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In this issue

Plenary Lecture | The whole is greater than the sum of its parts: a strong team for a better outcome

Greater than the sum of its parts: Summit teams in Everest's death zones

Mountaineer Rebecca Stephens captivated attendees of yesterday's Plenary Lecture, which explored the meaning and building of strong teams in cardiothoracic surgery. Stephens, who counts scaling Mount Everest among her many achievements, illustrated through the story of her expedition that an awareness of the human condition is crucial to nurturing an efficacious and trusting team environment.

The opportunity to climb Everest arose for Stephens while, working as a journalist, she covered an expedition hoping to submit the peak in 1989. She later undertook that challenge herself, with success, four years later.

In her talk, she discussed the importance of the triumph of collective goals over those of individual team members. She observed the enigmatic pull of the summit, and the difficulties that come along with the new commercial era of Everest climbers' individual ambitions, especially within the fabric of a foreign land where the role of the Sherpa remains underplayed given the considerable risk they submit themselves to.

"Rarely is there an extreme environment that is so fascinating to watch out the best and the worst of human behaviour," began Stephens. "The team was something that I had very little experience of being a part of before I went to Everest. I never really got how critical it was, and it is something that I developed and learned with passion on that mountain, because of the certainty of my knowledge that I could not have climbed Everest without these two extraordinary Sherpas, Ang Passang and Kami Tchering, who accompanied me right to the top – and, actually, the whole team.

"Thinking about that team, probably the three graces of teamwork that are relevant up a mountain, in business and in medical practice, are very old-fashioned values that sometimes we might forget. The first of those is respect. We met our Sherpa team when we got out to Kathmandu, and it was difficult not to respect those individuals who had far more knowledge than we did and were far more physically fitting for the high altitude that we were about to experience. The second thing is to be in a place of truth: of open and honest communication. The interesting thing about the Sherpas is that by nature or culture they are people that want to please. But it didn't take very long to read between the lines and to understand them, and for them to understand us. Tied in with that – and probably the most important of the three graces – is that of trust, exemplified by two climbers tied to a single rope. In the climbing world, you climb together – or, in extreme situations, you die together."

> *"That summit – if you want it to be yours – is unbelievably magnetic. It gets a grip on you. This is the power that you have to overcome."*
>
> Rebecca Stephens

The team, Stephens argued, is defined by its common purpose that is bigger than those of its individual members. Implicit within this is an acceptance of potentially sacrificing ones individual goals, overcoming the tensions this may create, in order for the best team outcome to be achieved. Where certain names leap out as those who reached Everest's peak, said Stephens, it is the contribution and sacrifices of those around them that made this notion concrete.

Contrasting the team spirit of days gone by with the commercial era of today, Stephens described the changes in the structure of Everest teams, encapsulated by the recent tragic death of sixteen Sherpas at the treacherous Khumbu Icefall, which lies 5,486 metres up Everest's Nepali slopes. "That was the biggest loss of life in a single day that has even happened," noted Stephens. "And I don't know if it strikes anyone as uncomfortable that it was all Sherpas that died. But one of the main reasons for that is that, in the commercial world, it is the Sherpas doing the work, fixing the ropes, carrying the loads, and establishing camps high on the mountain. Few clients know this: I spoke to one of the guides who said that on his expeditions, typically a Sherpa will expose himself to the risk of climbing through the Khumbu Icefall eight times, compared to once for the client."

Commercial Everest teams of today are divided, explained Stephens, with guides on one side, and

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Greater than the sum of its parts:
Summit teams in Everest's death zones

Continued from page 1

clients signing up to an expedition whose logistics have already been organised on the other. This shift from team to individual goals clearly has a price beyond the tangible financial capital that fosters it. But at the same time, the appeal of reaching the peak is difficult to suppress: "When you are there, looking at the summit peak in the closed shadow of Everest, that summit – if you want it to be yours – is unbelievably magnetic. It gets a grip on you. This is the power that you have to overcome.

"And we are all people who are subjected to 'optimistic bias'," continued Stephens. "You believe fate will treat you kindly. Yes, there were five people who died in the previous week in my case; but I was not going to die on that mountain. Against all rationality."

In the sphere of mountaineering, fixation on personal agenda and ambition can have fatal consequences, explained Stephens,

"Yes, there were five people who died in the previous week in my case; but I was not going to die on that mountain. Against all rationality."

Rebecca Stephens

citing a number of cases where climbers perished in their efforts to get to the summit, their ambition drowning out guides' clear advice to turn back. Guides, on the other hand, feel an individualistic burden to reach the peak, especially given that their following year's take-up depends on their previous year's successes. Stronger team members may resent having to sacrifice their goal of reaching the top for the sake of weaker members who need to turn back.

But cognisance of such personal biases can bear fruit, though, as can cognisance of the role of rivalry within a team environment – rivalry which, explained Stephens, spurred her to follow her team mates to the summit: "We are all subject to the human condition," she stressed, "and an awareness of that is important."

"I would argue very strongly that this price and reward (because it is a massive reward sometimes) of working together as a team for a bigger collective goal, more important than one's own agenda, is the way it has to go," she concluded. "For the individual who sometimes makes those sacrifices, the rewards from all that are farer-reaching. They have to be made to move forward, both on Everest and in your world."

Jeopardy competition gets underway on Sunday...

Don't miss the final round of the Jeopardy competition, taking place today at 14:15-15:45. Delegates will compete for a ticket to the next STS Annual Meeting in Houston in January 2017. The winning team will represent Europe and will compete against the American winners for the 'world champion' title. Come to cheer on the teams and try to test your own knowledge!

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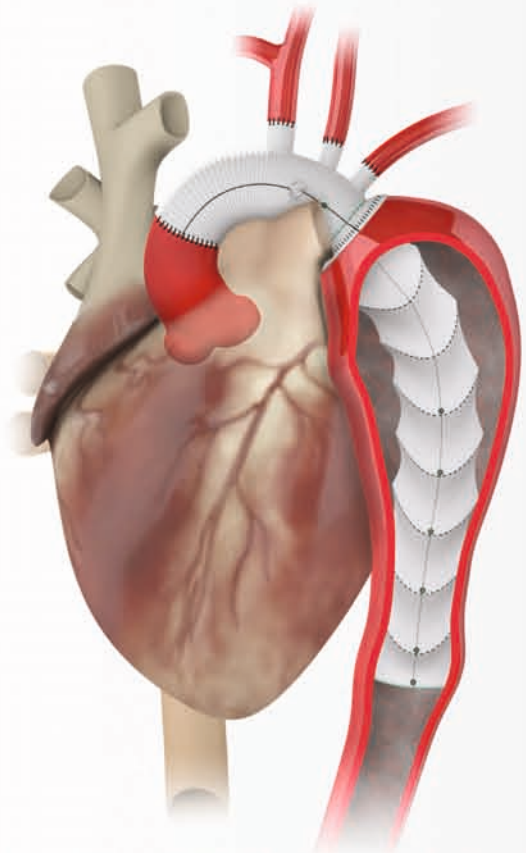

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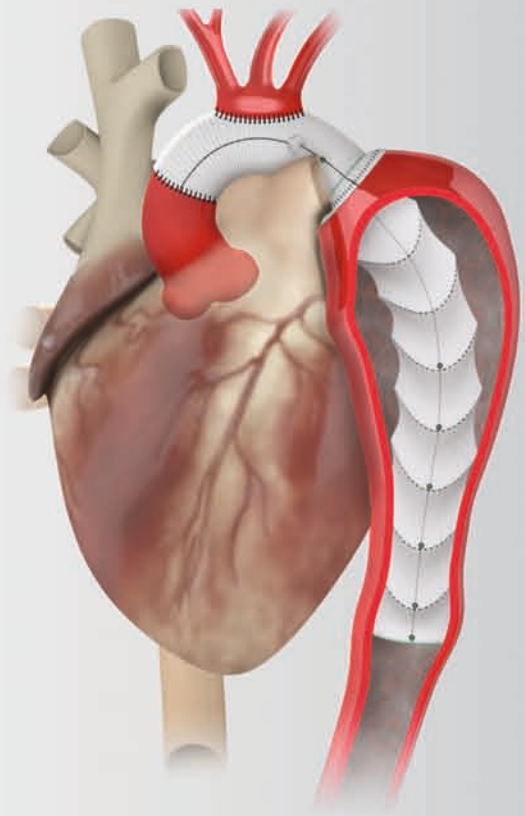

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Cardiac | Focus Session | Hypertrophic obstructive cardiomyopathy revisited

Mitral valve replacement, edge-to-edge repair or MitraClip for obstructive hypertrophic cardiomyopathy?

Surgical septal myectomy to remove excess muscle in the septum is now the established standard treatment for hypertrophic obstructive cardiomyopathy – but in recent years, other methods have become available to address the mitral valve components of the obstruction.

To that end, Ottavio Alfieri, from the Division of Cardiac Medicine at the University of San Raffaele Hospital, Milan, Italy, will review two decades of developments in treating valvular components of obstructive hypertrophic cardiomyopathy.

"Myectomy nowadays is a very well established treatment, and in the great majority of patients it is enough to treat the obstruction of the left ventricular output tract [LVOT]," he told *EACTS Daily News*. "It is very important to relieve the left ventricular obstruction because if the obstruction remains, the natural history of this patient is very poor.

"However, the mechanism of obstruction does not only have a muscular component, but it's also possible to have a valvular component contributing to the mechanism of obstruction. Therefore in some cases, myectomy – which is addressing only the muscular component – is not enough, and you have to add something to completely relieve the obstruction in the LVOT. That is why new methods have become available particularly to address mitral valve problems."

"This is a genetic disorder with a lot of phenotypes. The mitral valve can be abnormal in so many different ways, so the challenge is to recognise these precise abnormalities."

Ottavio Alfieri

Edge-to-edge repair

One of the key methods for treating the underlying valvular problems which contribute to obstructive hypertrophic cardiomyopathy is the edge-to-edge technique (also known as the Alfieri stitch). This involves suturing the free edges of the diseased leaflet to the edges of the corresponding leaflet in the central part of the valve.

"This surgical technique has been used for 10 to 15 years by several teams including our own", said Professor Alfieri. "Of course not every patient needs edge-to-edge techniques in addition to myectomy, but some of them do.

"In my own opinion, edge-to-edge repair can be recommended in the presence of mitral leaflet elongation and anterior displacement of the papillary muscle, particularly when the septal thickness is less than 18 mm. This is because if the septum thickness is not very pronounced – meaning the muscle component of the LVOT is not predominant, then it in turn means that the valvular component is playing an important role."

Professor Alfieri delved deeper: "The repair can also be used on patients after myectomy; when they come off the pump and you notice obstruction you can do mitral repair. These are the indications for the edge-to-edge repair. We've had experience of this combination of treatments: 17 patients underwent myectomy plus edge-to-edge repair at our own San Raffaele University Hospital between 2000 to 2015, and the results have been very, very gratifying, because the gradient in the obstruction was minimal, and there was no mitral stenosis, nor mortality."

Professor Alfieri said the combination of myectomy and edge-to-edge repair had also been reproduced by other groups including Duke University, which in 2016 published a paper on a series of 24 patients. "The edge-to-edge repair was carried out through the aorta without opening the left atrium, so the procedure was simplified and shortened," he explained.

"They also reported excellent results at Duke University with this technique. They have chosen to do it in the majority of people, although I think myectomy on its own can be enough in some cases, so we do it selectively."

Mitral valve replacement

As Professor Alfieri described, another option to treat the valvular component of hypertrophic obstructive cardiomyopathy is mitral valve replacement. "But nowadays we try and avoid this, reserving it only for patients with intrinsic mitral valve disease (for instance fibrosis or calcifications)," he commented. "This is because the results are suboptimal, due to the usual complications of inserting an artificial valve, including thrombolic episodes and haemorrhaging due to anticoagulant effects."

The MitraClip

Another option for treating the valvular component of hypertrophic obstructive cardiomyopathy is using a clip inserted subcutaneously to approximate the free edge of the mitral leaflets at the site of the regurgitant jet.

"The MitraClip [Abbott Vascular, USA] is a new procedure, and we have very few papers published on this as of yet," said Professor Alfieri. "Targeting only the mitral valve is sub-optimal, and less effective than targeting both the muscle and valve components. In my opinion, the MitraClip – which addresses only the mitral valve – should be reserved only for patients who are inoperable, or at high operative risk, until we have more data. And certainly not for routine patients.

"Edge-to-edge repair can be recommended in the presence of mitral leaflet elongation and anterior displacement of the papillary muscle, particularly when the septal thickness is less than 18 mm."

Ottavio Alfieri

"We should use it only on those particular patients, and with prudence. We shouldn't forget that in addition to the clip, we also have the possibility of using septum alcohol ablation. We have an algorithm for inoperable patients in our institution which is very simple – and that is considering the MitraClip only if the septum is less than 18 mm in thickness. If the septum is more than 18 mm thick then we also have the choice of septal alcohol ablation which can be carried out either on its own or in combination with the MitraClip."

Professor Alfieri continued: "As to how many patients have been corrected with the clip worldwide it's hard to know exactly, as these are sporadic cases in different centres. Only two papers have been published on this in the past two years: One was at the beginning of this year, and reported five cases only in Minneapolis, USA, and another in Hamburg, Germany describing three cases.

"While there is increasing emphasis on a less-invasive approach, it would be unwise to recommend this procedure to patients who can have almost a cure with conventional myectomy. It's really too early to start talking about extending the use of MitraClip to patients with hypertrophic obstructive cardiomyopathy, unless, again, they are inoperable or high-risk patients."

Challenges for the future

Professor Alfieri stressed that the main challenge for the future in the field would be to deliver highly personalised care for patients, with a pressing need to be able to diagnose the precise mechanism that is contributing to the obstruction, and tailor treatment individually.

"This is a genetic disorder with a lot of phenotypes," he said. "The mitral valve can be abnormal in so many different ways, so the challenge is to recognise these precise abnormalities. There is not going to be just one procedure that cures all – as it was in the past with myectomy – with MRI and ECHO we can see exactly where the septum is bulging and obstructing and myectomy will become much more precisely targeted."

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Cardiac | Professional Challenge | Wire skills transcatheter aortic valve implantation

TAVI – how to select the right prosthesis for the right patient

Ahead of his lecture held this morning, Neil Moat, Consultant Cardiac Surgeon at Royal Brompton and Harefield Foundation Trust, London, United Kingdom, and a leading specialist in surgical and catheter-based valve intervention, spoke the EACTS Daily News to outline the latest findings on transcatheter aortic valve implantation (TAVI).

Choosing the right bioprosthesis in patients undergoing AVR

"There's good evidence from randomised controlled trials that TAVI is a superior treatment for aortic valve stenosis in very high-risk patients, where mild paravalvar leaks, pacemaker implantation and durability are of no great concern," confirmed Mr Moat. "What is unclear at the present time is where the division lies between patients who should receive surgical treatment and those that should have TAVI.

"We also know that if a patient is 85, has a degree of renal dysfunction and a degree of COPD, that they are at much higher risk from surgery and should have a TAVI. So at that end of the spectrum it's easy to decide, just as it is in a young (say under 65 years) and low-risk patient. It's the grey, so-called intermediate area in which there is uncertainty."

The limitations of scoring systems

Although a number of risk scoring systems exist for AVR, and are being developed for TAVI, Mr Moat says that it's well recognised that scoring systems aren't of much value in choosing a treatment for an individual patient. "They're very important when you're looking at large populations of patients –registries or trials, but I think it's generally accepted that the best way, by far, of defining risk is a clinical assessment by a surgeon, or better still a heart team.

"For example, a 75-year-old patient who is otherwise well, but who has had coronary artery bypass surgery and has bilateral patent internal mammary artery graft surgery close to the back of the sternum, will have a very low risk score. But the heart team would look at that patient, recognise that the patient is actually at increased risk for further surgery (even though they have a low risk score) and recommend TAVI."

There is a strong trend to implant bioprostheses in younger patients with the concept that they will be able to have a valve-in-valve TAVI (v-i-v TAVI). Mr Moat stressed that whilst the results of v-i-v TAVI were encouraging, they were markedly sub-optimal in valves that had small internal diameters.

"I think this is an important message for surgeons generally: you really need to try and implant a valve that has a good internal fixed orifice. If you are going to use a stented device, try to avoid implanting a size 19 and 21 mm stented valve because we know that with a v-i-v TAVI you'll then not only leave the patient with a significant gradient, but the 30-day and 1-year mortality of the v-i-v TAVI procedure will be significantly increased. Also remember the label size might not always reflect the internal diameter of the prosthesis!"

As such, in patients with a small annulus, we must consider annular enlargement or implanting stentless or sutureless valves which have larger internal orifice diameters. He added: "A key message is for surgeons to implant a bioprosthesis at the initial operation that leaves the patient with a good option for a subsequent v-i-v TAVI".

Choosing the right TAVI device

"The question we face now is which sort of catheter-based device should we choose?" said Mr Moat. "This is influenced very much by the age and profile of the patients and their life expectancy. I think undoubtedly TAVI is an accepted part of practice now and therefore we do need to start tailoring the choice of the prosthesis to the individual patient as we would with a surgical valve."

"TAVI is an accepted part of practice now and therefore we do need to start tailoring the choice of the prosthesis to the individual patient as we would with a surgical valve."

Neil Moat

Mr Moat noted that although there was now increasing experience with a large range of devices; each with their own characteristics (e.g. balloon-expandable, self-expandable, one-shot application, retrievable and/or repositionable, etc.) it would be impossible to list every single consideration for each device.

One important aspect he did focus on was the annulus size, which is crucial when deciding which device to use, and does give surgeons some direction. "For example, mechanically-expanding devices such as the Lotus Valve [Boston Scientific, USA] seem to work particularly well in patients with a large aortic annulus, as does the DirectFlow Medical [USA] valve. Supra-annular devices such as the Evolut R [Medtronic, USA] perform particularly well in small anatomies leaving the patient with a better EOA. There are also important difference in rates of more than mild PVL and new conduction abnormalities between device designs. However, I don't think there's a design or device out there that is going to be perfect for every patient.

"For example, depending on the patient's age and where they are on the risk spectrum, the design and performance of the device is key. In the elderly, the fact that you end up with a pacemaker is probably of no concern, but when you get down to the younger, lower-risk patients in whom you've got a much longer life expectancy, and a pacemaker (with the ongoing risk of infection, late TR etc.) is not going to be acceptable. I think the same holds true for PVL and durability. All of these issues become more important the younger and healthier the patient is that you are treating. Also, as I said previously with regard to AVR, it is important to implant a TAVI device (and size) that will leave you and the patient with a good option to have a TAVI-within-TAVI down the line."

"One gets significant amounts of macroscopic emboli during TAVI. A lot of work is going into looking at embolic protection devices."

Neil Moat

Mr Moat went on to note that in extending the reach of TAVI to younger and lower-risk patients, we should probably be selecting devices that have the most comprehensive experience. "The two devices which have the most data behind them, dominate the world experience, and have robust trial and registry data are the Edwards Sapien [USA] and the Medtronic CoreValve [USA] series of valves," said Mr Moat. "These I would say are the established 'workhorse' devices for which we have a lot of data. Clearly there are a large number of newer devices, that in my view probably want to prove themselves in the higher risk patients – so there are data to prove that they are equivalent to the above devices before they move into younger patients."

Mr Moat stressed that it is a balancing act to make sure the diverse designs and benefits of each device are matched with the volume of activity of a particular centre. He continued: "All devices have their own unique characteristics in terms of sizing and implantation technique, but unless you have a very large centre you're not going to get good results if you have six or eight different types of devices on the shelf, and you're trying to use every one!

