificial intelligence and machine learning during the EACTS Annual Meeting.

Anything that allows us to get to a faster and more complete diagnosis, triage patients in a more efficient manner, or assimilate complex data into a concise narrative reliably can save lives. In an increasingly complex world with more data, we must develop neural networks that empower us to process the cacophony into a symphony for the patient.

The lowest-hanging fruit is to substitute slower, outmoded risk prediction rulesets with machine learning models. For example, the LACE Index is used to predict 30-day all cause readmissions. Length of stay (LOS), a primary variable in this index, cannot be factored in until the day of discharge, thus limiting real-time use and intervention while the patient is still in the hospital. And the datasets used to establish the scoring system are limited too. Machine learning can automatically predict a readmission using highly correlated data, so it's considerably more accurate. Where a LACE score calls fields from just a handful of variables, a machine learning model can call from hundreds.

Using machine learning models is more challenging upfront – though still easier than using a clinical trial to select LACE characteristics – because the machine learning model must be trained with data, but on the hand the algorithm doesn't need to be invented because the machine does this, so it's incomparably more efficient in the long run.

### Five steps to building a machine-learning model according to healthcare catalyst

What follows are five critical steps to building a machine-learning model. While some might seem so obvious, they are easy to overlook:

1. Define the "use case". It must have a broad impact and be actionable. For example, a readmission risk score is much more valuable while the patient is still in the hospital than after discharge. Predicting a risk score solves part of the problem, but it needs to get into the hands of somebody who can act on it. Define the who, what, how, and why of the problem you are trying to solve with machine learning. Who is going to deliver the intervention? When is it going to be delivered? Rather than jumping ahead to how machine learning will be used, get to the problem first and then figure out how machine learning will be used to solve that problem.
2. Prepare the data. Machine learning models are built on datasets with many different patients and features (age, gender, diagnosis, LOS, financial class, health habits, etc.) The more information, the better. Features are presented as columns in a data table; rows are the individual patients or patient encounters. With a good use case and a dataset of 10 features and 5,000 rows (of course, more is better!), it's possible to predict something.
   It's also necessary to label the dataset. Using the readmission risk prediction example, each row of data needs an outcome associated with it, either yes/readmitted or no/not readmitted. This is called labelling the dataset. When it's time to train the model, the algorithm learns associations between features and labels. Over the course of learning, the algorithm recognises patterns – for example, that all patients under a certain age were not readmitted, or that all female patients between 55 and 65 diagnosed with condition X who had a recent LOS of less than two days were readmitted. The learning can become very specific and the algorithm uses the learning to generate a risk score for the next new patient.
   Data needs to be arranged and prepared for machine learning. The dataset cannot have missing values. If a row is missing a blood pressure reading, then that feature must be filled in using, for example, the average blood pressure for that patient.
   The feature engineering process takes existing variables and transforms them to make them more useful to the model. For example, a calendar date may need a day of the week associated with it to understand what day of the week has the highest rate of catheter-associated urinary tract infections (CAUTI) in the hospital.
3. Train the model. To do this, set aside a quarter of the labelled data (the testing or validation set) for later use. Use the other three-quarters (the training set) to train the model. Other splits, such as 80 percent/20 percent are also fine.
   All algorithms generally work by checking data and looking for patterns. The machine learning algorithm (e.g. logistic regression or random forest) learns patterns in the labelled training set to predict outcomes. When a solution is reached, the algorithm is trained.
   Now, the question is how well it generalises new data. A model can fit perfectly to the data it was trained on, but then new data is essentially useless because the algorithm is too specific (doesn't generalise well). The validation dataset is used to evaluate the model for how well it generalises new data. This defines model accuracy.
   During this process, it's common to try 10 different algorithms, tweaking each one with slightly different parameters to see the variation in performance. Typically, most of the models perform similarly. It comes down to how good the dataset is at predicting the outcome and what the underlying structure of the data is like. An algorithm might do well on some datasets, but poorly on others. Therefore, it's important to try different algorithms. Typically, a poor dataset will generate poor results from any algorithm. The quality of the data is what really matters for the quality of the machine learning model.
4. Make predictions on new data. This step is more conceptual than technical. Save the approved model so that when new data comes in (a patient is admitted), it can predict a score that's in line with the training data.
   We build our models so that, once trained, they can be put into production. When tables containing all the patient information are refreshed every night, the model runs and gives a prediction for those patients. We're only limited by how often data refreshes, though we have the potential to generate risk scores in real time, as patients are admitted.
5. Deliver risk scores for use in clinical decision support. Give risk scores to clinicians in visualizations that are easy to interpret and quick to deliver insight and value.

These five steps are an iterative process. Once arriving at the third step, it may be apparent that the model isn't accurate. This is an opportunity to change the use case so it still addresses valuable questions, while making it easier for the model to answer them. If the desired results are still elusive, it's possible to add more data (find more patients) or more features.

*"In an increasingly complex world with more data, we must develop neural networks that empower us to process the cacophony into a symphony for the patient."*

Shanda H. Blackmon

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Cardiac | Focus Session | How do I start my coronary practice: The devil is in the details

# Do not neglect the vein! A view from a resident

**Miia Lehtinen** University of Helsinki, Helsinki, Finland and Kymenlaakso Central Hospital, Kotka, Finland

During the last decade, arterial grafts for coronary bypass surgery have caught much attention: many trials have reported the superiority of an arterial graft over a vein graft with regards to graft patency. However, both in Europe and in the US, the majority of surgeons still prefer to use vein grafts [1,2] and only rarely is total arterial revascularisation performed. The use of saphenous vein grafts has a long tradition as it was the first graft to be used in the early days of modern bypass surgery. In addition, especially for a young surgeon, easier techniques and easier access to a vein graft make it the number one choice for a second conduit.

Despite trials pointing to the inferior patency rates of vein grafts, it can be argued that, at least to some extent, it is the harvesting techniques that determine the fate of this graft type. A lot of attention should be paid to make this graft reservoir of even greater value and quality. In my presentation during the session "How do I start my coronary practice: The devil is in the details" I will go through different aspects of vein harvesting that can hamper the success of the whole bypass operation. A vein is a delicate structure and is easily damaged by, for example, too much distension or the incorrect storage solution.

Different surgical techniques for harvesting a vein graft have been reported as affecting patency rates, too. A classic example is a traditional open harvest technique versus endoscopic vein harvest. Regarding the latter, after the early, somewhat upsetting results, conclusions drawn from numerous later studies remain more indecisive. Another example is traditional open harvest technique versus the so-called no-touch technique and Kim technique. The latter two have been studied only in a handful of trials but show encouraging results. These techniques deserve more patient data from well-performed large-scale studies.

Today, the indifference towards the vein graft is clearly mirrored in the number of randomised clinical trials (RCTs) studying ways to improve vein graft patency. Fortunately, it seems that surgeons have noticed this unfairness and a couple of very interesting RCTs are currently under way. I definitely look forward to their results.

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Cardiac | Abstract | Beyond conventional risk scores: Predicting mortality and serious morbidity

# Early warning intensive-care scores can accommodate intra-operative events in predicting surgical outcomes

**Priyadharshanan Ariyaratnam**
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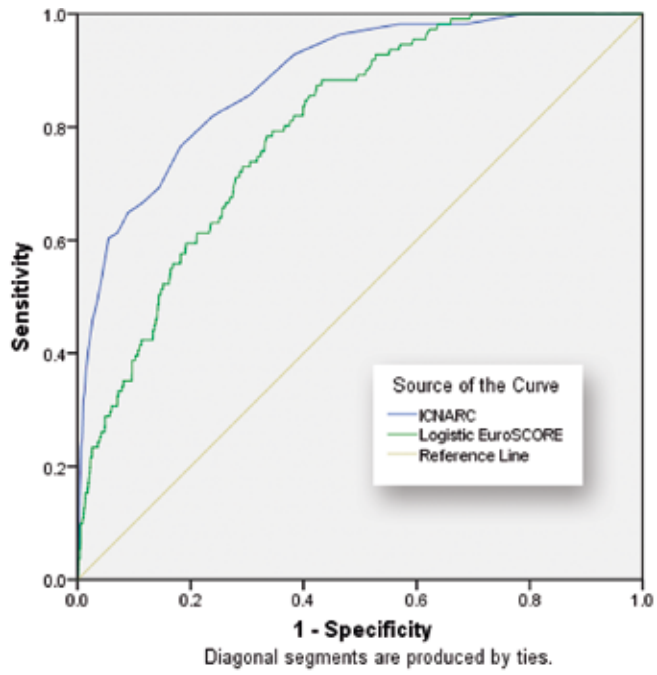
In an era of cardiac surgery in which we are becoming more and more focused on minimising adverse events, risk prediction models become more and more relevant. Preoperative scoring systems such as the EuroSCORE and STS scoring systems are excellent in predicting postoperative mortality but do not adjust for events that take place intraoperatively. For example, what may look like a routine set of grafts with a preoperative EuroSCORE mortality risk of 1% suddenly become a nightmare postoperatively when the patient is placed on emergency extracorporeal membrane oxygenation (ECMO) due to inadequate myocardial protection, excessive bleeding or the inability to graft calcified coronaries intraoperatively.

The EuroSCORE therefore becomes less meaningful in predicting what will happen in these scenarios, and it may be better to use a risk model that we can extrapolate from the first few hours of admission into intensive care after cardiac surgery – a model which takes into account intraoperative events in predicting not only mortality but also complications such as renal failure.

We evaluated whether one such score used in the UK, ICNARC (Intensive Care National Audit and Research Centre), could accurately predict perioperative and long-term outcomes in cardiac surgery. The ICNARC score is made up of biochemical and physiological variables in intensive care. We performed a prospective cohort study using peri-operative data from the ICNARC Audit and Dendrite database of 4,446 consecutive cardiac surgical patients operated between January 2011 and April 2018 at our institution. Receiver Operating Curves (ROCs) were used to evaluate how well the ICNARC scores predicted in-hospital mortality and post-operative complications (renal failure, pulmonary complications, gastrointestinal complications and multi-organ failure) and Cox-regression analysis was used to determine factors affecting long-term survival.




ROC Curve for ICNARC vs EuroSCORE for predicting Multi-Organ Failure

The mean Logistic EuroSCORE I was 6.75 (± 8.4) and the mean ICNARC Score in the first 24 hours of ICU was 13.4 ± 5.3. The c-indices for the ROC graphs for the ICNARC score were 0.840 for in-hospital mortality, 0.858 for renal failure, 0.665 for pulmonary complications, 0.764 for gastro-intestinal complications, 0.702 for neurological complications in general and 0.654 for confusion, and 0.885 for multi-organ failure showing excellent discriminatory potential. The comparison of ROC curves for predicting multi-organ failure between EuroSCORE (c-index 0.797) and ICNARC is shown in the figure.

From Cox-regression analysis, the significant ($p < 0.05$) predictors of mid-term mortality (5 years) were a higher ICNARC Score, higher age at surgery, COPD, pre-operative renal failure, pre-operative neurological co-morbidity, arteriopathy and non-CABG surgery.

We conclude from our data that ICNARC is simple to collect and an excellent scoring system for predicting postoperative mortality, renal failure and multi-organ failure in the first 24 hours of cardiac surgery – and it can predict long-term mortality too. ICNARC can therefore be used as an early warning screening tool to predict which patients are at higher risk for post-operative organ failure so as to implement more aggressive monitoring and treatment strategies.

Cardiac | Rapid Response | Optimising perioperative care in cardiac transplantation

# The Glasgow experience of extended myocardial protection: A novel method of implantation to reduce primary graft dysfunction after heart transplantation

**Sanjeet Singh Avtaar Singh** Scottish National Advanced Heart Failure Service, Golden Jubilee National Hospital, Glasgow, UK

Around 2,000 heart transplants are performed in Europe annually. Primary graft dysfunction (PGD) rates in Europe are among the highest in the world, the increasing use of marginal donor organs being suggested as a potential cause. In turn, this has resulted in a renewed interest in perfecting myocardial protection techniques to increase the yield of organs retrieved.

We compared our experience with this method with the national UK cohort of patients (control group; 2015–2016).

A total of 253 patients were studied; 28 patients were in the Glasgow group and 225 in the control group. The mean age of the recipients was 47.2 ± 13.5 years and the donors 38.3 ± 12.1 years. The incidence of PGD was 40.7% (n = 103) with 17.8% (n = 45) having severe PGD requiring institution of advanced mechanical circulatory support within 24 hours of transplantation.

The Glasgow method patients had a lower pulmonary capillary wedge pressure and mean pulmonary arterial pressure compared to the control group, with an overall reduction in post-operative PGD rates. The odds ratio of PGD in the control group was 2.97 (95% CI 1.0148–8.6765) when compared to the Glasgow group.


Heart transplant recipients at the Golden Jubilee National Hospital during an organ donation campaign

The Glasgow experience caused significant reductions in PGD and short-term mortality post-transplantation. This is likely attributed to the shorter warm ischaemic time. Larger studies are needed to show differences after further adjustment for known confounders of PGD. We believe this novel technique is safe, cost-effective and reproducible.

Cardiac | Abstract | The tricuspid valve dilemma: between confirmations and denials

# Tricuspid regurgitation in aortic valve replacement, what should we do?

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Published transcatheter aortic valve implantation (TAVI) results have indicated how right ventricular function, tricuspid regurgitation (TR) and pulmonary hypertension (PH) negatively affect these procedures, leading clinical practice guidelines to favour surgery as the therapeutic option for this patient group when the risk is manageable.

However, there are few studies that back surgical results and evaluate whether TR should be treated at the same time as the aortic valve replacement (AVR). Indeed, the impact that TR and HP have on patients undergoing AVR is unclear, and the pathophysiological mechanisms through which TR and PH appear in aortic stenosis (AS) are exceedingly complex.

That is why we decided to analyse these aspects, studying the clinical profile, TR incidence in AS and the possible effects of tricuspid annuloplasty in patients with moderate-severe TR. We designed a retrospective cohort study (January 2001 to January 2018) which included 8,080 patients with AVR. From this population we analysed those who presented TR, dividing the sample into two groups: patients with mild TR (non-significant, n = 92) and those with moderate-severe TR (significant, n = 51). Patients presenting severe HP constituted 95.8%. Functional class was more advanced in patients with significant TR, with 84% being in functional class III-IV (p = 0.028). EuroSCORE 1 was greater among patients with significant TR (23.1 ± 16.9; p = 0.001), as was the ratio of women to men (46% vs 26%; p = 0.013).

There were differences in the tricuspid annular plane systolic excursion (TAPSE) score (11 vs 13.2) and in left atrial diameter (47 mm vs 52 mm; p = 0.001). There were no differences in left ventricular ejection fraction (LVEF), reoperation surgery occurred in 38.5% of the cases.

Proportional Cox analysis demonstrated that significant TR was associated with increased mortality regardless of sex (hazard ratio [HR] 2.14, 95% confidence interval [CI] 1.27 to 3.61), respiratory failure (HR 3.68, 95% CI 2.06 to 6.57), liver failure (HR 8.0, 95% CI 2.95 to 21.68), renal failure (HR 1.14, 95% CI 1.05 to 1.24), EuroSCORE (HR 1.02, 95% CI 1.00 to 1.03), LVEF (HR 1.01, 95% CI 1.00 to 1.03 for EF < 50%) and tricuspid annuloplasty (HR 4.006 [1.262–12.716]; p = 0.019]. The presence of TR increased the risk of in-hospital mortality compared to patients without TR. However, in the group of patients with analysed TR, mortality did not correlate with TR degree (p = 0.387). The Cox multivariate model revealed that tricuspid annuloplasty was associated with increased mortality risk. By multiple regression analysis, only tricuspid annuloplasty (p = 0.012), postoperative length of hospital stay (p = 0.001), chronic obstructive pulmonary disease (p = 0.001), and NYHA (class III-IV) (p = 0.022) remained significant predictors of overall mortality. Overall survival was similar in patients with significant TR and non-significant TR (log rank p = 0.404), and also if patients with tricuspid annuloplasty were excluded (log rank p = 0.271).

Although the series is small, the results observed are highly relevant. It is possible that we do not have an in-depth grasp of the mechanisms by which pulmonary hypertension or right ventricular dysfunction appear, nor our ability to reverse them once established – despite surgical treatment.

**Professional Leadership Course, 26–27 November 2018, Windsor, UK**

# The Hybrid surgeon

"What's special about surgery is that you are invading people's bodies in a dangerous way," says neurosurgeon and acclaimed writer of *Do No Harm*, Henry Marsh. "It is the seriousness of things if they go wrong – the thought of the damaged patient and a miserable family after the operation – that makes things difficult. You have to keep your nerve despite these anxieties and yet at the same time remain human."

To be a surgeon requires a high degree of intellectual concentration and extensive training, as well as manual dexterity and excellent hand-eye co-ordination and visuospatial awareness. But it demands something from another dimension as well. "You don't just want to give a patient the technical information," Marsh continues, "you want to support them as well. But the nicer you are to patients, the more it hurts when things go badly, so there's a strong element of self preservation in treating patients in a cold and slightly detached way, to enable you to do your work."

So, surgery is a balance of detachment and compassion, hope and realism. It requires emotional resilience, a calm temperament and the ability to work well under pressure. It demands excellent social awareness and relationship management skills to deal with colleagues, patients and their families. As in many walks of life, it requires the ability to lead and manage a team. And above all, it requires the finest judgement to make the best decisions on behalf of another, the patient. That's quite a blend of skills and personal qualities.

The learning journey as a consultant surgeon never stops. Experience counts – as does exploring other interests in life that broaden our perspectives – but so too can the choice to engage in continuous professional development. With this in mind, and following the success of the course in the autumn of 2016, EACTS is once again hosting a two-day Professional Leadership Course for consultant surgeons in Windsor, UK on 26–27 November. Last time, participants told us it was "a good investment," and "something they would definitely recommend to a colleague or friend."

The course isn't clinically focussed – rather it explores the core values required for effective leadership with a strong emphasis on Emotional Intelligence, or EI – a learnable set of skills, attitudes and approaches which inform a leader's style and which, research indicates, contributes 90% of the difference between average and great leaders.

The Course is interactive, fully engaging participants with objectives to increase their self-awareness, and develop leadership skills for the benefit of themselves, the team, and most importantly, the patient. Ethics and logistics are also key themes throughout; it is understood that in today's environment, hospital departments are in a continuous state of flux, therefore navigating the politics and managing high-performance teams is critical if the best outcome for the patient is to be ensured.

The two-day event draws on tested academic behavioural models in exploration of several key topics: EI and authenticity, building and maintaining high performance teams, and integrity and ethical decision-making. There will also be a highly interactive workshop on Political Savvy, designed to equip and encourage individuals to steer a course around organisational barriers, and actively engage in the political sphere in an ethical and systematic way.

The programme will be delivered once again by the warm, self-effacing master of emotional intelligence, Roger Delves, together with consultant haematologist Jane Stevens, currently preparing for a doctorate focusing on the personal development of doctors, and the sustainability of the National Health Service (NHS) in the UK. They will be joined by Rebecca Stephens, a leadership coach and Britain's first woman to climb Mount Everest.

There'll be reading beforehand. Come prepared. Expect to be stretched. This is a course for consultant surgeons serious to further every aspect of their careers.

## Course Facilitators

Roger Delves is Professor of Leadership Practice and Dean of Qualifications at Ashridge Hult International Business School in the UK. He is a member of the Ashridge management team and teaches across a range of Ashridge and Hult qualification programmes.

Rebecca Stephens, MBE is the first British woman to climb Everest and the Seven Summits – the highest mountains on each of the seven continents. A writer, lecturer and leadership coach, she is Adjunct at the Ashridge Executive Education Hult International Business School, and head of the Rotterdam School of Management's Kilimanjaro MBA Leadership elective.

Dr Jane Stevens MD, MCRP, FRCPath, MBA studied medicine at Manchester University, UK. With 20 over years of experience in the NHS, latterly as a divisional director in an acute provider trust, she developed an interest in the current challenges facing doctors in the NHS. She is currently writing a doctorate in organisational change at Ashridge Hult International Business School, where she has recently been appointed as a member of the faculty.

Aortic Valve Repair Summit

# EACTS Aortic Valve Repair Summit 2019

## The world's largest meeting on aortic valve repair

Dear Colleagues,

It is with a great pleasure that we invite you to the fifth edition of the Aortic Valve Repair Summit (AVRS) to be held 20–21 June 2019 in Brussels, Belgium. Save this date in your agenda – it is your chance to participate in the largest meeting on aortic valve repair ever. This time the Summit comes back to Brussels where it was born four years ago thanks to a collaborative effort between two pioneers in aortic valve repair, Professor Gebrine El Khoury and Professor Hans-Joachim Schäfers. After the first two editions in Brussels, a third AVRS was held in Ottawa (led by Dr Munir Boodwani), followed by last year's in Paris, organised by EACTS and led by Dr Emmanuel Lansac. Hence, many experts have joined this project.

The enthusiasm and the need for such a big meeting on aortic valve repair was felt ever since the beginning of the Summit story. Aortic valve repair is establishing itself so much into daily practice worldwide that more than 45 countries have participated in each edition of the Summit. Conscious of this fact, and in pursuit of their educational mission, last year EACTS accepted not only to endorse the Summit but to also to integrate aortic valve repair into their very well-structured educational programme. Indeed, this is a very unique opportunity for surgeons who want to initiate such a programme or develop their skills.

Enriched by the collaboration of committed experts and EACTS, the AVRS has become a scientific meeting where all schools of thought are represented. As you can expect, this generates two exciting days of intellectual challenges and fruitful debates. The Summit's roster of lectures, debates, abstract sessions, live surgeries and live-on-tapes ensures that there are plenty of learning opportunities, with a programme that not only covers surgical treatment, but also assessment modalities, medical management and timing for surgery. The Summit is an ideal opportunity for adult and congenital heart teams to get stuck in to the latest developments in these exciting fields.

The most recent edition of the Summit, held in Paris, was a real success, welcoming an attendance of 250 participants from 47 different countries. Endorsement of the AVRS by EACTS has added another dimension to the meeting, helping it reach a level reserved only for the leading events dedicated to valve repair.

In Paris, the lectures and debates were very well appreciated by the audience and the two abstract sessions were of very high quality. The best abstract prize rewarded a study from Dr Vincent Chauvette and Dr Ismail El Hamamsy from the Montreal Heart Institute, Canada (*"Is root remodelling with annuloplasty a reasonable alternative to root reimplantation in patients with connective tissue disorders? A multi-centre study from the AVIATOR registry"*). The objective of the Paris meeting was to mix highly technical training with discussion. Therefore, live cases were a big part of the programme, with participants being able to follow entire procedures and interact with the surgeons. The live cases were completely different from each other, and they basically represented the prime indications of valve repair with main validated techniques such as valve-sparing procedures and isolated aortic valve repair, including bicuspid and unicuspid repair.


Furthermore, because the AVRS meeting aims to gather together all of the different schools of aortic valve repair, the live cases were interweaved with pre-recorded cases which demonstrated different perspectives and techniques on a given issue. By doing so, participants could choose the approach that spoke most to their skillset, and opt to participate in one of the Level 4 courses organised by EACTS in Paris, Brussels, Homburg or Rome. These courses, limited to a core audience, offer a deep dive into the techniques developed by the different schools of aortic valve repair.

Despite growing standardisation and the availability of very efficient techniques for aortic valve repair, many questions remain unsolved and debated. The AVRS is the place where all of those questions will be placed front and centre of the discussion. If you want to participate actively in this exciting event don't hesitate to prepare your best abstract and video. Submission will open at end of this year on the EACTS website.

We're expecting to meet you at the next Aortic Valve Repair Summit in Brussels.

**Laurent de Kerchove**

On behalf of the organisation committee.

**The Level 3 EACTS technical course on aortic valve repair, 'Annuloplasty for aortic valve repair: a standardised approach' will take place from 27–29 March, 2019 in Paris, France.**

Vascular | Rapid Response | Flying over the arch with a parachute on board

# Benefit without risk: adding the classic elephant trunk to total arch replacement

**Leonard N. Girardi** Department of Cardiothoracic Surgery, NewYork-Presbyterian Hospital / Weill Cornell Medicine, New York, NY, USA

Since the introduction of the elephant trunk technique by Borst in 1983, the ideal management of extensive aortic disease remains elusive. Over the last two decades, enthusiasm for a variety of hybrid techniques to manage aortic disease involving multiple segments including the arch has grown. Literature searches on aortic arch surgery and the elephant trunk technique currently produce results saturated by studies of hybrid techniques, in particular the frozen elephant trunk.

Proposed advantages of hybrid techniques have included the potential to avoid the morbidity and mortality associated with the use of deep hypothermic circulatory arrest and the potential to avoid second stage open descending thoracic and thoracoabdominal aortic repair. The most concerning disadvantages seen with these novel hybrid techniques include higher than expected incidences of devastating spinal cord injury and renal failure, and a lack of data supporting improvement in operative mortality. Furthermore, the reported rates of distal aortic reintervention remain significant. All of these factors call into question the reality of a hybrid, single-stage "ideal." Despite the technical advances in both endovascular and open repair, extensive aortic disease remains a difficult challenge to manage and continues to incur significant morbidity and mortality. It is thus imperative to continue critical evaluation in both endovascular and open arenas in order to improve outcomes for this formidable disease.

We examined our own prospectively collected data on patients undergoing open aortic arch replacement over the last twenty years in order to examine differences in outcomes for patients undergoing total arch replacement vs total arch replacement with elephant trunk. During the study period, 200 patients had isolated total arch replacement. Ninety-seven had total arch replacement with a classic elephant trunk. Preoperative characteristics were similar to those reported in the literature for total arch repair performed with hybrid techniques, including the presence of a large percentage of patients requiring emergent repair. Propensity matching was used to neutralise the differences in baseline characteristics among patients undergoing the two different types of operation. There were no significant differences in major adverse events or in mortality. The rate of overall in-hospital mortality was 3.3%. The rate of permanent neurologic deficit was 1.2%, and the rate of paraplegia was zero. Postoperative renal failure requiring dialysis was 2.4%. Procedure type did not predict worse outcomes.

Our data suggest that open repair of aortic arch disease, including the use of the classic elephant trunk, remains a viable technique with favourable results when performed in a high-volume aortic centre. Extensive aortic disease continues to incur significant morbidity and mortality, and ongoing research to improve outcomes is necessary. This must include reflection on our current capabilities in open repair in order to guide our enthusiasm for novel hybrid approaches.

Cardiac | Abstract | Modern antithrombotic therapy after cardiac surgery

# Effects of ticagrelor with or without aspirin on saphenous vein graft patency under on-pump or off-pump one year after coronary artery bypass grafting: a post-hoc subgroup analysis of the DACAB trial (DACAB-PUMP)

**Yunpeng Zhu** Ruijin Hospital Jiaotong University School of Medicine, Shanghai, China

The DACAB trial (NCT02201771) was a randomised controlled trial comparing different antiplatelet regimens (ticagrelor plus aspirin, T+A; ticagrelor alone, T; or aspirin alone, A) on saphenous vein graft (SVG) patency one year after CABG. At one-year follow-up, the proportion of patent grafts was significantly greater in the T+A group when compared with T alone and A alone at both the graft- and patient-level. Compared with US and European practice, a higher proportion of patients (approximately 75%) in this trial underwent CABG surgery without cardiopulmonary bypass support (off-pump CABG). Some studies have suggested that more potent antiplatelet therapy is important in off-pump CABG. In this subgroup analysis, we aimed to explore the effects of ticagrelor with or without aspirin on SVG patency one year after on-pump or off-pump CABG.

Five-hundred patients (1,460 grafts) from the DACAB trial were included in this subgroup analysis, with 121 patients in the on-pump subgroup (T+A = 39, T = 36, A = 46) and 379 patients in the off-pump subgroup (T+A = 129, T = 130, A = 120). The generalised estimating equation model was applied in graft outcome analyses. Per-graft analysis revealed that one-year SVG patency was 86.4% for on-pump and 81.5% for off-pump CABG (adjusted OR = 0.63, 95% CI: 0.37–1.08), p = 0.092. The one-year SVG patency was 91.7% for on-pump and 87.7% for off-pump in the T+A group, 84.2% for on-pump and 82.4% for off-pump in the T group, and 83.2% for on-pump and 73.9% for off-pump in the A group. Compared with A alone, T+A showed higher patency rate in the off-pump subgroup (adjusted OR = 0.35, 95% CI: 0.20–0.62), and in the on-pump subgroup (adjusted OR = 0.62, 95% CI: 0.16–2.45); interaction p-value = 0.647. Ticagrelor alone did not show higher patency rate in either off-pump (OR = 0.92, 95% CI: 0.31–2.76) or on-pump subgroup (OR=0.58, 95% CI: 0.34–1.00), interaction p-value = 0.430. Similar results were seen in patient-level analyses.

Thus, we observed that the on-pump subgroup showed numerically better one-year SVG patency than the off-pump subgroup in the DACAB trial. Ticagrelor plus aspirin showed consistent benefit for achieving one-year SVG patency in both on- and off-pump subgroups, with particular benefit being seen in the off-pump subgroup.

Thoracic | Rapid Reponse | Oncology 2

# Comparison of salvage surgery and pulmonary resections after induction chemoradiotherapy for locally advanced lung cancer patients

**Aki K. Kobayashi** Department of Thoracic Surgery, National Cancer Centre Hospital, Tsukiji, Tokyo, Japan

For early-stage, non-small-cell lung cancer (NSCLC) patients, surgical resection with lymph node dissection has been the standard of care. However, for patients with locally advanced NSCLC, the optimal treatment remains controversial, and effort has been ongoing to find better loco-regional and systemic treatments.

Local recurrence after definitive chemoradiation therapy (CRT) is often seen in patients with advanced stage lung cancer, and the prognosis after failure of definitive CRT is poor, with a survival rate of as low as 5% to 25%.

In recent years we have heard more about salvage surgery and its feasibility, and due to the introduction of more effective chemical or molecular agents and more sophisticated methods of radiation therapy for locally advanced lung cancer treatment, we tend to encounter patients in relatively good physical condition, with recurrence of disease after definitive chemoradiation therapy in our daily practice.

In order to determine the feasibility of salvage surgery after definitive chemoradiation therapy, we compared a salvage group (S) and an induction group (I) undergoing pulmonary resection after induction of chemoradiation therapy for clinical N2 NSCLC. Mean age was 63.5 years (range 20–78) in the S group and 61.4 (38–74; p = 0.951) in the I group. Median radiation dose was 60 Gy in the S group (range 26–72) and 45 Gy (40–45) in the I group.

Surgery in group S consisted of 6 pneumonectomies (right:left = 1:5), 1 bilobectomy, 8 lobectomies, 2 segmentectomies and 1 lymphadectomy for remaining lymph nodes. In the I group, 2 bilobectomies and 16 lobectomies were performed.

The timeframe from completion of chemoradiotherapy to surgery was a mean of 916 days (range 85–5,070) in group S and 32 days (range 19–127) in group I (p = 0.001).

Operation time was 177 minutes (mean, range 88–381) in the S group and 128 minutes (mean, range 112–313) in the I group (p = 0.841). Blood loss was 579 ml (mean, range 3–292), and 127 ml (mean, range 6–760) in the S and I groups, respectively (p = 0.136).

Post-operative hospital stay in the S group was 7.4 days (mean range 4–49) and 6.9 days in the I group (mean, range 4–14; p = 0.846). Post-operative morbidities were found in two S-group patients (broncho-pulmonary fistula and SSI), and one patient required oxygen therapy at home following discharge from hospital. There were two cases of prolonged air leakage, chylothorax and tachycardia in the I group. There was no mortality 30 days after surgery in either group.

The overall survival at five years in the S and I groups was 28.1% and 61.8%, respectively, while progression-free survival was 19.2% and 37.5% at five years. There was no 30-day mortality in either group, and there was no significant difference in terms of perioperative and postoperative course. The only difference was found in the length of the interval from chemoradiotherapy to surgery which did not affect the outcomes in our study.

Salvage surgery is feasible in highly selected patients with a tolerable rate of morbidity and post-operative outcome.

Aki K. Kobayashi

**Figure 1: Aim : to evaluate feasibility of salvage surgery after CRT**

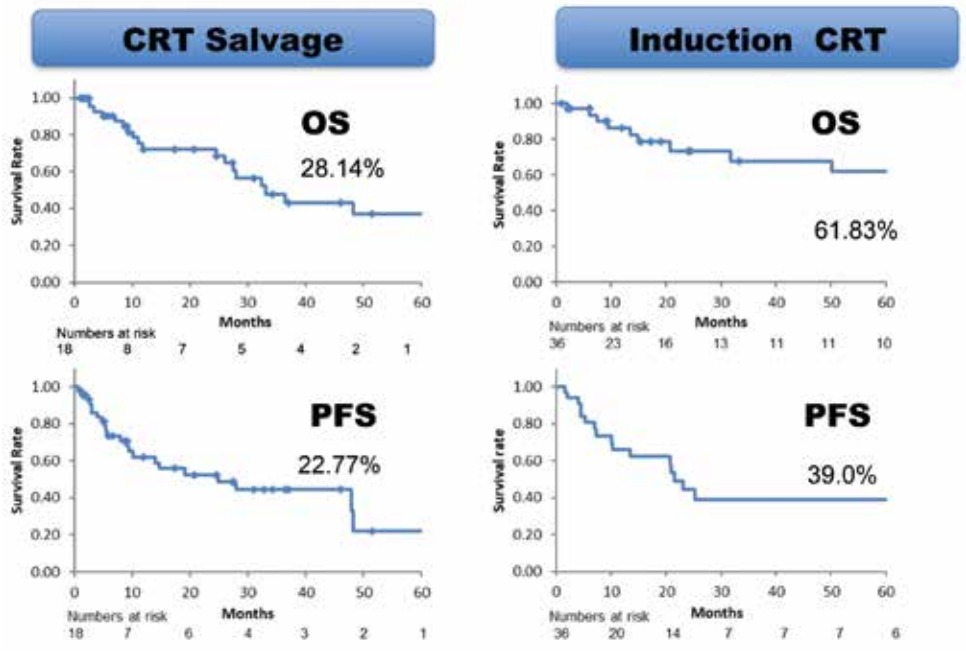
7,290 cases of surgery for lung cancer (2000-2018), 18 Salvage surgery (0.25%), 36 Induction CRT (0.49%)

| | Salvage n=18 | Induction n=36 | |
|---|---|---|---|
| Age (years mean) | 63.5 (20-78) | 61.4 (38-74) | p=0.951 |
| PS<br>0<br>1<br>2<br>n/d | <br>14<br>2<br>1<br>1 | <br>24<br>7<br>4<br>1 | |
| Radiation dose (Gy) | 60 (26-72) | 45 (40-45) | p=0.001 |
| Time to surgery (days) | 916 days (85-5070) | 32 days (19-127) | p=0.001 |
| Surgical procedures<br>Pneumonectomy<br>Bilobectomy<br>Lobectomy<br>Segmentectomy<br>Lymphadectomy | <br>6<br>1<br>8<br>2<br>1 | <br>2<br>34 | |

**Figure 2: Post-operative course of the patients**

| | Salvage n=18 | Induction n=36 | |
|---|---|---|---|
| Operation time (mins) | 177 mins (88-381) | 128 mins (112-313) | p=0.841 |
| Blood loss (ml) | 579 (3-292) | 127 (6-760) | p=0.136 |
| Postoperative hospital stay (days) | 7.4 (4-49) | 6.9 (4-14) | p=0.846 |
| Morbidity | 2 (11.1%)<br>SSI,<br>broncho-pulmonary fistula | 4 (11.1%)<br>2 Prolonged air leakage,<br>Tachycardia, Chylothorax | |
| Mortality in 30 days | none | none | |
| R0 resection | 18 (100%) | 36 (100%) | |
| Therapeutic effect<br>0<br>1a<br>1b<br>2<br>3<br>n/d | <br>1<br>7<br>2<br>1<br>0<br>7 | <br>1<br>6<br>8<br>16<br>3<br>2 | |

Figure 3



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Congential | Abstract | Heart failure and mechanical circulation

# A new 2D echocardiographic approach to evaluate the membrane and valve movement of the Berlin Heart EXCOR VAD chamber in paediatric VAD patients

**Arianna Di Molfetta** Policlinico Gemelli Hospital, Università Cattolica del Sacro Cuore, Rome, Italy

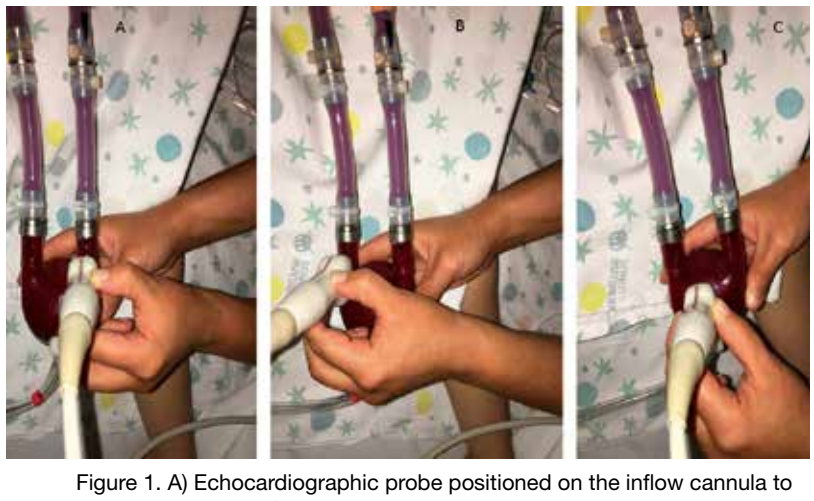



Figure 1. A) Echocardiographic probe positioned on the inflow cannula to examine valve function. B) Echocardiographic probe positioned on the outflow cannula to examine valve function. C) Echocardiographic probe positioned on the Berlin Heart EXCOR VAD chamber to study membrane movement.

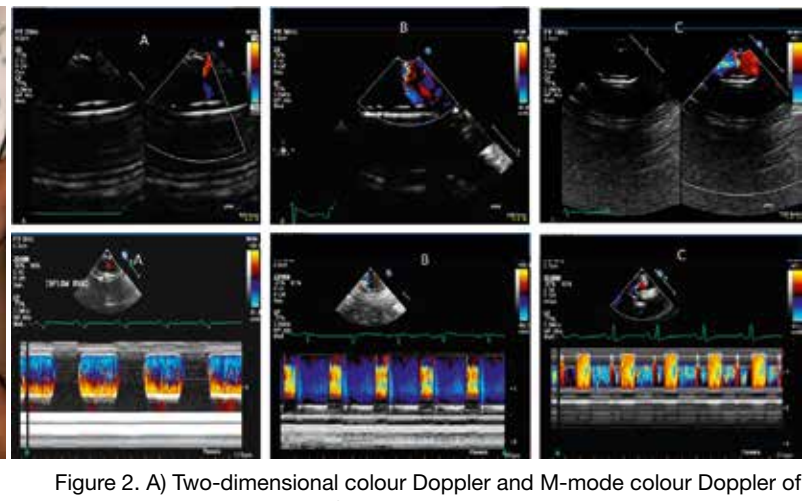



Figure 2. A) Two-dimensional colour Doppler and M-mode colour Doppler of a normal functioning valve. B) Two-dimensional colour Doppler and M-mode colour Doppler of a valve with a mild regurgitation, (c) Two-dimensional colour Doppler and M-mode colour Doppler of a valve with a moderate regurgitation

Echocardiography is useful to evaluate VAD function and the interaction between VAD and the native ventricle. There is a paucity of data regarding the evaluation of pulsatile flow VADs functioning such as the Berlin Heart EXCOR VAD (BH), which is mostly used in paediatrics. Assuming that the BH is a system composed of two artificial valves and a moving membrane, we conducted a serial and systematic echocardiographic study of these BH components enrolling all paediatric patients undergoing BH implantation at our institution from 2014 to 2017. For all patients, the BH pump was evaluated weekly by ECHO (Figure 1).

Forty BH chambers in 18 paediatric patients were prospectively analysed: 18 were 10 mL pumps, 6 were 15 mL, 12 were 25 mL, 2 were 30 mL, 1 was 50 mL and 1 was a 60 mL pump. Seven BHs were placed as right-sided VADs, and 33 on the left. Concerning the inflow valves, results revealed that 20 had no regurgitation, 14 had mild regurgitation and 5 a moderate regurgitation (Figure 2). For the outflow valves, there were 15 cases of no regurgitation, 21 with mild regurgitation and 3 with moderate regurgitation (Figure 2). In three cases, severe valve regurgitation was observed with backflow into the heart chamber.

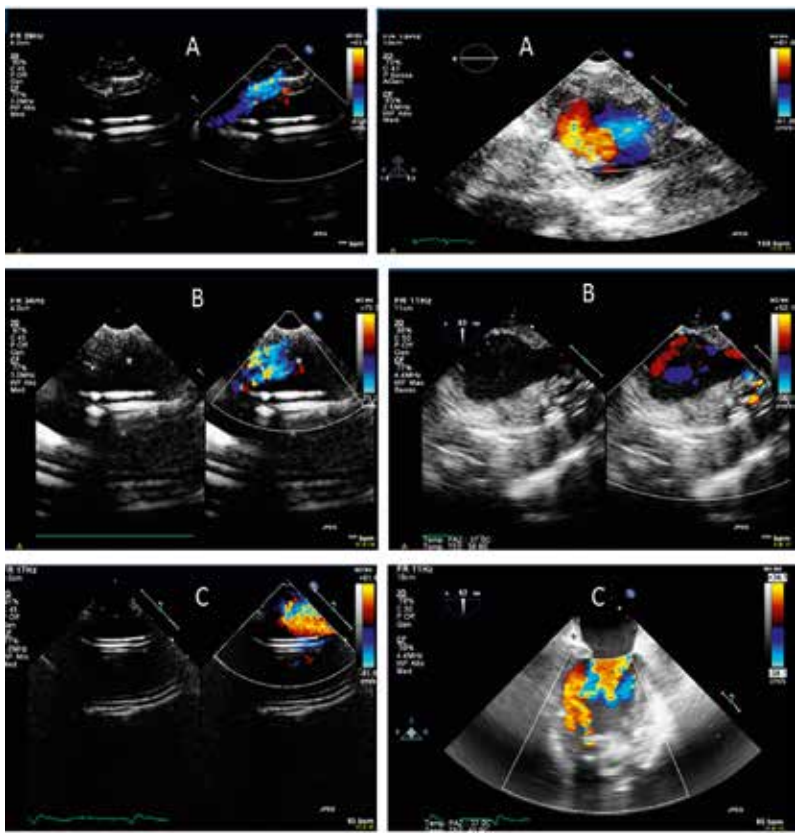



Figure 3. A) Two-dimensional colour Doppler images of a valve with severe regurgitation and recycling into the left ventricle. B) Two-dimensional colour Doppler images of a valve with severe regurgitation and recycling into the right atrium. C) Two-dimensional colour Doppler images of a valve with severe regurgitation and recycling into the left ventricle

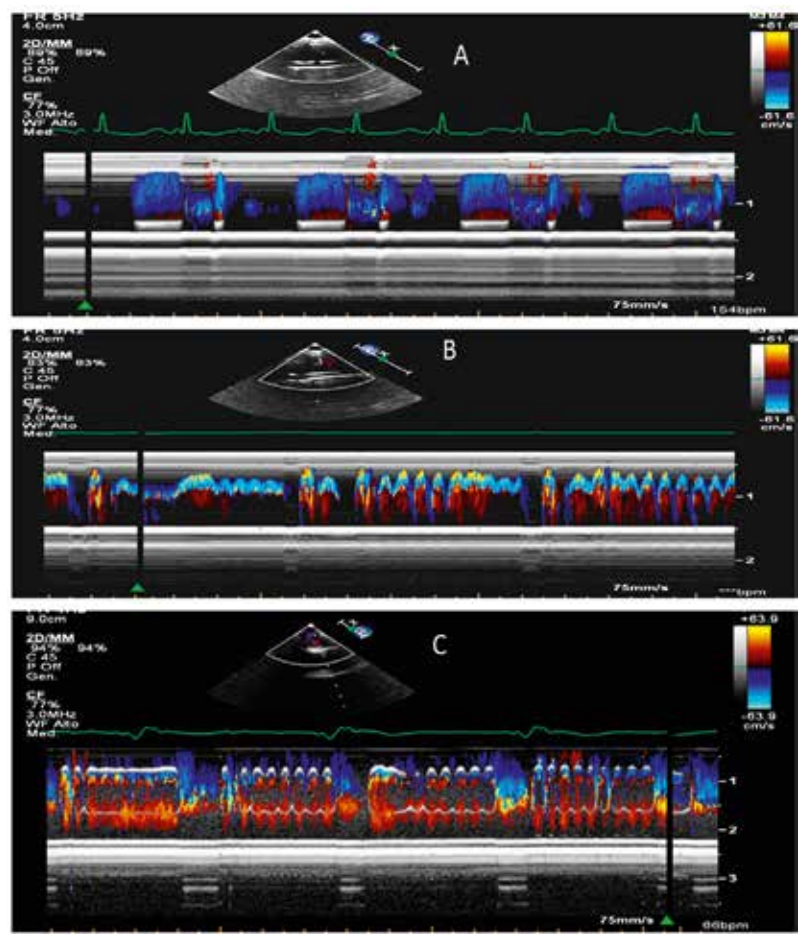



Figure 4. A) Beat phenomenon due to asynchronous work of the VAD and heart. B) Beat phenomenon due to atrial fibrillation. C) Beat phenomenon due to cannula compression

In the first case, the BH chamber was sent to the manufacturer who confirmed the BH valve alteration (Figure 3A). In the second case (Figure 3B), the valve regurgitation was due to cannula compression stemming from a combination of the patient's small chest and the large size of the cannulas. The problem was solved by keeping the patient's chest partially opened. In the last case, the valve regurgitation was due to suction phenomena (Figure 3C) and was solved by replacing the inflow cannula.

Finally, as the BH and the native heart are not synchronised, we evaluated the beat phenomenon when the aortic valve opens and the BH is ejecting, i.e. how this disturbance is transmitted to the BH and to the patient's cardio-circulatory system (Figure 4).

In conclusion, we observed that mild regurgitation of BH valves is often present but can be tolerated. Any time we observed moderate to severe regurgitation, we were able to correlate it to specific events such as BH malfunction, patient tamponade, cannula compression, or the patient's arrhythmias. The use of echo on the VAD could be an additional diagnostic tool to evaluate VAD patients permitting formulation of diagnostic hypotheses. Further studies are necessary to refine the method and to collect additional data to deeply understand the BH function and the interaction between the heart and the VAD using echocardiography as well as the possibility to detect thrombus formation.

# ‘Go with the flow’ for improved patient outcomes in CABG

On Saturday, final results of the prospective Registry for Quality Assessment with Ultrasound Imaging and TTFM (transit time flow measurement) in Cardiac Surgery (REQUEST) study will be presented, supporting the significant role played by intraoperative ultrasound imaging and flow measurements in improving patient outcomes in coronary artery bypass grafting (CABG).

REQUEST was an observational registry study gathering information on the frequency and type of procedural changes to CABG surgical strategy following routine assessment and imaging using MiraQ™ or VeriQ™ (Medistim ASA, Norway) systems combining high-frequency ultrasound (HFUS) and TTFM.

David Taggart (Professor of Cardiac Surgery, University of Oxford, UK) – one of seven lead investigators located across sites in Europe and North America – will present the final results of REQUEST during the symposium sponsored by Medistim.

“The most important thing is to go with the flow,” emphasised Professor Taggart in conversation with *EACTS Daily News*. “If the probe tells you there’s a problem, then there is one. If the probe tells you there is no flow in the graft, then there is no flow in the graft. Surgeons often think there’s something wrong with the probe, but there isn’t. The flow doesn’t lie.”

Intra-operative assessment is all about revising and improving outcomes on the spot. There are three key benefits to using the system intraoperatively during CABG: to guide aortic manipulation – clamping, cannulation, and side-biter by identifying and avoiding diseased areas of aorta; to guide the anastomotic target and internal mammary artery in situ; and to provide instant and accurate feedback on graft functionality.

The intraoperative probes used with MiraQ have regulatory approval for direct contact with the heart and vessels, in contrast to traditional ultrasound probes, which require use of a sterile sleeve.

Direct imaging of the aorta provides an excellent planning tool to assist in aortic handling, guiding clamp placement and where to cannulate. Further, the condition of the conduits may be evaluated prior to harvesting. The imaging probe also allows the surgeon to locate intramural coronaries and to find the best anastomotic site.

The TTFM component of the technology provides real time information on blood flow patterns; while on-screen calculations provide a Pulsatility Index (resistance parameter), percent of flow occurring during diastole and flow volume. Awareness and correction of these situations before chest closure results in improved patient outcomes.

“If you are doing something technically more challenging then it is a prerequisite that the patient is checked prior to leaving the operating room,” said Professor Taggart, who is an expert in the use of MiraQ. “If it’s 11 pm, and the phone rings at home, it’s not the hospital saying what a great job I’ve done, they’re calling to say there’s a problem. That problem will be a graft that did not appear to be an issue in the operating room, but which became one many hours later: the graft is now declaring itself blocked. When a graft fails in the operating room there is usually no change in blood pressure, or haemodynamic measures, so you wouldn’t know if you didn’t check.”

## REQUEST study

All patients included in the REQUEST trial had 2–3 vessel disease and were scheduled for CABG. Of these participants, 86% were men, mean age was 67 years, and mean body mass index was 29 kg/m$^2$.

The primary outcome was a change to planned procedure at the time of the operation, and procedural adaptions made by a surgeon when TTFM and/or HFUS identified suboptimal graft function. Secondary outcome measures included the number of revisions (intraoperative graft revision, the type of revision, and the key identifier motivating the revision); post-surgical major adverse cardiac and cerebral events (MACCE) prior to discharge of all bypass procedure patients entered into the registry; and the incidence rate of Serious Adverse Events (SAE) and/or Unanticipated Adverse Events (UAE).

Interim results were impressive. In summary, the results indicate that combining TTFM and HFUS imaging, in order to guide surgery and verify graft patency intraoperatively, led to surgical strategy changes in 26% of patients, and resulted in low-level in-hospital mortality and stroke rates.

*“By using this technology routinely, surgeons can improve their clinical result records, for example mortality and major morbidity figures.”*

David Taggart

The HFUS component of MiraQ was used for surgical guidance imaging of the aorta, conduit and coronary target. This led to changes in the planned aortic manipulation in 10% of patients, and HFUS specifically of the coronary target resulted in surgical strategy changes in 20% of patients. TTFM and HFUS were used for quality assessment of the anastomosis and led to an anastomotic revision rate of 3% in 8% of patients. Finally, in-hospital outcome measures (MACCE) revealed a mortality rate of 0.5% and stroke rate of 0.7%.