"Perhaps an option would be to choose two devices with completely different characteristics that cover most of the patient population. I think this would be a reasonable approach, or if you're doing more cases, maybe three devices."

Aortic regurgitation

Selecting TAVI devices for use in aortic regurgitation cases is more complicated than for aortic stenosis, because aortic regurgitation has a much more diverse range of pathologies, noted Mr Moat. "By and large it's a more challenging environment for the implant, where the lack of calcification raises issues in terms of achieving stable fixation. There are certain device designs that tend to lend themselves to aortic regurgitation. Some of the more novel devices which employ leaflet capture have shown promise in this area, as they use the non-calcified leaflet as an adjunct to fixation, but at the moment our experience in treating aortic regurgitation is still very limited – a tiny fraction of the experience of dealing with aortic stenosis."

Key issues for the future

Looking to which facets of TAVI development could benefit from more focus going forward, Mr Moat firstly highlighted macroscopic cerebral embolisation, saying: "I think one of the key areas that will need resolving is the fact that one gets significant amounts of macroscopic emboli

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Edwards

Neil Moat

Continued from page 6

during TAVI. A lot of work is going into looking at embolic protection devices. There are some encouraging data emerging but much more evidence and device iteration are needed."

The durability of devices is also key: "One issue is whether TAVI valves will be as durable as surgically-implanted valves, or will they be more durable?" said Mr Moat. "There are certain design characteristics of some of the valves, which have a very low forward-flow gradient, a bit like stentless valves, that theoretically may be expected to be more durable than a stented surgical valve. However some slight concerns have been raised in terms of early degeneration but to date there is no robust data.

"This is another reason why it's so important that patients in the trials of AVR vs TAVI are followed up not just for five years, but maybe for 10 or 12 years. One of the difficulties at the moment is that almost all the trials have recruited very elderly, high-risk patients whose survival rates at five years are low, so we haven't got a lot of TAVI patients who have survived beyond that. But we will not address the issue from these initial trials. Other issues for the future include residual paravalvular leak with its potential for an increased risk of endocarditis, stroke avoidance and the sub-clinical neuro-psychological effects of cerebral embolisation."

He concluded: "TAVI has been a revolution in the treatment of patients with severe AS. Cardiac surgeons MUST embrace this technology and become an integral part of the heart team's decision-making and device implantation process.

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

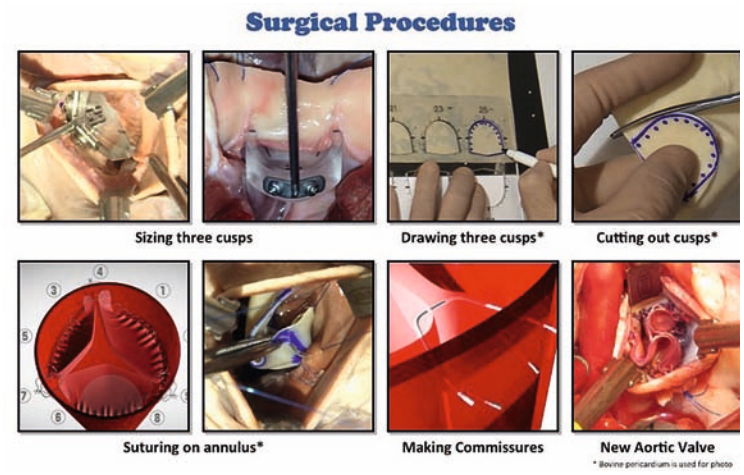
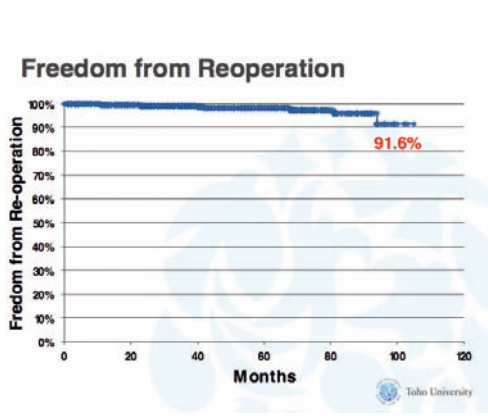


Figure 1: Surgical procedures



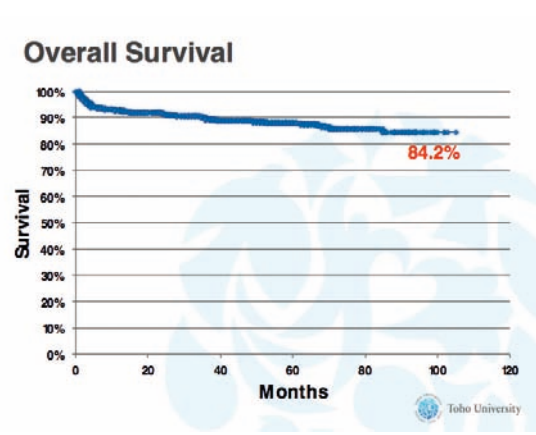


Figure 2: Freedom from Reoperation & Overall Survival

By Prof. Shigeyuki Ozaki
September 2016

The Ozaki Aortic Valve Neo-Cuspidization (AVNeo) procedure using autologous pericardium is a novel and innovative surgical procedure for any aortic valve disease, regardless of the age of the patient or the size of annulus.

By suturing three meticulously designed pericardium cusps onto the annulus, this surgery can treat both adult and pediatric patients with aortic stenosis, with or without endocarditis. What makes the Ozaki AVNeo procedure different from others are the following:

1. Measurement of the distances between commissures, not the annular diameter
2. Suturing the cusps directly onto the annulus
3. Raising the contact point of the cusps to the commissural level (Figure 1)

By designing new cusps from intercommissural distances, it is possible to design cusps uniquely, regardless of the height of the commissures from the base of the annulus. Suturing these cusps directly onto the annulus enables the annulus to move naturally, preserving natural hemodynamics. Reduced mechanical stress to the cusps facilitates the reduction of calcification and postoperative pressure gradients. By raising the contact point, the new cusps make the new coaptation zone longer than the native valve. The elongated coaptation zone warrants the minimised postoperative aortic insufficiency. Anticoagulation is not necessary, as there is no stent or prosthesis left in the circulation system.

We have performed the Ozaki AVNeo procedure in more than 900 patients over the past 9 years. Other surgical teams in Japan and overseas have already performed as many as 1000 cases. The overall outcome of this procedure is remarkable, as shown in Figure 2. The rate of freedom from reoperation reached 91.6% for the 850 cases, where the longest follow up was 105 months. In addition, there are several reports that demonstrate better hemodynamics after AVNeo, as compared to conventional prosthetic valves.

The Ozaki AVNeo procedure is very promising, not only for adults, but also for pediatric and congenital patients. Major pediatric centers have incorporated the Ozaki AVNeo procedure into their programs, with the youngest patient at 23 months old. Although mid to long term outcomes in pediatric surgery are not yet clear, the Ozaki AVNeo procedure may be a good substitute for the Ross procedure or other aortic valve repairs, where long term outcomes are not always satisfactory.

Cost efficiency is another appealing feature of this procedure. The in-hospital cost of the Ozaki procedure reduced conventional AVR costs per case. Costs are further reduced when unnecessary anticoagulation therapy is taken into account.

Reproducibility is particularly important in any surgical technique, therefore we have developed a set of proprietary sizing devices; The Ozaki VRec Sizer™. This device is now registered and marketed as a medical device in the US, Japan, Europe, China and South Korea by JOMDD, Inc. (Tokyo, Japan). Appropriate training for the Ozaki procedure is necessary and available.

The Ozaki AVNeo procedure may shift the paradigm of treatment for aortic valve diseases in the near future.

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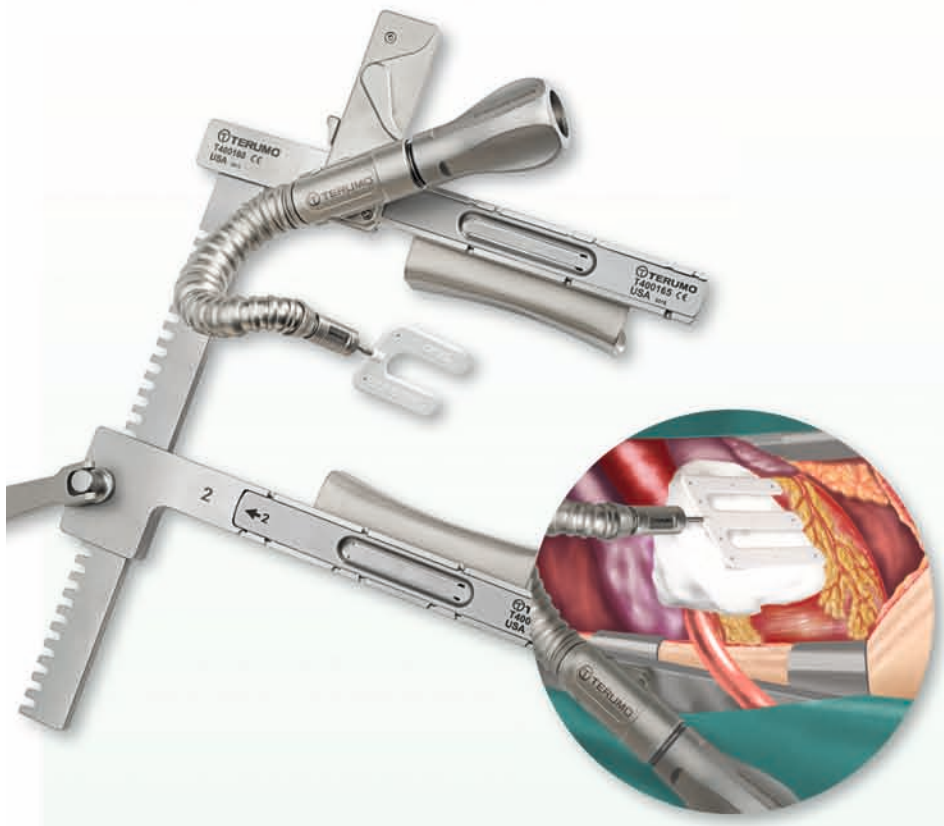

Retraction during On-Pump CABG
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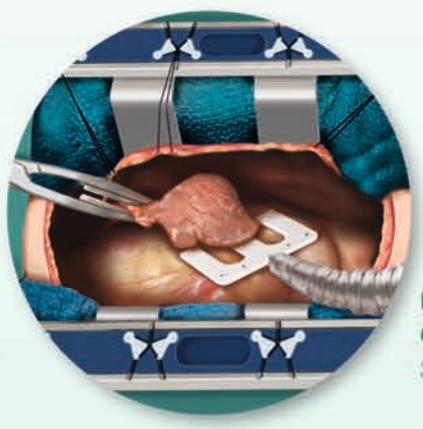

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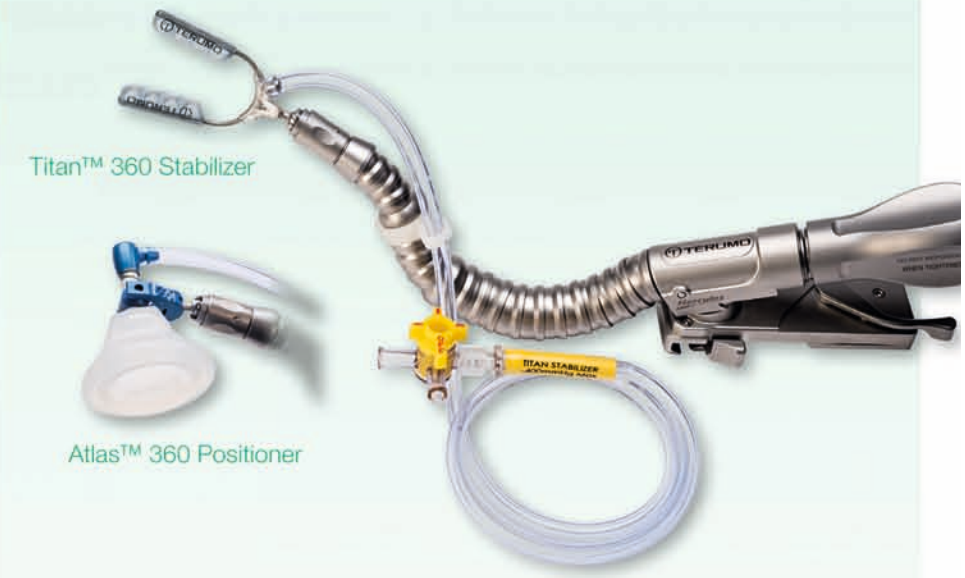

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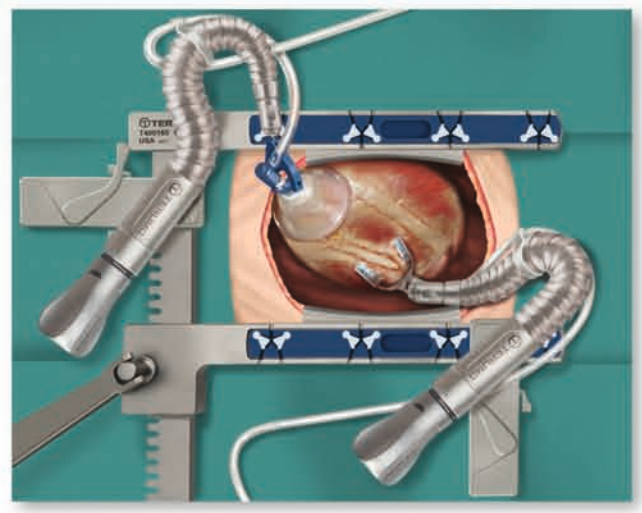

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Cardiac | Rapid Response | Developments in assist devices and transplantation

Pharmacological preconditioning with gemfibrozil preserves cardiac function in experimental model of heart transplantation

Kálmán Benke
Heart and Vascular Center, Semmelweis University, Budapest, Hungary

Ischaemia/reperfusion injury is one of the major determinants of primary graft failure in heart transplantation. After implantation during the reperfusion phase, the myocardium suffers from biochemical and metabolic alterations, including generation of reactive oxygen species, intracellular calcium overload, energy depletion and acidosis. There have been several attempts to reduce these biochemical changes, however one of the most promising therapeutic avenues is the nitric oxide (NO)/soluble guanylate cyclase (sGC)/ cyclic guanosine monophosphate (cGMP) pathway, which plays an important role in controlling vasodilatation, inhibits platelet aggregation and prevents vascular smooth muscle proliferation. Gemfibrozil (GEM) is a member of the fibrate drug family which have been used for decades for the management of combined dyslipidaemia. However, in 2015 Sharina et al. described an existing side effect of this widely-used lipid-lowering fibrate, which showed to be an activator of the soluble guanylate cyclase in an *in vitro* setup. Based on the above data, we aimed at investigating the sGC activator properties and the potential cardioprotective effects of gemfibrozil in a clinically relevant, well-established rat model of heterotopic heart transplantation (Figure 1).

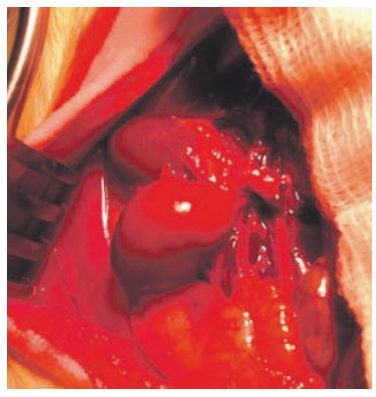


Figure 1. Picture of the implanted donor heart in the recipient rat's abdomen

Donor Lewis rats received p.o. gemfibrozil (150mg/kg BW) or vehicle for two days. After the pharmacological preconditioning, the hearts were explanted, stored for one hour in cold preservation solution (Custodiol), and heterotopically transplanted. After one hour of reperfusion time, left ventricular (LV) pressure-volume relations and coronary blood flow were assessed to evaluate early post-transplant graft function. Additional histological and molecular biological measurements were performed. After transplantation, the left ventricular systolic pressure and peak positive dP/dt were significantly higher in the gemfibrozil-treated group in comparison with the control group (Figure 2). Moreover, gemfibrozil treatment resulted in a significant increase in dP/dtmin values compared with the vehicle-treated transplant group, reflecting better myocardial relaxation (Figure 3). Coronary blood flow measurements showed a significant increase after one hour of reperfusion compared with the corresponding control (2,7±0,2 vs. 2,1±0,2ml/min/g, p=0.02). Protein expression of sGC β1 was significantly reduced in the vehicle-treated transplant group whereas the gemfibrozil treatment restored the enzyme activity. We detected elevated caspase 3 protein expression in the control transplant group, whereas the application of gemfibrozil significantly reduced the expression of this caspase-3 (western blot). The number of TUNEL-positive nuclei was significantly increased in the myocardium after transplantation in the LV myocardium referring to pronounced DNA fragmentation, whereas gemfibrozil successfully reduced the ischaemia/reperfusion injury induced DNA-strand breaks.

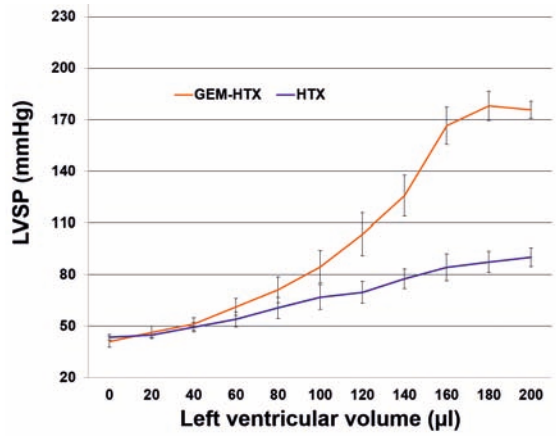


Figure 2. Gemfibrozil improves left ventricular systolic function (LVSP:left ventricular systolic pressure)

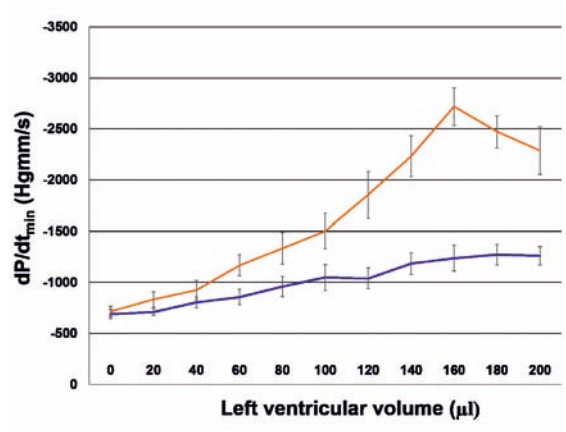


Figure 3. Gemfibrozil improves myocardial relaxation

The vehicle treated transplant group was associated with increased nitrotyrosine immunoreactivity in LV myocardium, referring to pronounced nitro-oxidative stress which was significantly alleviated by gemfibrozil treatment.

To conclude, gemfibrozil treatment improves donor heart function in an experimental model of heart transplantation. These findings show that pharmacological preconditioning with this drug could be a promising option to reduce ischaemia/reperfusion injury and could increase the ischaemic time in order to gain enough donors to keep up with the need in cardiac transplantation.

Cardiac | Abstract Session | Improving outcomes in hypertrophic obstructive cardiomyopathy

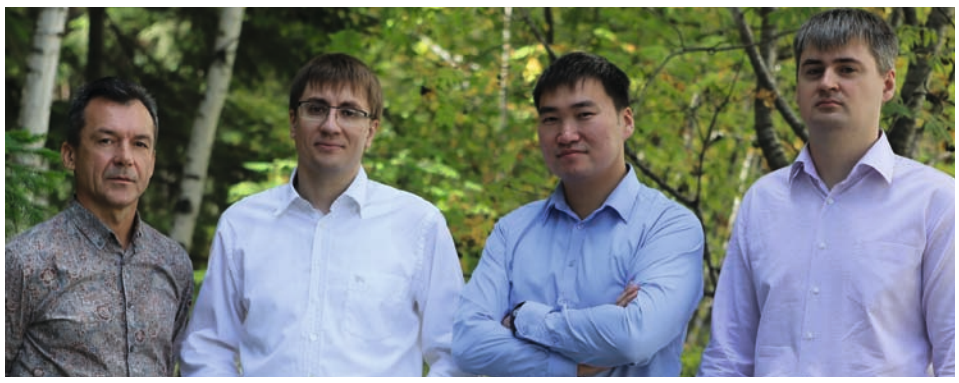
Mitral valve repair versus replacement in hypertrophic obstructive cardiomyopathy patients: a prospective randomised study

Alexander Bogachev-Prokophiev, Sergei Zheleznev, Alexander Afanasyev, Michael Fomenko, Ravil Sharifullin, Alexander Karaskov Novosibirsk State Research Institute of Circulation Pathology, Novosibirsk, Russian Federation

The diagnosis of hypertrophic cardiomyopathy (HCM) is based on detection of left ventricle (LV) wall thickness ≥ 15 mm by any image modalities, with LV outflow tract obstruction (LVOTO) defined as a peak LVOT pressure gradient ≥ 30 mm Hg at rest or during provocation. Most patients with HCM and LVOTO have mitral regurgitation (MR). Mitral valve (MV) abnormalities such as papillary muscle hypertrophy and displacements, fibrotic and retracted secondary chordae, and others cause abnormal tethering of the MV and results in outflow tract obstruction, and according the current guidelines, every third patient will have resting systolic anterior motion (SAM) of the anterior mitral leaflet.

Crucially, conventional surgery (septal myectomy) for outflow tract hemodynamics may be insufficient to relieve LVOTO. And, while complex MV repair in addition to myectomy may improve LVOT gradient relief, MV replacement remains a simple surgical alternative. Thus the purpose of our randomised study was assessment of MV repair or replacement during extended myectomy in patients with HCM and moderate to severe MR.

Between November 2010 and August 2013, a total of 198 consecutive HCM patients with LVOTO underwent a surgical myectomy. We can now report results of 88 HCM patients who were randomly assigned to receive MV repair or MV replacement in addition to septal myectomy.



Left to right: Zheleznev SI, Bogachev-Prokophiev AV, Afanasyev AV and Sharifulin RM

Each of these patients had LVOTO gradient ≥ 50 mm Hg (89.9±27.2 mm Hg) and SAM at rest, resulting in moderate (42.1%) or severe (57.9%) MR. The MV repair group include 44 patients, with three cases that in the end led to MV replacement. The MV replacement group included 44 patients, with three patients who had previous MV repair failure. The mean age was 51.4±14.4 years (range 22 to 74 years).

In our results, there was one (2.4%) early death in MV replacement group (p=0.314). There were no group differences in terms of complete AV block presence, septal defect and LV wall rupture (p=1.0). At last follow-up (26 months) New York Heart Association functional class significantly decreased pre-operatively in both groups, with no patients in class III or IV. The resting LVOT gradient decreased from 96.6±28.1 and 89.1±20.4 to 12.6±5.7 and 13.1±6.4 mm Hg ($p < 0.001$) in repair and replacement groups, respectively, without differences between groups. There were no significant MR recurrences (grade 2 or greater) in both groups at their most recent evaluation. The Kaplan-Meier survival rate in MV replacement and repair groups was 78.9% and 96.6%, respectively (Figure 1, log-rank test, p=0.034); freedom from thromboembolic events was 83.2% and 100%, respectively (Figure 2, log-rank test, p=0.026).

We conclude that MV replacement and MV repair in addition to extended septal myectomy in HCM patients is an effective method to eliminate MR and LVOTO. Clinical benefits for MV repair in HCM patients with LVOTO over replacement alternative are lower rate of thromboembolic events and better two-year survival.

Figure 1. Kaplan-Meier survival estimates

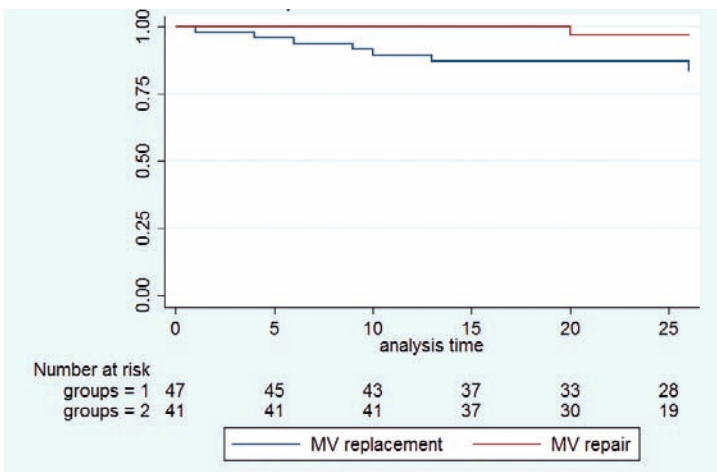
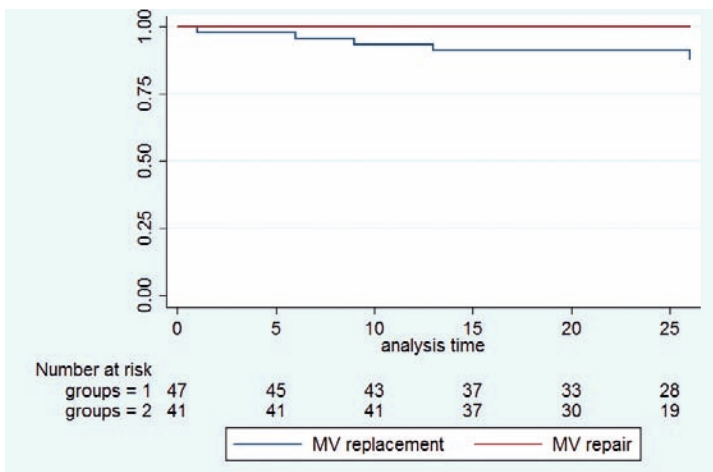


Figure 2. Freedom from thromboembolic events

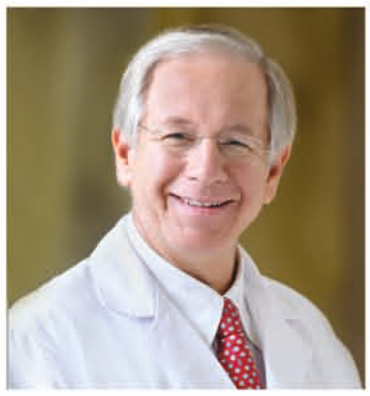


Vascutek Symposium

Monday 3 October
12:45 - 14:00
Room 114

Management and Treatment of the Diseased Aortic Arch

Chairman: Professor Joseph Coselli, USA



12:50 - 12:55

Introduction by Professor Joseph Coselli, USA

12:55 –13:10

Professor Ruggero De Paulis, Italy

Gelweave™ Valsalva – 15 Year History

13:10 –13:25

Professor Xavier Chaufour, France

Thoraflex™ Hybrid – The French Experience

13:25 – 13:40

Professor Martin Czerny, Germany

Patient Selection – Thoraflex™ Hybrid versus Gelweave™ Siena

Panel

Professor Malakh Shrestha
Germany

Professor Roberto Di Bartolomeo
Italy

Professor Christian Hagl
Germany

Professor Eric Roselli
USA

Professor Joseph Bavaria
USA

14:00 Close

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Thoracic | Abstract Session | Oncology I

Validation of the 8th edition of TNM staging system for lung cancer in 2043 surgically treated non-small cell lung cancer patients

Kezhong Chen
Department of Thoracic Surgery, Peking University People's Hospital, Beijing, China

The International Association for the Study of Lung Cancer has proposed a revision of current TNM classification for lung cancer. However, the data was limited to institutions who participated, with some regions underrepresented. Besides, although the sample size is large, the data quality was irregular. Indeed, according to different institutions, certain tumour descriptors were collected too infrequently to permit a robust analysis of their impact. With this in mind, there is great precedent to conducting an appropriate external validation.

On the other hand, in the last 10 years, targeted therapy has played an important role in advanced-stage lung cancer treatment, and extended the overall survival (OS) , which renders the measurement of OS inaccurate. Recurrence free survival (RFS) has seen less 'interference' from targeted therapy, and may be more consistent with TNM stage than OS. However, few studies have assessed the predictive value of TNM stage system for RFS.

This study compared the 8th- and 7th-edition TNM staging systems in a 10-year institutional database featuring consecutive cohorts of patient who underwent curative-intent surgery. The reversed OS of stage curves of IIA (54.6%) and stage IIB (77.5%) in the 7th edition were corrected in the 8th edition (IIA :78.9%, IIB :59.1%). In addition, better prognostic values were incorporated into the 8th edition, including a stronger differentiation, monotone trend, a better model fit, a stronger discriminatory ability and a lower predicting error. RFS analysis of subsets of patients stratified by T and N descriptors showed a stepwise deterioration. We also compared the RFS of stage IA patients by using the total tumour size (invasive part). In the 8th staging system, although both measuring methods showed significant differences, the curves of IA1, IA2 and IA3 calculating invasive part as the tumour size showed increased separation in the RFS rate, which supports the recommendation by the IASLC. Therefore, both the total tumour size and radiological invasive component should be considered before surgery to determine the optimal surgical approach for stage IA patients.

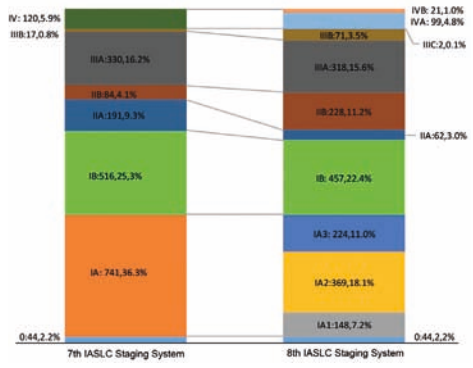

Figure 1: Stage distribution of the patients staged by the 7th and 8th editions of TNM staging system for lung cancer

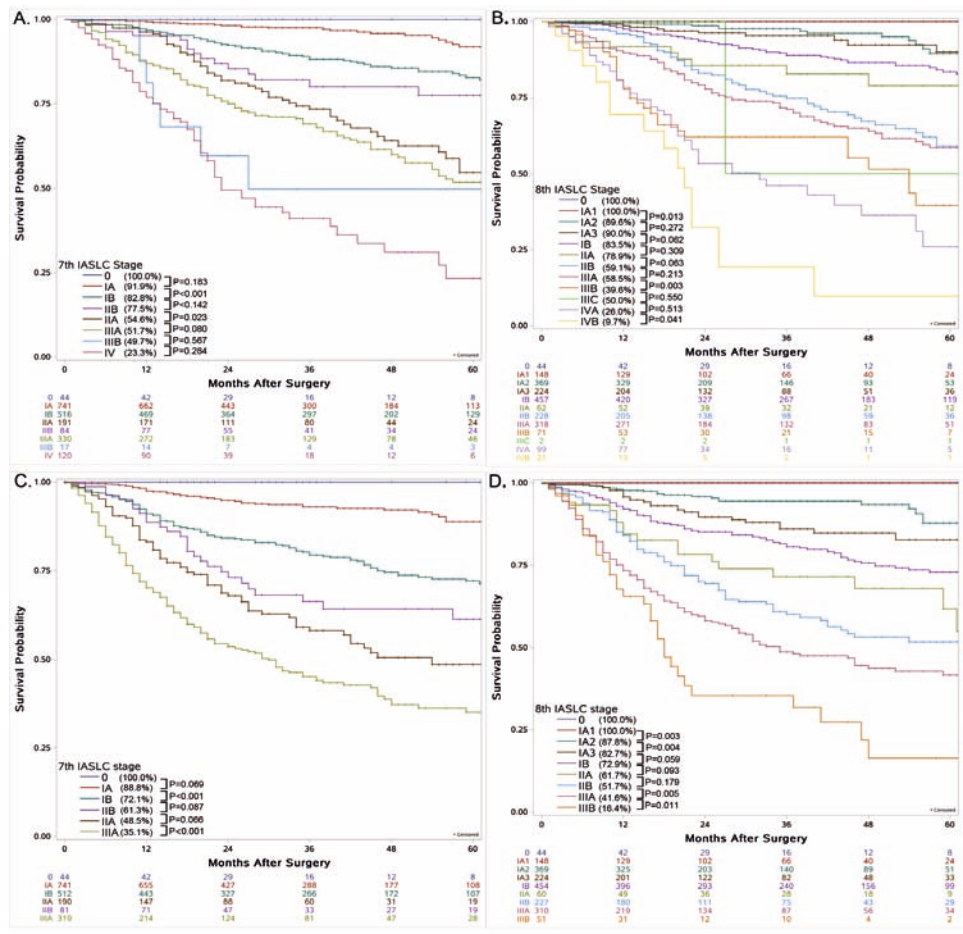

Figure 2: Overall survival curves stratified by the 7th (A) and 8th (B) staging systems. Recurrence-free survival curves stratified by the 7th (C) and 8th (D) staging system. The 5-year recurrence free survival rate of each stage is indicated in brackets

Both the total tumour size and radiological invasive component should be considered before surgery to determine the optimal surgical approach for stage IA patients. As far as we know, this is the first study to compare the predictive value of 8th and 7th staging systems using an external validation, and also the first study to estimate whether TNM classification could predict RFS.

Cardiac | Abstract Session | Regeneration – Preservation

Electrospinning of a bioresorbable polymeric anisotropic valved arterial conduit for paediatric cardiac surgery

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Conduits currently used to reconstruct the right ventricular outflow tract (RVOT) have no growth potential and require reoperations, resulting in an increased level of morbidity and mortality. As part of a programme targeted at developing a resorbable valved tube for replacement of the RVOT, we initially demonstrated the ability of a monovalved polydioxanone (PDO) patch to restore a functional RVOT in growing lambs. Then, we showed that peptide-functionalised polymers may be substituted for cell-loaded materials in such an application.

Design of the polymeric scaffold remains a challenging task. For the scaffold to be effective, it must be capable of regulating a positive cellular function without compromising tissue- specific mechanical properties. It is known that electrospinning, a technique that uses an electrical charge to draw very fine fibres from a liquid, can be used to produce scaffolds that recapitulate key structural features of the native extracellular matrix. Our present work investigates the effect of electrospinning parameters on the mechanical properties and biocompatibility of bioresorbable tubular scaffolds, as part of a programme to develop a tissue-engineered valved tube for RVOT replacement.

In this work, electrospinning was used to develop tubular scaffolds of polydioxanone, with the experimental parameters systematically varied. Three electrospinning parameters (volume of liquid, flow rate, and speed of mandrel rotation) were investigated and their effect on the mechanical properties and cellular response of the scaffolds were analysed using scanning electron microscopy, X-ray diffraction, differential scanning calorimetry, gas chromatography, uniaxial tensile test, cell viability test and cytotoxicity tests. Mechanical properties were compared to those of the native RVOT reported in the literature.

We showed that increasing mandrel rotation speed tended to increase fibre alignment, stress at failure and Young modulus, increasing fibre anisotropy (Figure 1). The increase of flow rate also increased the rigidity of the tubes. We also showed that cell viability and cytotoxicity assays showed an excellent biocompatibility of all the tubes produced.

There is an increasing consensus that the primary role of tissue-engineered constructs designed to restore the RVOT is to foster endogenous responses enabling scaffold colonisation by host cells leading to the ultimate generation of an autologous "living" conduit. However, tissue regeneration does not only respond to chemical signals with regard to cell homing, survival, proliferation and differentiation. The regenerative process is also very sensitive to physical cues like the topography and elasticity of the supporting substrate. As such, the data reported in this work may be useful for leveraging electrospinning parameters to fine-tune the three-dimensional scaffold architecture and thus optimise the patterning of mechanical cues in a way that optimises mechanical properties of the scaffold on the one hand, and the cell-material interactions critical for an appropriate scaffold repopulation by host-derived cells on the other hand. The electrospun scaffolds obtained in this study demonstrated clear anisotropic behaviour with significantly different mechanical properties in the longitudinal and perpendicular directions. Given the fact that such a behaviour is one of the most important mechanical features of native vascular and valvar tissues, the electrospinning-based generation of medical-grade polymeric tubes with reproducible anisotropic properties close to the native RVOT could pave the way to a bioresorbable device to replace the RVOT in congenital heart surgery.

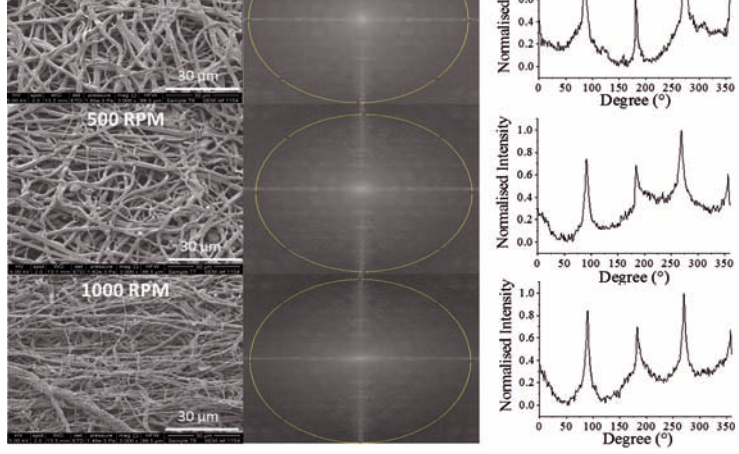

Figure 1. SEM images of polydioxanone tubes prepared at increasing mandrel rotation speeds, with their respective circular projection of the Fast Fourier Transformation output image, and radial summation of the pixel intensities.

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Monday, October 3rd 2016

CCBI CONGRESS CENTER
Plaça de Willy Brandt, 11-14
Barcelona, Spain

12:45 pm
2:00 pm

Meeting Room 111

AORTIC AND MITRAL EXPERIENCES ACROSS THE OCEANS

Monday, October 3rd 2016
12:45 pm - 2:00 pm · Meeting Room 111

CCBI CONGRESS CENTER Plaça de Willy Brandt, 11-14 · Barcelona, Spain

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Moderators: O. Alfieri, *Italy* · S. Moten, *Australia* · S. Wan, *Hong Kong*

- **Case Presentation on Mitral Repair**
  P. Punjabi, *UK*

  Discussant: S. Wan, *Hong Kong*

- **Case Presentation on Aortic Replacement**
  N. Ad, *US*

  Discussant: S. Moten, *Australia*

Lunch boxes are available for the Symposium attendees.