“We wanted to look at the importance of quality improvement in bypass grafting,” continued Professor Taggart. “Overall, the results of CABG are good, but we want to improve on this by doing more arterial grafts and off-pump surgery in high-risk patients, which are technically more challenging. It is almost mandatory that if we are doing technically more complex procedures that may benefit the patient more over the long term, we need to check before the patient leaves the operating room that we’ve got it right.”

With respect to imaging the aorta, the intraoperative information obtained via MiraQ tells the surgeon where not to touch the aorta in terms of cannulation or cross-clamping, said Professor Taggart. In addition, the probe also indicates the flow within the bypass graft. “In reality, in the vast majority of grafts that fail in the operating room, unless you attempt to measure it, you would not know that there was a problem until later,” he said, reinforcing his message about trusting the equipment and the information it provides.

Reflecting on the interim results of the REQUEST study, Professor Taggart said that the major outcomes were changes to proposed surgical strategy for aortic manipulation. “All surgeons can see and feel a heavily diseased aorta, but with an aorta that appears okay externally, you cannot determine and detect soft pliable plaque on the inside. It is this plaque that could potentially move to another part of the body and cause harm. For example, if it moves to the brain, it could cause a stroke.”

There were also significant changes as to where the surgeons proposed to place the graft. “[Visually], and by palpating with a finger, the surgeon can tell if there’s a soft spot, but it does not reveal disease on the posterior wall of the artery, meaning that the artery can potentially be opened in the wrong place,” added Professor Taggart.

Furthermore, problems connected to the anastomoses can be discovered by using the MiraQ ultrasound probe. This enables the surgeon to redo the anastomosis or change the conduit, if necessary.

## NICE and ESC/ EACTS guidelines

Implementation of combined TTFM/ HFUS imaging is highly variable. In Japan, Germany and the Nordic countries, > 80% of all operations are assessed using intraoperative flow assessment, but in the UK it is less than 15%. “The UK is conservative of this approach, and there might be a financial implication in its use,” remarked Professor Taggart.

However, in February this year, the National Institute for Health and Care Excellence (NICE) issued guidance on use of MiraQ for assessing graft flow. They stated that, “The case for adopting the MiraQ system in the NHS for assessing graft flow during CABG is supported by clinical evidence. The evidence suggests that intraoperative TTFM is effective in detecting imperfections that may be corrected by graft revision, and this may reduce the incidence of graft occlusion and may reduce perioperative morbidity and mortality.”

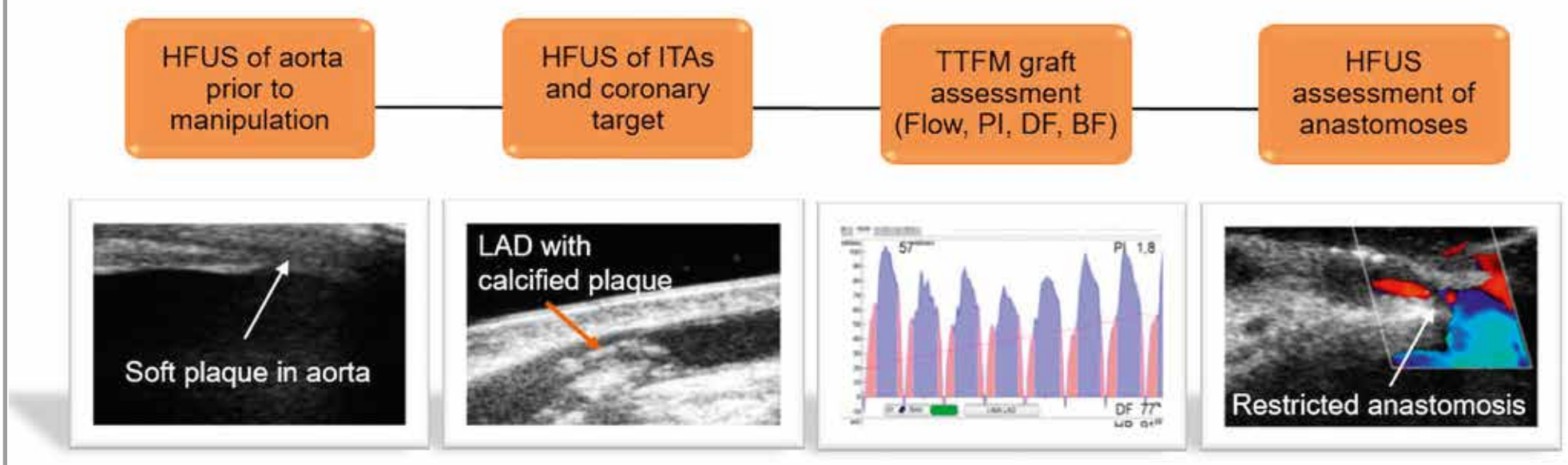
Of particular note, NICE added that, “The MiraQ system is associated with an estimated cost saving of £141 per patient compared with clinical assessment alone when it is used routinely for assessing CABG surgery in every patient.”

In addition, revisions to the ESC/ EACTS guidelines on myocardial revascularisation earlier this year provided some recommendations of relevance to the use of CABG. Firstly, there was a recommendation for CABG versus percutaneous coronary intervention (PCI) in complex disease with left main coronary artery or triple-vessel disease, with or without diabetes. This recommendation remains strong, with a strengthened level of evidence to support it. However, PCI remains an alternative in triple-vessel disease with low SYNTAX score, and without diabetes. The second recommendation of relevance was that epiaortic scanning should be considered prior to aortic manipulation (recommendation class IIa, level of evidence C). This latter recommendation is new. Thirdly, there was a recommendation for consideration of routine use of TTFM.

Ultimately, Professor Taggart stands by his mantra of “go with the flow”, highlighting that the key benefit is for the patient, because by routinely assessing the ascending aorta it significantly reduces the risk of a patient having a stroke. But there are benefits for the surgeon too: “By using this technology routinely, surgeons can improve their clinical result records, for example mortality and major morbidity figures,” he said. “By checking the patient prior to leaving the operating room the chances of subsequent difficulties are significantly reduced.”

Adding a comment on the system, Ms. Kari E. Krogstad, President and CEO, Medistim, said: “We acted upon advice from leading surgeons, that combining information from flow measurements with ultrasound imaging would take intraoperative guidance and graft functionality assessment to a higher level. The REQUEST study is proving that to be great advice.”

**Medistim’s session, ‘Intraoperative graft and aorta assessment: How to improve results in the OR. Lessons learned from the 1000 Patient REQUEST Registry’ will take place on Saturday at 12:45–14:00 in room Amber 5.**



# EACTS 2018 **Agenda**

## Thursday 18 October

| | | | |
|---|---|---|---|
| 8:15 | Degenerative mitral regurgitation: Bespoke management | Amber 1&2 | Adult Cardiac |
| 8:15 | Conflicting evidence on patient-prosthesis-mismatch | Amber 3 | Adult Cardiac |
| 8:15 | Modern antithrombotic therapy after cardiac surgery | Amber 5 | Adult Cardiac |
| 8:15 | Innovations in thoracic surgery | Amber 6 | Thoracic |
| 8:15 | Flow analysis and annulus modification after valve sparing surgery | Amber 7 | Vascular |
| 8:15 | Heart failure and mechanical circulation | Botticelli | Congenital |
| 8:15 | The Ross procedure solves all problems! | Brown 2 | Adult Cardiac |
| 8:15 | Minimising neurological risk in coronary surgery | Brown 3 | Adult Cardiac |
| 8:15 | Circuit of life | Michelangelo | Adult Cardiac |
| 8:15 | MMCTS Video cases – Vascular bailouts | Raphael | Vascular |
| 8:15 | Rapid Response 1 – Thoracic | Titian | Thoracic |
| | **Break** | | |
| 9:30 | Tetralogy of Fallot and pulmonary atresion / ventricular septal defect : Part 1 | Botticelli | Congenital |
| 9:30 | Relevant factor determining outcome after cardiac surgery | Michelangelo | Adult Cardiac |
| 9:30 | EACTS-STS – Treatment of type B aortic dissection in the era of stent-grafting – Acute dissection | Raphael | Vascular |
| 9:30 | Expert experiences with drafting your manuscript | Suite 5 | General |
| 9:30 | Oncology 1 | Titian | Thoracic |
| 9:30 | Trachea/airway | Amber 6 | Thoracic |
| 9:30 | New technology meets common practice – How to enhance your surgical portfolio | Auditorium | Adult Cardiac |
| 11:00 | Thoracic Mixed | Amber 4 | Thoracic |
| 11:00 | Tetralogy of Fallot & pulmonary atresion / ventricular septal defect. Part II | Botticelli | Congenital |
| 11:00 | Pulmonary thrombosis and hypertension and ventricular complications of myocardial infarction | Michelangelo | Adult Cardiac |
| 11:00 | EACTS-STS – Treatment of type B aortic dissection in the era of stent-grafting – Chronic dissection | Raphael | Vascular |
| 11:00 | Insights into clinical trials | Suite 5 | General |
| 11:00 | Time-pressured reactions to avoid casualties in type A dissections | Titian | Vascular |
| | **Lunch** | | |
| 12:45 | Transcatheter aortic valve implantation training | Amber 7 | Adult Cardiac |
| 14:15 | Transcatheter valve-in-valve implantation 2018 | Amber 1&2 | Adult Cardiac |
| 14:15 | Think Tank on European Cardio-Thoracic Surgery Training: Next Steps? | Amber 3 | General |
| 14:15 | Oncology 2 | Amber 4 | Thoracic |
| 14:15 | Coronary Artery Disease, Experimental Myocardial infarction and Heart Regeneration | Amber 5 | Adult Cardiac |
| 14:15 | HOCM | Amber 6 | Adult Cardiac |
| 14:15 | The tricuspid valve dilemma: between confirmations and denials | Botticelli | Adult Cardiac |
| 14:15 | Nightmares in end stage heart failure | Brown 1 | Adult Cardiac |
| 14:15 | Classics and novelties in the technical aspects of coronary artery bypass grafting | Brown 2 | Adult Cardiac |
| 14:15 | Functional mitral valve disease | Brown 3 | Adult Cardiac |
| 14:15 | Atrial fibrillation surgery: room for improvement | Michelangelo | Adult Cardiac |
| 14:15 | Working from inside the aorta with surgical input | Raphael | Vascular |
| 14:15 | Analyzing survival and events during follow-up | Suite 5 | General |
| 14:15 | Rapid Response – Congenital | Titian | Congenital |
| 14:15 | Hands-on Training Atrial Fibrillation | EACTS Training Village | Adult Cardiac |
| 14:15 | A practical approach to aortic valve repair | Auditorium | Adult Cardiac |
| | **Break** | | |
| 16:00 | Prediction and avoidance of complications in transcatheter procedures | Amber 1&2 | Adult Cardiac |
| 16:00 | Nightmares in cardio-thoracic surgery (Residents) | Amber 3 | Adult Cardiac |
| 16:00 | Beyond conventional risk scores: Predicting mortality and serious morbidity | Amber 4 | Adult Cardiac |
| 16:00 | Controversies & catastrophes in adult cardiac surgery | Amber 5 | Adult Cardiac |
| 16:00 | Update on molecular biology in lung cancer – for surgeons | Amber 6 | Thoracic |
| 16:00 | The host beyond valve surgery | Amber 7 | Adult Cardiac |
| 16:00 | Surgical videos | Botticelli | Congenital |
| 16:00 | How do I start my coronary practice: The devil is in the details | Brown 1 | Adult Cardiac |
| 16:00 | Minimally invasive mitral valve surgery – start up tool box | Brown 3 | Adult Cardiac |
| 16:00 | Optimising perioperative care in cardiac transplantation | Michelangelo | Adult Cardiac |
| 16:00 | Strategies to minimize end-organ damage in aortic surgery | Raphael | Vascular |
| 16:00 | EACTS/PASCaTS Joint Session | Suite 5 | Adult Cardiac |

## Friday 19 October

| | | | |
|---|---|---|---|
| 8:15 | How to do it (video) | Amber 3 | Adult Cardiac |
| 8:15 | Repeat before you treat | Amber 4 | Adult Cardiac |
| 8:15 | Heart transplantation | Amber 5 | Adult Cardiac |
| 8:15 | Oligometastatic disease | Amber 6 | Thoracic |
| 8:15 | Mechanical assist devices, extracorporeal support and left ventricular remodelling matrices | Amber 7 | Adult Cardiac |
| 8:15 | Ventricular assist device therapy: Problem or solution | Amber 8 | Adult Cardiac |
| 8:15 | New developments in left main disease | Auditorium | Adult Cardiac |
| 8:15 | Congenital miscellaneous | Botticelli | Congenital |
| 8:15 | Surgical aortic valve replacement from bench to bedside | Brown 2 | Adult Cardiac |
| 8:15 | Standard of care for P2 prolapse? | Brown 3 | Adult Cardiac |
| 8:15 | A Journey in coronary artery bypass surgery | Michelangelo | Adult Cardiac |
| 8:15 | “Gut feeling”: management for type A dissection while awaiting evidence. PART 1 | Raphael | Vascular |
| 8:15 | Expert experiences with science: starting a new project | Suite 5 | General |
| 8:15 | Non-oncology | Titian | Thoracic |
| 8:15 | Introduction to mitral valve repair: Wetlab | EACTS Training Village | Adult Cardiac |
| 8:15 | How to become a hybrid surgeon | Brown 1 | Adult Cardiac |
| | **Break** | | |
| 10:00 | Surgery for functional mitral regurgitation: potential for improvements! | Amber 1&2 | Adult Cardiac |
| 10:00 | Is less more? Hybrid and minimally invasive coronary revascularisation | Amber 3 | Adult Cardiac |
| 10:00 | New strategies to reduce bleeding beyond prolene | Amber 4 | Adult Cardiac |
| 10:00 | The new kid in town | Amber 5 | Adult Cardiac |
| 10:00 | Rare thoracic cancers (EUROCAN) | Amber 6 | Thoracic |
| 10:00 | Work in progress | Amber 7 | General |
| 10:00 | New data in atrial fibrillation ablation | Amber 8 | Adult Cardiac |
| 10:00 | Trial update – ART, IMPAG and MITRA FR & COAPT | Auditorium | Adult Cardiac |
| 10:00 | Long-term outcome after surgical repair in congenital heart disease | Botticelli | Congenital |
| 10:00 | Mechanical Circulatory Support (ventricular assist device) | Brown 2 | Adult Cardiac |
| 10:00 | Choosing the best valve sparing technique and how they compare with Bentalls | Brown 3 | Adult Cardiac |
| 10:00 | Infections and malignancy in cardiac surgery | Michelangelo | Adult Cardiac |
| 10:00 | “Gut feeling”: management of type A dissection while awaiting evidence. Part 2 | Raphael | Vascular |
| | **Break** | | |

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

| | | | |
|---|---|---|---|
| 11:45 | The importance of simulation training for CT surgeons | Amber 1&2 | Adult Cardiac |
| 11:45 | Work life balance/ Diversity in cardio-thoracic surgery | Amber 3 | Adult Cardiac |
| 11:45 | Optimizing outcomes of extracorporeal life support therapy | Amber 4 | Adult Cardiac |
| 11:45 | TAVI registries: Outcomes, impact and access in different countries | Amber 5 | Adult Cardiac |
| 11:45 | 2018 ESC/EACTS Guidelines on myocardial revascularisation | Auditorium | Adult Cardiac |
| 11:45 | Regenerative medicine hypoxia preconditioning and inflammation translation from bench to clinical practice | Brown 1 | Adult Cardiac |
| 11:45 | Tips and tricks to optimise your endocarditis practice | Brown 2 | Adult Cardiac |
| 11:45 | Settling the on vs off pump debate | Brown 3 | Adult Cardiac |
| 11:45 | PCI: Friend and foe | Michelangelo | Adult Cardiac |
| 11:45 | Let the pachyderm proboscis freeze: FET experience is increasing | Raphael | Vascular |
| 11:45 | Flying over the arch with a parachute on board | Titian | Vascular |
| 11:45 | Quality Improvement Using Data: International Experience | Amber 8 | Adult Cardiac |
| 11:45 | Thoracic – Featured abstracts | Amber 6 | Thoracic |
| | **Lunch** | | |
| 13:00 | How to set up and run a ventricular assist device programme | Amber 3 | Adult Cardiac |
| 13:00 | Oesophagus | Amber 7 | Thoracic |
| 13:00 | Nightmare cases & unsolved clinical problems | Botticelli | Congenital |
| 13:00 | ECMO/ECLS | Brown 2 | Adult Cardiac |
| 13:00 | Dusk or dawn for SAVR? | Michelangelo | Adult Cardiac |
| 13:00 | Endovascular fix of open failure | Raphael | Vascular |
| 13:00 | Meta-analyses: breaking down different methods | Suite 5 | General |
| 13:00 | Interventional Therapies | Auditorium | Adult Cardiac |
| 13:00 | Jeopardy | Titan | General |
| | **Break** | | |
| 14:15 | Teaching root repair techniques by experts | EACTS Training Village | Adult Cardiac |
| 14:45 | LVAD Outpatient Management | Amber 3 | Adult Cardiac |
| 14:45 | Rapid Fire – Congenital 2 | Amber 4 | Congenital |
| 14:45 | Open access – who is paying the bill: the reader or the writer? | Amber 6 | Thoracic |
| 14:45 | Second conduit: choices beside RITA | Amber 7 | Adult Cardiac |
| 14:45 | Optimised perfusion | Brown 2 | Adult Cardiac |
| 14:45 | New solutions in mitral repair: come and see! | Michelangelo | Adult Cardiac |
| 14:45 | The bigger picture – from aortic surgery towards comprehensive aortic medicine | Raphael | Vascular |
| 14:45 | The propensity score: opening a black box | Suite 5 | General |
| 14:45 | Chest Wall | Titian | Thoracic |
| | **Break** | | |
| 16:30 | Key technical points in coronary surgery | Amber 1&2 | Adult Cardiac |
| 16:30 | Ventricular Assist Devices | Amber 3 | Adult Cardiac |
| 16:30 | Thymic surgery | Amber 4 | Thoracic |
| 16:30 | The role of the cardiac surgeon during lead extraction | Amber 5 | Adult Cardiac |
| 16:30 | Enhanced recovery in thoracic surgery | Amber 6 | Thoracic |
| 16:30 | “Cold” Topics in Heart Transplantation | Amber 7 | Adult Cardiac |
| 16:30 | Endocarditis: a battle in different directions | Amber 8 | Adult Cardiac |
| 16:30 | Progress in TEVAR/EVAR | Auditorium | Adult Cardiac |
| 16:30 | Surgical videos 2 | Botticelli | Congenital |
| 16:30 | Aortic valve and root infection | Brown 1 | Adult Cardiac |
| 16:30 | Tough clinical decisions for improved sAVR therapies | Brown 2 | Adult Cardiac |
| 16:30 | From basics to challenges in mitral valve surgery | Brown 3 | Adult Cardiac |
| 16:30 | Outside the box (Residents) | Michelangelo | General |
| 16:30 | Breaking old concepts on acute aortic dissections | Raphael | Vascular |
| 16:30 | EACTS Aviation task force and NATO Research Task Group – safe surgery for safe flights | Suite 5 | Adult Cardiac |
| 16:30 | Challenges in mitral surgery | Titian | Adult Cardiac |

## Saturday 20 October

| | | | |
|---|---|---|---|
| 8:15 | Aortic valve surgery made cosmetic | Amber 1&2 | Adult Cardiac |
| 8:15 | Rare and uncommon diseases | Amber 3 | Adult Cardiac |
| 8:15 | EUROMACS | Amber 4 | Adult Cardiac |
| 8:15 | S.O.S. – Save our surgeon! critical situations in cardio-thoracic surgery | Amber 5 | Adult Cardiac |
| 8:15 | Enhanced recovery after surgery (ERAS) | Amber 7 | General |
| 8:15 | Single ventricle 1: Can we avoid univentricular palliation | Botticelli | Congenital |
| 8:15 | Heart team perspective in atrial fibrillation | Brown 1 | Adult Cardiac |
| 8:15 | Challenges and solutions in proximal aortic diseases | Brown 2 | Vascular |
| 8:15 | Evidence based decision making in transcatheter aortic valve implantation | Brown 3 | Adult Cardiac |
| 8:15 | Living with a ventricular assist device – living with problems? | Michelangelo | Adult Cardiac |
| 8:15 | Myocarditis, acute myocardial infarction and hypertrophic obstructive cardiomyopathy remodelling | Suite 5 | Adult Cardiac |
| 8:15 | Put your lead vest on: Transcatheter aortic valve implantation under rapid fire | Titian | Adult Cardiac |
| 8:15 | Coronary | EACTS Training Village | Adult Cardiac |
| 8:15 | Anatomical segmentectomies | Amber 6 | Thoracic |
| 8:15 | Managing patients with multi-vessel disease in the modern era | Auditorium | Adult Cardiac |
| | **Break** | | |
| 10:00 | Bicuspid aortic valve repair: I do the best technique for my patient | Amber 1&2 | Adult Cardiac |
| 10:00 | The right solution for the right ventricle | Amber 3 | Adult Cardiac |
| 10:00 | How to train the next generation of cardiovascular surgeons – Joint EACTS/ BSCVS | Amber 4 | Adult Cardiac |
| 10:00 | The cardiac surgeon and the anesthesiologist tell each other what is important to make a decision for their patient Joint Session EACTS – EACTA | Amber 5 | Adult Cardiac |
| 10:00 | Zooming in topics | Amber 7 | General |
| 10:00 | Single ventricle 2: Can we optimise univentricular palliation? | Botticelli | Congenital |
| 10:00 | Left atrial appendage management in the direct oral anticoagulants era | Brown 1 | Adult Cardiac |
| 10:00 | Challenging the guidelines in thoracic aortic surgery | Brown 2 | Vascular |
| 10:00 | From tricuspid valve repair to transcatheter replacement options | Brown 3 | Adult Cardiac |
| 10:00 | Emerging trends in tricuspid valve repair surgery | Michelangelo | Adult Cardiac |
| 10:00 | Career development | Suite 5 | General |
| 10:00 | Jeopardy Final | Titan | General |
| | **Lunch** | | |
| 12:45 | Allied Health – Abstracts | Amber 7 | General |
| 12:45 | Residents lunch | Panorama Lounge | General |
| 14:15 | Surgery for ground glass opacities – a waste of time? | Amber 6 | Thoracic |
| 14:15 | Allied Health – Workshop | Amber 7 | General |
| 14:15 | Surgery in adults presenting with congenital heart disease | Botticelli | Congenital |
| 14:15 | Aortic arch repair – The brain in focus | Brown 2 | Vascular |
| 14:15 | Optimisation of cardiac function and underlying mechanisms in cardiac surgery | Michelangelo | Adult Cardiac |
| 14:15 | The Lion’s den and emerging technologies | Auditorium | Adult Cardiac |
| 14:30 | Ross procedure (Reinforced Ross, Root or subcoronary Ross) | EACTS Training Village | Congenital |
| | **Break** | | |
| 16:00 | Film – Thoracic | Amber 6 | Thoracic |
| 16:00 | Thoracoabdominal aorta surgery – standards and perspectives | Brown 2 | Vascular |
| 16:00 | Rapid fire – Congenital 3 | Titian | Congenital |

Cardiac | Abstract | Surgical aortic valve replacement from bench to bedside

# Fifteen-year outcomes following bioprosthetic versus mechanical isolated aortic valve replacement for aortic stenosis in patients aged 50 to 65 years: the Andalousian aortic valve multicentric study (ANDALVALVE)

**Emiliano Rodríguez Caulo**
Hospital Universitario Virgen de la Victoria, Málaga, Spain

At present, aortic valve replacement (AVR) surgery remains the standard of care for most cases of severe aortic stenosis. It is performed in ~280,000 patients worldwide annually, and 5,000 in Spain alone. The latest guidelines from the European Society of Cardiology and the European Association of Cardio-Thoracic Surgery (ESC/EACTS) state that bioprostheses should be considered as the treatment of choice in patients >65 years of age. However, in patients aged 60–65 years, both valve types – mechanical and biological – are considered acceptable options (recommendation class II-a) and decision should be based on a thoughtful analysis of other important factors.

In this sense, the latest release from the American Heart Association/ American College of Cardiology (AHA/ ACC) highlights the importance of an informed, shared decision-making process between doctor and patient to select the most convenient alternative, extending the age range from 60–70 to 50–70 years for both prostheses (recommendation class II-a). The indication of bioprostheses in primary isolated AVR for patients aged 50-65 is still controversial in Europe and their long-term durability /reoperation rates seems a pivotal factor.

To the best of our knowledge this issue has not yet been addressed in a Mediterranean population such as the Andalusia region in southern Spain (~9,000,000 population). This research aims to analyse long-term survival and major morbidity (30-day mortality, stroke, any prosthetic reoperation and major bleeding) within this population.

Our multicentre observational retrospective study included all subjects aged between 50–65 years undergoing a primary isolated AVR intervention due to severe aortic stenosis at all seven public hospitals equipped with a cardiovascular surgery department in Andalusia during 2000–2015. Concomitant surgery, reoperations and endocarditis were exclusion criteria. A total of 1,443 patients were registered (272 biological and 1,171 mechanical). Multivariate analyses, including 2:1 propensity score matching (506 mechanical and 257 biological), was conducted.