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Cardiac | Abstract Session | Transcatheter aortic valve implantation

Redo procedures for degenerated stentless aortic xenografts and the role of valve-in-valve transcatheter techniques

Herko Grubitzsch et al.
Department of Cardiovascular Surgery, Campus Charité Mitte, Charité – Universitätsmedizin Berlin, Germany

Stentless xenografts have been increasingly used for aortic valve replacement (AVR) due to their favourable hemodynamic profile. As these valves will soon reach the limits of their durability, an increase in the number of reinterventions can be anticipated. The present study analyses results with redo surgery and valve-in-valve transcatheter aortic valve implantation (ViV-TAVI) for treatment of degenerated porcine and pericardial stentless aortic bioprostheses, aiming to define the potential role of ViV-TAVI in this particular setting. Between 2010 and 2015, 52 consecutive patients (age 72±9.7 years, EuroSCORE II 11±8.9%) underwent reinterventions for failed stentless aortic valves (60% porcine, 40% pericardial, 87% subcoronary, 81% isolated/combined regurgitation). Mean time from previous AVR was 10±4.8 years. During the study period, the relative frequency of ViV-TAVI performed ranged from 20% to 71% per year (Figure 1).

Table 1: Most important criteria for heart team decision

ViV-TAVI	(n=27)	Redo surgery	(n=25)	p
Age	Mean±STD	75.3±9.9 years	69.0±8.6 years	0.060
EuroSCORE II	Mean±STD	13.0±10.4	8.9±6.5	0.054
Pulmonary hypertension	n (%)	21 (77.8)	12 (48.0)	0.043
Renal failure	n (%)	16 (59.3)	4 (16.0)	0.006
Patent IMA graft	n (%)	9 (33.3)	2 (8.0)	0.040
Concomitant intervention required	n (%)	3 (11.1)	15 (60.0)	<0.001

IMA, internal mammary artery, ViV- TAVI, valve-in-valve transcatheter aortic valve implantation

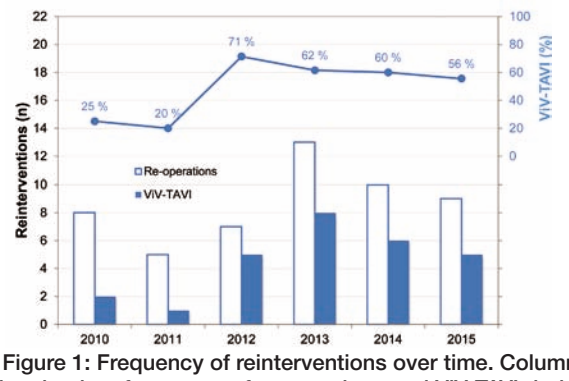

Figure 1: Frequency of reinterventions over time. Columns depict absolute frequency of reoperations and ViV-TAVI during the study period. The dots of the line graph reflect relative frequency of ViV-TAVI in the respective year

Based on criteria listed in Table 1, the heart team assigned 25 patients to reoperation and 27 to ViV-TAVI. Valve implantation was successful in all surgical (24.0% root replacement) and in 24 (89%) ViV-TAVI cases (93% transfemoral, 56% balloon-expandable). With ViV-TAVI, the following complications occurred in nine patients (33%): transcatheter heart valve (THV) malpositioning (n=3), coronary obstruction (n=4), intraprocedural resuscitation (n=4), and implantation of covered stents for vascular access site complications (n=2). In 11%, conversion to open surgery was required due to coronary obstruction (n=2) and failed THV implantation (n=1). Deployment of >1 THV and post-implant balloon-dilatation was necessary in two and five patients, respectively. There was no instance of annular rupture. One case of aortic dissection occurred during surgery. Thirty-day mortality (9.6%, 3 ViV-TAVI patients, 2 surgical patients, p=1.0) was associated with preoperative renal failure, with more than one concomitant procedure, the occurrence of life-threatening bleeding or coronary obstruction, and the necessity of prolonged circulatory support. ViV-TAVI was beneficial regarding ventilation time, transfusion requirements, and the incidence of sepsis. Overall, functional (94% NYHA-class I/II) and echocardiographic results (indexed effective orifice area 0.95±0.27 cm²/m², mean transvalvular gradient 14±6.8 mmHg) were favourable. Figure 2 shows haemodynamic results in subgroups. Transvalvular gradients were significantly lower after ViV-TAVI compared to reoperation, with self-expanding compared to balloon-expandable THVs, and with identical or larger size of the new surgical valve. According to EOAI<0.65 cm²/m², patient-prosthesis mismatch occurred in three patients, in two after ViV-TAVI with balloon-expandable valves and in one after reoperation with a conventional stented xenograft (p=0.582). Only after ViV-TAVI, aortic regurgitation was mild and moderate in two and three patients. One-year survival was 82±5.4%, similar after surgery (83±7.7%) and ViV-TAVI (82±7.5%, p=0.764).

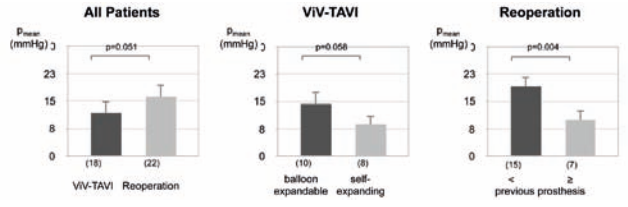

Figure 2: Haemodynamic results in subgroups. Subgroup analysis of mean aortic valve gradients (pmean) after reintervention in all patients as well as after ViV-TAVI and reoperation. Figures in parentheses indicate numbers of measurements per subgroup.

In conclusion, reinterventions – redo surgery as well as ViV-TAVI – for degenerated stentless aortic valves are technically challenging and accompanied by a significant periprocedural risk. Although ViV-TAVI is appropriate in high-risk patients (e.g. older age, significant comorbidity and/or previous CABG), limitations and potential complications must be considered. Therefore, assessing the individual anatomy of the aortic root is of paramount importance. Redo surgery has its place in younger patients with lower risk, in particular in those requiring concomitant surgical procedures.

Cardiac | Abstract Session | Extra corporeal circulation/ Left ventricular assist device/Transplantation

Outcome of patients treated with left ventricular assist device as bridge to heart transplantation or bridge to candidacy versus marginal heart transplantation

Antonio Loforte S. Orsola-Malpighi Hospital, Bologna University, Italy

Background

Heart transplantation (Htx) therapy currently faces a severe paucity of donors together with long waiting lists. Marginal donors and recipients negatively impact upon the probability of Htx success. Mechanical circulatory support (MCS) continues to evolve in terms of device technology, patient selection, and long-term patient management while on durable MCS systems.

The aim of this study is to compare the outcomes of end-stage heart failure (HF) patients treated with continuous-flow (CF) left ventricular assist device (LVAD) versus marginal Htx.

Methods

We evaluated 239 consecutive patients with advanced HF who underwent CF left ventricular assist device (LVAD) implant or marginal Htx between January 2004 and October 2015.

We compared outcomes in patients who received continuous-flow LVAD as bridge to transplantation (BTT) or bridge to candidacy (BTC) (overall n=81 patients; n=55 HeartMate II; n=21 HeartWare; n=4 Jarvik 2000; n=1 Berlin Heart InCor), with those who underwent marginal HTx (n=158, out of 479 adult Htx, 32.9%).

Mean patient age was 56.8±9.9 years with an age range of 31-76 years. Marginal Htx was defined by age >60 years, BMI >30 kg/m², severe pulmonary hypertension, arterial vasculopathy, and pre-Htx extracorporeal membrane oxygenation (ECMO) support.

Results

Early (30-day) mortality was 7.4% in LVAD, versus 24.8% in marginal Htx (p=0.002). Kaplan-Meier survival curves estimated a one-year survival of 83.6% in LVAD versus 66.5% in marginal Htx patients (hazard ratio 1.47; 95% confidence interval 0.75-2.84; p=0.03 for LVAD vs. Htx). Patients treated with LVAD as BTT indication (n=43, 53.1%) showed a significant better outcome, with a 90.1% survival at one-year. After adjustment per cohort of Htx population and matching with the LVAD population, BMI >30 in marginal recipients resulted to be the strongest predictor of mortality (p<0.001).

Conclusions

Given the scarce number of donors for Htx, LVAD therapy represents a valid option, consequently affecting the current allocation strategy of heart donors. Potential Htx marginal recipients should be referred to LVAD implantation to improve outcomes and to provide an higher probability of obtaining a suitable graft in potential non-marginal Htx recipients.

Cardiac | Rapid Response | Adult Cardiac

Save your breath – The impact of COPD on outcome in patients undergoing transfemoral vs. transapical transcatheter aortic valve implantation (TAVI)

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1 Department of Cardio-Vascular Surgery, Hospital Hietzing and Karl Landsteiner Institute for Cardio-Vascular Research, Vienna, Austria
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Notably, a large number of patients undergoing transcatheter aortic valve implantation (TAVI) have been diagnosed with concomitant chronic obstructive pulmonary disease (COPD) as this high-risk population is generally regarded as inoperable in conventional cardiac surgery.

The purpose of this study was to evaluate the impact of COPD on clinical outcomes in patients referred for transfemoral (TF) as well as transapical (TA) aortic valve implantation and furthermore to discuss possible advantages considering the selection of access evaluation.

In total, 298 patients undergoing TAVI were included in the present study between June 2009 and December 2015: 105 (35.1%) suffered from concomitant COPD, whereas 193 (64.8%) did not. Severity of airflow limitation in COPD was assessed according to the Society of Thoracic Surgeons (STS) definition based on spirometry results (FEV1 <75% predicted) and/or the requirement for bronchodilator therapy. Furthermore, TF (46.8%) or TA (53.2%) approaches were selected primarily depending on size, degree of calcification as well as kinking of iliofemoral arteries. Spirometry was performed prior to the intervention and before discharge. New York Heart Association (NYHA) functional status was evaluated at baseline and at 6- and 12-months follow-up. Outcome was measured and classified according to VARC-II criteria, and survival was estimated by Kaplan-Meier-Plot.

The present analysis suggests that patients with concomitant COPD show no significant difference in 30-day mortality after TAVI (COPD 6.6% vs. non-COPD 5.2%, p=0.840) and long-term survival over five years (log-rank p=0.979). Furthermore, ventilation time and post-procedural pneumonia rates are not increased in COPD patients (7.6% vs. non-COPD 4.1%, p=0.563). Post-procedural spirometry at six months did not differ from pre-procedural results in the TA-cohort (FEV1: 75.6% vs 78.3% p=0.784; FVC: 81.8% vs 81.2% p=0.891). Comparing TF to TA demonstrated no significant difference on the impact of COPD on post-procedural outcomes, especially pneumonia rates (TF 6.5% vs. TA 8.1%, p=0.204). Both cohorts featured significant improvement in NYHA functional class after performing TAVI, although COPD patients experienced less progress. COPD is considered high-risk for operability in patients undergoing aortic valve repair, although the present study shows no significant difference in short-term mortality or long-term survival in our TAVI population. The access site selection does not imply a significant difference in VARC-2 defined clinical outcomes in COPD patients.

Evaluating these results, transfemoral transcatheter aortic valve implantation cannot be considered a superior technique in treating patients with aortic stenosis and concomitant COPD compared to the transapical approach.

Disclosure: Dr. Mach has received an institutional grant / research support from Edwards Lifesciences, Symetis SA and Jena Valve. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

Cardiac | Abstract Session | Coronary artery bypass graft and percutaneous coronary intervention

Midterm results of revascularisation in patients with chronic kidney disease requiring dialysis (CABG versus PCI)

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Farideh Roshanali

The prevalence of chronic kidney disease (CKD) has grown in the past few years. The risk of cardiovascular events is higher in patients with CKD and 30-60% of these patients suffer from coronary heart disease. The mortality rate in patients with coronary artery disease and CKD concurrently is higher than that in patients without CKD. Similarly, coronary artery disease is a leading cause of death in patients with end-stage renal disease (ESRD). To reduce the high mortality rate in patients with concurrent coronary artery disease and CKD we need an optimal strategy for coronary revascularisation on which there is not a consensus. CABG and PCI are the most commonly performed interventions. 30% of patients undergoing CABG and 40% of those receiving PCI have CKD. Previous studies mostly show better long-term outcomes and lower rate of mortality in CKD patients undergone CABG than PCI. However, CABG is associated with high risk of perioperative acute kidney injury in these patients. Besides, CKD patients may prefer less invasive interventions such as PCI. Merits of each approach alongside its potential risks motivate further studies on the impact of PCI and CABG in this group of patients.

The high prevalence of cardiac events in CKD patients, besides excess cardiac risk, as well as high prevalence of CKD in patients requiring revascularisation, prompted us to evaluated outcomes of CABG versus PCI in patients on dialysis, to determine the most appropriate method for coronary revascularisation in this group of patients.

Our study demonstrated that PCI was associated with slightly lower short-term risk of death, but mid and long-term outcomes reveal CABG was associated with a significant reduction in all-cause mortality, cardiac death, and sudden death relative to PCI.

Being consistent with many prior papers, the risk of restenosis and repeat revascularisation after PCI in our study was significantly higher than those after CABG were. This finding underscores the result of three recent studies comparing the outcomes of CABG with PCI using DES in patients with multivessel diseases. These papers show the overall superiority of CABG over PCI regarding to restenosis and repeat revascularisation. This could be the result of the coronary lesion's characteristics in CKD patients, which are often complicated, calcified and branched, superimposed on a background of accelerated atherosclerosis. This calcification in CKD patients can make stents under-expanded, and reduce the efficacy of drug eluted from the stent. Besides, incomplete revascularisation of PCI cannot remove these stenosis effectively, and this residual stenosis related to extensive coronary calcification may lead to higher restenosis rate in PCI arm. Moreover, the smaller size of dilated vessels by PCI, and an increased prothrombotic risk may explain the restenosis in patients on haemodialysis.

However, some patients may prefer PCI to CABG because of its lower invasive nature and quicker recovery period. In such circumstances, all factors implicated in the outcome of revascularisation, such as the number of involved vessels, associated comorbidities, GFR, and the risk of post-operative complications should be considered to define the optimal approach for each individual.

Cardiac | Abstract Session | Translational vascular biology

Characterization of agonist-induced vasoconstriction in the human pulmonary artery

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In recent years, human pulmonary artery rings are commonly used for an insight into pulmonary vascular resistance that leads to pulmonary hypertension. However, there are little data available on the systematic characterisation of the basic physiological pulmonary vascular reactivity. To bridge this intellectual gap, we performed a study to characterise pharmacological properties of pulmonary artery (PA) and excitation-contraction coupling of the PA using isolated human PA rings.

Patients undergoing lung resection were consulted and consented for resected lung tissue to be studied for our research. Research ethics committee approval was obtained and a total of 19 patients were enrolled in the study.

Pulmonary arteries dissected from disease-free areas of lung resection, and 57 PA rings of internal diameter 2-4 mm, 2 mm in length were prepared. The integrity of the endothelium was confirmed with 1uM acetylcholine (ACh), and potassium chloride (KCl) was used to check the contractility of PA rings. A Multi Wire Myograph system was used to mount the PA rings under physiological conditions in modified Krebs solution. A basal tension of 1.61 gm was applied and the rings were left to equilibrate for 60 mins. After equilibration, increasing concentrations of KCl, noradrenaline, adrenaline, vasopressin, endothelin-1 and prostaglandin (PG)F2a were used.

The result shows that endothelin 1 is more potent, and PGF2a and KCl are equally highly efficacious. The vasopressin has no effect on PA, so can safely be used in pulmonary hypertensive patient while adrenaline and noradrenaline need to be cautiously used as they result in significant increase in pulmonary vascular resistance.

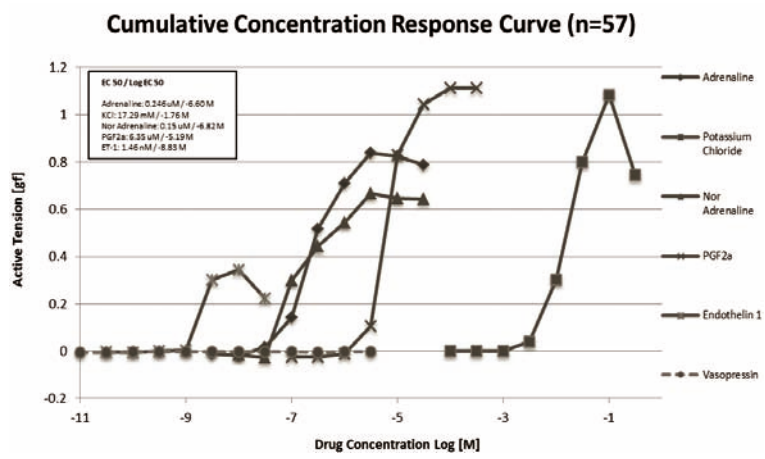

Figure 1. Cumulative concentration response curve to adrenaline (♦, n=8), noradrenaline (▲, n=12), endothelin 1(*, n=8), prostaglandin F2a (x, n=8), KCl (■, n=13) and vasopressin (●, n=8). The findings show that PGF2a and KCl equally cause maximal constriction while endothelin 1 had less effect. Vasopressin has no effect. The order of efficacy was KCl = PGF2a > Ad > NA > ET-1 and the order of potency was ET-1 > Ad = NA > PGF2a > KCl. EC50 for adrenaline, noradrenaline, endothelin-1, PGF2a and KCl was 246 nM, 150 nM, 1.46 nM, 6.35 uM and 17.24 mM respectively.

Cardiac | Abstract Session | Coronary artery bypass graft and percutaneous coronary intervention

Influence of practice patterns on outcome among countries enrolled in the SYNTAX trial

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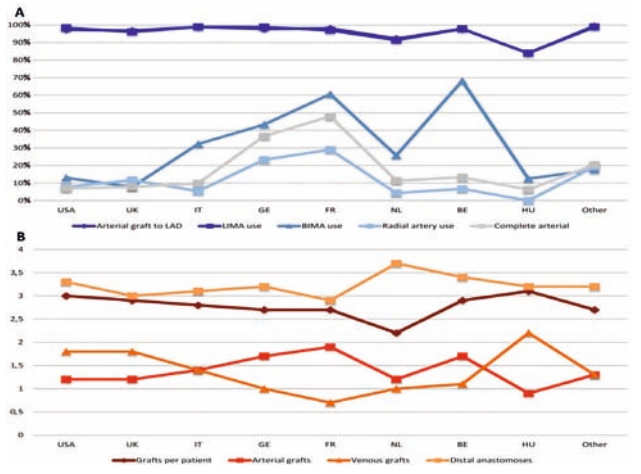
There is a growing trend for large multinational randomised clinical trials in order to expand recruitment, reduce costs and shorten the timespan of studies. However, internal consistency may be affected by differences in baseline characteristics, medical practice patterns and outcome within participating countries or sites. Several recent reports including those from the PLATO and HORIZONS-AMI trials have addressed the difficult issues of generalisability and cross-geographical clinical variations. Findings from geographical subgroup analyses may allow a better understanding of risk-benefit ratios and suggest an explaination about potential heterogeneity of the study results.

We evaluated the differences in baseline characteristics, practice patterns, and outcomes among countries that enrolled patients in the SYNTAX trial. It was a prospective multinational randomised trial that took place in 85 centres, across 18 countries in the USA and Europe. In this study, 1,800 patients with de novo LM or three-vessel coronary artery disease were randomly assigned to undergo CABG or PCI with first-generation paclitaxel-eluting stents.