Bioprostheses were implanted in 18.8% of cases (n = 272; 35% women, mean EuroSCORE of 3%). Mean follow-up was 8.1 ± 4.9 years in a matched sample, 8.8 ± 4.9 years for mechanical prostheses versus 7.1 ± 4.5 years for biological prostheses (p = 0.001). In the paired sample, 15-year survival was 73% for the biological valves versus 76% for mechanical valves (Hazard Ratio [HR] 0.80; Confidence interval [CI] 95%, 0.54–1.20, p = 0.159). No significant differences were observed in patients ≥55 years of age (74% of 15-year survival in both groups: HR: 0.88; CI 95%, 0.56–1.34, p = 0.527, Figure 1). A higher rate of major bleeding was found in mechanical prostheses (p = 0.004), whereas reoperation was more frequent among biological prostheses (p = 0.01; Table 1). All these data were confirmed using the Fine-Gray Competing risk analysis method (Figure 2), with a very low cumulative incidence of reoperation in biological valves (5% at 15 years), and two-fold higher rates of major bleeding in mechanical prostheses (12% mechanical vs 6% biological), without differences in stroke (6% at 15 years).

In conclusion, long-term survival was comparable in patients above 55 years. Mechanical prostheses were associated with more major bleeding, while bioprostheses incurred higher rates of reoperation. Bioprosthesis use in patients above 55 years of age is a reasonable choice.

| Endpoints | Mechanical (n = 506) | Biological (n = 257) | P-value[b] |
|---|---|---|---|
| 30-day mortality | 12/506 (2.4%) | 5/257 (1.9%) | 0.491 |
| Stroke | 31/506 (6.1%) | 16/257 (6.2%) | 0.957 |
| Major bleeding | 66/506 (13%) | 16/257 (6.2%) | **0.004** |
| Prostheses reoperation | 10/506 (2%) | 17/257 (6.6%) | **0.010** |
| Bleeding OR Transfusion | 122/506 (24.1%) | 39/257 (15.1%) | **0.004** |
| Transfusions | 90/506 (17.7%) | 35/257(13.6%) | 0.142 |
| All-cause late mortality | 79/506 (15.6%) | 38/257 (14.7%) | 0.765 |
| Cardiac rehospitalisation | 84/506 (16.6%) | 49/257 (19%) | 0.396 |
| Infective endocarditis | 6/506 (1.1%) | 7/257 (2.7%) | 0.098 |
| Mean gradient (mmHg) | 16.2 +/- 6.1 | 17.3 +/- 9.1 | 0.070 |
| Mean valve size (mm) | 21.7 +/- 1.8 | 22.1 +/- 1.9 | 0.090 |
| MACCE-combined (patients)[a] | 105/506 (20.7%) | 41/257 (15.9%) | 0.111 |
| Categorical values are expressed as n (%). a) MACCE: Major Adverse Cardiac and Cerebrovascular Events; b) Bold letters are statistically significant. | | | |

Table 1: Follow-up of major adverse cardiac and cerebrovascular events (MACCE) in a 2:1 matched sample (Bivariate analysis).

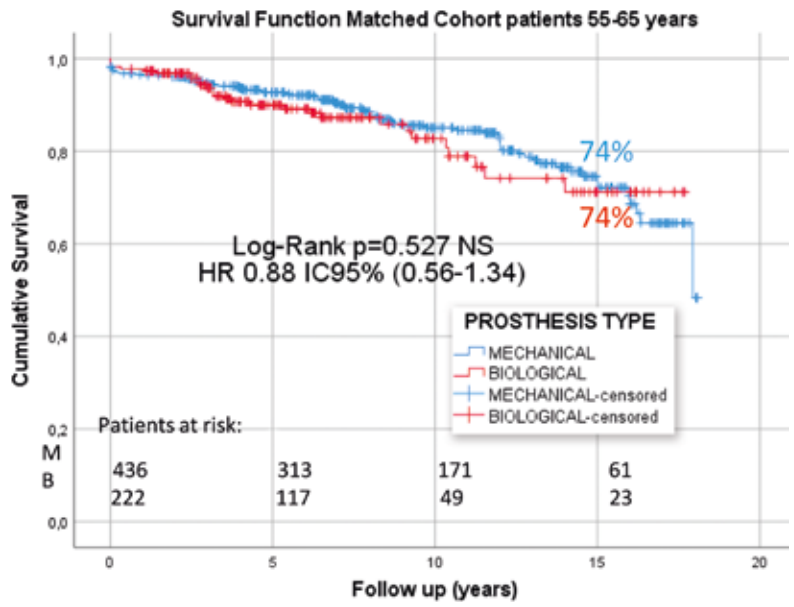
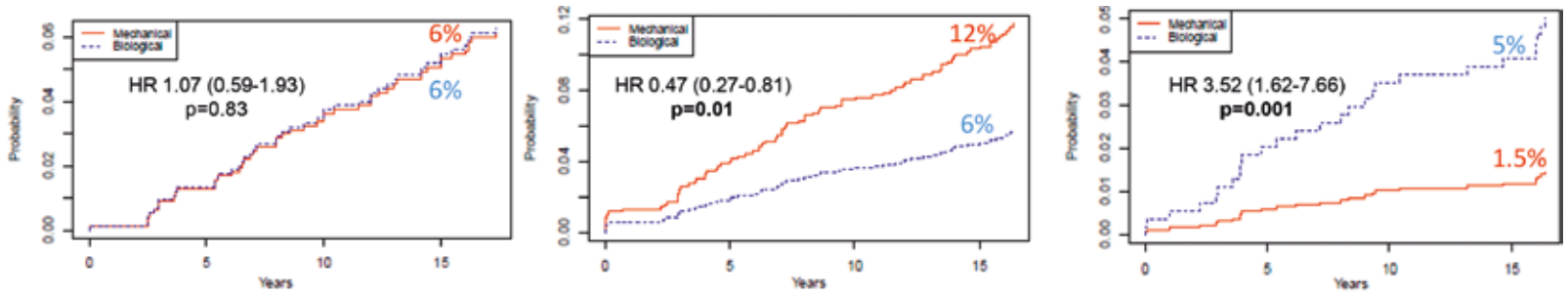



Figure 1

Figure 2: Left to right: Stroke, Major bleeding and Reoperation




Cardiac | Focus Session | Coronary Artery Disease, Experimental Myocardial infarction and Heart Regeneration

# From bench to bedside: a roundtrip for cell therapy in heart disease

**Massimiliano Gnecchi** University of Pavia, Italy


Cell therapy as a means to cure ischaemic heart disease and end-stage heart failure has been under investigation for several years. Many clinical studies have been conducted with different cell types: skeletal myoblasts (SM), bone marrow-derived mononuclear cells (BM-MNC), mesenchymal stromal cells (MSC) and resident cardiac stem cells (CSC), to name but a few. The efficacy results obtained so far are inconclusive, and cell therapy has never entered the routine clinical practice.

Despite this apparent failure, we have learned quite a few things from the first clinical trials, and these now well-established concepts must drive our choices when designing the new cell therapy protocols if we want to eventually succeed in repairing failing hearts. On top of that, more recent animal studies allowed us to better understand the main issues still hampering an effective translation from the promising pre-clinical results to the bedside. Among them, the most relevant are the low engraftment rate and the incapacity of the cells so far tested to differentiate into fully mature cardiomyocytes, resulting in the lack of heart regeneration – the original goal that scientists aimed to reach when they started testing cell therapy.

The issue of poor cell engraftment is common to all cell types tested in clinical trials: BM-MNC, MSC and CSC. Several approaches have been proposed to overcome this hurdle, from the overexpression of protective genes to cell preconditioning. More recently, administration of cells together with degradable biomaterials, or other tissue engineering techniques, have been tested in animal models with promising results. Also, the incapacity to robustly differentiate into cardiomyocytes is a problem shared by BM-MNC, MSC and CSC. There are a couple of possibilities that scientists are considering in order to overcome this problem: either by optimising the use of pluripotent cells – like embryonic stem cells (ESC) and induced pluripotent stem cells (iPSC) – or developing effective strategies to potentiate the limited innate regenerative capacity of the heart.

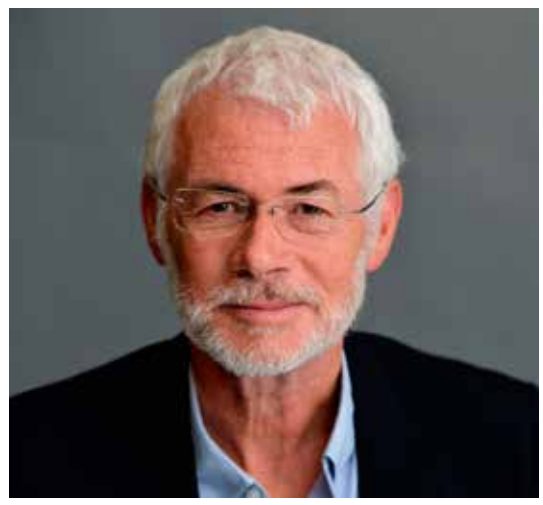
Animal studies have also allowed us to clarify that the mechanism of stem cell action is mainly though production and release of soluble factors rather than direct cardiac regeneration. In particular, cardiac protection, improved angiogenesis, metabolism and possibly endogenous regeneration, together with reduced scarring are the main effects mediated by the cell's secretome. Proteins, exosomes and non-coding RNAs are the putative mediators of these positive paracrine effects. The demonstration that stem cells secrete therapeutic factors provides a potential breakthrough in that, rather than administering cells, one may be able to administer the whole secretome, the exosomes or even specific proteins. This approach opens new and unexplored therapeutic options, which present several advantages over the use of cell preparations.

In conclusion, our initial expectations regarding the capacity of stem cells to regenerate cardiac tissue were just too high, and the protocols used for administration were over-simplistic. However, the lessons learned from previous experiences will certainly help us to progress toward the development of more effective cell and molecular therapies to regenerate, or more realistically to repair, broken hearts.

Cardiac | Focus Session | Quality Improvement Using Data: International Experience

# Getting it right the first time

**David Richens** National GIRFT Lead for Cardiothoracic Surgery, UK



"Getting It Right First Time" (or GIRFT) is an English national benchmarking programme focusing on 35 clinical work streams across surgery, medicine and other clinical services. It has a budget of £60 million, funded by the UK Government. GIRFT entails analysis of central data registries followed by a series of clinically led deep dive visits to each provider unit. It is driven by a desire to ensure better care and outcomes for patients and to address some of the challenges faced by clinicians in their day-to-day practice. It focuses on the unwarranted variation in the quality and efficiency of the services that exist.

The Cardiothoracic GIRFT project commenced in April 2016 and the associated deep-dive visits finished in November 2017. The Cardiothoracic Report was published in March 2018.

I found my visits to all of the 31 cardiothoracic centres in England to be inspirational. Overwhelmingly, clinical staff are striving to do things better. They combine high levels of energy and enthusiasm with intellectual rigour and a commitment to innovation – qualities that have characterised the development of cardiothoracic surgery as a distinct surgical specialty since the 1950s.

Our review of cardiothoracic surgery identified significant opportunities to improve patient care and outcomes. We also identified a total national financial opportunity of over £50 million.

The report describes the variation we have found, examples of good practice, and our recommendations on how our specialty can realise the opportunities open to us. We have found significant degrees of unwarranted variation in a number of key areas, including patient pathways and associated bed management, management of clinical risk and adverse clinical outcomes, lung cancer services, aortovascular surgery, mitral valve repair, and clinical coding.

GIRFT is putting in place a comprehensive programme to help implement the recommendations highlighted in the national report including support to individual providers to implement these recommendations locally. For GIRFT to be a success it needs the backing of clinicians and senior trust managers.

GIRFT's success to date has been acknowledged in an independent report by the King's Fund. The report said, "The evidence to date suggests that the GIRFT programme is achieving what it has set out to achieve – higher-quality care in hospitals at lower cost – with the engagement of both clinicians and management in the process."

# Aprotinin stronger than ever

Patient blood management remains an unmet medical need in patients undergoing cardiac surgery, according to experts who will discuss the matter and present potential solutions at a symposium sponsored by Nordic Pharma Group later today.

First on the podium will be Kai Zacharowski from University Hospital Frankfurt, Germany. "Cardiac patients are at high risk of bleeding and therefore of transfusion, which brings a high risk of complications," he told *EACTS Daily News*. "This is aggravated nowadays because many cardiac patients are on various anticoagulant medications, and 30-40% have iron-deficiency anaemia. These patients start at low haemoglobin, then they have major surgery with high risk of bleeding. Together, this can precipitate a very poor outcome."

In fact, according to Patientbloodmanagement.eu, a website recommended by Professor Zacharowski, 11–48% of surgical patients suffer from anaemia prior to surgery, and if undiagnosed and untreated, preoperative anaemia is likely to dramatically affect patient outcome. Preoperative anaemia is an independent risk factor for increased morbidity, mortality and length of hospital stay.

"We need to improve outcomes by reducing the risk of death, myocardial infarction, and stroke among other things," continued Professor Zacharowski, who advocates three steps to minimise complications during major heart surgery.

"Firstly, treat anaemia prior to surgery so that patients have a very good chance of entering surgery with a normal haemoglobin level. Studies have shown that if a patient enters surgery with mild anaemia then they have a five-fold increased risk of death, and if they have severe anaemia then this increases to a 13-fold increased risk of death."

Secondly, it is important to be aware of a patient's anticoagulant therapy and when to stop it, and thirdly, the team needs to follow a blood transfusion algorithm including ways to reduce the need for transfusion.

Identifying the unmet medical need, Professor Zacharowski highlighted that all of these measures should be utilised together to improve outcomes. "This is the solution, but it is not happening in practice often enough. Only a few hospitals in Europe are introducing all these measures together." He estimates that by implementing all the measures together, mortality would be reduced by approximately 10%, although official figures are yet to be obtained.

"We also need to reduce the amount of blood being taken during the hospital stay," he continued, adding that studies show if a cardiac surgery patient stays in hospital for 50 days, then the patients loses approximately five litres of blood via venopuncture.[1]

Turning to aprotinin, he relayed that the drug is administered during surgery in patients who still have a high risk for bleeding, even after other measures have been put in place. "It has been shown in thousands of patients that bleeding can be reduced by administering aprotinin, which is associated with better patient outcomes," said Professor Zacharowski.

Aprotinin is a basic trypsin inhibitor of the bovine pancreas, which is antifibrinolytic in nature and inhibits trypsin and related proteolytic enzymes, reducing bleeding via the slowdown of fibrinolysis. Use of aprotinin aims to reduce the need for blood transfusions during surgery, as well as end organ damage due to hypoperfusion.

Initially launched by Bayer in 1959 for pancreatitis, aprotinin received its license for coronary artery bypass grafting (CABG) in 1993. However, in 2007, a worldwide suspension was enacted due to results from a major evaluative study known as the BART [Blood Conservation Using Antifibrinolytics in a Randomized Trial] study that included frequent cardiac surgeries with an expected mortality over double that seen with primary CABG and an estimated risk for reoperation due to bleeding greater than 5%. The results showed an increased mortality with use of aprotinin.[2] Then in 2011–12, the drug was reinstated after an official European Medicines Agency (EMA) re-assessment of the BART study that found it was methodologically flawed. In 2016, aprotinin was relaunched in European Union (EU) with its original indication: isolated CABG with high risk of bleeding.

Average bleeding after cardiac surgery is estimated to be 400 mL (+/- 200 mL) and can be up to 1,200 mL in patients treated with aspirin and clopidogrel. Around 5% to 7% of patients lose greater than 2 L of blood, and up to 5% require reintervention for bleeding after sternotomy closure.[1]

Severe post-operative bleeding can lead to increased morbidity and mortality for cardiac surgery patients and is a relatively common complication of cardiac surgery.[3] Regarding transfusion in cardiac surgery, an Austrian benchmarking study in isolated CABG found that 57% of isolated CABG patients received transfusion, despite the use of patient blood management techniques. Patients who were transfused received a median of 3.4 units of blood products.[4] Despite the use of tranexamic acid, 23% of cardiac surgery patients require a major transfusion (four or more red blood cell units).[3]

Jan van der Linden from the Karolinska Institute, Stockholm, Sweden, will tackle the place of aprotinin in current clinical practice, adding discussion of why re-assessment of the BART study led to dismissal of the evidence and the drug's reinstatement and licensing.

"Based on the BART study, the authorities were justified in taking aprotinin off the market at this point," he told *EACTS Daily News*. "But it turned out that this study was incorrect. An independent data and safety monitoring committee stopped the study at a point when there were no significant differences in mortality, but after an unexplained exclusion of 137 patients by the trial investigators the study reached significance. But a re-analysis, that included originally excluded patients, showed no statistically significant mortality signal for aprotinin.[5]

*"It has been shown in thousands of patients that bleeding can be reduced by administering aprotinin, which is associated with better patient outcomes."*

Kai Zacharowski

There was also an unusually large number of reclassifications of outcomes from the originally reported data, with a large (~75%) change in the primary outcome measure: massive postoperative bleeding. "There were serious limitations in the conduct of this study according to the EMA and expert advisory panel that re-evaluated the data," continued Professor van der Linden, adding that it was an investigator-led study, not initiated by a pharmaceutical company.

Professor van der Linden discussed how, in 2013, the EMA assessed the therapeutic benefit of aprotinin from RCTs and observational studies, including the BART study. The assessment found a lower risk of bleeding; a lower risk of risk of blood transfusion; and a lower risk of re-exploration for bleeding. Since reinstatement for use by the Canadian regulatory authority (Health Canada), and the EMA, aprotinin has been indicated for 'prophylactic use to reduce blood loss and blood transfusion in adult patients who are at high risk of major blood loss undergoing isolated Cardiopulmonary Bypass Graft surgery (CABG not combined with other cardiovascular surgery)'.

"It's more effective than other antifibrinolytics at minimising blood transfusions and reoperation rate, including tranexamic acid [TXA] and EACA [epsilon-aminocaproic acid]," said Professor van der Linden. A Cochrane Review showed that aprotinin alone compared with TXA/ EACA significantly reduced allogenic blood transfusion rate (risk ratio (RR) 0.82; 95% CI 0.71–0.95), and re-operation rate due to bleeding (BART; RR 0.67, 95% CI 0.46–0.98).[6]

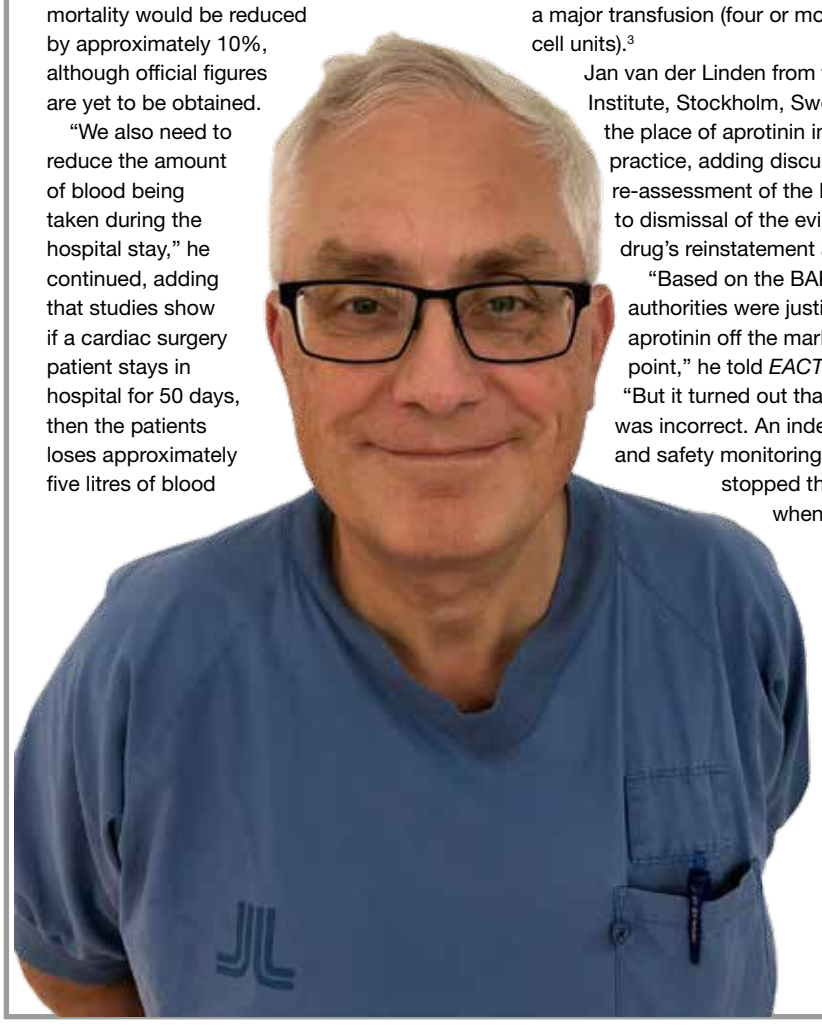
"Aprotinin works by a wide range of effects," he remarked, advocating use of the drug in patients with high risk for bleeding, cardiac failure and sepsis. "It preserves platelet function during cardiopulmonary bypass, and decreases anti-inflammatory response, which is very important if a patient is in shock or has sepsis. The inflammatory response is amplified by cardiopulmonary bypass."

After the EMA assessment in 2013, other retrospective studies regarding withdrawal of aprotinin and replacement with tranexamic acid revealed results to support use of aprotinin. For example, a German study in 320 open-heart procedures found a significant risk factor for mortality with tranexamic acid compared with aprotinin (16.2% TXA vs 7.5% aprotinin)[7]; and a UK study found there were significantly more transfusions and a 151% increase in 30-day mortality in high-risk patients (HR 2.51, CI 1.00–6.29).[8]

"Now, as a precautionary measure, the regulatory authorities require centres using aprotinin to contribute to a registry [Nordic Aprotinin Patient Registry (NAPaR)] to follow-up on all use of the drug," remarked Professor van Der Linden. "The registry records all usage including off-label. In fact, the majority of use is off-label, in children and in adult patients at high risk of bleeding and mortality – dissections, for example." As of September 2018, there were 2,247 patients included on the registry, and altogether 65 sites in Europe have committed to use the NAPaR.

"We never stopped using this drug," continued Professor van Der Linden. "It wasn't totally banned in Europe. It could be used under a special license in the UK and Sweden. Admittedly, we were more cautious in using it for a few years until it was reinstated but we always used it in CABG patients who were on dual anti-platelet treatment."

In 2017, the EACTS and the European Association of Cardiothoracic Anaesthesiology (EACTA) released new guidelines on patient blood management for adult cardiac surgery. These noted that antifibrinolytic therapy (TXA, aprotinin, and EACA) is recommended to reduce bleeding and transfusions of blood products and reoperation for bleeding (TXA and aprotinin). The evidence was rated as class 1, level A.[9]



*"It preserves platelet function during cardiopulmonary bypass, and decreases anti-inflammatory response, which is very important if a patient is in shock or has sepsis. The inflammatory response is amplified by cardiopulmonary bypass."*

Jan van der Linden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Vascular | Abstract | Let the pachyderm proboscis freeze: FET experience is increasing

# Preliminary results of a debranch-first technique in frozen elephant trunk procedure

**Luca Bertoglio[1], Paola Redaelli[2], Alessandro Verzini[2], Marta Bargagna[2], Ilaria Giambuzzi[2], Roberto Chiesa[1], Ottavio Alfieri[2] and Alessandro Castiglioni[2]** 1. Division of Vascular Surgery, "Vita – Salute" University, Scientific Institute H. San Raffaele, Milan, Italy; 2. Department of Cardiac Surgery, "Vita – Salute" University, Scientific Institute H. San Raffaele, Milan, Italy

In 1983 Borst proposed a two-step surgery for combined aortic arch and descending aorta pathologies, called the "elephant trunk technique". In 2003, a big step forward was achieved by endovascular stent graft technology: the frozen elephant trunk (FET) was introduced, but yet the aortic arch seemed to be excluded from its benefit. Arch repair with FET remains a complex intervention, with suboptimal organ protection and non-negligible rates of in-hospital mortality (1.8–17.2%), as well as complications including reintervention for bleeding in up to 30% of the cases, stroke and spinal cord ischaemia (SCI) in 2.5–20% and 0–21% of patients respectively and acute kidney injury (AKI) in 4–34.8% of procedures.

In 2016 – 35 years after Borst's proposal and 15 years after FET – the Vascular Surgery Department and the Cardiac Surgery Department of San Raffaele Hospital joined together to start an ambispective single-centre study called the frozen elephant trunk organ perfusion technique (FET-OPT), using a novel custom-made E-vita open plus prosthesis from Jotec (Germany). Two additional branches were added on the side on the surgical graft portion (Figure 1) to allow distal aortic perfusion and reimplantation after supra-aortic vessel debranching. The reperfusion branch originates with a 90° angle from the main Dacron graft, the debranching branch is at 30 mm from the reperfusion branch and it originates with a 60° angle from the main Dacron graft. The stent graft is identical to a standard E-vita open plus device: the length and diameter can be tailored according to preoperative planning and individual surgical strategies in only 19 (interquartile range [IQR]: 18–23) days. The graft diameter is oversized according to the diameter of the distal aorta measured outer edge to outer edge for native distal aortas (20% oversize), while the in case of dissected aortas it is sized according to the true lumen (0% oversize).