Our findings demonstrate numerous important differences in the baseline characteristics, clinical practice, medications regimens which might correlate with outcomes among investigating countries. Also beyond the clinical characteristics, unmeasured factors such as medical care delivery system, community level, and patients culture might also play an important role in the trial results. An important feature was that despite recommendations provided in the study protocols, a lack of secondary prevention medications was notable in some countries and might have a significant influence on the outcome, especially during the first year after PCI and CABG. Likewise, compared with CABG, antiplatelet agents and statins recommendations were followed stronger by cardiologists to maintain stent patency after PCI.

The substantial differences were noted in surgical practice across the European countries and in the USA. Several major differences in the use of the left and/or right IMAs, total arterial revascularisation, the number of grafts as well myocardial protection are likely to be influenced by the prevalent surgical culture rather than to the overall risk profile of the patient, although the latter unquestionably plays a role (Figure 1). The differences in execution of procedures between countries show that there is room for standardised evidence-based techniques, especially in developing countries where resources may be limited. This provides an opportunity for improvement country-based practice patterns. For future trials, this means that there need to be standardized protocols for techniques and treatment strategies. Rigorous training and monitoring of adherence to these protocols will be key improving the quality of the trial.

These findings provide independent information related to clinical



patterns and outcomes and may lead to academic debate and improving individual medical practice for reducing potential adverse events. In addition, it may identify areas in which practice varies between countries and may therefore generate awareness among outliers to improve patient care. As the research community invest the magnitude of the resources and efforts in new medications and device, the development of standardized treatment strategies would help to improve comparability for decision-makers and also the outcome of patients.

Cardiac | Focus Session | Aortic valve repair – When and how

What makes the difference between Yacoub, David, sleeve and all their modifications'?

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The controversy surrounding aortic root replacement is focussed primarily on two conditions: Marfan Syndrome (MFS) and the aortopathy associated with a bicuspid aortic valve (BAV). In MFS, a characteristic dilatation of the aortic root exists in approximately 80% of patients. If left untreated there is a high risk of death due to dissection, rupture of the aorta or heart failure consequent upon aortic regurgitation, but aortic root replacement has dramatically improved the survival of these patients.

Total aortic root replacement (TRR) using a composite mechanical valve conduit, the Bentall operation, has long been considered the gold standard, providing excellent early and late post-operative outcome. Over the last 15 years there has been increasing use of valve-sparing aortic root replacement (VSRR). Pioneers in this field have been Magdi Yacoub and Tyrone David who developed the remodelling and re-implantation procedures, respectively. Ten years after the operation, in patients under the age of 40, the re-implantation procedure has proved to be more durable than remodelling, and thus most surgeons have adopted the David method. The David procedure constrains the annulus, the Yacoub procedure does not. Another approach has been the external ring annuloplasty by Lansac and colleagues which involves the insertion of a prosthetic ring at the level of the annulus, to control the diameter of the outflow tract. The early results are promising but the follow-up is short.

A number of excellent reviews and meta-analyses have shown that VSRR is a valuable option for patients with MFS, but considerable judgement and experience are required to produce durable results. Even in experienced hands the failure rate is 1-2% per year. This sounds rather small until you consider that for a 20-year-old patient, this will mean that by the time he or she reaches 50, there is a 50% chance of them requiring a revision operation. Another approach for MFS patients early in the natural history of their disease is to offer a pre-emptive operation – a personalised external aortic root support (PEARS). This is an emerging technology which involves the deployment of an external bespoke sleeve of a soft polyester macroporous mesh around the aortic root and ascending aorta from the ventricular-aortic junction proximally to the brachiocephalic artery distally. It is designed to halt aortic root expansion and maintain aortic valve function in MFS patients.

More recently, attention has turned to the BAV. El-Khoury has classified repair of the aortic valve and has pioneered leaflet repair in BAV. He has outstanding results but these are yet to be widely replicated. The problem with BAV is that we are largely ignorant of the natural history of the ascending aorta, making it difficult in individual patients to predict which aortas are going to expand and which are not. For the present, most surgeons follow the international guidelines which are necessarily incomplete. Possibly, molecular magnetic resonance scanning may allow us to predict the future more accurately in these patients.

Thoracic | Rapid Response | Thoracic

Comparison of outcomes and cost between open and thoracoscopic pneumonectomy: a 13-year multicentre study

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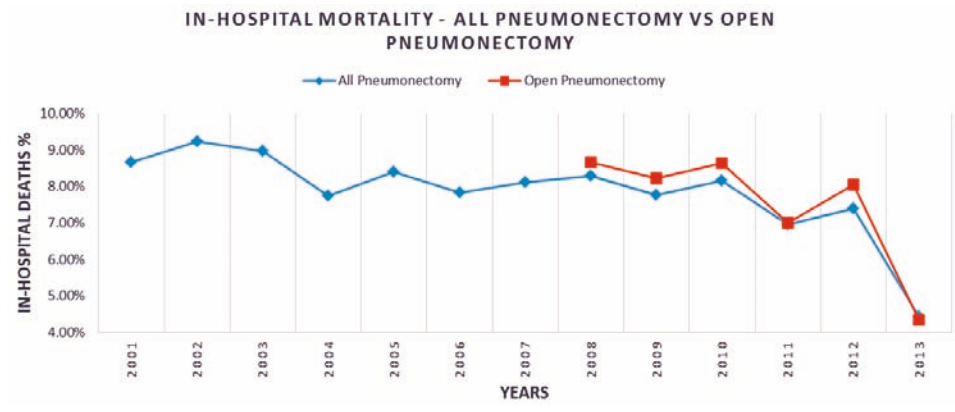
Making patients better is the goal that all of us involved in the field of medicine share. Every day and night we are discussing and questioning our methods of treatment for a variety of diseases. Even though as doctors and other medical professionals we want the medical knowledge to be black and white, when it comes to the patient, the reality is a big grey zone. To cover this grey zone we commonly use the words "judgment" and "experience" as a reason to create a treatment algorithm. Converting theory into practice is what we all do, sometime not knowing for sure, anxiously waiting and hoping for the best to happen. And one such dilemma in modern medicine is minimally-invasive surgery.

I finished my training at the world No.1 MD Anderson cancer centre. There we had all the modern technologies of surgery available at our disposal. I participated in thoracic surgeries performed by robots, thoracoscopes, lasers, stents and good old single incisions. I learnt all these different techniques, technologies applications during my training. I thought at the end of it I would be staring at a clear sky, but the reality was otherwise. Now I have moved to a developing country, trying to apply the cornerstones of modern medicine to make things better is challenging. For example, when I asked to purchase thoracoscopic staplers, the cost was astronomical when compared to a silk tie or a prolene suture. For the cost of thoracoscopic equipment, we could instead perform many open surgeries.



So the question surfaced again as to whether minimally-invasive modern medicine is really worth the investment of patient money, and a surgeon's efforts. With this in mind, I looked back at US data on the outcomes of thoracoscopic surgeries, focussing on pneumonectomies – a procedure with a very high mortality and morbidity rate, if compared to other thoracic procedures. In particular, I wanted to look at how outcomes differed between open and thoracoscopic pneumonectomies, thus, to investigate, I decided with my research team to look at the multi-year data provided by The Agency for Healthcare Research and Quality (AHRQ).

AHRQ's mission is to produce evidence to make healthcare safer, higher quality, more accessible, equitable, and affordable. The Healthcare Cost and Utilization Project (HCUP) is a family of databases and related software tools and products developed through a Federal-State-Industry partnership and sponsored by AHRQ. HCUP includes the largest collection of longitudinal hospital care data in the United States. HCUP creates the National Inpatient Sample (NIS) to make it possible for researchers to conduct national and regional analyses of hospital inpatient care. The NIS is the largest publicly available all-payer inpatient health care database in the United States. Unweighted, it contains data from more than seven million hospital stays each year. Weighted, it estimates more than 36 million hospitalisations nationally taken from more than 4,000 HCUP participating hospitals.

Using the National Inpatient Sample database, we performed a retrospective cohort study that involved patients who underwent pneumonectomies. To identify these patients we used three ICD 9 CM procedure codes: A.32.5 – pneumonectomy (excision of lung NOS and pneumonectomy with mediastinal dissection); B.32.50 – thoracoscopic pneumonectomy; C.32.59 – other and unspecified pneumonectomy (excludes thoracoscopic pneumonectomy 32.50). We found that, between 2001 and 2012, the number of pneumonectomies have decreased from 3,518 to 2,710. Mortality was 8.67% in 2001, decreasing to 4.43 % in 2013, and the mean charge was $48,412 in 2001, rising to $121,990 in 2012.

We also found that the cost of thoracoscopic pneumonectomy patient admission was reduced in comparison to open, as well as a trend for patients to be discharged home earlier. Therefore, even though the thoracoscopic procedural cost is higher, the overall cost of care is less. Open pneumonectomies have a higher mortality as compared to all pneumonectomies. We think this analysis provides important insight, and has rejuvenated my quest to steer our centre's thoracic surgery in the minimally-invasive direction.

Cardiac | Focus Session | Video assisted right anterior mini-thoracotomy aortic valve replacement and aortic root surgery

Video-assisted right anterior mini-thoracotomy AVR and aortic root surgery

Amber L. Melvin, Joshua K. Wong and Peter A. Knight University of Rochester Medical Center, Rochester, NY, USA

Peter A. Knight

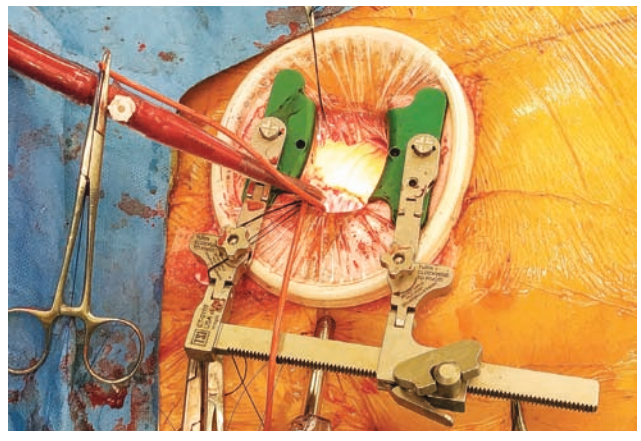
For cardiac surgery to be sustainable, cardiac surgeons must adopt minimally-invasive techniques. During the past 25 years, reduction or elimination of sternal trauma during surgical exposure of the aortic root has promised improved patient outcomes. Today, there is a paucity of data clearly confirming any clinical benefits of partial sternotomy over full sternotomy. While options for the treatment of diseased heart valves continue to expand and improve, complementary customised techniques and technology for less invasive cardiac valve procedures are still needed.

Patients rightfully expect and demand less invasive, long-lasting therapies. Technical difficulties, prolonged cardio-pulmonary bypass (CPB) and aortic cross-clamp times and – for aortic valve replacements (AVRs) – questions of prosthetic valve security have limited the acceptance of performing heart surgery through small intercostal incisions.

For aortic stenosis patients, non-sternotomy surgical access coupled with durable surgical prosthetic valves can offer most patients the benefits of a less invasive procedure and time-proven prosthetic longevity. When long-term survival is not expected, transcatheter aortic valve replacement (TAVR) offers a short-term reasonable alternative. To provide durable patient outcomes, the structural integrity of implanted prosthetic replacement cardiac valvevs should be routinely capable of outlasting the patient's expected lifespan.

At the University of Rochester Medical Center, we believe that the many worthwhile and desirable, but frequently elusive, benefits of less-invasive heart surgery can be realised through scrupulous attention to technical and clinical details. The judicious use of innovative technologies, as well as a dedication to targeting improved post-operative and long-term outcomes, enables optimal clinical benefits for our isolated AVR patients. We have developed a reproducible and teachable approach to isolated AVR surgery through a right anterior mini-thoracotomy (RAM®) incision. The aortic root is accessed through a 5 – 6 cm opening in the second intercostal space. For CPB, central arterial cannulation over a guidewire in the ascending aorta is established in conjunction with percutaneous cannulation of the femoral vein. A rigid 5 mm 30° endoscope is used to significantly enhance surgical site visualisation and to coordinate operating team activities (Figure 1).

At the beginning of our ongoing, now 80-patient, isolated mini-AVR series, manual suturing techniques were used to place sutures in the aortic annular tissue and prosthetic sewing cuff. For the most recent 27 patients, these sutures were placed using automated RAM® and SEW-EASY™ suturing technology. COR-KNOT® titanium fasteners were used to secure all prosthetic valves.



Today's EACTS video presentation ('Video assisted right anterior mini-thoracotomy AVR and aortic root surgery') highlights three early AVR patients; one receiving a bioprosthetic valve, the next a mechanical valve, and the third a bioprosthetic valve along with an annular enlargement. To date, three patients in this series have received aortic root enlargements and one patient required the planned revision of a saphenous vein graft. Three subaortic membrane resections were performed through this access. Today's video also presents a mini-Bentall procedure performed in a cadaver. We have subsequently completed a successful mini-Bentall in our clinical practice.

Cardiac | Abstract Session | Transcatheter aortic valve implantation

Transapical aortic valve replacement is a safe option in patients with poor left ventricular ejection fraction. Results from a national registry

Augusto D'Onofrio on behalf of the Italian Transcatheter Balloon-Expandable Registry (ITER) investigators. University of Padova, Italy

Transcatheter aortic valve implantation (TAVI) is a well-established treatment for high risk or inoperable patients with severe symptomatic aortic valve stenosis. The most used approaches for TAVI are transfemoral (TF) and transapical (TA) access. Since the latter requires direct entry in the left ventricle, there are concerns about its use in patients with reduced left ventricular ejection fraction (LVEF).

However, during the 2015 EACTS Annual Meeting in Amsterdam, we showed that after transapical TAVI (TA-TAVI) LVEF worsens only in a minority of patients. In those who experience LVEF worsening, outcomes are not affected. In order to further evaluate the impact of apical manipulation on outcomes of patients undergoing TAVI, we decided to focus our analysis only on patients with depressed LVEF and to compare outcomes of TA-TAVI versus TF-TAVI. In other words, in this multicenter retrospective study, we aimed at answering the question, 'Is transapical TAVI safe in patients with poor LVEF?' And our answer is 'Yes, it is'. The results of our study show that the TA access is not associated with worse mortality if compared to the TF approach in patients with LVEF ≤35%.

Our data were obtained from the Italian Transcatheter Balloon-Expandable Registry (ITER), which enrolls patients undergoing TAVI with the Sapien bioprosthesis in 33 National centers. Patients were divided into two groups according to the access: TA and TF. A proportional risk survival model was performed to identify independent preoperative predictors of one-year mortality. Since 2007 through 2012, 1,884 patients were enrolled in the registry. LVEF ≤35% was found in 208 (11%) patients. TA-TAVI and TF-TAVI were performed in 69 (33.2%) and 139 (66.8%) patients, respectively. Euroscore II (11.5±8% vs. 12.7±14.5%; p=0.2375) and STS score (12.5±8.8% vs. 12.8±11.6%; p=0.3032) were similar between groups. Overall VARC mortality was 9.1% (19 patients) and it was not different between groups: 11.6% (8 patients) and 7.9% (11 patients) in TA and TF patients, respectively (p=0.4454). Overall one-year mortality was 23.6% (49 patients) and it was not different between groups: 29% (20 patients) and 20.9% (29 patients) in TA and TF patients, respectively (p=0.1937).

The adjusted proportional risk survival model identified as independent predictors of mortality: serum creatinine level (HR: 1.430, 95%CI: 1.163-1.759; p=0.0007), permanent pacemaker at admission (HR: 3.037, 95%CI: 1.679-5.494; p=0.0002) and NYHA class IV (HR:8.299; 95%CI:1.456-47.218; p=0.0171)-. The TA approach was not a significant predictor of mortality (HR: 0.758, 95%CI: 0.373-1.669; p=0.4752) .

In conclusion, TAVI physicians should not be discouraged in performing TA-TAVI in patients with poor LVEF, since the impact of apical manipulation is negligible and does not affect patient outcomes.

Cardiac | Abstract Session | Blood management

A structured blood conservation program in adult cardiac surgery

Serdar Gunaydin Numune Training & Research Hospital, Ankara-Turkey

Despite the recent introduction of a number of technical and pharmacologic blood conservation measures, bleeding and allogeneic transfusion remain persistent problems in open-heart surgical procedures. The use of blood products carries several risks, such as immunologic sensitization, anaphylactic reaction, and disease transmission. The underlying pathophysiology has not been described entirely; however, there is evidence on the activation of inflammatory genes and cytokines in circulating leukocytes with transfusion of red blood cells.1 Efforts should be made to decrease or completely avoid transfusions to avoid these negative reactions.

There is a wide variation in the prevalence of perioperative transfusions in cardiac surgery. Most likely, institutional and individual differences in transfusion practice, guidelines and attitudes influence the frequency and number of transfusions. The decision to transfuse is based on multiple patient factors and it is impossible to designate a single transfusion trigger. The high prevalence initiated a multifactorial blood conservation program with the intention of reducing transfusions without compromising patient safety.2

Our Coronary Artery Bypass Grafting (CABG) database was reviewed retrospectively. A total of 198 patients who underwent cardiac surgery with cardiopulmonary bypass (CPB) (group 1 – blood conservation) were studied in a 12-month period (March 2015 – February 2016) after the implementation of the new program. This was compared with 205 patients (group 2 – control; no blood conservation) of the previous 12-month period (March 2014 – February 2015).

The blood conservation program was designed as follows:

Education: All the staff involved in the care of the patients, including surgeons, anesthesiologists, residents, OR, ICU and ward nurses, nurse helpers, physiotherapists and perfusionists were educated about the risks and benefits of blood transfusions and the new transfusion guidelines in a 45-minute lesson.

Guidelines: We revised our guidelines for transfusions based on the STS Guidelines. In the institutional guidelines, the decision to transfuse red cells should be based on clinical judgment of the patient's clinical and hemodynamic status. The final decision to transfuse or not was always at the discretion of the physician responsible.

Transfusion log was created

Reduction in IV fluid volume

CPB Circuit Design: Significantly less prime volume via oxygenator with integrated arterial filter, condensed circuit, pole mounted vents, microplegia, ultrafiltration, use of cerebral oxymetry, retrograde autologous priming, vacuum assisted venous drainage and cell salvage of the residual blood.

The proportion of patients transfused with red blood cells was 80.9% (n=166) in control group and reduced by 20.8% in the study group (60.1%; 119 patients; p <0.01). Blood transfusion rate (1.7±1 units within blood conservation group vs. 3.05±1 units in control group), postoperative hemorrhage (545±50 mL vs. 775±55 mL), respiratory support duration (12.4±7 h vs. 16.8±8 h) and ICU stay (2.2±1.1 days vs. 3.5±1.2 days) were significantly better in blood conservation group with respect to the control group.

Blood administration is never without the risk of consequence. As such, it is desirable to attempt to reduce or eliminate allogeneic blood product transfusions. These findings, in addition to risks and side effects of blood transfusion and the rising cost of safer blood products, justify blood conservation in adult cardiac operations. Circuit miniaturization, ultrafiltration, and reduced postoperative bleeding, presumably secondary to higher fibrinogen and other coagulation factor levels, contributed to this outcome.

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Cardiac | Abstract Session | Coronary artery bypass graft and percutaneous coronary intervention

Impact of dual antiplatelet therapy after coronary artery bypass surgery on one-year outcomes in the Arterial Revascularization Trial (ART).

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2. Nuffield Department of Surgery, University of Oxford, John Radcliffe Hospital, Oxford, UK
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The appropriate antiplatelet regimen after coronary artery bypass grafting (CABG) remains an area of controversy. The addition of an oral P2Y12 antagonist, such as clopidogrel, to aspirin early after CABG has been proposed to further enhance graft patency by inhibiting platelet-mediated processes that lead to saphenous vein graft disease. Whereas cardiac surgeons are well-versed with the guidelines regarding discontinuation of dual antiplatelet therapy (DAPT) prior to CABG to minimise bleeding risks, there is considerable variability in DAPT resumption in post CABG.

The Arterial Revascularization Trial (ART) is one of the largest studies of contemporary CABG comparing single versus bilateral internal mammary artery grafts. By performing a post-hoc analysis of the ART trial we shed further light as to whether the use of DAPT following CABG can improve outcomes when compared to aspirin only. Patients were enrolled into ART from 2004 to 2007 and clopidogrel was the only P2Y12 antagonist used in this trial in addition to aspirin. In fact, prasugrel and ticagrelor were approved for use in Europe 2009 and 2010 respectively. The final study population consisted of 2760 patients. Of them 573 (21%) and 2187 (79%) were discharged on DAPT and aspirin only respectively.

Endpoints were the incidence of major adverse cerebrovascular and cardiac events (MACCE) including cardiac death, myocardial infarction, stroke and repeat revascularisation from discharge to one-year follow-up, and major bleeding requiring hospitalisation. Propensity score (PS) matching was used to compared the two groups.

When compared to aspirin only, DAPT was not protective in terms of MACCE (HR 1.05;95%CI 0.56-1.97;P=0.9) and for the composite endpoint of cardiac-related death/MI and stroke (HR 0.77;95%CI 0.34-1.75; P=0.5) (Figure 1). Before PS-matching, DAPT was associated with a significant two-fold increased risk of major bleeding (HR 2.83;9%%CI 1.30-6.15;P=0.009) although this effect was no longer significant after PS-matching (HR 2.2; 0.76-6.33; P=0.1) (Figure 2). At 1 year, 60% of subjects initially discharged on DAPT were found to be on aspirin only. However the rate of adverse event was not increased in these cases when compared to cases who remained on DAPT (Figure 3).

In conclusion, there is still paucity of evidence to support routine DAPT following CABG. The present retrospective post-hoc analysis of ART does not support the hypothesis that when compared to aspirin only, DAPT significantly reduces adverse events after CABG. On the other hand, DAPT can increase the risk of major bleeding. Large prospective RCTs evaluating the use of DAPT post-CABG with available P2Y12 antagonists are urgently needed to provide more definitive guidance for clinicians.

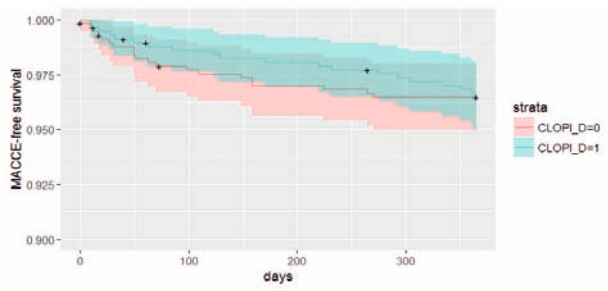

Figure 1. MACCE (Major cerebrovascular and cardiac events) and composite of cardiac death/myocardial infarction(MI) and stroke-free survival in and matched sample according to use of dual antiplatelet therapy (DAPT) following surgery (=1: yes; =0: no)

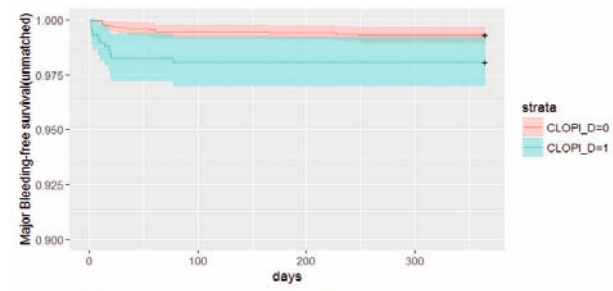

Figure 2. Major bleeding post discharge free survival in the unmatched and matched groups according to use of dual antiplatelet therapy (DAPT) following surgery (=1: yes; =0: no)

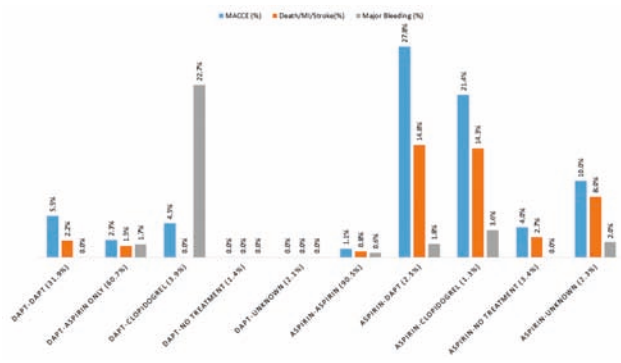

Figure 3. Incidence of MACCE (Major cerebrovascular and cardiac events), composite of cardiac death/myocardial infarction (MI) and stroke and major bleeding according to antiplatelet therapy status at discharge and at one year after surgery.

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Cardiac | Abstract Session | Endocarditis

Neurologic outcomes after early surgery for infective endocarditis in patients with combined cerebral septic embolism

Do Yeon Kim, Hwan Wook Kim and Keon Hyon Jo Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Republic of Korea

Infective endocarditis (IE) continues to be considered a difficult disease to manage, because there has been no change in its incidence or mortality despite the development of cardiac surgery. Many articles have advised early surgery in patients with progressive heart failure, multiple septic emboli, or uncontrolled infection. There is minimal evidence regarding surgery in cases with progressive cerebral septic embolism or hemorrhage, although many articles have mentioned various guidelines regarding the optimal time of surgery. In our institution, cardiac surgery is performed despite the risk of postsurgical complications in patients with IE and cerebral septic embolism or microbleeds. Herein we report neurologic outcomes after early surgical management according to the existence or absence of cerebral septic embolism. Thus far, to our knowledge there have been no studies examining the outcome of cerebral microbleeds (CMBs) detected by brain magnetic resonance imaging (MRI) in patients with IE. As a result, we also analyzed the interaction between CMBs and neurologic outcomes after cardiac surgery using cardiopulmonary bypass.

We retrospectively studied 74 patients with IE who underwent cardiac surgery between May 2010 and May 2015. 55 patients were included, and they comprised the cerebral embolic group (n=33) and non-cerebral embolic group (n=22). Among the cerebral embolic group, 13 patients had CMBs on brain MRI. These patients were then placed into a CMB group.

After cardiac surgery, intracranial hemorrhage and hemorrhagic complications occurred in two patients (9.1%) in the non-embolic group and five patients (15.1%) in the embolic group. There was no statistically significant difference in postoperative neurologic problems between the non-embolic group and the embolic group (22.7% vs. 30.3%, respectively, p=0.54). Early mortality was 4.5% in the non-embolic group and 9.1% in the embolic group (p=1.00). In the cerebral microbleeds combined with septic embolism group, the neurologic problem rate (38.5%) was higher than in the non-cerebral microbleeds group (20.0%), but the difference was not statistically significant.

To evaluate for neurologic problems, analysis was made of neurologic complications including ICH, hemorrhagic transformation, cerebral microbleeds, brain abscess, cerebral mycotic aneurysm and meningitis. Cognitive dysfunction such as delirium and seizure after surgery was also investigated. Except for the above-mentioned complications, no other neurologic complications were included in the results because they did not occur in our cohort. The presence of preoperative cerebral septic emboli did not statistically increase the rate of ICH, and the rate of hemorrhagic change of postoperative stroke was not different between the cerebral embolic and non-cerebral embolic groups. A higher rate of neurologic problems occurred in the cerebral embolic group as expected, however the results were not statistically significant.

Thus, early cardiac surgery can increase the risk of neurologic problems in patients who have cerebral septic emboli caused by IE, but the presence of cerebral septic embolism should not be a hindrance to life-saving surgery. Cerebral septic emboli combined with CMBs may cause an increase in neurologic problems. Further studies are needed to explore the relationship between CMBs and neurologic outcomes after early cardiac surgery in IE. v

Postoperative neurologic outcomes

Variables	Non cerebral embolic group (N=22)	Cerebral embolic group (N=33)	P value
Postoperative neurologic problems,n (%)	5 (22.7%)	10 (30.3%)	0.537
Intracranial hemorrhage	1 (4.5%)	3 (9.1 %)	0.642
Hemorrhagic transformation	1 (4.5%)	1 (3.0 %)	1.000
Cerebral microbleeding	0	1 (3.0 %)	1.000
Seizure	1 (4.5%)	2 (6.1 %)	1.000
Delirium	2 (9.1%)	6 (18.2%)	0.349

Other neurologic complications was not occurred in our study.

Neurologic Outcomes related Cerebral Microbleeds

Variables	Non CMBs group (n=20)	CMBs group (n=13)	p value
Symptomatic stroke	3 (15.0%)	5 (38.5%)	0.213
Size of stroke lesion (mm)	15±14.2	25±18.8	0.115
Numbers of stroke lesions (n)	3.9±2.3	4.2±2.5	0.652
Neurologic recovery	2 (10.0%)	2 (15.4%)	1.000
Neurologic problems	4 (20.0%)	6 (46.2%)	0.139
Intracranial hemorrahge	1 (5.0%)	2 (15.4%)	0.547
Hemorrhagic transformation	1 (5.0%)	0	1.000
Microbleeding	0	1 (7.7%)	0.394
Seizure	1 (5.0%)	1 (7.7%)	1.000
Delirium	2 (10.0%)	4(30.8%)	0.182

Cardiac | Rapid Response | Adult Cardiac

Twenty years' experience with the Ross operation in middle-aged patients – The autologous principle is still alive

Francisco Costa Santa Casa de Curitiba PUCPR, Curitiba, Brazil

The choice of a valve substitute for aortic valve replacement (AVR) in middle-aged patients (40-60 years) can be very challenging, and remains controversial. For the vast majority of centres worldwide, conventional biological or mechanical valves are used almost exclusively in this subset of patients, and no further consideration is given to other options such as the Ross Operation.

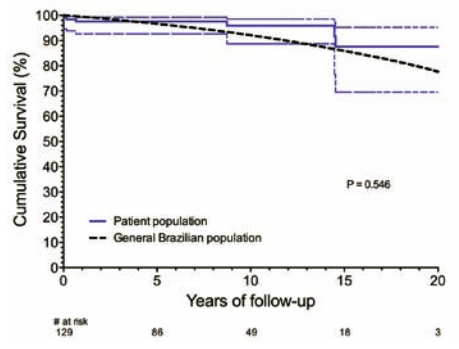
The Ross operation (RO) has been criticised for its technical complexity, an alleged increased early mortality risk, the creation of double valve pathology in patients with single valve disease and for complex scenarios for which reoperations are required. These arguments have led the Society of Thoracic Surgeons (STS) to consider the RO as a class III (Level of Evidence C) recommendation for AVR in middle age patients, despite a randomised trial and the robust German Ross Registry, neither of which were referenced.

Given the very satisfying global experience with more than 500 patients, we decided to analyse our long-term results of the Ross Operation when applied to the cohort of middle-aged patients. This subset included 129 consecutive patients (106 males, 23 females; mean age (mean±standard deviation [SD]) 47.2±5.2 years; range: 40–60 years). The most frequent aetiology was the bicuspid aortic valve. The pulmonary autograft was implanted as a root replacement in 110 cases, and with the inclusion technique in the remaining 19. Patients were allocated into two groups depending on the type of the allograft used for the right ventricular outflow (RVOT) reconstruction. In Group 1 (n = 45), the reconstruction was performed with cryopreserved allografts and in Group 2 (n = 84) de-cellularised allografts were used.

The early mortality rate was 1.5% (2/129). One important finding of this study was that long-term survival, including hospital mortality, was 87.6% (95% CI: 69.5–95.3%) at 20 years, parallel to that from an age- and sex-matched general population (Figure 1). The incidence of thromboembolic, haemorrhagic and infectious complications were very low.

Only seven patients underwent a reoperation: three on the pulmonary autograft, one on the pulmonary allograft, one in both autograft and allograft simultaneously and two for myocardial revascularisation. The linearized rate for reoperation on the pulmonary autograft was 0.39%/patient-year and the 16-year freedom from reoperation on the pulmonary autograft was 96%. The 16-year freedom from reoperation on the right side was 99%.

A careful look at the pulmonary autograft function revealed that around 40% of the patients will develop more than mild degree of aortic insufficiency and 30% had a pulmonary autograft diameter greater than 45 mm at 16-years of follow-up. These two complications were more frequent in patients with a preoperative diagnosis of aortic insufficiency and/or had a dilated aortic annulus at the operation. Another important finding of this study was that de-cellularised allografts had a better performance than cryopreserved allografts for RVOT reconstruction. The overall 16-year freedom from gradient > 40 mmHg was 87%



in the cryopreserved group, but none of the 79 patients in the de-cellularised group develop a gradient > 40 mmHg, with a 10-year freedom of 100% of this complication.

In our opinion, the RO when performed in experienced centres is an excellent alternative for middle-age patients, especially for those with pure AS, and should be part of the surgical armamentarium.

Congenital | Abstract Session | Univentricular heart – Fontan

Impact of early Fontan completion on postoperative outcomes in patients with a functional single ventricle

Masamichi Ono, Melchior Burri, Julie Cleuziou, Jelena Pabst von Ohain, Alfred Hager, Christian Schreiber and Rüdiger Lange German Heart Center Munich at the Technische Universität München, Munich, Germany

After the introduction of the staged Fontan procedure, the total cavopulmonary connection (TCPC) procedure was gradually advanced to include younger ages, between one and two years. However, performing TCPC at an earlier age remains controversial, and the benefit of early Fontan completion is not clearly understood. The present study was undertaken to evaluate whether early timing of TCPC affects postoperative outcomes and exercise capacity.

Between May 1994 and December 2015, 460 patients underwent TCPC at the German Heart Centre in Munich. During the study period, our institutional policy changed towards an earlier timing of TCPC. Patients were divided based on the timing of TCPC, into group A (TCPC before or at 18 months of age, n = 51) and group B (TCPC after 18 months of age, n = 409). We compared the clinical outcomes and exercise capacity between groups.

Median age at TCPC was 1.4 [1.3 – 1.5] years in group A and 2.5 [1.9 – 4.5] years in group B. Prior partial cavopulmonary connection (PCPC) was performed in 50 (98.0%) patients in group A and in 361 (88.3%) patients in group B (p=0.03). Patients in group B exhibited higher mean pulmonary artery pressure (p=0.03), more atrioventricular valve (AVV) regurgitation (p=0.03), and more pre-TCPC surgeries (p=0.03). The median cardiopulmonary bypass time and the percentage of patients requiring aortic cross-clamping were significantly higher in group B. Death within 30 days following TCPC occurred in 8 patients (1.7%), all of whom were in group B. Duration of intensive care unit stay (6 vs. 7 days) and hospital stay (20 vs. 20 days) was not significantly different between groups. The median follow-up period was 6.6 [2.3-11.7] years in 442 patients. Estimated survival (95.3 vs. 92.1%), freedom from reoperation (93.7 vs. 86.3%), freedom from catheter intervention (60.1 vs. 77.0%), and freedom from protein losing enteropathy (97.6 vs. 93.8%) at 10 years was not significantly different between groups. At last follow-up, no patient in group A but 13 patients in group B exhibited reduced ventricular function (p=0.03). Mild or moderate AVV regurgitation was observed in 14 patients (27.5%) in group A and 126 (33.2%) in group B (p=0.69). Exercise-capacity testing showed that both peak oxygen uptake (peak VO2, 36.4 vs. 28.6 mL/kg/min; p=0.03) and its percentage of predicted value (82.9 vs. 70.0%; p=0.004) were significantly higher in group A (n=6, median postoperative period: 7.8 years) than in group B (n=119, median postoperative period: 8.6 years). There was a significant negative correlation between age at TCPC and peak VO2 ($p < 0.01$).

In conclusion, TCPC can be performed before or at 18 months of age without the expense of increased morbidity or mortality. Earlier unloading of the systemic ventricle by early PCPC and shorter duration of cyanosis through early TCPC might be advantageous for the preservation of systemic ventricular function and provides better exercise capacity in the long term.

Cardiac | Rapid Response | Adult Cardiac

Unilateral carotid cannulation using a side graft facilitate minimal invasive surgery of the ascending aorta and aortic arch

Constanze Bening, Khaled Hamouda, Dejan Radakovic, Christoph Schimmer, Mehmet Oezkur, Ivan Aleksic, Armin Gorski ,Rainer Leyh Medical University Wuerzburg, Germany

Introduction

Minimally invasive surgery of aortic aneurysms and the aortic arch using a partial upper sternotomy is a promising approach to achieving reduced surgical trauma, reduced hospitalization time, higher sternum stability and earlier respiratory recovery.

Strategies regarding perfusion are necessary for achieving such advantages of minimally invasive surgery. The main advantage of unilateral carotid cannulation, whose only manner of implementation is extracorporal cannulation (ECC), is unilateral brain perfusion.

This strategy is technically easy to carry out, whereas cannulation of the subclavian artery presents one main disadvantage, namely that the pump flow is mainly directed towards the aortic arch. This might lead to the Venturi effect with significant decrease of flow through the right common carotid artery, because the blood can be sucked from the right carotid artery.

This effect is not seen in carotid cannulation. Studies have shown that the Venturi effect can cause serious cerebral hypoperfusion in patients with right subclavian cannulation. We therefore wanted to evaluate the impact and clinical outcome of right

carotid artery cannulation using a side graft in combined aortic valve, ascending aortic surgery with and without arch surgery using an upper hemi-sternotomy.

Methods

Between July 2012 and April 2016, 50 patients underwent aortic valve surgery and replacement of the ascending aorta with or without arch surgery using a minimal invasive technique with an upper hemi-sternotomy at our institution. Arterial return of the cardiopulmonary bypass was performed in all patients via cannulation of right carotid artery using a side graft.

In patients requiring aortic arch surgery, unilateral cerebral perfusion was performed using this side graft. 30% (15/50) required aortic root surgery and 70% (35/50) required aortic arch surgery. The median age was 66.1±9.9 years.

Regarding clinical characteristics, no significant differences existed among the patients undergoing aortic arch surgery versus those with aortic root surgery. 39 patients underwent replacement of the aortic valve (78%), and four patients underwent repair of the aortic valve (4%). All patients underwent replacement of the aortic ascendens, and 14 patients (28%) underwent aortic root surgery, with conduit replacement in 10 patients (20%) and reimplantation in 4 patients (8%). In those 35 patients undergoing aortic arch surgery, 31 had subtotal/hemiarch replacement (70%), one patient had total arch replacement (2%), and in three patients open distal anastomoses were performed (6%).

Results

CPB time was 119±39 minutes and aortic cross clamp time was 86.6±36.0 minutes with a rectal temperature of 28.5±3.5 °C. Median ventilation time and ICU stay time was 15 hours and 1 day, respectively. Prolonged ventilation time (>24h) was necessary in 8% (4/50) of patients. 48% (24/50) required red blood cell transfusion with a median of 1 unit each. Re-thoracotomy for bleeding was performed in 4% (2/50) of patients.

According to AKIN-classification, stage I acute kidney injury developed in 18% (9/50) of patients. Stage III developed in in 4% (2/50), requiring temporal renal replacement therapy. There was no 30-day mortality. One patient (2%) with severe calcification of the aortic valve suffered a minor embolic stroke.