The new design, combined with a propaedeutic carotid-to-subclavian bypass (CSB), eliminates the need for complex access to the subclavian artery (that may be difficult in a deep chest or in redo surgeries) and allows near-physiological brain perfusion through the CSB with antegrade cerebral perfusion (ACP) through bilateral axillary artery cannulation. The new configuration allows a reduction in both the cerebral ischaemic time and systemic ischaemic time: brachiocephalic vessels reconstructed with a debranching-first technique can be performed at the beginning or at the end of the procedure under normotermic conditions, thus allowing a short cerebral ischaemic time (median 103 min; IQR 94–120). Similarly, the systemic ischaemic time is shortened by using the reperfusion branch – a very important aspect especially in patients requiring additional aortic or cardiac procedures (Figure 2).

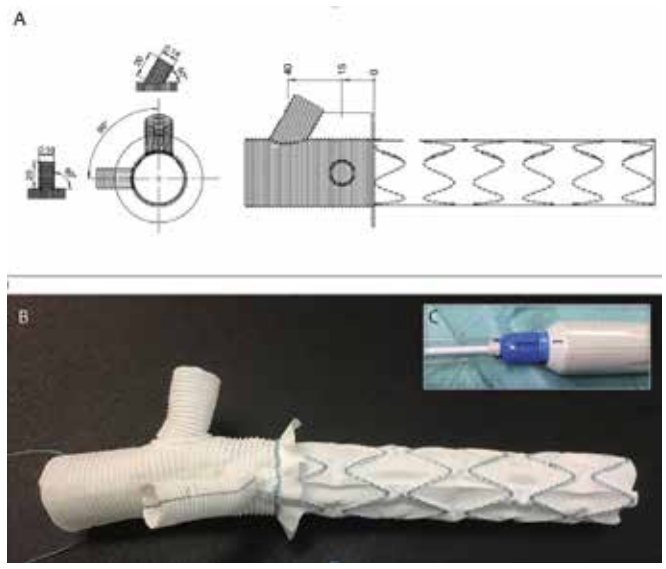



Figure 1, Above. (A) Technical sketch of the custom-made E-vita GRAFT (Jotec GmbH, Germany); (B) The custom-made E-vita graft is shown fully deployed with the surgical graft already retrieved and pulled back; (C) Orientation of the perfusion branch is marked with a black line on the standard delivery system of the device.

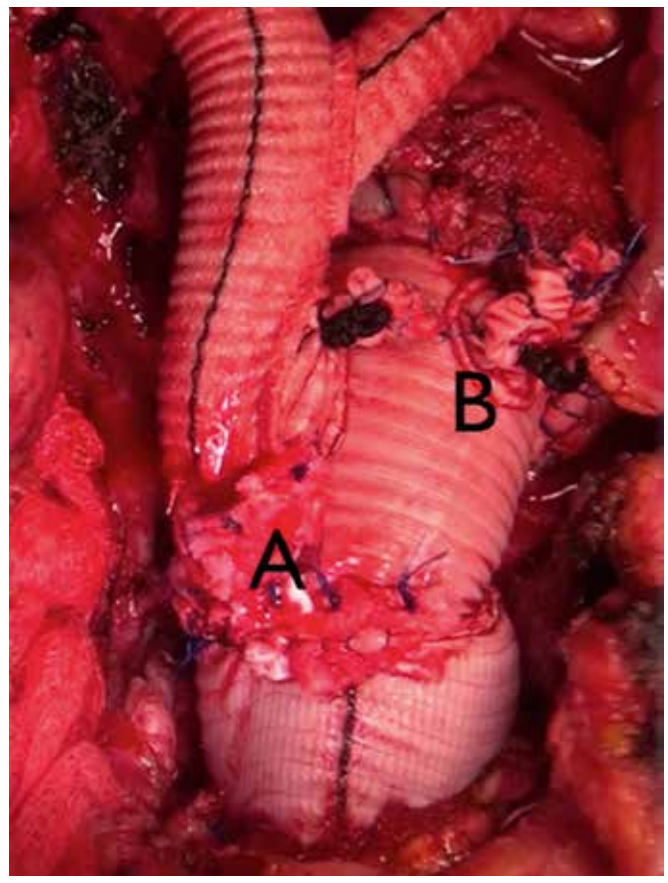



Figure 2, Right. Final result of the frozen elephant trunk at the end of cardiopulmonary bypass, showing the debranching branch (A), the reperfusion branch (B), the proximal and the distal anastomosis.

This new concept, the custom-made E-vita open plus prosthesis, has been used in 21 patients undergoing FET surgery between November 2016 and July 2018 in the FET-OPT study. Early-term results are promising in terms of in-hospital death (0%) and major cerebrovascular events, transitory ischaemic attack (1 patient [5%]). Spinal cord injury occurred in two (10%) patients, with complete resolution within one month, and surgical revision for bleeding was seen in three patients (14%).

Cardiac | Abstract | Circuit of life

# Bernoulli effect aggravates leg malperfusion during extracorporeal life support with femoral arterial cannulation

**Philippe Grieshaber**
University Hospital of Giessen and Marburg, Germany

During extracorporeal life support (ECLS) using a femoral arterial cannulation strategy, malperfusion up to the point of critical limb ischemia is frequently observed in the cannulated leg. This effect has mainly been attributed to obstruction of the femoral artery by the cannula. However, leg malperfusion also occurs in patients without peripheral arterial disease and large femoral vessels. We have investigated the pathomechanism of this phenomenon in an in-silico study, whereby we generated virtual CAD (Computer-aided design) 3D models from DICOM-data of a standard 16 F cannula and a life-sized model of the aorta and its major arterial branches.

After virtual cannulation of the common femoral artery, time-transit flow simulations were conducted with different stages of cardiac output and corresponding ECLS flow rates with a total circulating volume of 5 L per minute. The flow characteristics of the ECLS jetstream and the blood flow around the cannula were visualised.

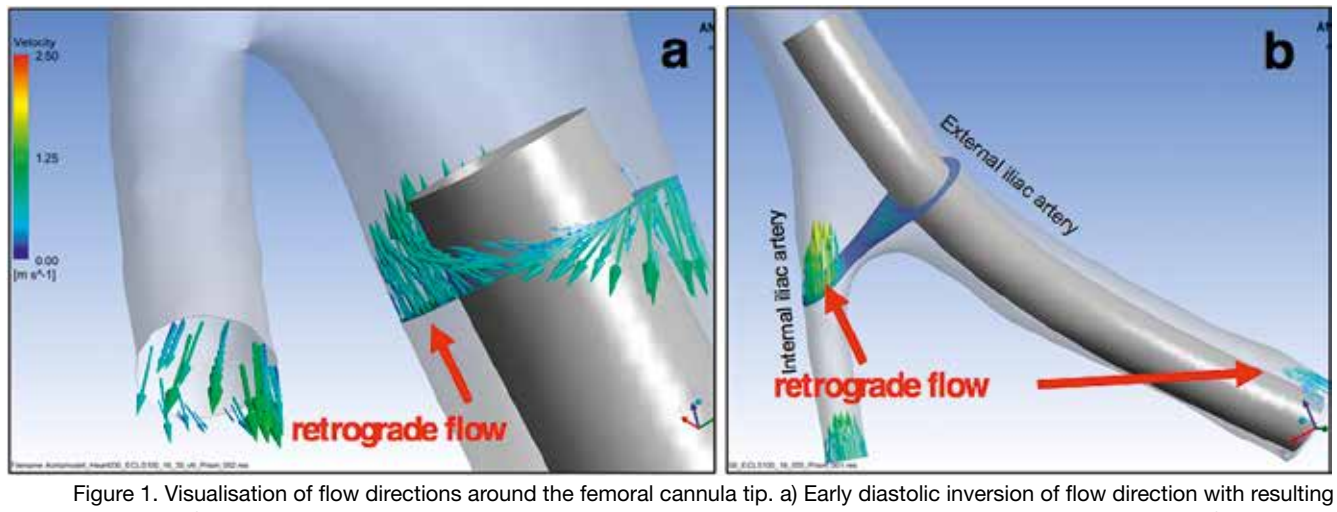



Figure 1. Visualisation of flow directions around the femoral cannula tip. a) Early diastolic inversion of flow direction with resulting retrograde flow. b) If the cannula is advanced more proximally, even retrograde flow from vessels distal to the cannula tip (internal iliac artery) is induced.

Interestingly, particularly during diastole, we observed not only stasis of blood distal to the cannulation site, but also retrograde flow besides the cannula (Figure 1). This phenomenon can be explained with the Bernoulli principle, i.e. high-velocity jetstreams induce areas of low pressure with consecutive liquid flow towards this region.

These in silico results imply that, even in patients with sufficient vessel diameters undergoing ECLS via femoral arterial cannulation, blood flow into the cannulated leg is impaired due to suction of blood from the limb by retrograde ECLS flow. We conclude from these data that in ECLS patients with femoral arterial cannulation, placement of a separate leg perfusion cannula is mandatory, irrespective of vessel diameters or peripheral arterial occlusive disease.

EACTS | European Mechanical Circulatory Support Summit

# The European Mechanical Circulatory Support Summit

**Evgenij V. Potapov** Scientific Director, EACTS-European Mechanical Circulatory Support Summit 2018

In as early as 1995 the German Heart Center Berlin inaugurated a biennial international "Mechanical Circulatory Support Symposium" as an excellent opportunity for the exchange of knowledge and experience at the highest level in this growing field.

Later, the successful symposium was united with the European Mechanical Circulatory Support Summit and held under the auspices of the EACTS in Berlin in November 2016. This three-day summit attracted over 450 participants from around the world.

After a successful event hosted in 2017 by our esteemed partners from the Heart and Diabetes Center in Bad Oeynhausen, Germany, this year the Summit is returning to the German capital. And we are proud that we have again been able to attract global experts as speakers – leading surgeons as well as renowned cardiologists and intensive care specialists. Alongside the stuff of legend, many innovations and many new ideas will be presented by young but already experienced cardiologists, intensivists and surgeons – our rising stars.

We are deeply convinced that this year's Summit will again offer our guests stimulating and varied contributions in the field of short- and long-term mechanical circulatory support (MCS), including unusual cases – and their creative solutions – as well as showcasing the latest developments and long-term perspectives. All sessions will be followed by prolonged panel discussions, and for the first time we will be using an app to receive questions directly from smartphones in the auditorium.

This year there will be a special session about frailty in collaboration with experts from the USA. Particularly intriguing during the session will be the debate on who should receive an assist device – everybody who needs one or only those who can read and understand the manual?

What's more, one session is dedicated to discussion of the current incorporation of MCS into heart failure guidelines and their practical implementation, based on interactive cases presented by J. Stehlik from Salt Lake City, USA. For the first time, the new, as yet unpublished EACTS expert opinion on long-term MCS will be presented during the meeting by F. Gustafsson from Copenhagen, Denmark.

Evgenij V. Potapov

We will also discuss what the future may hold for MCS – for example intelligent pumping and smart materials that may be used to improve biocompatibility.

Although it will be taking place only for the third time, many already consider our "Rising Star Quiz" a tradition of the Symposium. Teams of junior doctors under time pressure will answer quite demanding, not-every-day questions about various aspects of the past and present of MCS. New this year, a team of shining stars, legendary in the MCS field, will pit themselves against the young, dynamic and knowledgeable rising stars. The auditorium will also be able to participate in the competition using the special app, and we promise that although the world's most experienced professionals will be amongst our audience, none of you will be able answer all of the "nasty" questions correctly! The best junior team and the best participant from the auditorium will be honoured with special prizes.

And last but not at all least: what would the European Mechanical Circulatory Support Summit be without the very personal exchange of ideas that occurs during those long parties held after the sessions come to a close? With that in mind, we welcome you to join us in the young and vibrant capital of Germany to keep the discussion flowing.

So, on behalf of our chairmen Jan Gummert and Volkmar Falk, we are looking forward to seeing you at the 2018 EACTS European Mechanical Circulatory Support Summit.

Willkommen in Berlin!

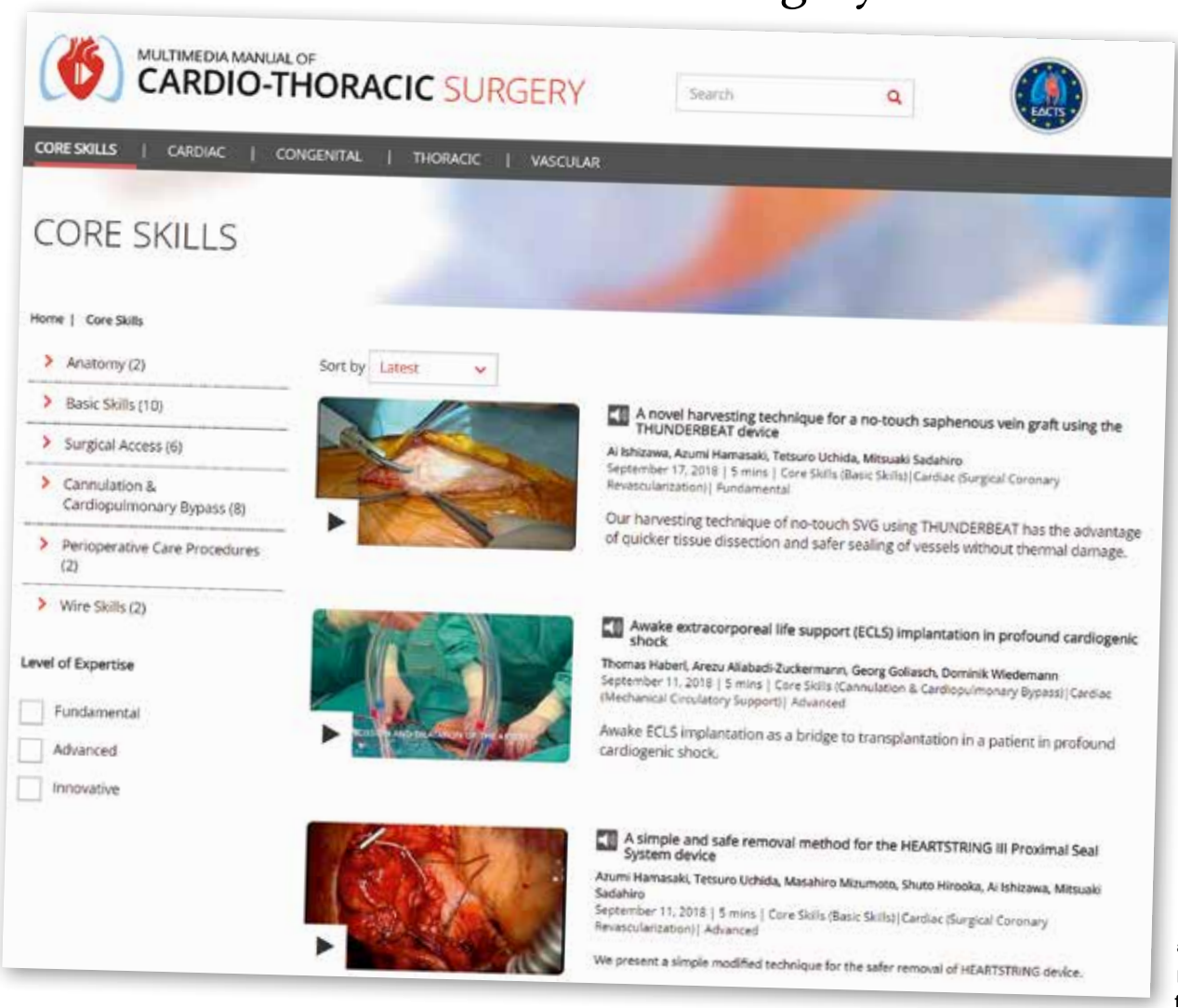
MMCTS

# See one and teach one with MMCTS

## The Multimedia Manual of Cardio-Thoracic Surgery

**Jane Hunter and Cori Mackin** EACTS

Free access to high-quality, expert-reviewed surgical videos is revolutionising the art of teaching surgery and reinventing an old adage.




*MMCTS* was created by Marco Turina, in collaboration with EACTS, in 2005 to provide cardio-thoracic surgeons with free step-by-step surgical demonstrations by some of the biggest names in the profession. When it was updated and relaunched at the end of 2016, the editors-in-chief, Roberto Lorusso and René Prêtre encouraged new authors to focus more on teaching than reporting on cases, and to add voice-over narration to their videos.

Users have been showing their appreciation by sharing tutorials with colleagues and friends, and the site's usage metrics tell the story of its success. In the past six months, *MMCTS* has seen its audience grow at a phenomenal rate. Total video watch-time and views have increased by a factor of 20 and the number of surgeons using the site has increased by nearly 40%. Users come from all over the world (as do the site's authors) and, reflecting universal trends, *MMCTS*'s users are now taking advantage of the website's new responsive design and they are watching, reading, and listening to tutorials using their smartphones.

### Comprehensive but not completed: Will you help us "teach one"?

*MMCTS* is an excellent educational resource with a global audience that is rapidly growing and fully engaged. The next step in reaching our goal of offering a complete online textbook of cardio-thoracic surgical procedures needs your support.

When *MMCTS*.org was relaunched in 2016, many tutorials that were out of date or did not fit the new format were archived. Since relaunch we have published over 70 new tutorials and now have more than 250 surgical procedures live on *MMCTS*.org.

**Will you help us "teach one"? Our goal is to have 500–600 tutorials live on the site within the next two to three years. If you have authored a tutorial that has been archived, please get in touch to learn how to get it republished. If you are new to MMCTS and interested in publishing your work with us, we look forward to hearing from you: please visit https://mmcts.org/page/431 or contact Cori Mackin at info@mmct.org for more information.**

EACTS Academy

# Annuloplasty for aortic valve repair: a standardised approach

## An EACTS technical course on aortic valve repair; March 27–29, 2019: 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).[1] 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) aortic root aneurysms (sinuses of Valsalva 45 mm); 2) tubular ascending aortic aneurysms (sinuses of Valsalva 40–45 mm); 3) isolated aortic insufficiency (all diameters < 40 mm; Figure 2).[2] 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 geometric 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 3).[2]

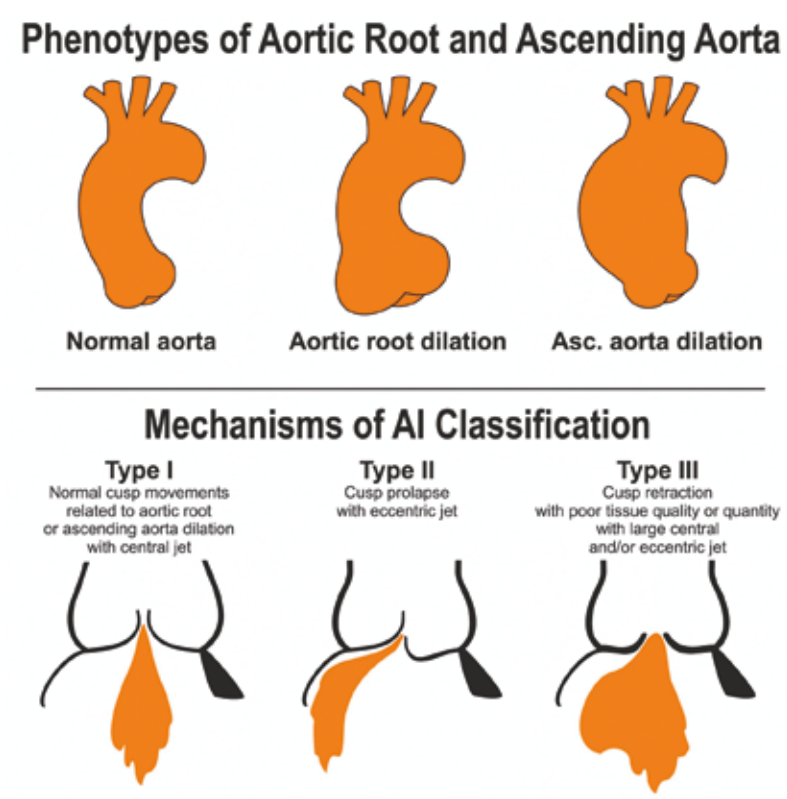



Figure 2

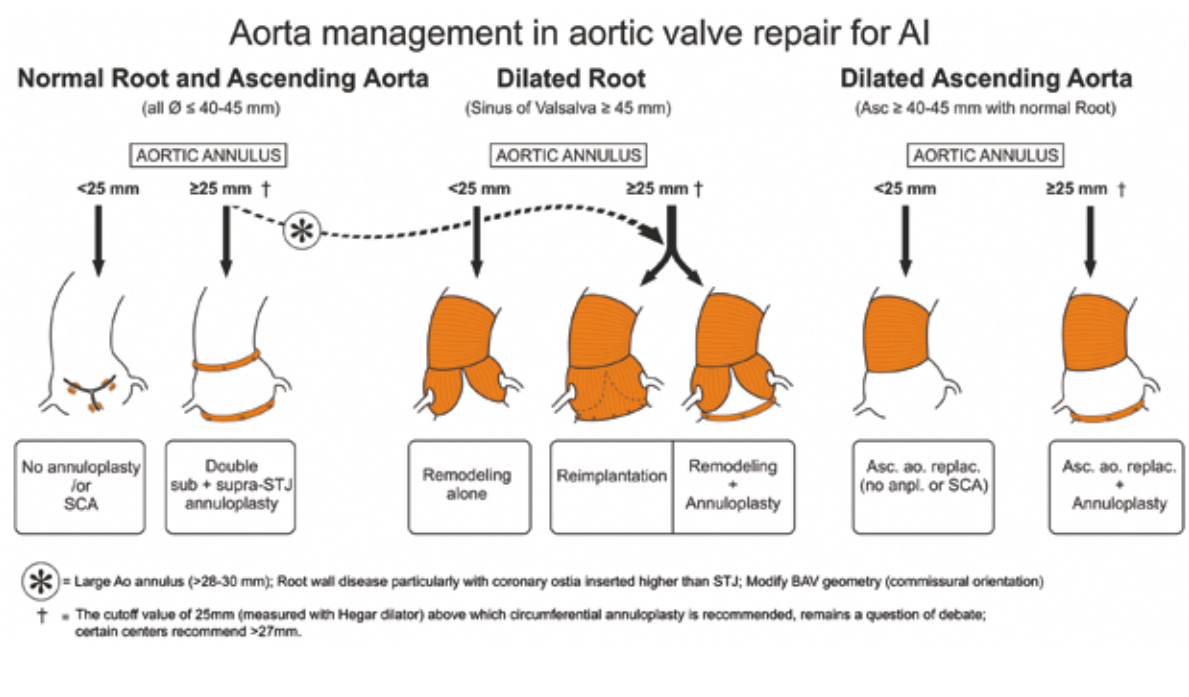
Figure 3

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 aortic annuloplasty techniques to protect the repair. In addition, specific facets of aortic dissections as well as the paediatric population will be addressed.

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.




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

| Indications for surgery | Class[a] | Level[b] |
|---|---|---|
| **A. Severe aortic regurgitation** | | |
| 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[c] 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$^2$ BSA in patients with small body size) [58, 66]. | IIa | B |
| **B. Aortic root or tubular ascending aortic aneurysm[d] (irrespective of the severity of aortic regurgitation)** | | |
| Aortic valve repair, using the reimplantation or remodelling 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:<br>• ≥45 mm in the presence of Marfan syndrome and additional risk factors[e] or patients with a *TGFBR1* or *TGFBR2* mutation (including Loeys–Dietz syndrome).[f]<br>• ≥50 mm in the presence of a bicuspid valve with additional risk factors[e] or coarctation.<br>• ≥55 mm for all other patients. | 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.[g] | 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.

[a]Class of recommendation.

[b]Level of evidence.

[c]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].

[d]For clinical decision making, dimensions of the aorta should be confirmed by ECG-gated CT measurement.

[e]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).

[f]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].

[g]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.[1]

**This Level 3 EACTS Aortic valve repair technical course, 'Annuloplasty for aortic valve repair: a standardised approach' will take place 27–29 March, 2019 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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1. Falk V, Baumgartner H, Bax JJ, De Bonis M, Hamm C, Holm PJ et al. 2017 ESC/EACTS Guidelines for the management of valvular heart disease: the Task Force for the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Eur J Cardiothorac Surg 2017;52: 616–64.
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EACTS

# Vascular Disease Domain A 2018 review and a hybrid 2019

**Davide Pacini** Chair, EACTS Vascular Disease Domain; Department of Cardiac Surgery, University of Bologna, Sant'Orsola-Malpighi Hospital, Bologna, Italy

I took over from Professor Ruggero De Paulis as Chair of the Vascular Disease Domain last year and I would like to thank him for the hard work and the impressive contribution he gave to the Domain. Aortic surgery can in many ways be considered the centre of innovation in cardiovascular disease. Examples are the growing treatment of aortic aneurysms and dissections, the use of catheter-based technology and the necessity to treat an increasingly aging population. The consolidated and expanding use of endografts has facilitated many high-risk procedures and paved the way to less invasive and hybrid procedures for the future. For this reason, the Vascular Disease Domain, whose main mission is to advance education, is continuing to offer its contribution to the Academy in the organisation of courses aimed at various levels.

Even this year, the traditional appointment of the Vascular Academy – the Introduction to Aortic Surgery Course (March) – received very impressive feedback from the delegates. We spent two-and-a-half days covering the major aspects of open and transcatheter aortic surgery from the proximal aortic root to the thoraco-abdominal aorta. It offered an incredible opportunity to meet the experts and translate theory into practice with wet labs and hands-on simulation.