Conclusion

These preliminary data indicate that arterial cannulation of right carotid artery using a side graft is an efficient and safe method for combined surgery of the aortic valve, ascending aorta and aortic arch in a minimal invasive technique using upper hemi-sternotomy.

EACTS 2016 **Agenda**

Saturday 1 October

Techno College

08:00	Aortic valve	Forum	Cardiac
10:30	Atrioventricular valve 1	Forum	Cardiac
13:15	Aorta, Ablation, and Assist devices	Forum	Cardiac
15:10	Atrioventricular valve 2	Forum	Cardiac
09:00	Beyond conventional video assisted thoracic surgery: Part 1	113	Thoracic
13:30	Beyond conventional video assisted thoracic surgery: Part 2	113	Thoracic

Wetlab

14:00	Valve sparing aortic root replacement	114	Congenital

Sunday 2 October

Professional Challenge

08:15	EACTS/STS – Acute type A dissection	113	Vascular
10:00	EACTS/STS – Type B aortic dissection	113	Vascular

Focus Session

08:15	Latest trials in cardiovascular medicine	116 & 117	Cardiac
08:15	Perfusion – Session 1	115	Cardiac
09:45	TAVR versus SAVR: David and Goliath	116 & 117	Cardiac
08:15	State of the art in airway and esophageal endoluminal therapy	131 & 132	Thoracic
08:15	Basic science: Thoracic	120 & 121	Thoracic
08:15	Failing Fontan	111	Congenital
09:00	Allied Health Professionals Programme – Pain	133 & 134	All Domains
10:00	Perfusion – Session 2	115	Cardiac
10:00	When strategy fails – Case based	112	Cardiac
10:00	Training in cardiothoracic surgery	118 & 119	Cardiac
10:00	Meet the experts – nightmare/complicated cases	111	Congenital
10:00	Neuroendocrine lung tumours: where do we stand?	131 & 132	Thoracic
10:00	Allied Health Professionals Programme – Innovation	133 & 134	All Domains
10:30	QUIP Adult Database: Present and Future	120 & 121	All Domains
10:45	Allied Health Professionals Programme – Nursing	133 & 134	All Domains
13:30	Perfusion – Session 3	115	Cardiac
13:30	Latest news and research on treatment of aortic valve stenosis	112	Cardiac
13:30	Treatment of patients with bicuspid aortic valves	118 & 119	Cardiac
13:30	Basic Science – Cardiac	120 & 121	Cardiac
13:30	Oncology tumour board	131 & 132	Thoracic
13:30	Allied Health Professionals Programme – Abstracts	133 & 134	All Domains
15:15	Expanding indications for transcatheter heart valves	116 & 117	Cardiac
15:15	Monitoring Quality in Your Unit: State of the Art	112	Cardiac
15:15	Surgery for advanced infectious disease	131 & 132	Thoracic
15:15	Allied Health Professionals Programme – Closing the day	133 & 134	All Domains
15:15	Balancing a surgical career with a family	114	All Domains

Abstract Session

08:15	Young Investigator Awards	212	Cardiac
13:30	Surgical videos	111	Congenital
13:30	Defining good outcomes after aortic root surgery	113	Vascular
15:15	Arch and descending aortic pathology	113	Vascular

Abstract Rapid Response

15:15	Congenital Rapid Response – Miscellaneous	211	Congenital
15:15	Trends in Aortic valve replacement	212	Cardiac

Training in Research Session

08:15	Preparing your scientific breakthrough: from abstract to paper	122 & 123	All Domains
13:30	Statistics from scratch: finding your way through the forest of options…	122 & 123	All Domains

Plenary

11:45	The whole is greater than the sum of its parts: a strong team for a better outcome	116 & 117	Plenary

Competition

13:30	Jeopardy Competition Round 1	212	Competition

Monday 3 October

Professional Challenge

08:15	Wire skills transcatheter aortic valve implantation	116 & 117	Cardiac
14:15	Rhythm Surgery in the upcoming decade	112	Cardiac

Focus Session

08:15	Personalized revascularization strategies	115	Cardiac
08:15	Aortic valve repair – When and how	114	Cardiac
08:15	Evidence based decision making in aortic valve surgery	112	Cardiac
08:15	Joint Session EACTS SBCCV PASCaTS – Cardiac surgery in underserved regions	120 & 121	Cardiac
08:15	Update on thymic surgery	129 & 130	Thoracic
08:15	The aorta and the bicuspid valve	113	Vascular
10:15	Robotics revisited	122 & 123	Cardiac
10:15	The future of early stage non-small cell lung cancer	129 & 130	Thoracic
10:15	Repairing a bicuspid valve	113	Vascular
10:15	Nightmares in cardiothoracic surgery	115	All Domains
10:15	Your educational pathway in surgery: how can EACTS help you?	118 & 119	All Domains
10:15	How can we work together? Latin America, Africa and Asia Perspective	120 & 121	All Domains
14:15	Mitral valve repair beyond P2	116 & 117	Cardiac
14:15	Hypertrophic obstructive cardiomyopathy revisited	115	Cardiac
14:15	How to – video session 1	113	Vascular
16:00	Minimally invasive aortic valve replacement – How to do it right in all patients	118 & 119	Cardiac
16:00	Diaphramatic disease	129 & 130	Thoracic
16:00	Thoracic and thoraco-abdominal aneurysms treatment: Surgery after thoracic endovascular aortic repair and thoracic endovascular aortic repair after surgery	113	Vascular
16:00	Meet the experts	122 & 123	All Domains

Abstract Session

08:15	Extra corporeal circulation/Left ventricular assist device/ Transplantation 1	133 & 134	Cardiac
08:15	Univentricular heart – Fontan	111	Congenital
08:15	Oncology I	131 & 132	Thoracic
08:15	Work in progress	122 & 123	All Domains
10:15	Coronary artery bypass graft and percutaneous coronary intervention	114	Cardiac
10:15	Endocarditis	112	Cardiac
10:15	Extra corporeal circulation/Left ventricular assist device/ Transplantation 2	133 & 134	Cardiac
10:15	Basic science and lung transplantation	131 & 132	Thoracic
10:15	Hypoplastic left heart syndrome	111	Congenital
14:15	Transcatheter aortic valve implantation	114	Cardiac

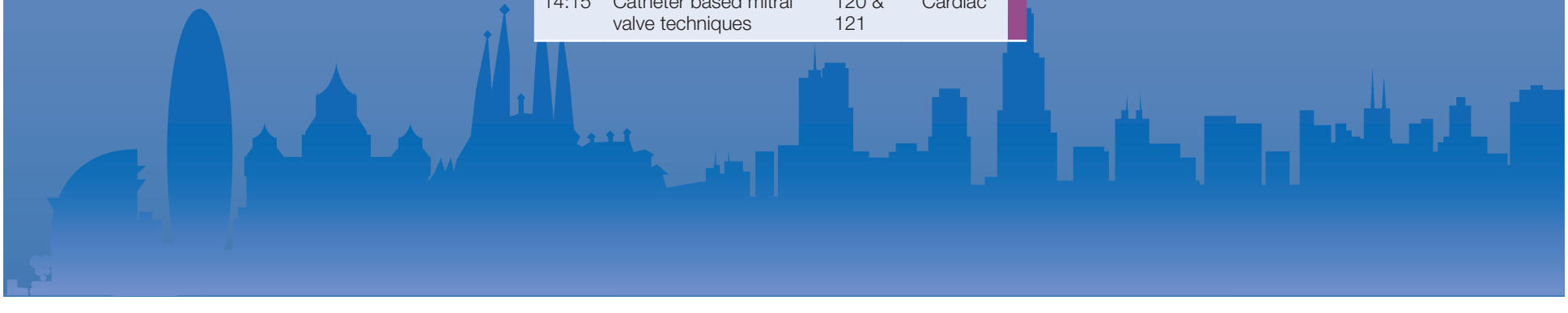
14:15	Blood management	133 & 134	Cardiac
14:15	Oesophagus	131 & 132	Thoracic
14:15	VATS lobectomy	129 & 130	Thoracic
14:15	Congenital miscellaneous 1	111	Congenital
16:00	Improving outcomes in hypertrophic obstructive cardiomyopathy (HOCM)	115	Cardiac
16:00	Translational vascular biology	133 & 134	Cardiac
16:00	Regeneration – Preservation	120 & 121	Cardiac
16:00	Congenital miscellaneous 2	111	Congenital
	Abstract Rapid Response		
08:15	Minimising sternal wound complication	211	Cardiac
08:15	Type A Aortic dissection from research to clinical application	212	Vascular
10:15	Cardiac General	211	Cardiac
10:15	An update on mitral valve interventions	212	Cardiac
14:15	Developments in assist devices and transplantation	211	Cardiac
16:00	Adult Cardiac	211	Cardiac
16:00	Thoracic	212	Thoracic
	Training in Research Session		
08:15	How to perform more advanced statistics: basics and pitfalls	118 & 119	All Domains
14:15	Meta-analysis from start to finish	118 & 119	All Domains
	Plenary		
11:50	Presidential Address	116 & 117	Plenary
	Competition		
14:15	Jeopardy Final	212	Competition

Tuesday 4 October

	Professional Challenge		
08:15	Fighting infection in cardiac surgery	116 & 117	Cardiac
08:15	Management of coarctation in newborn and infants	111	Congenital
10:15	Management of aortic arch obstruction beyond infancy	111	Congenital
	Focus Session		
08:15	Bioprosthetic valve durability: also for younger patients?	115	Cardiac
08:15	Atrial fibrillation and management of the left atrial appendage	114	Cardiac
08:15	Experimental models for basic research in thoracic surgery	129 & 130	Thoracic
08:15	Translational regenerative medicine for cardio-thoracic surgeons	118 & 119	Cardiac
08:15	Bicuspid aortic valve and its challenges	122 & 123	Cardiac
08:15	Connective tissue disorders and aortic disease: New frontiers in diagnosis and management	113	Vascular
10:15	Late tricuspid regurgitation after previous mitral valve surgery	115	Cardiac
10:15	Improving outcome of left ventricle assist device therapy	120 & 121	Cardiac
10:15	Interdisciplinary maximally invasive thoracic surgery	131 & 132	Thoracic
10:15	Arch surgery: Towards a low mortality and low complications rate	113	Vascular
10:15	Simulation based training	122 & 123	All Domains
14:15	People skills for surgeons	116 & 117	Cardiac
14:15	Designing a valve centre of excellence; not just numbers!	113	Cardiac
14:15	Electrophysiology and the surgeon	112	Cardiac
14:15	Pro and Cons debates	122 & 123	All Domains
16:00	From cardiac surgery guidelines to aircrew licensing regulations	133 & 134	Cardiac
16:00	Future surgical approach for routine anatomical lung resections	131 & 132	Thoracic
16:00	Endovascular competence for the cardiac surgeon. Keeping in track.	113	Vascular
16:00	EACTS publications: Best papers	211	All Domains
	Abstract Session		
08:15	Tricuspid valve – repair and replacement	112	Cardiac
08:15	Mesothelioma	131 & 132	Thoracic
10:15	Transcatheter aortic valve implantation 2	118 & 119	Cardiac
10:15	Stand-alone and concomitant MAZE is an evidence based procedure	114	Cardiac
10:15	Coronary artery bypass graft: From start to finish	112	Cardiac
10:15	Functional mitral insufficiency	133 & 134	Cardiac
10:15	Non-oncology	129 & 130	Thoracic
14:15	Coronary artery bypass graft: Minimally invasive and hybrid revascularisation	115	Cardiac
14:15	Who will do well after aortic valve replacement?	114	Cardiac
14:15	Catheter based mitral valve techniques	120 & 121	Cardiac
14:15	Chest wall and mediastinum	131 & 132	Thoracic
14:15	Valves	111	Congenital
16:00	Complications in mitral valve surgery	116 & 117	Cardiac
16:00	Tissue repair and myocardial homestasis	114	Cardiac
16:00	Aortic valve replacement – rapid deployment valves	112	Cardiac
16:00	Oncology 2	129 & 130	Thoracic
16:00	Tetralogy of Fallot / pulmonary atresia	111	Congenital
	Abstract Rapid Response		
08:15	Coronary artery bypass graft: Decreasing complications & improving graft potency	211	Cardiac
10:15	Risk modelling and scoring systems in cardiac surgery	212	Cardiac
14:15	Thoracic	212	Thoracic
14:15	The old, the new, the evident in aortic surgery	211	Vascular
16:00	Beyond lines and clips	212	Cardiac
	Training in Research Session		
08:15	Starting a trial: what you must know	120 & 121	All Domains
14:15	Interpreting randomized trial data	118 & 119	All Domains
	Plenary		
11:50	Honoured Guest Lecture	116 & 117	Plenary
	Resident's luncheon		
12:30	Resident's luncheon – The force awakens: training of the new Jedi	Banquet Hall 1	All Domains

Wednesday 5 October

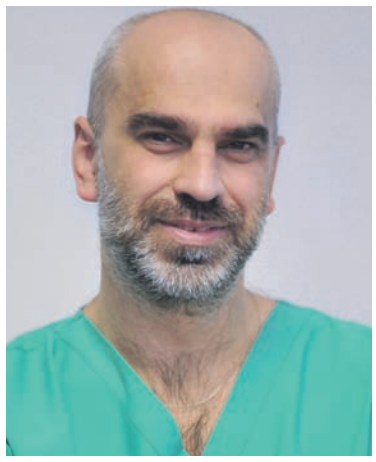
	Advanced Techniques		
09:00	Controversies and catastrophes in Adult Cardiac Surgery	122 & 123	Cardiac
09:00	Multiple arterial grafting: vhow I do it	133 & 134	Cardiac
09:00	A future without suture: where we stand?	112	Cardiac
09:00	How to do it, with live in box?	127 & 128	All Domains
	Abstract Session		
09:00	Video & Case Study 1	129 & 130	Thoracic
11:00	Video & Case Study 2	129 & 130	Thoracic
	Wetlab		
09:00	Mitral Valve Repair	111	Cardiac
09:00	Thoracic	131 & 132	Thoracic
09:00	Aortic Valve Repair	118 & 119	Vascular
11:00	Thoracic	131 & 132	Thoracic



Cardiac | Rapid Response | Cardiac general

Results of giant left atrium reduction with plication versus cardiac autotransplantation procedure in patients with mitral valve disease

Evgeny Vladimirivich Rosseikin, Vladlen Vladlenovich Bazylev, Evgeny Vladimirovich Nemchenko, Alexey Vladimirovich Lavreshin, Vadim Aleksandrovich Karnakhin Federal Center for Cardiovascular Surgery (Penza), Ministry of Health of the Russian Federation



Giant left atrium (LA) is a complication of mitral valve disease characterised by a significant increase in LA size. According to different studies, its frequency varies from 8% to 19%. Patients with extremely large LA volumes are in the particularly high-risk group due to long-existing mitral valve disease history, pulmonary hypertension, high risk of prosthetic dysfunction and thromboembolic complications, as well as surgical complexity. The question of necessity and choice of optimal atriomegaly correction method remains uncertain. Various types of surgical techniques have been suggested to reduce LA volume: wedge resection, suture atrioplasty, and heart autotransplantation, the latter providing optimal conditions for atrial cavity reduction.

In our clinic, quite a large experience (in comparison with published research) of patients with atrial volume exceeding 300 ml (giant LA) treatment has been accumulated. The aim of this study was to compare short-term and long-term results of giant (more than 300 ml) left atrial volume reduction with heart autotransplantation and suture plication techniques in patients with mitral valve disease.

The retrospective study included 55 patients with giant (more than 300 ml) left atrium (GLA), operated upon from 2008 to 2015. In 39 patients the correction of mitral valve disease combined with suture plication (SP) method was performed, and in 16 cases the reduction of left atrial cavity using the heart autotransplantation (HAT) method was performed. Since the HAT method is a more 'aggressive' technique, it has been used in patients with an initially larger LA volume. The average LA volume was 673.7±344.5 ml (from 320 ml to 1620 ml) in the HAT group and 407.0±125.4 ml (from 300 ml to 760 ml) in the SP group. Suture LA plasty was performed using the modified Kawazoe method with double-row blanket suture in a para-annular manner, followed by resection of excessive tissue of left atrial edges. In the HAT group, superior vena cava, aorta and pulmonary trunk were cut off, the heart was positioned upwards and atriotomy was performed. Mitral valve disease treatment was followed by a wide sleeve resection of the left atrium and LA appendage excision and heart reimplantation with continuous locking stitches of vessels.

Each of the methods leads to a significant reduction in size and volume of the LA – more than 2.6 times in the SP group and 3.7 times in the HAT group. Short-term results in both groups did not differ in general, but in the HAT group cardiopulmonary bypass (p=0.03) and myocardial ischemia (p<0.01) time were statistically higher. The factors that had previously been reported as the most important predictors of patient survival rate, such as age, initial LA volume and EuroSCORE points, had no effect on long-term survival rate after atrioplasty, as well as the type of LA reduction technique. The duration of myocardial ischemia was the only significant factor influencing long-term survival. It was found that with every minute of myocardial ischemia, the chance of death in a long-term period increases by 2.8% monthly. Therefore, during preparation for HAT surgery, the surgeon must be confident in his own skills in order to quickly carry out the cross-clamping stage. On the other hand, the suture atrioplasty technique can serve as an alternative method to heart autotransplantation for giant left atrium volume reduction in patients with mitral valve disease.

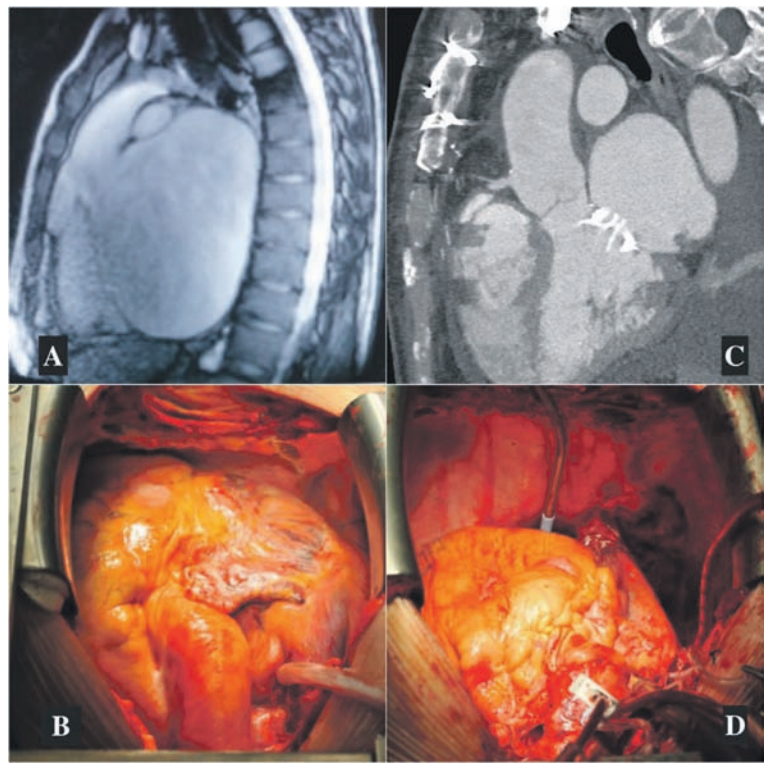


Figure 1. CT (A), MRI (C) and intraoperative photos (A and D) of the heart prior to the surgery (A and B) (LA volume – 1620 ml) and after the surgery (C and D) (LA volume – 482 ml) using autotransplantation technique.