In addition, this year we decided to spend more time on training simulation sessions. Section 1 focused on an introduction to thoracic aortic diseases and surgical repair and gave many updates on biomarkers (including how useful they are in acute and chronic aortic pathology), on arterial access options for cardiopulmonary bypass and refreshed knowledge on embryology, physiology and the haemodynamics of the aortic root with bicuspid/tricuspid valves.

Regarding surgical techniques, the two well-known techniques of a valve-sparing procedure – remodelling and re-implantation – were both examined in detail, the tips and tricks exposed and, on day two, re-analysed during a much-appreciated wet lab (pictured). The same day, a new wet lab was offered focusing on annulus enlargement techniques.

For those cardiac surgeons wishing to embark upon an endovascular programme, we offered the opportunity to learn and train in the basics on TEVAR. A dedicated session walked through a basic overview of wires, catheters and sheaths before dealing with the indications for endovascular treatment and procedural planning, brought to life visually with a practical simulator session.

Extremely positive feedback came back from the evaluation questionnaire: all course attendees felt it had met the expectations and they would recommend it to a colleague. Moreover, the majority of them learned useful takeaways they could use to advance their careers.

Listening to the participants, helping them during the hands-on labs and carefully reading the suggestions coming from the questionnaires are some of the keys to improve the courses year-by-year. The Vascular Domain keeps trying to ameliorate the educational value offered during the course and provide the best instrument to make it possible. For example, the new section on thoracic endovascular aortic repair was the most appreciated, both in terms of content and delivery, and therefore will be confirmed and enhanced next year. Moreover, the course will be strong on live-in-the box presentations during which a surgical manoeuvre will be directly shown, explained, discussed and repeated in order to encourage more live interaction.

This year, together with the Adult Cardiac Domain, we were also active in organising two level III/IV courses on aortic valve repair and aortic valve sparing procedures: The Aortic Valve Repair and Ross Operation Course in Brussels, Belgium (March) and The Aortic Valve Repair Summit in Paris, France (June).

In a continually-changing world where transcatheter technology modifies the paradigm of standard and well-known surgical techniques, it is important to acquire knowledge, specific skills and leadership in every aspect of the aortic surgery. Indeed, a great deal of effort by EACTS is going to be channelled into supporting hybrid surgeons with multidisciplinary competences, and the Vascular Disease Domain is also trying to embrace this aim, focusing more on endovascular techniques. To do this, next year we are planning a multi-modular educational TEVAR programme consisting of four courses that will offer certification of competence of an acquired skill.

Another important goal will be to expand connections with other international societies. To that end, a closer cooperation with the European Society for Vascular Surgery will be founded to foster joint activities and more opportunities for our community.

Finally, as part of its continuing effort in education, the Vascular Disease Domain is also planning to organise advanced courses focused on many aspects of open aortic surgery.

Cardiac | Rapid Response | New solutions in mitral repair: come and see!

# Evolution of perioperative outcome in minimally invasive mitral valve surgery – A single centre experience of 4,382 patients

**Martin Misfeld**
University Department of Cardiac Surgery, Heart Center, University of Leipzig, Germany

Since its introduction by Alain Carpentier in 1996, minimally invasive mitral valve surgery (MIMVS) has increasingly been used as a standard procedure for mitral valve surgery. Through the years, MIMVS has undergone a variety of technical modifications, which currently peaks in endoscopic surgery with 3D vision.

As one of the pioneering centres for MIMVS, the Leipzig Heart Center has performed more than 4,500 MIMVS procedures over more than 23 years. During this year's EACTS Annual Meeting, we present our clinical data on the evolution of MIMVS. Through the years, the surgical technique has been modified from endo-clamping to X-clamping, from direct vision to totally endoscopic techniques, as well as undergoing further modifications to several steps of the procedure. Meanwhile, the surgical techniques used to repair mitral valve incompetence have also been standardised, e.g. the loop-technique, which was introduced by Professor Friedrich Mohr in 2000.

Analysis was performed by dividing 21 years of data (1994–2015) into four equal time frames (F1–F4). Mean age was 60 ± 13 years (range: 18.2–88.9 years) and patients were predominantly male (61.9%). Despite increased complexity of the procedure and liberal use of additional tricuspid valve repair (Figure 1), hospital, and 30-day, mortality decreased to 1.2%, including emergency cases, combined procedures with tricuspid valve and cryoablation surgery, and endocarditis (Figure 2).

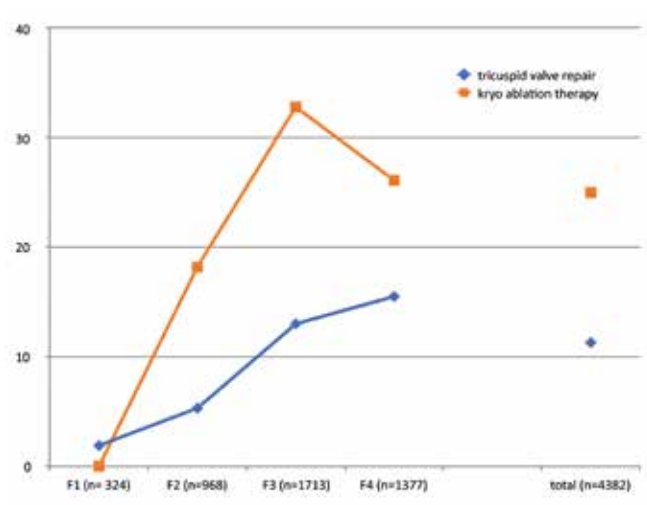



Figure 1: Number of concomitant procedures

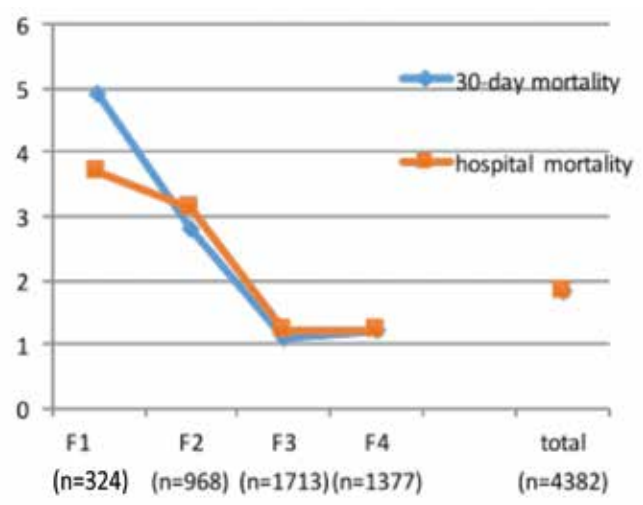



Figure 2: Mortality

A selected group of surgeons focus on MIMVS at our centre. This enables us to follow the 2017 ESC/EACTS Guidelines for the management of valvular heart disease even "in asymptomatic patients with preserved LVEF (>60%) and LVESD 40–44 mm, when a durable repair is likely, surgical risk is low, and the repair is performed in a heart valve centre."

The exact number of MIMVS procedures in Europe is unknown. It is suggested that around 10% of isolated mitral valve procedures are being performed by a minimally-invasive approach in the UK, less than 5% in Scandinavia, around 11% in Poland, around 20% in Spain and nearly 50% in Germany. However, a wide range of centres are performing MIMVS only in very selected patients, while others are using MIMVS as a standard approach for nearly all patients. This is also the case at the Leipzig Heart Center.

A multinational data base of minimally-invasive cardiac surgery would be desirable to be able to standardise and judge outcomes from this procedure. This would enable the surgical community to compare surgical, interventional and medical data for the benefit of our patients.

To the best of our knowledge, the data presented at this Annual Meeting represent the largest single centre MIMVS series – one which offers relevant information on the outcomes of MIMVS from an experienced and dedicated heart valve centre.

Cardiac | Focus Session | EACTS/PASCaTS Joint Session

# Integrated multi-disciplinary simulation training: aiming at proficiency

**Francis E Smit and Jehron Pillay**

The Robert W M Frater Centre for Cardiovascular Research, University of the Free State (UFS), Bloemfontein, South Africa

The simulation programme development at the UFS aims at the establishment of an integrated multi-disciplinary simulation program for South Africa and sub-Saharan Africa. This training program focusses on the stepwise training of cardiothoracic surgeons in a safe environment, aiming at proficiency rather than competency. The modular programme combines a human-factor approach to training (Crew Resource Management or CRM widely used in the aviation industry), educational theory, a theoretical syllabus and stepwise surgical simulation in an integrated multi-disciplinary programme. Simulation can include bench models, virtual reality equipment addressing surgical and diagnostic training and finally high fidelity integrated multidisciplinary simulation programmes involving a multidisciplinary team (Figure 1).

The system will be implemented as a hub-and-spoke construct involving participating training units. After completion of introductory modules in human factors and educational theory (providing basic background on learning, training, practice, the development of competency and proficiency), participants will be able to participate in a programme involving both distant learning and contact sessions at the UFS. Every subject will be introduced with a human factors section, followed by clearly stating the educational objectives.

A theoretical evaluation of prior knowledge (as set out in the programme) will be conducted and upon being successful the participant will perform a simulation exercise after a demonstration or video, if required, using the OSAT evaluation and feedback sessions. It is intended that a web application will be available for communication, data collection and evaluation purposes for mobile devices and smartphones (Figure 2).

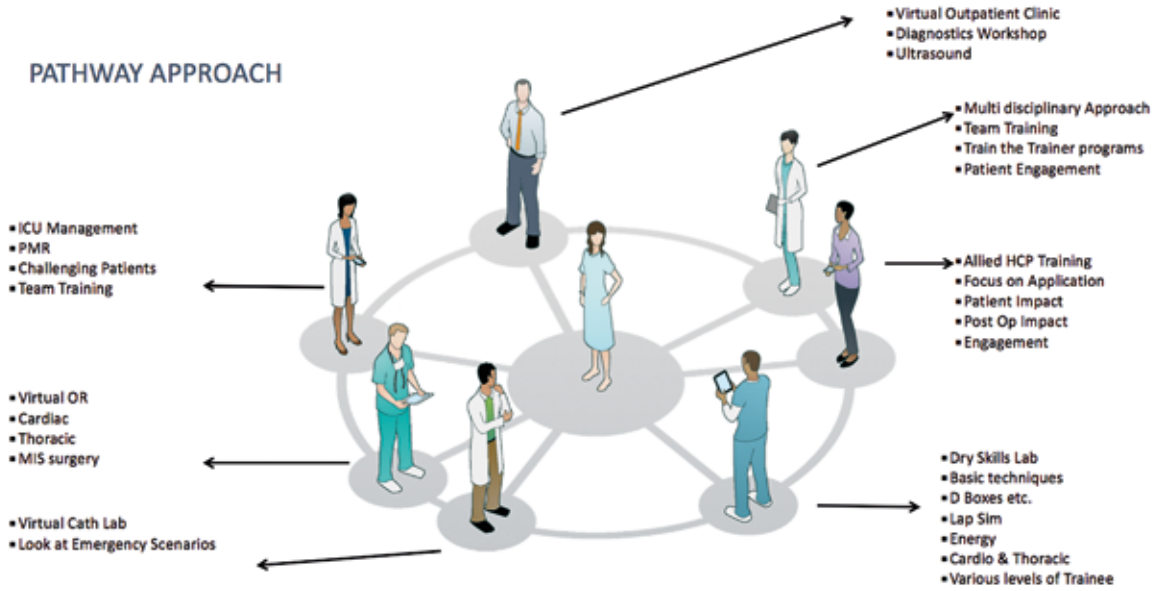
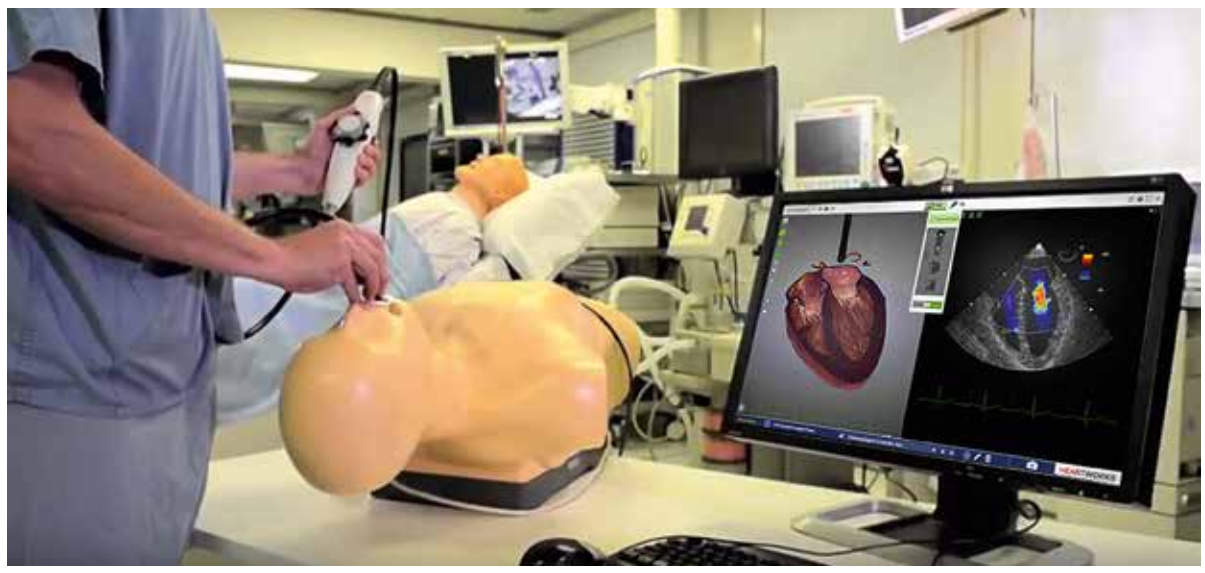



Figure 1: Cardiac simulation centre for Africa

Califia surgery on beating porcine heart



TEE simulation

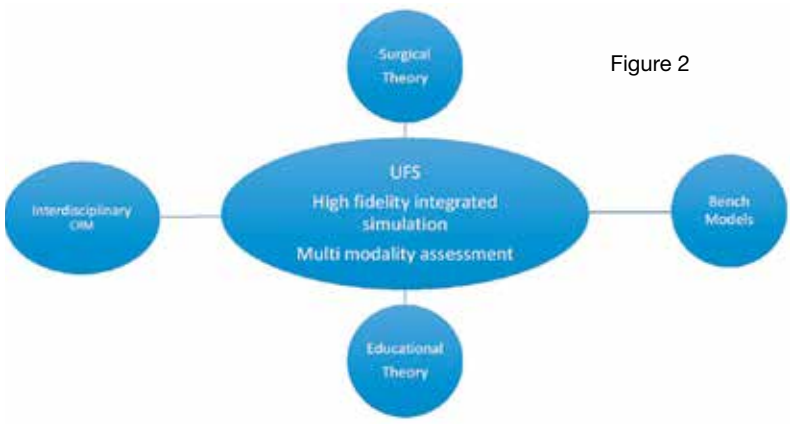
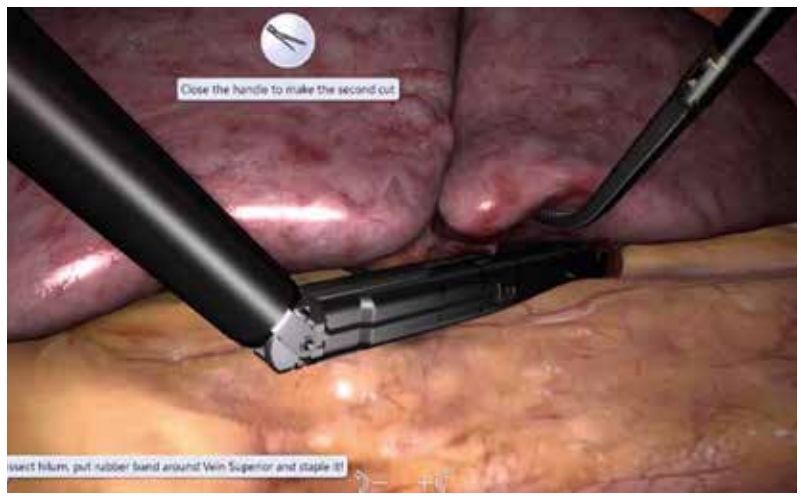



Figure 2

Virtual reality training on TEE / echo as well as VATS surgery will take place in Bloemfontein. The use of the Califia perfusion system integrated with a pulsatile porcine heart provides interdisciplinary training involving anaesthetists, perfusionists, operating room nursing personnel and surgeons. The system can also be used to train a multidisciplinary team on VAD and ECMO exercises.

Some aspects of the programme were demonstrated and evaluated during the annual Hannes Meyer Registrar Symposium held 21–23 September 2018 at the UFS. The system was experienced and evaluated by 102 delegates from surgical training programmes in South Africa and other African countries, incorporating surgical registrars, senior surgeons, perfusionists, anaesthetists, nursing personnel and industry representatives. All delegates supported the further development of this programme as a two-year modular course.




Virtual reality VATS surgery

**This symposium has been supported and attended by EACTS-delegates since 2008.**

Cardiac | Abstract | Degenerative mitral regurgitation: Bespoke management

# Which patients are candidates for minimally invasive mitral valve surgery?

## Establishment of risk calculators using a national clinical database

**Hiroyuki Nishi[1], Hiroaki Miyata[2], Noboru Motomura[2], Toshiki Takahashi[1], Yoshiki Sawa[3] and Shinichi Takamoto[2]** on behalf of the Japan Cardiovascular Surgery Database Organization; 1. Department of Cardiovascular Surgery, Osaka Police Hospital; 2. Japan Cardiovascular Surgery Database Organization; 3. Department of Cardiovascular Surgery, Osaka University Graduate School of Medicine

With advances in minimally invasive cardiac surgery (MICS) over the past 25 years, minimally invasive mitral valve surgery (MICS-mitral) via a right mini-thoracotomy has become increasingly utilised worldwide. Even though MICS-mitral is widely performed, controversy remains regarding its application because of procedure-related complications such as stroke or reoperation for bleeding. MICS-mitral should not compromise the clinical outcome, thus some surgeons may be reluctant to utilise this technique. Since the indications for MICS-mitral will likely be expanded with advancements of techniques and devices, an appropriate tool for risk assessment of patients undergoing mitral valve surgery is important to ensure quality control, and would be helpful when deciding whether MICS-mitral or conventional mitral valve surgery with a sternotomy is more appropriate for a patient who has undergone mitral valve surgery. Therefore, we aimed to develop MICS-mitral risk calculators using data from the Japan Adult Cardiovascular Surgery Database (JCVSD), in order to provide useful information for patient selection.

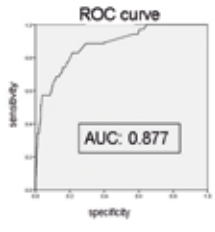
Between 2008 and 2015, 3,240 patients (mean age 59 ± 14 years, males 1,950) underwent a MICS-mitral procedure in Japan and were registered in JCVSD. In this study, we examined mortality and composite outcome (operative mortality, stroke, reoperation for bleeding) using multivariate analysis, then developed a risk calculator for each using stepwise analysis. Furthermore, we examined the relationships of various preoperative factors with in-hospital mortality and composite outcome, as well as the effect that patient volume at each institution has on postoperative outcome by checking the distribution of MICS-mitral cases in the latest study year (2015). According to the number of MICS-mitral cases treated at each hospital, we divided the patients into those treated at institutions that experienced less than 10 cases per year and at those that had 10 or more cases per year, and conducted the same analysis.

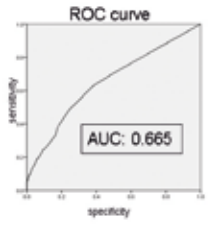
Risk of Operative mortality
= EXP(X)/(1+EXP(X))

X = age * 0.300+ Respiratory dysfunction (mod to severe)* 1.283 +Thoracic aortic disease* 1.696 + MI* 1.478 + BMI ≥ 30* 1.864 + NYHA class IV * 1.187 + moderate or severe AR * 1.720 + MV replacement * 1.007 - + Multiple valve surgery* 0.822 - annual cases ≥ 10 cases * 0.426 -5.865

Risk of composite outcome
= EXP(Y)/(1+EXP(Y))

Y = age * 0.224+Recent history of CVD* 1.642 + carotid artery disease* 1.138 + Respiratory dysfunction (mod to severe)* 1.156 + MI * 1.056 + moderate or severe TR * 0.502 - annual cases ≥ 10 cases * 0.426 -3.427




Operative mortality was 1.1% and the composite outcome rate was 5%. Multiple regression analysis for all patients identified several risk factors affecting operative mortality and composite outcome. Four risk factors were found to be associated with both operative mortality and composite outcome; age, respiratory dysfunction, myocardial infarction, and the number of annual cases. In the multivariate analysis, risk factors associated with operative mortality were age, respiratory dysfunction, thoracic aortic disease, myocardial infarction, BMI >30, NYHA class IV, moderate or severe aortic regurgitation, mitral valve replacement, multiple valve surgery and annual cases, while those associated with a composite outcome were age, recent cerebrovascular disease, carotid artery disease, respiratory dysfunction, myocardial infarction, moderate or severe tricuspid regurgitation and annual cases.

Our prediction formulas for mortality and composite outcome are shown in the figure. Comparison of outcome between institutions with small (< 10 cases/year) and large (≥ 10 cases/year) caseloads revealed significant differences with regards to postoperative complications.

We showed that MICS-mitral procedures were safely performed with acceptable outcomes in the present study cohort. Results obtained by this comprehensive multicentre analysis provide valuable information for appropriate selection of patients for MICS-mitral. In addition to its usefulness for patient selection, we consider that the present risk calculator formulas may influence future applications for this procedure.

Thoracic | Rapid Response | Thoracic Mixed

# An unusual pneumothorax

## From the neck to the lung: the strange case of the migrating needle

**Marco Cosci, Marina Vidali and Francesco De Marchi** Chirurgia Generale, Ospedale S.Bortolo, Vicenza Italy

### Introduction to the case

We report the case of a 30-year-old male drug-user who tried to inject himself with a syringe through the neck, on the left side, because of poor and abused peripheral venous accesses.

During the attempt the needle accidentally broke and got stuck inside of the patient's neck and eventually he came to the emergency department (Figure 1).

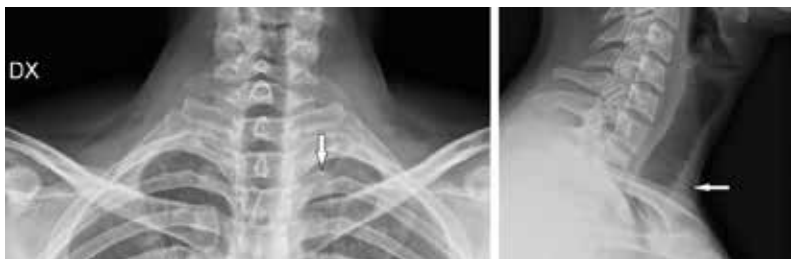



Figure 1. A-P and L-L X-rays locating the foreign body

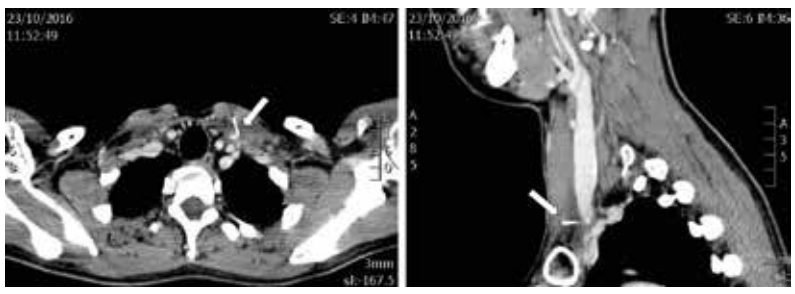


Figure 2. CT scan images showing the depth level of the foreign body and its proximity to the vessels

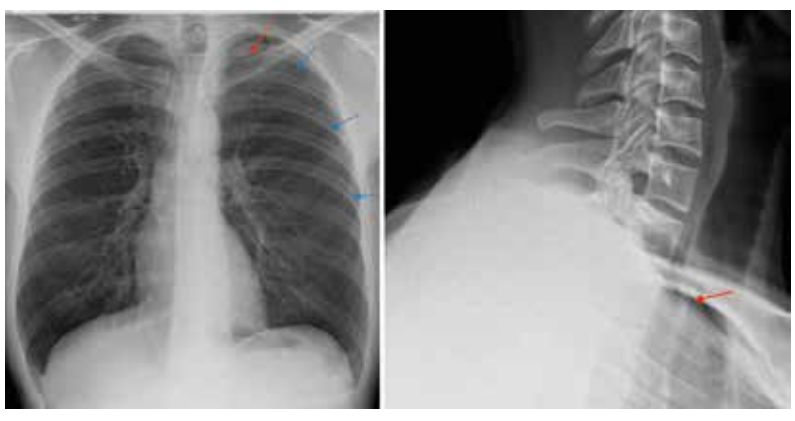


Figure 3. One month later: left pneumothorax and the descent of the needle

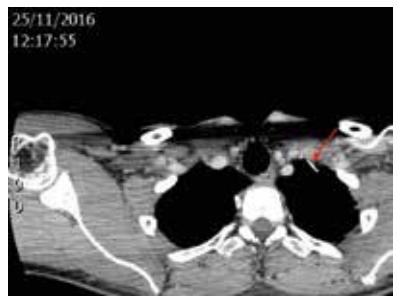
CT scanning of the neck revealed the presence of the foreign body close to the neuro-vascular bundle but with no clear signs of penetration into the vessels or evident damage to the surrounding structures (Figure 2). A vascular surgeon was consulted and a request for an ENT visit was done before the patient left the hospital due to a panic attack.

One month later the patient came back to the emergency department complaining of a persistent cough, chest pain and some difficulty in breathing. Chest X-rays were performed and a left pneumothorax was evident with the suspicious image of a possible foreign body at the apex of the lung (Figure 3).

### Treatment and complications

The patient was admitted to our department. A chest drain was placed first and then a CT scan of the thorax was performed: it showed the presence of the needle and its position between the apical parietal pleura and the underlying lung (Figure 4).

The patient subsequently underwent triportal VATS: some pleuro-pulmonary adhesions were released and the exploration at the apex of the pleural cavity revealed the small foreign body penetrating the lung from above. The needle was removed by VATS. No consistent bleeding occurred and there were no significant air leaks after re-expansion of the lung, therefore no pulmonary resections were necessary. Apical pleural scarification was performed in order to achieve sufficient pleurodesis. No complications were observed in the post-operative course.



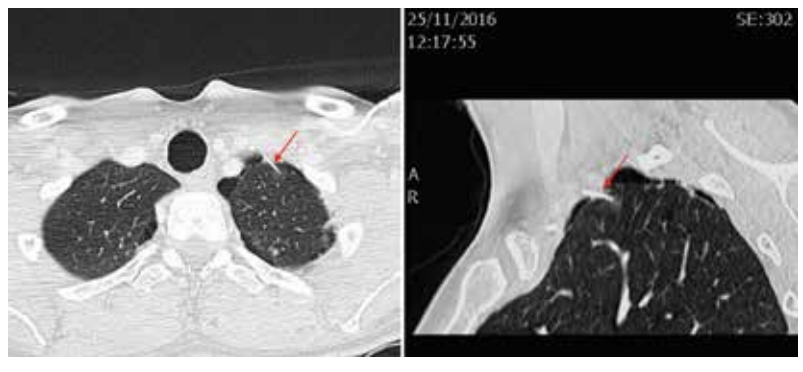




Figure 4. One month later: CT scan location of the needle, axial and sagittal views

### Results and lessons to be learned

The patient had a good and fast recovery from surgery and was discharged on post-operative day four, with no recurrence of pneumothorax observed on follow-up.

This case teaches how cervical foreign bodies, even if small and apparently unharmful like a broken needle, may harm the patient not only in the acute phase but also in the long-term. History is crucial to link the events and to understand the mechanism of damage.

Similar to the pathophysiology of some infective conditions descending from the neck to the mediastinum (necrotising mediastinitis from ENT abscesses), cervical mobile foreign bodies may follow anatomical plans that displace them.

Contrast-enhanced CT scan is essential to localise foreign bodies from the neck to the thoracic inlet; it can reveal active (or potential) vascular and visceral lesions, and sagittal and coronal reconstructions may help in the planning of surgical technique and access.

Vascular | Abstract | Working from inside the aorta with surgical input

# Radical open surgery after complications following thoracic endovascular aortic repair (TEVAR)

**Malakh Shrestha, Axel Haverich and Andreas Martens** Hannover Medical School, Germany

Thoracic endovascular aortic repair (TEVAR) has become a less invasive alternative to open surgery for descending thoracic aortic disease.

Although short-term durability is promising, the long-term durability of TEVAR is unknown. Complications related to the endograft, such as endoleak, stroke, retrograde type A dissection and aorto-oesophageal as well as aorto-pulmonary fistula remain a concern.

We retrospectively reviewed our database (1/2001–12/2017) to study the peri-operative results after radical open surgery for complications following TEVAR. In this time period, a total of 17 patients underwent radical surgery after complications following TEVAR.

Our study showed that although not common, complications related to thr endograft, such as rupture and aorto-oesophageal as well as aorto-pulmonary fistula may occur following TEVAR. In such cases, radical open surgery for complications following TEVAR can be performed with acceptable results.

Emergent thoraco-abdominal aortic replacement for rupture/fistula after TEVAR has high immediate post-operative mortality but good midterm survival.

Thoracic | Abstract | Oesophagus

# Comparison of pulmonary function changes using neoadjuvant chemoradiotherapy or neoadjuvant chemotherapy followed by minimally invasive oesophagectomy: a randomised, controlled trial

**Yaxing Shen[1,2], Yushun Gao[2], Shugeng Gao[2], Lijie Tan1 and Jie He[2]** 1. Zhongshan Hospital, Fudan University, Shanghai, China; 2. National Cancer Center/National Clinical Research Center for Cancer/ Cancer Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China

During Friday's dedicated oesophageal session, Yaxing Shen will present randomised controlled trial results from a registered multicentre study focused on neoadjuvant chemoradiotherapy or neoadjuvant chemotherapy followed by minimally invasive oesophagectomy for patients suffering from locally advanced oesophageal cancer. The team members from Zhongshan Hospital, Fudan University and Cancer Hospital, Chinese Academy of Medical Science demonstrated the primary outcomes drawn from the trial's Chinese multi-institutional study group focusing on oesophageal cancer (CMISG1701).[1] The study demonstrated the safety on pulmonary complications when neoadjuvant chemoradiotherapy was offered to oesophageal cancer patients, while cautioning that surgeons should be careful about the drops in FEV1 and DLCO due to the radiation.

According to cancer statistics, the incidence and death rate of oesophageal cancer in China remains the highest in the world, while most of the new cases found were at locally advanced stage requiring neoadjuvant therapy. The successful treatment of these oesophageal cancer patients requires a cooperation of multi-institutional and multi-disciplinary efforts to achieve a combination of surgical and oncological benefits. The impressive outcomes of CMISG1701 recalled the famous study on neoadjuvant therapy from Cross (*NEJM* 2012) and the study on open versus minimally invasive esophagectomy (*Lancet* 2012).

The study is scheduled to finish recruitment at the end of this year, with plans for more investigation in the coming years. As the large volume of oesophageal cancer patients in China contributes a lot to the quick registration of the study, we are also looking forward to international cooperation on this topic. A cross validation between European databases and CMISG1701 would be exciting since realising that there were many great teams working in the field of oesophageal cancer with promising results published every year.

This is the second time that Zhongshan Hospital and Fudan University from Shanghai, China has given a presentation at EACTS. As a Chinese team focused on oesophageal cancer, we hope to continue more collaboration between the Association and our young investigators, supporting joint study, and would be more than happy to welcome you all to Shanghai soon.

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Minimally invasive oesophagectomy in the semi-prone position: the Zhongshan Experience

Cardiac | Abstract | HOCM

# Obstructive hypertrophic cardiomyopathy or obstructive left ventricular outflow cardiomyopathy?

## HOCM without septal hypertrophy – new management options

**Daniel G. Swistel**
NYU School of Medicine, NYU/Langone Medical Center, New York, NY, USA

The pathophysiology of Hypertrophic Cardiomyopathy (HOCM) is commonly accepted to include at least a modestly thickened anterior basal septum protruding into the outflow tract of the left ventricle. As awareness of outflow tract obstruction has increased, along with the resolution of echocardiography, multiple anatomic variants have been identified that cause symptoms and gradients without necessarily having the profound basal hypertrophy we are accustomed to expect. These variants might include accessory papillary muscle heads, antero-basal displacement of the main antero-lateral papillary muscle, mid and apical hypertrophy without basal hypertrophy and elongation of the anterior and sometimes even posterior leaflet of the mitral valve.

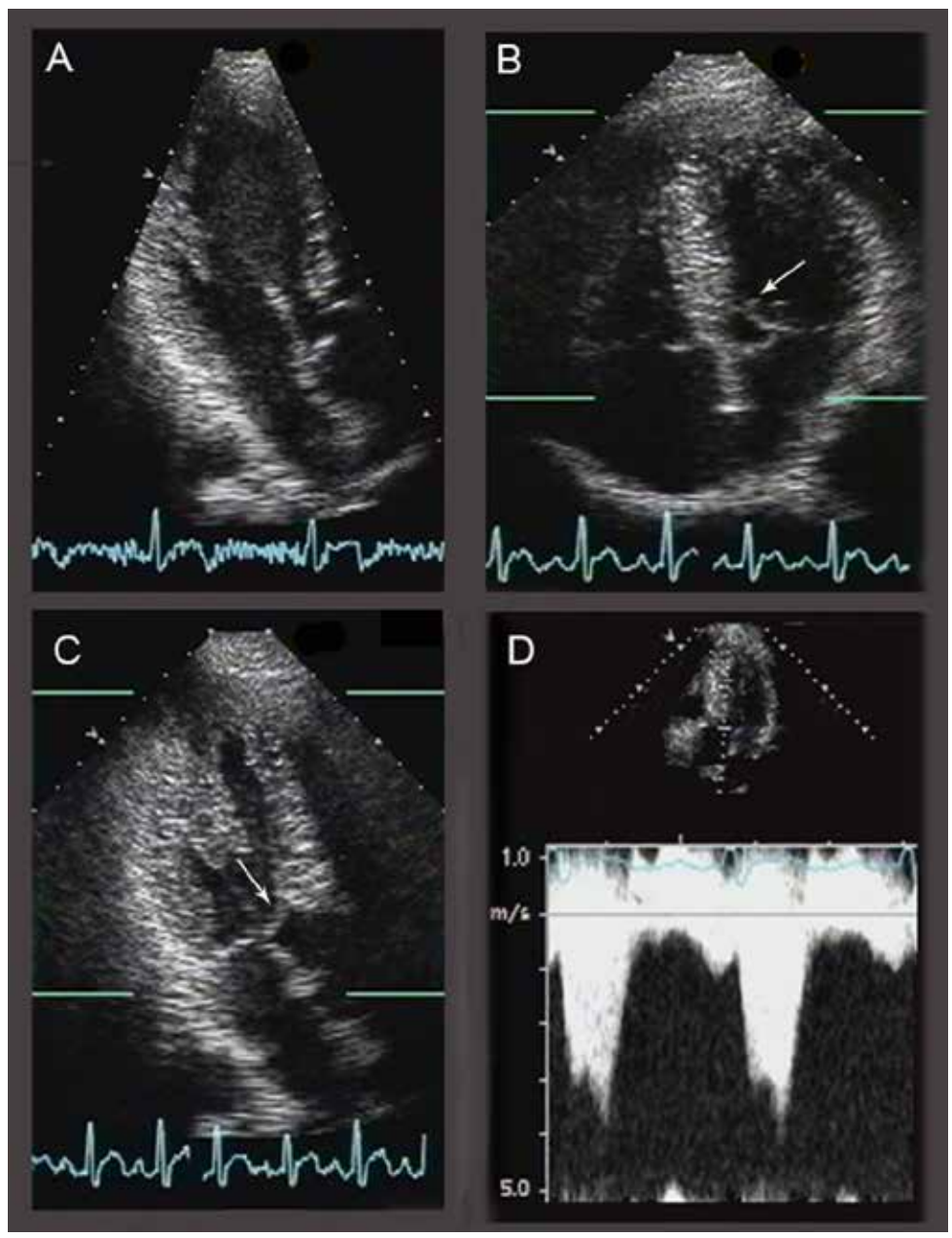
Patients may suffer profound symptoms, but on routine echo study may have a completely benign and normal-appearing cardiac anatomy. Mitral-septal contact may only appear under stress-echo conditions and may necessitate even more profound provocation by preceding the stress-echo with a heavy meal. Furthermore, a high index of suspicion may be required to look for either mitral-septal or mid-ventricular contact or apical or mid chamber obliteration.

Recognising these variants is critical if a successful resolution of obstruction is to be obtained with a surgical approach. Furthermore, obstruction caused by these ever more commonly discovered variants is frequently less successfully treated pharmacologically and is not at all amenable to alcohol septal ablation.

It remains, then, important for the surgeon to have an appreciation for these variations and the knowledge and understanding of the pathophysiology and how to treat them. Firstly, good pre-operative diagnostic testing is required which usually includes a TTE, MRI, and cardiac catheterisation – both right and left – to rule out coronary obstructive pathology and pulmonary hypertension. A TEE may be helpful in equivocal cases where accessory papillary muscle heads may be suspected as part of the pathophysiology. In the operating room, 3D TEE may be especially helpful to help determine the location of accessory papillary muscle attachments that are involved with obstruction. The decision to resect these attachments must be carefully considered so as to not inadvertently cause leaflet prolapse and central insufficiency.

Other therapeutic options include leaflet plication, residual leaflet resection, papillary muscle tethering and accessory papillary muscle head thinning of resection. In cases which include some degree of modest septal hypertrophy, an intracardiac echo probe may help quantify more precisely the amount of available muscle for resection to minimise the risk of creating an iatrogenic ventricular septal defect.

In short, obstructive HOCM might be better renamed "Obstructive Left Ventricular Outflow Cardiomyopathy", but whatever it is labelled, a thorough understanding of the pathophysiology and the surgical treatment options is critical for successful alleviation of mitral insufficiency, outflow tract gradients and symptoms.




A) Resting study, diastolic apical three chamber view shows normal LV wall thickness and elongated anterior mitral valve leaflet that was 36 mm long. B) Four chamber view showing post-exercise mitral-septal contact. C) Three-chamber view showing post-exercise mitral-septal contact (arrow). D) LVOT CW Doppler post-exercise systolic gradient of 64 mm Hg due to mitral-septal contact.

2018 EBCTS Examinations – the Level 1 MEBCTS exam

# The Cardiothoracic surgeon: A competent, safe, and certified physician

**Eduard Quintana and Pietro Bajona** on behalf of EBCTS

Some national European surgical programmes continue to grant professional licensing without any type of standardised examination taken before independent practice. However, exit examinations may be in the best interests of healthcare systems – certainly for the patients, the public, employers and some national healthcare regulators, who put great stock in such examinations.

EACTS have a declared aim of advancing care through training education and assessment – the European Board of Cardiothoracic Surgery (EBCTS) are endeavouring to deliver these assessments through the development of examinations which have the potential to provide a common standard of certification for European surgeons and beyond.

The 2017 European Board MCQ (multiple choice questions) examination was of high quality, driven by knowledgeable question writers, standard-setting panellists, experienced educators and external quality assurance assessors. The large proportion of surgeons who took the exam provided positive feedback. The Level 1 EBCTS exam continues as a multiple choice, 180-question single-best-answer paper in the generality of cardiothoracic surgery (cardiac, thoracic, congenital and critical care). The latest exam was delivered on 17 October here in Milan.

There is growing worldwide interest in assessing professional competencies in cardiothoracic surgery through the EBCTS Section 1 examination. Candidates are coming from an increasing number of nations, and the number of registered candidates for this year's venue continued to grow exponentially. Several countries have registered an interest in the EBCTS exam becoming part of their credentialing process for completion of training.

A panel of 25 Level 1 (MEBCTS) question writers is now well established. With the support of EACTS, this group of motivated surgeons have been trained in exam question development and educational standards. This endeavour has required several meetings during the year and a significant amount of online work to produce and review questions. We continue to welcome self-nominated question writers, so if you are interested please see the EBCTS website where you will find an appraisal process for all examiners.

A large number of new questions have been added to the Level 1 question bank and are ready to be used. Revision of original questions is a continuous process with the advent of new clinical evidence or revised clinical guidelines. We have reached the point where new questions are now routinely and continuously submitted. During face-to-face examiner meetings, new questions are appropriately assessed, discussed, criticised, refined and finalised. At this point, questions are stored and prepared for subsequent standard setting.

This year's Level 1 (MEBCTS) exam was reviewed by a panel of senior cardiothoracic surgeons on 1 October at EACTS House in Windsor, UK. This served to establish the fair pass mark, and all of the questions were reviewed to detect potential ambiguities, errors and any other problems including an inappropriate level of difficulty. Feedback from last year's examinees has also been considered and found to be useful in the continued improvement of the examination.

The ongoing development and delivery of high-standard assessment is one of our profession's key needs. It is also expected by our patients, thus it will help assure them of the quality of care that they receive from us.

Professional trust in the examination is continuing to expand and there may be an opportunity for this to become a regulatory requirement across Europe. However, regardless of diverse national political and legal decisions, this assessment and certification should be appreciated as a common standard of competence in our specialty in the international arena.



**For more information on the European Board of Cardiothoracic Surgery examinations, please head to www.ebcts.org.**

Thoracic | Rapid Response | Rapid Response 1 – Thoracic

# Thoracoscopic evacuation compared to reinsertion of thoracostomy tube in persistent traumatic haemothorax

**Hussein Elkhayat[1], Mohamed A.K. Salama Ayyad[1], Mohamed Emad[1] and Abdelradi Farhgaly[2]**

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Trauma is the most common cause of death all over the world. Morbidity and mortality in multiple injury patients accounts for 25% of deaths annually. Haemothorax is the most frequent complication of chest trauma. In most of cases chest tube will be enough for treatment but in a minority of patients they will need more intervention to evacuate a persistent haemothorax.

In this study we aimed to compare between VATS evacuation of persistent clotted blood and our standard approach of reinsertion of thoracostomy tube, thereby exploring the safety and complications of such techniques, as well as drainage days. We conducted a prospective, randomised case-control study of patients presented by persistent haemothorax admitted to a trauma unit from July 2017 to July 2018. During this timeframe our trauma unit received 44,879 patients, with 14,722 of them needing admission, only 288 patients requiring primary chest tubing for haemothorax, of which 35 patients met the inclusion criteria of this study. These 35 were then divided into 2 groups; A (16 patients) who underwent evacuation by VATS, and group B (19 patients) who received re-insertion of a chest tube. We found that the most common mode of trauma was blunt trauma (62%) in both groups.

In group A, drainage days ranged from 2 to 7 days (mean: 3.31 days), while in control group B, drainage days were significantly increased (4 to 10 days, mean: 6.47 days; p = 0.001). One patient (6.25%) underwent thoracotomy (failed VATS) due to extensive fibrosis in group A. In group B, 15.8% (three patients) needed a third thoracostomy tube, while 21.1% (four patients) underwent open thoracotomy.

Operative time for VATS ranged from 24 to 130 minutes, with a mean time of 79.8 minutes. There was a strong positive linear correlation between the operative time and the duration between initial chest tube and VATS evacuation (r = 0.702; p = 0.002). The mean operative time of multiport VATS was 96.25 minutes, compared to 63.5 minutes in uniportal VATS evacuation (significant difference, p = 0.024).

We concluded that VATS for evacuation of retained haemothorax is feasible and safe for trauma patients. Early VATS evacuation leads to shorter hospital stay and reduced need for open thoracotomy in comparison to re-insertion of a chest tube. Uniportal VATS evacuation can lead to similar results as multiport VATS, with shorter operative time and better patient experience. The motto is clear: "No incision other than that of a chest tube".

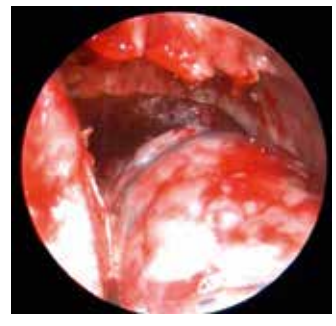

Figure 1: Thoracoscopic view of persistent haemothorax with prominent edges of ribs fractured on the upper most part.

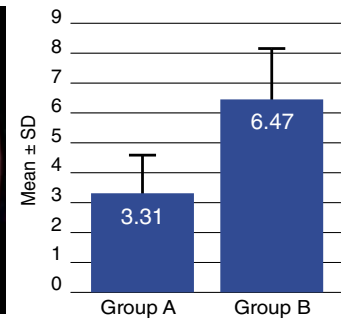


Figure 2: Drainage days after second intervention (p = 0.001)

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Cardiac | Rapid Response | Challenges in mitral surgery

# Mitral valve repair in Marfan Syndrome: medium- and long-term outcomes in a contemporary series

**Susana Villar, Carlos Esteban Martín, Jorge Rivas, Yazmín Vera, Daniel Martínez, Santiago Serrano-Fiz, Susana Mingo and Alberto Forteza** Hospital Universitario Puerta de Hierro, Majadahonda-Madrid, Spain

The most common and conditioning cardiac lesion in Marfan Syndrome (MS) is aortic disease, but it has also been reported that more than 40% of these patients will also have mitral valve prolapse and progressive mitral disease that can occasionally determine premature valvular regurgitation. Mitral insufficiency in MS patients has similarities with myxomatous disease, but with more severe fibroelastic involvement. Currently, there are limited studies describing mitral valve repair in this special population, and the long-term outcomes of this surgery continue to be debated.

The aim of this study was to review our experience and outcomes in mitral valve repair in MS patients treated in our multidisciplinary Marfan Unit. The study population consisted of patients diagnosed preoperatively of MS and with significant mitral valve regurgitation known in previous echocardiographic studies. Results were analysed in terms of survival and freedom of reoperation.

This retrospective and descriptive study included 21 MS patients who underwent elective mitral repair surgery from January 2005 to December 2017.

The mean age was 30.67 ± 12.75 years and 12 patients (57.1%) were men. Most of the patients needed other surgery in addition to the mitral valve repair, for example aortic valve-sparing (David's technique), which was the most common, performed in 61.9% of the patients (n = 13).

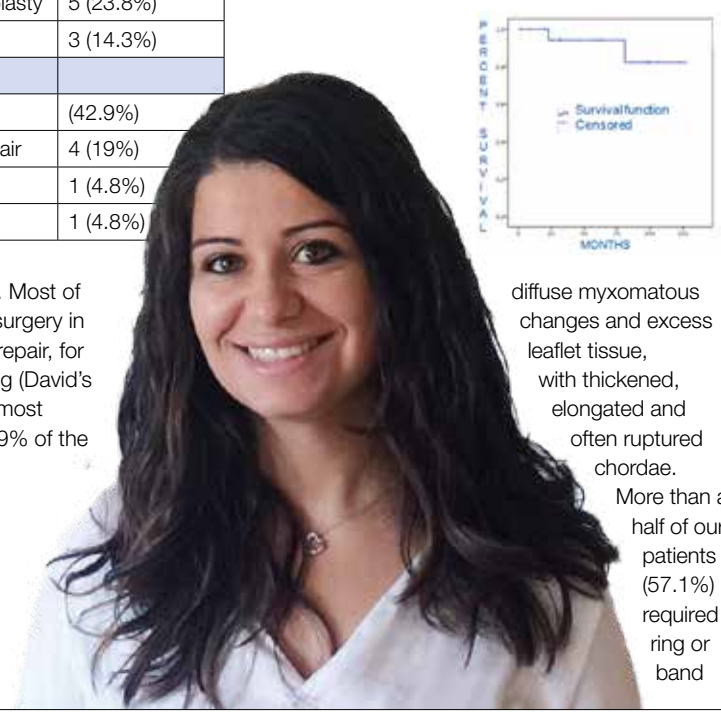
Mitral valve repair in MS patients remains a complex technique due to the wide impact seen by the components of the valve. We observed large valve sizes, with diffuse myxomatous changes and excess leaflet tissue, with thickened, elongated and often ruptured chordae. More than a half of our patients (57.1%) required ring or band annuloplasty with implantation of neo-chords and/or valve resections. Mean perfusion and cross-clamp times were 135.05 ± 51.39 minutes and 116.45 ± 46.45 minutes, respectively. When we analysed the echocardiographic and surgical findings, we found that 33.3% of the population had significant mitral annulus calcification, more than 65% had moderate to severe left ventricle dilatation and 33.3% had bileaflet prolapse. In-hospital mortality was 0% and 2 patients (9.5%) required reoperation for bleeding. We did not observe any other major complications.

Mean follow-up was five years (59.29 ± 38.97 months) and one patient required reoperation due to severe mitral regurgitation after 23 months from the surgery. There were no endocarditis or cerebrovascular events in follow-up. The survival at 1, 5 and 10 years was 100%, 94.12% and 82.35%, respectively. At final echocardiographic monitoring, 80.9% (17) of the patients had mitral regurgitation lower than grade III, and 57.1% (12) had trivial or zero regurgitation. The calcification of the mitral annulus was associated with recurrent mitral insufficiency (Rho Spearman 0.611, p = 0.004).

We can conclude that mitral valve repair surgery in MS patients achieves good clinical and functional medium- and long-term results, and should be considered as a first-choice procedure in MS mitral regurgitation. Due to the high technical complexity of the procedure, and MS' association with other pathologies, these patients should be centralised in experienced centres.

| Surgical data | |
|---|---|
| Perfusion time (minutes) | 135.05 ± 51.39 |
| Cross-clamp time (minutes) | 116.45 ± 46.45 |
| **Type of mitral valve repair:** | |
| Ring annuloplasty | 7 (33.3%) |
| Band | 2 (9.5%) |
| Resection + Ring annuloplasty | 4 (19%) |
| Neochords + Ring annuloplasty | 5 (23.8%) |
| Neochords + Band | 3 (14.3%) |
| **Surgery associated:** | |
| David | (42.9%) |
| David + Tricuspid valve repair | 4 (19%) |
| Aortic valve repair 9 | 1 (4.8%) |
| Bentall | 1 (4.8%) |

| Follow-up results | |
|---|---|
| Follow-up time (months) | 59.29 ± 38.97 |
| Surgery in follow-up | 1 (4.8%) |
| **Mitral regurgitation in follow-up:** | |
| Grade 0-I | 12 (57.1%) |
| Grade II-III | 6 (28.6%) |
| Grade IV | 3 (14.3%) |




Congenital | Abstract | Long-term outcome after surgical repair in congenital heart disease

# Surgery for anomalous aortic origin of coronary arteries (AAOCA).

## A multicentre study from the European Congenital Heart Surgeons Association (ECHSA)

**Massimo A. Padalino** Paediatric and Congenital Cardiac Surgery, University of Padova Medical School, Italy – On behalf of ECHSA

Anomalous aortic origin of coronary arteries (AAOCA) is a rare anatomical abnormality which has been pinpointed as a cause of sudden cardiac death in some individuals, especially young people, and there are no recommendations or guidelines on either surgical indication or best surgical treatment. Single-centre studies are based on small series describing surgical repair as safe, although late effects on symptoms and risk of sudden cardiac death (SCD) remain unknown. The emotional burden, the limited data available in the literature and the variable management approaches of AAOCA prompted us in the European Congenital Heart Surgeons Association (ECHSA) to retrospectively evaluate patients who have undergone surgical repair of such an anomaly in Europe.

To the best of our knowledge, this is the widest cohort of surgical patients ever reported, involving 14 centres within ECHSA (13 in Europe, and one in the US), focusing on all patients undergoing surgical treatment for AAOCA since 1991. We collected 156 patients with a median age of 39 years (interquartile range [IQR] 15–53). As predicted, most of them were symptomatic, mostly at effort, however a not insignificant portion was comprised of asymptomatic patients, with anomalous aortic origin of the right coronary artery being the most frequent.

The study analysed correlation between anatomical features and types of surgery, revealing that surgery for AAOCA is safe, with very low operative mortality and rate of postoperative complications, which mostly occurred in old patients or with poor preoperative conditions, either in left or in right AAOCA. Unroofing and coronary reimplantation were the most common and safest procedures, showing 0% operative mortality. In addition, it seems that most athletes, especially if young, are returning to competitive sports after surgery. Late occurrence of adverse events is not negligible, and effectiveness in terms of objective evidence of alleviation of ischaemia or of reducing the long-term risk of SCD cannot be completely demonstrated in this study because of a relatively short follow-up. Therefore, long-term surveillance is mandatory in all patients.

3D CTA reconstruction of anomalous aortic origin of the right coronary artery from the left aortic sinus

The next research step is creation of an ECHSA-AAOCA registry which could possibly involve all European centres for a long-term, prospective multi-institutional study of this rare but potentially lethal condition which would provide answers to the remaining issues. In addition, it would extremely interesting to evaluate if surgery is really lifesaving in all cases by means of an accurate comparison of matched populations of surgical and non-surgical patients. This kind of data on patients who were not treated surgically, along with a general comparison of these two groups is likely to be revealing. However, this last task may not be really feasible since recruitment of compatible and truly comparable patients may be complicated due to biases in numbers, surgical centre philosophy and patient will.

Cardiac | Rapid Response | Relevant factor determining outcome after cardiac surgery

# Artificial intelligence in cardiac surgery

**Barbara Alexandra Rosser**
University Heart Center Zurich, Switzerland

Articles about artificial intelligence (AI) are popping up every month. We find them in the innovation and technology section of high-ranking newspapers and magazines. Mostly without noticing, we are surrounded by products in our daily life that have AI already implemented. Our phone unlocks by facial recognition or fingerprint. The self-driving car seems to be only a few legal decisions away. Yet many questions, including liability, remain to be discussed. Some predict the end of jobs due to new AI robots. Do we have to worry about getting replaced at work by AI? And if so, when?

## The evolution of AI

The concept of a smart machine with programmed intelligence was broadly introduced over 60 years ago, about the same time as cardiopulmonary bypass. Since then, AI underwent several highs and lows, referred to as "AI fevers" and "AI winters". The defining theories of AI, based in mathematics, programming, robotics and often influenced by philosophy, changed their direction several times. More than once, contradictive theories led to a "cold war", driving the whole field in a next AI winter. The current fever is a different one, spreading out into all sorts of places. Some of them already prove to be highly functional and of big advantage, and this new form of hype is promising to be more stable.

## Why to talk about it now?

Until recently, AI and cardiac surgery developed separately and had no interaction, but contemporary progress in technology boosted the development of AI, giving broad access to better developed methods and facilitating new applications. Also, the approaches broke down from trying to rebuild and improving the human brain into smaller, more simple applications. This finally brings the field out from lecture halls and theory books into today`s life. Image recognition, automation and Big Data analysis are now a reality in daily life, and AI underwent a division into various subfields, led by different methods. Indeed, the increasing performance of personal computers and free availability of AI methods reduced the threshold of introducing these advancements to literally any device, including light bulbs.

## What can AI do for us?

What can we gain from AI in modern cardiac surgery? We grouped AI in seven fields of interest: planning, learning, communication, decision-making, knowledge representation, perception and motion. For each of these fields, we explored their current technological progress and established methods and applications in other medical and non-medical areas in a descriptive and experimental way. We further assessed the fields in a quantitative and qualitative manner regarding possible applications in cardiac surgery, what would be required to develop and implement solutions and what could be gained from an enhancement of cardiac surgery in each of the subfields.

The big question, "When will our job be replaced by the robot?" we still cannot answer; rather we should think about the small everyday tasks that AI can already do for us, and start putting it to work.

Congenital | Professional Challenge | Tetralogy of Fallot & pulmonary atresion / ventricular septal defect. Part II

# Choice of pulmonary artery rehabilitation procedures in patients with pulmonary atresia and ventricular septal defect: a prospective randomised pilot study

**Alexey V. Voitov, Alexander Y. Omelchenko, Yuriy N. Gorbatykh, Alexey N. Arkhipov, Alexander V. Bogachev-Prokophiev and Alexander M. Karaskov** Pediatric Cardiac Surgery Department, National Medical Research Center, Novosibirsk, Russia

Figure 1. Cryopreserved femoral vein allograft (hydraulic test)

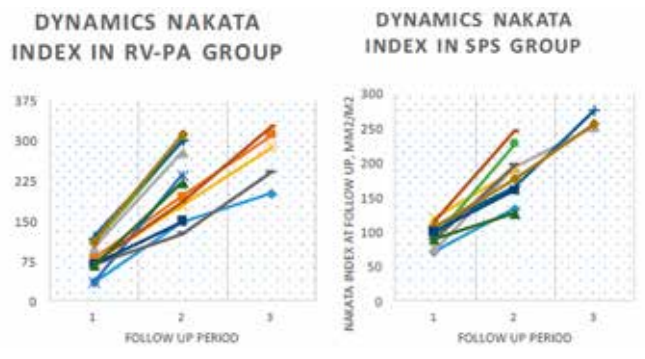



Figure 2. Development of the Nakata index in both groups

The final goal of surgical treatment of pulmonary atresia with ventricular septal defect (PA-VSD) is a complete repair (complete separation of the pulmonary and systemic blood circulation with the maximum possible pressure reduction in the right ventricle). However, the primary complete repair is associated with high risks due to the complex anatomy of the defect (diminutive pulmonary arteries [PAs] and multiple pulmonary blood supply) or the poor initial condition of the patient, with up to 25% mortality expected after a one-stage complete repair.[1]

Therefore, the staged approach for "rehabilitation" of the native hypoplastic PAs is the procedure of choice in the most centres. There are different staged strategies to promote growth in native PAs: right ventricular outflow tract (RVOT) reconstruction and systemic to pulmonary shunts (SPS). However, prospective data comparing RVOT to PA (RV-PA) reconstruction and SPS techniques have not been reported.

Between June 2014 and February 2018 we conducted a prospective randomised study of 24 consecutive patients with PA-VSD enrolled into two groups: RV-PA (allogenic vein valve graft group, n = 12) and SPS (MBTS-7, central shut-5) group (n = 12). Sample size was calculated on Nakata index difference based on the retrospective study[2]. The main inclusion criteria were hypoplastic confluent pulmonary arteries with Nakata index less than 120 $mm^2/m^2$. The primary endpoint was pulmonary artery development (Nakata index, McGoon index, Redy index). The average age in the RV-PA and SPS groups was 18.5 (12.5–83) days and 10 (4–112.5) days, respectively. The average Nakata index was 71.4 (66.7–102.9) $mm^2/m^2$ and 90.6 (74.7–107.9) $mm^2/m^2$, respectively. Computer tomography or angiography were used for pulmonary artery assessment.

In RV-PA group induced ventricular fibrillation for proximal anastomosis between RV and cryopreserved femoral vein allograft was used (Figure 1). The median follow-up period in both groups was 24.7 months (range 9.5–36 months) and was completed for all patients.

MSCT and angiography was used to estimate pulmonary artery growth; there was significant growth of the PAs in both groups (Figure 2), however the RV-PA met the primary end point (mean Nakata index: RV-PA group -282.7 $mm^2/m^2$, SPS group -210.6 $mm^2/m^2$ [p = 0.024]).

Induced ventricular fibrillation without cardioplegic arrest is a safe and effective method for RVOT. Reconstruction with femoral allogenic veins allows the achievement of one-way direct flow, and has shown benefit in PA rehabilitation for patients with pulmonary atresia and ventricular septal defects.

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Vascular | Rapid Response | Time-pressured reactions to avoid casualties in type A dissections

# The fate of the down-stream aorta after open aortic repair for acute DeBakey I aortic dissection: Total arch replacement versus non-total arch replacement

**Yuki Ikeno, K. Yokawa, H. Tanaka and Yutaka Okita**
Department of Cardiovascular Surgery, Kobe University, Japan

## Background

The aim of this study was to evaluate the fate of the down-stream aorta following open aortic repair for acute DeBakey type I aortic dissection, comparing total arch replacement (TAR), elephant trunk (ET) and non-total arch replacement (non-TAR).

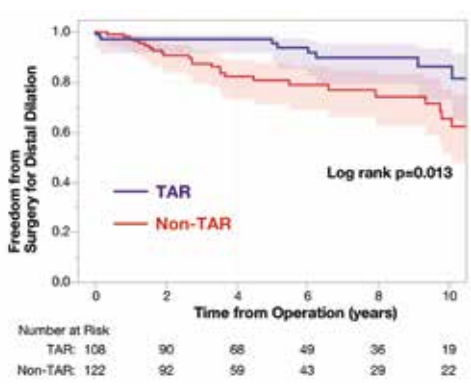
## Methods

From October 1999 to December 2016, 267 patients underwent open repair for acute DeBakey type I aortic dissection. A tier-oriented strategy was predominantly used to determine the extent of graft replacement. The non-TAR group included hemiarch replacement and partial arch replacement, and ET insertion was exclusively performed in the TAR group. Aggressive TAR was also used in patients with aortic arch dilation or severe dissection involving supra-aortic orifices, younger patients or patients with suitable status. Hospital mortality was 10.0% (12/120 patients) in the TAR group and 17.0% (25/147 patients) in the non-TAR group (p = 0.070). Late outcomes were compared in 230 hospital survivors (TAR, n = 108; non-TAR, n=122). Mean follow-up was 6.5 ± 4.6 years. Aortic diameters were measured at four levels, across six time points, using computed tomography.

## Results

Freedom from additional aortic surgery for distal dilation was significantly better in the TAR group than the non-TAR group (TAR, 97.5 ± 1.8% at five-years; non-TAR, 88.2 ± 3.4% at five-years; p = 0.045). Freedom from a distal aortic event was also significantly better in the TAR group compared with the non-TAR group (TAR, 97.2 ± 1.6% at 5-years; non-TAR, 80.7 ± 4.2% at 5-years; p = 0.013). In the non-TAR group, aortic arch diameter increased significantly (p < 0.001). Significant aortic remodelling occurred at the proximal descending aorta in the TAR with ET group (p<0.001).

Yuki Ikeno, left and Professor Yutaka Okita from the Department of Cardiovascular Surgery, Kobe



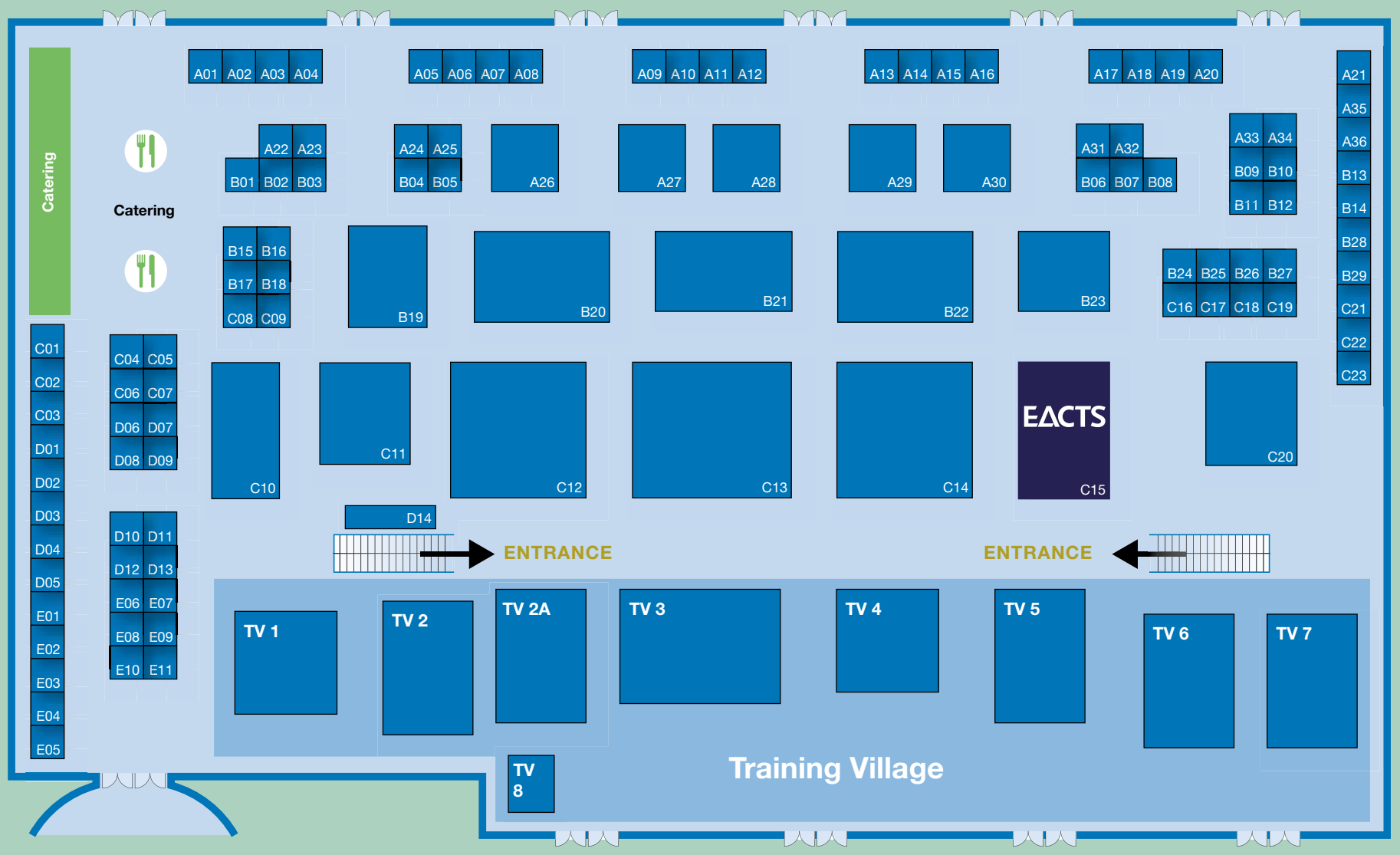

## Conclusions

TAR with ET reduced the need for additional distal aortic repair compared to non-TAR. TAR with ET prevented unfavourable aortic growth in both the aortic arch and the proximal descending aorta.

# EACTS 2018
# Floor Plan

**Exhibition opening times:**

| | |
|---|---|
| Thursday 18 October | 14:00–19:00 |
| Friday 19 October | 09:00–17:00 |
| Saturday 20 October | 09:00–17:00 |

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|---|---|
| **A09** | 3-D Matrix Ltd |
| **A15, A16** | A&E Medical Corporation |
| **B28** | AATS-American Association for Thoracic Surgery |
| **C10** | Abbott |
| **TV Unit 1** | Abbott |
| **E10** | ABIOMED Europe GmbH |
| **D01** | Admedus |
| **A05** | Advancis Surgical |
| **B24** | Andocor NV |
| **D08** | AngioDynamics |
| **E09** | Ansabere Surgical, S.L. |
| **E02** | Argentum Medical LLc |
| **B07** | Asanus Medizintechnik GmbH |
| **C20** | AtriCure BV |
| **E01** | Aziyo Biologics/Biomatic International, Inc. |
| **C11** | B Braun Aesculap |
| **A29** | Berlin Heart GmbH |
| **B01** | BioCer Entwicklungs-GmbH |
| **A14** | Biointegral Surgical, Inc |
| **D03** | Biometrix, s.r.o. |
| **A13** | BioStable Science & Engineering, Inc |
| **C01** | Cardia Innovation AB |
| **B15, B17** | CardiaMed B.V. |
| **C08** | Cardio Medical GmbH |
| **B25** | Changzhou Waston Medical Appliance Co., Ltd |
| **A07** | CORONEO Inc |
| **B23** | Cryolife Inc./JOTEC GmbH |
| **TV Unit 5** | Cryolife Inc./JOTEC GmbH |
| **C21** | CTSNet |
| **C04, C06, D06** | CytoSorbents Europe GmbH |
| **D10** | De Soutter Medical Limited |
| **C22, C23** | Delacroix-Chevalier |
| **B08** | Dendrite Clinical Systems Ltd |
| **A18, A19** | Dr. Franz Koehler Chemie GmbH |

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|---|---|
| **C15** | EACTS – The European Association For Cardio-Thoracic Surgery |
| **TV Unit 7** | EACTS – The European Association For Cardio-Thoracic Surgery |
| **TV Unit 4** | Edwards Lifesciences |
| **C14** | Edwards Lifesciences |
| **A20** | Ethicon, Johnson & Johnson Medical Devices Companies |
| **TV Unit 6** | Ethicon, Johnson & Johnson Medical Devices Companies |
| **TV Unit 8** | Eurosets s.r.l. |
| **B19** | Eurosets s.r.l. |
| **B16** | Evaheart GmbH |
| **B03** | Exstent Limited |
| **C18, C19** | Fehling Instruments GmbH & Co KG |
| **B27** | Fuji Systems |
| **A28** | GEISTER Medizintechnik GmbH |
| **A04** | Genesee BioMedical Inc |
| **C12** | Getinge |
| **C03** | Heart and Health Foundation of Turkey |
| **B02** | Heart Hugger / General Cardiac Technology |
| **A36** | Heart Valve Society |
| **A17** | HMT Medizintechnik GmbH |
| **B13** | ISMICS-International Society for Minimally Invasive Cardiothoracic Surgery |
| **D11, D13** | Japan Lifeline Co., Ltd. |
| **A01** | Jarvik Heart Inc |
| **B10** | JOMDD Inc |
| **C16, C17** | KLS Martin Group – Gebrueder Martin GmbH, Co KG |
| **TV Unit 2A** | LivaNova |
| **B20** | LivaNova |
| **E03, E04, E05** | LSI Solutions |
| **TV Unit 2** | LSI Solutions |
| **A25** | Medela AG |
| **A26** | Medistim ASA |
| **TV Unit 3** | Medtronic International Trading SÁRL |

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|---|---|
| **C13** | Medtronic International Trading SÁRL |
| **A06** | Nordic Pharma |
| **A21** | OmniGuide Surgical |
| **A31, A32** | OpInstruments GmbH |
| **B14** | Oxford University Press |
| **E08** | Paragonix Technologies, Inc. |
| **B04, B05** | Peters Surgical |
| **D12** | Philips |
| **B06** | Posthorax s.r.o |
| **B11, B12** | Qualiteam s.r.l. & SyGan Medical GmbH |
| **A33, B09** | Redax S.p.A. |
| **A34** | Rumex International Corp. |
| **C05, C07, D07, D09** | Scanlan International Inc |
| **A27** | Siemens Healthcare GmbH |
| **E07** | Somahlution |
| **B21** | Spectrum Medical |
| **B29** | STS-The Society Of Thoracic Surgeons |
| **E11** | Sunoptic Technologies |
| **A24** | SynCardia Systems Inc |
| **E06** | Tecnohealth srl & 4Medika |
| **B22** | Terumo Europe NV + Terumo Aortic |
| **A22** | Thompson Surgical Instruments, Inc. |
| **A23** | Tianjin Plastics Research Institute Co Ltd (TPRI) |
| **A02** | Tianjin Welcome Medical Equipment Co., Ltd. |
| **B26** | Transonic Europe |
| **B18, C09** | Vascular Graft Solutions |
| **D02** | Vygon |
| **A10, A11, A12** | Wexler Surgical, Inc. & TeDan Surgical Innovations & Designs for Vision |
| **D14** | Wisepress Online Bookshop |
| **C02** | WL Gore & Associates GmbH |
| **A30** | Xenios AG |
| **A08** | Xenosys Co Ltd |
| **A03** | Zeon Medical Inc |
| **D04, D05** | Zimmer Biomet |

# RELAY®PRO

THORACIC STENT-GRAFT SYSTEM

## Low profile without compromise

A low profile Thoracic Stent-Graft System that utilises the same stent design and material as the proven Relay®Plus.

- 19 Fr to 23 Fr
- Dual sheath technology
- Bare stent and non-bare stent configurations

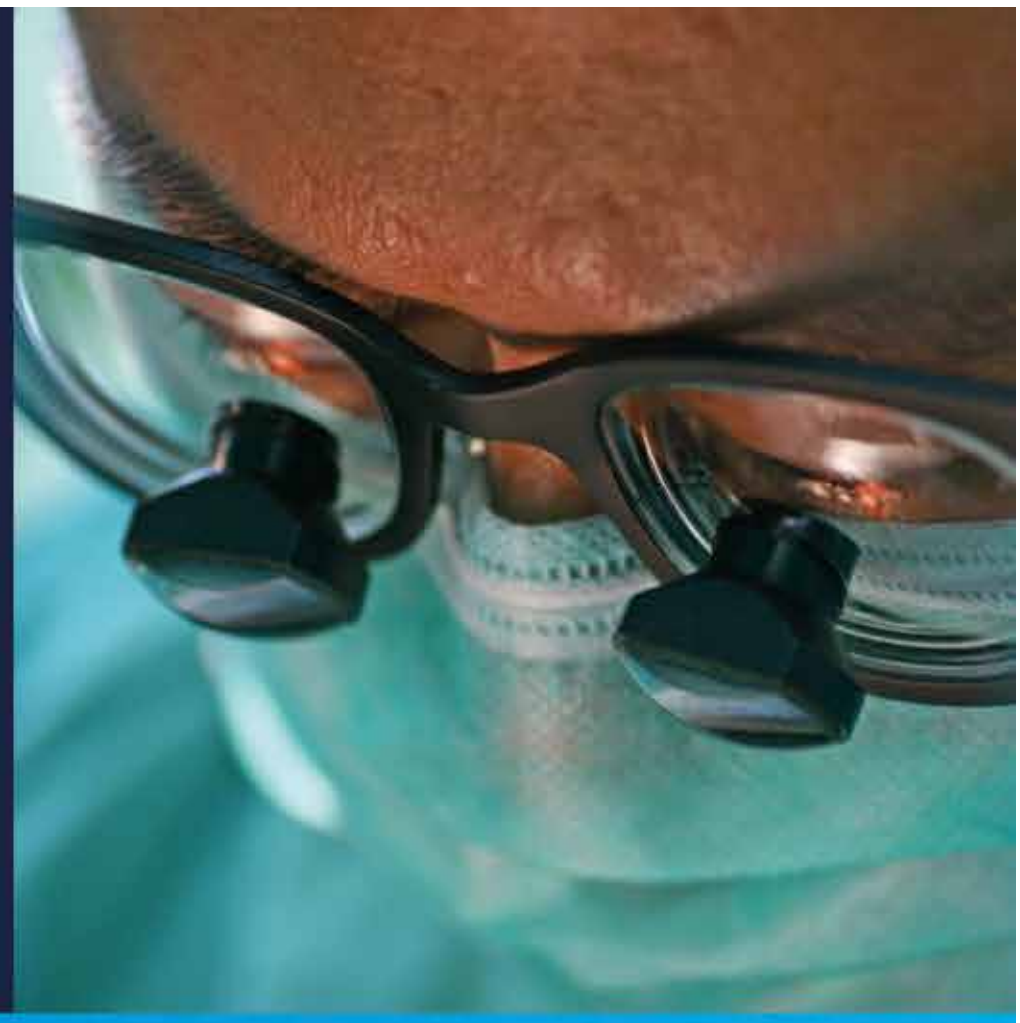
Certified by SGS (0120) according to MDD 93/42/EEC as amended 2007/47/EC.
Caution: Federal Law (US) restricts this device to investigational use only.
RelayPro is not approved in the US or Japan.

TERUMO Aortic | Powered by Bolton & Vascutek

# WE HEAR YOU.

## INNOVATION

The first thing we do as collaborators is listen. You share your experience and expertise, and together, we develop meaningful and comprehensive options for your patients.



# EXTEND YOUR REACH

ONLY WE OFFER THE SURGICAL VERSATILITY AND THE TOOLS **TO HELP YOU TREAT MORE PATIENTS**

HeartWare™ HVAD™ System approved for both Thoracotomy and Sternotomy

HeartWare™ HVAD™ System
Optimized Surgical Tools

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 1.2m². 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. The IFU can be found at www.heartware.com/clinicians/instructions-use.



Medtronic
Further, Together