Thoracic | Rapid Response | Thoracic

The clinical utility of objective chest tube management after pulmonary resection based on the digital monitoring of air flow and intrapleural pressure

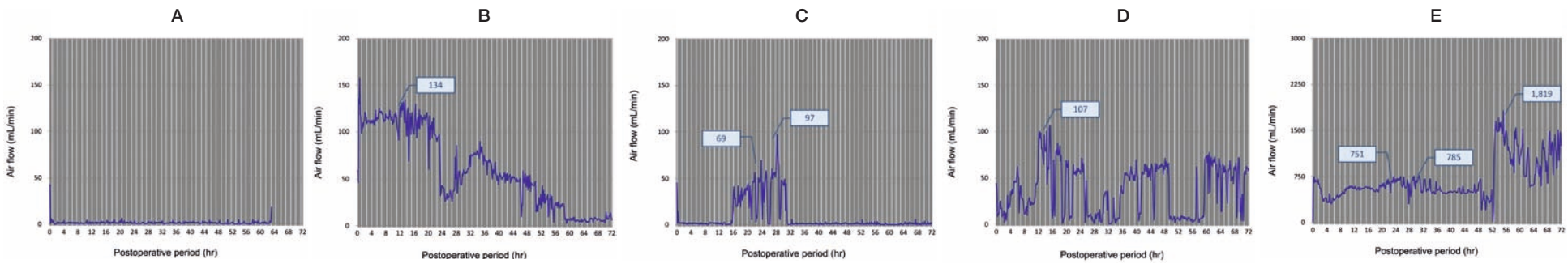


Figure 1. A – no air leakage; B – gradually decreasing air leakage; C – a postoperative de novo air leak; D – an exacerbating and remitting air leak; and E – an air leak without a trend toward improvement.

Kazuya Takamochi Juntendo University, Tokyo, Japan

Because the traditional thoracic drainage system measures and grades air leaks in a subjective manner, inter-observer disagreement on the presence of an air leak is frequent, even among experienced surgeons. In response, a digitally monitored thoracic drainage system (Thopaz™, Medela Healthcare, Baar, Switzerland) has been designed to provide objective measurements of air leakage and pleural pressure. Using this system, air leakage and pleural pressure can be accurately measured in mL/min and mmH_2O, respectively. Here, we evaluated the clinical utility of objective digital physiologic measurements for chest tube management after pulmonary resection, looking at air leaks and pleural pressure changes. In particular, we tried to establish reliable criteria for the prediction of PAL based on the findings of digital monitoring, and to elucidate the clinical utility of these criteria.

We prospectively recorded the perioperative data of 308 patients who underwent pulmonary resection between December 2013 and January 2016. Based on information from the ThopazTM system, we measured peak air leakage over the first 24 hours after the operation, patterns of air leakage over the first 72 hours, and patterns of pleural pressure changes until removal of the chest tubes. The patterns of air leakage are defined as Types A–E (Figure 1).

There were 240 patients with lung cancer and 68 patients with other diseases. The surgeries included 49 wedge resections, 58 segmentectomies and 201 lobectomies. A postoperative air leak was observed in 61 (20%) patients. A prolonged air leak >20 mL/min lasting ≥ 5 days (PAL) was observed in 18 (5.8%) patients. The risk of PAL was higher in patients with a peak air leak of ≥100 mL/min compared to those with <100 mL/min (P=0.004). The risk of PAL was higher in patients showing type D or E air leakage patterns compared to those showing type B or C (p<0.001). On multivariate analysis of various perioperative factors, FEV1 <70%, type D or E air leakage patterns, and peak air leakage ≥100 mL/min were significant positive predictors of PAL. Fluctuations in pleural pressure occurred just after the air leakage rate decreased to <20 mL/min (Figure 2).

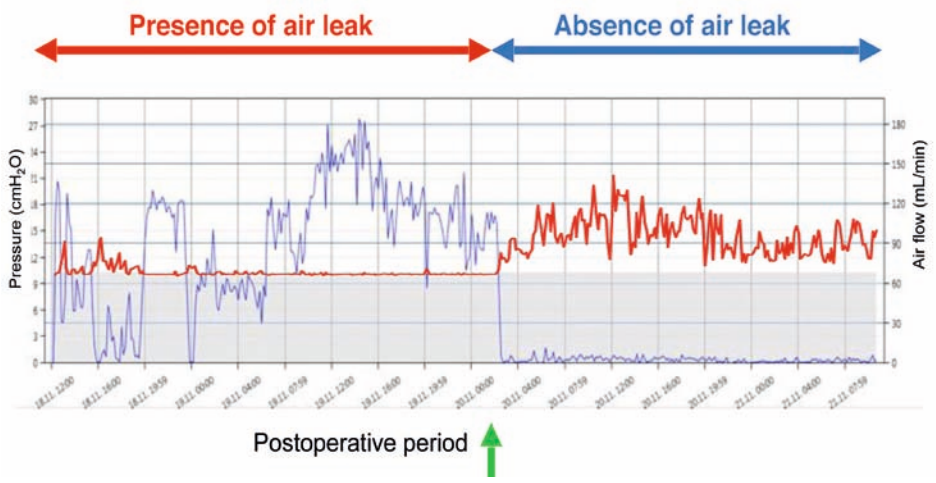


Figure 2. Blue line indicates the rate of air leakage; red line indicates pleural pressure; and green arrow indicates the time of air leak resolution.

Digital monitoring of peak air leakage and patterns of air leakage were useful for predicting PAL after pulmonary resection. Information on the disappearance of air leak was derivable from both the change in the rate of air leakage and the increase in fluctuation of pleural pressure.

VEST venous external stent, demonstrating perfect patency of vein grafts at 5 years

In recent years, external stenting is emerging as a promising strategy with a potential to significantly improve vein graft patency and the outcome of CABG. The poor longevity of vein grafts remains the Achilles Heel of CABG and despite extensive efforts to develop novel strategies to treat vein graft disease, no major breakthroughs have reached the clinical setting.

Several studies evaluated the early effect of external stenting on vein grafts. Taggart et al (ATS, 2015) have shown that 1 year after CABG, VEST external stent significantly reduces intimal hyperplasia and increase vein grafts perfect patency rates. Meirson et al (JTCVS, 2015) demonstrated that VEST reduces oscillatory shear stress which was correlated with the reduction of intimal hyperplasia. Webb et al (EHJ Imaging, 2015) performed OCT analysis of supported and unsupported vein grafts and showed that VEST improves lumen uniformity and reduces thrombus formation.

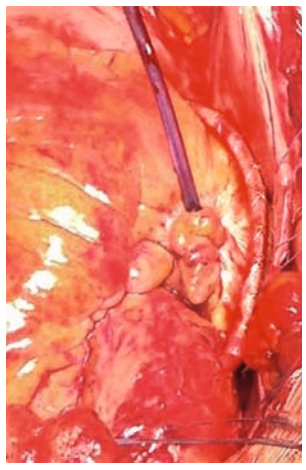


Figure 1: Application of VEST external stent over SVG to the right territory

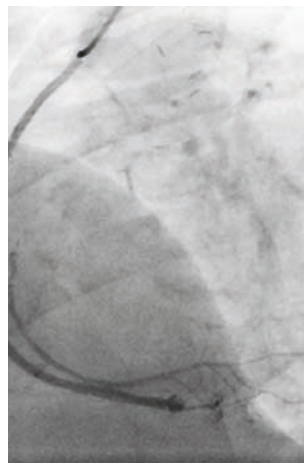


Figure 2: 5 years follow up of VEST supported SVG demonstrating perfect patency

Early clinical experience generated important technical data. The use of fibrin glue and over constriction of the vein graft's outer diameter (<4mm) were found to be associated with early graft failures. In addition, Taggart et al (VEST II study, AATS 2016) demonstrated that avoiding clip ligation of side branches and/or fixation of the external stent to the anastomoses improves the early patency of externally stented vein grafts to the right coronary territory.

VEST external stent, has the potential to create a new hybrid conduit which combines the benefits of arterial and venous grafts: available, versatile high flow conduit with high resistance to intimal hyperplasia and atherosclerosis.

Several ongoing randomized trials aim to establish the role of external stenting of saphenous vein grafts. Long term angiographic data from the VEST IV study (4-5 years after CABG) will be published in 2017. Initial results are promising and demonstrate that externally stented vein grafts maintain perfect patency (Fitzgibbon I) also at 5 years.

EACTS Master Class on Aortic Valve Repair: A step-by-step approach

First EACTS Master Class on Aortic Valve Repair: A step-by-step approach

Recent ESC guidelines for aorta disease recommend "aortic valve repair using the re-implantation or remodelling with aortic annuloplasty technique, in young patients with aortic root dilation and tricuspid aortic valves" (class I indication; Figure 1)[1] However although there is increased medical 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 still is rarely performed. There has been a stable incidence of valve-sparing root replacement over the years (around 14% of root procedures), while 80% of composite valve and graft replacement are performed for dystrophic bicuspid or tricuspid aortic valve insufficiency (Table 1)[2-6] This fact brings into question the lack of technical standardisation of valve-sparing procedures in order to improve the reproducibility and reduce the risk of reoperation. Now, by organising the first dedicated Master Class on Aortic Valve Repair, EACTS is taking the first step towards standardisation: teaching.

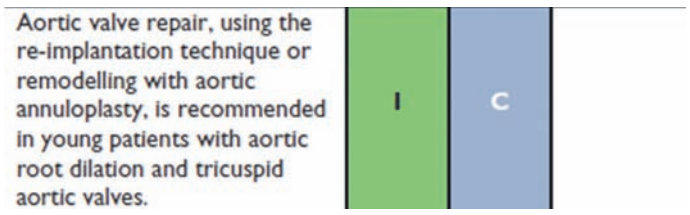


Figure 1. 2014 ESC Guidelines on the diagnosis and treatment of aortic diseases

Good candidates for aortic valve repair are 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) 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)[7] According to each phenotype, a standardised approach to valve repair was developed, based on: 1) dynamics 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)[8-10]

Table 1: Linearised occurrence rates of late outcome events

Pooled late outcome events	LOR + 95% CI*	
	Valve Sparing Root Replacement[4] (4777 patients)	Mechanical composite valve and graft replacement[6] (7629 patients)
Late mortality	1.53 (1.19 – 1.96)	**2.02 (1.77 – 2.31)**
Reoperation on aortic valve	**1.32 (1.0 – 1.74)**	0.46 (0.36 – 0.59)
Hemorrhage	0.23 (0.13 – 0.42)	**0.64 (0.47 – 0.87)**
Thromboembolism	0.41 (0.22 – 0.77)	**0.77 (0.60 – 1.00)**
Endocarditis	0.23 (0.11 – 0.51)	**0.39 (0.33 – 0.46)**
MAVRE	1.66 (1.24 – 2.23)	**2.66 (2.17 – 3.24)**

LOR indicates linearised occurrence rates; CI, confidence interval; MAVRE, major adverse valve-related events.

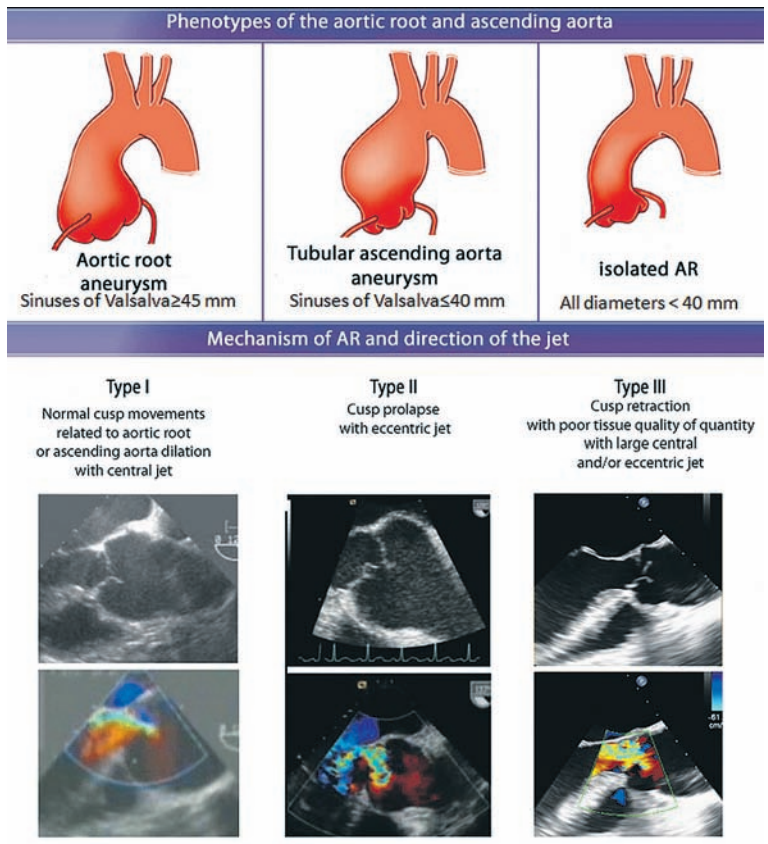


Figure 2. Aortic root and ascending aorta phenotype with aortic insufficiency classification

The objective of this first EACTS Master Class on Aortic Valve Repair is to provide a step-by-step approach, from 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, echocardiographers (cardiologists and anaesthesiologists) and radiologists who are willing to start, or are already part of, a valve-sparing aortic root replacement and aortic valve repair program. 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, indications and limitations of guidelines, the selection of patients as well as surgical presentations from the different approach of aortic valve repair and 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 the standardised management of the valve with cusp geometric and effective height assessment, 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 program 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 and bailout techniques in such conditions. The course will end with a Wetlab which will bring together the theoretical knowledge with a practical application on an anatomical human heart.

The aim is also to gather international physicians interested in aortic valve repair, in order to share experience and to combine forces to evaluate current practice to clarify the place of repair versus replacement in aortic valve surgery.

The first 'EACTS Master Class on Aortic Valve Repair: A step-by-step approach' will run from 22-24 March, 2017. For registration, programme and other details, head to the course website at: www.eacts.org/academy/courses/master-class-on-aortic-valve-repair/

Course director, Dr Emmanuel Lansac, Institut Mutualiste Montsouris, Paris, France, emmanuel.lansac@imm.fr

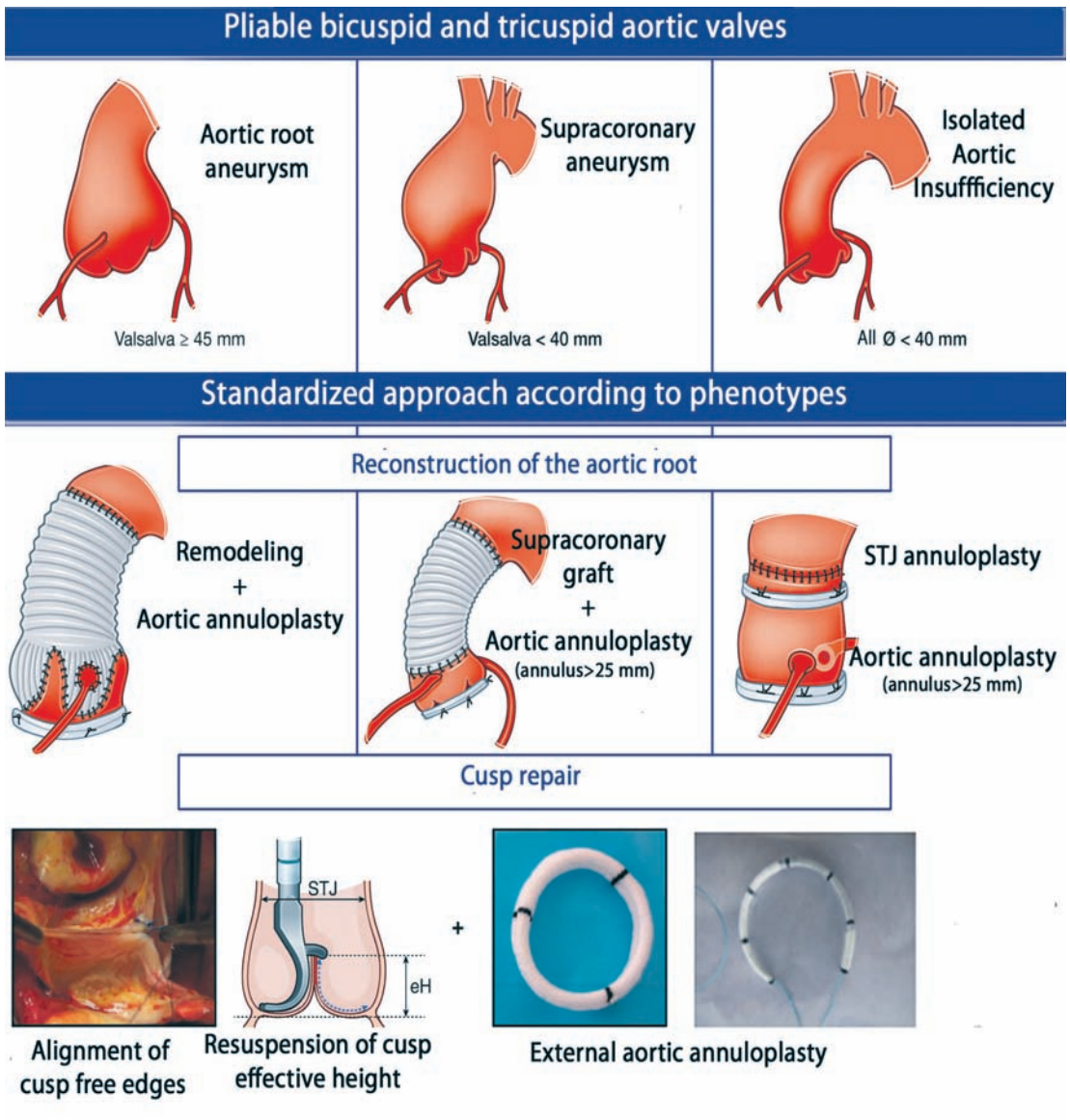


Figure 3. Standardised approach to aortic valve repair for dystrophic aortic insufficiency according to each phenotypes of the aorta

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Cardiac | Abstract Session | Extra corporeal circulation/Left ventricular assist device/ Transplantation 1

Vasoplegia after heart transplantation: outcomes at one year

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Vasoplegia syndrome, marked by profound systemic vasodilation in the presence of normal or high cardiac output, is a phenomenon attributed to a substantial inflammatory cascade that follows cardiopulmonary bypass. Its management can be challenging as it may be refractory to conventional therapeutic strategies such as fluid administration and vasoconstrictive pharmacologic agents, and its development can be a predictor of poor prognosis. Patients undergoing heart transplantation have been cited as one such risk factor associated with this condition, although our understanding of vasoplegia syndrome and its effects beyond the acute postoperative transplant period remains limited. We therefore sought to assess our institutional experience, the largest reported cohort of patients with vasoplegia after heart transplantation, and described its impact on outcomes at one-year post transplantation.

During the four-year study period, 347 patients underwent orthotopic heart transplantation, with 30.8% meeting criteria for diagnosis of vasoplegia syndrome (defined as systemic hypotension within 48 hours of transplantation and vasopressor requirement for > 24 hours to maintain MAP > 70 mmHg). While substantial differences in several pre-transplant comorbidities were not found between groups, we did observe that the presence of mechanical circulatory support was strongly associated with vasoplegia syndrome. This is especially notable as the use of VADs within the bridge-to-transplantation model is becoming ever more prevalent – these artificial cardiac devices have been known to precipitate distinct derangements in vascular inflammation.

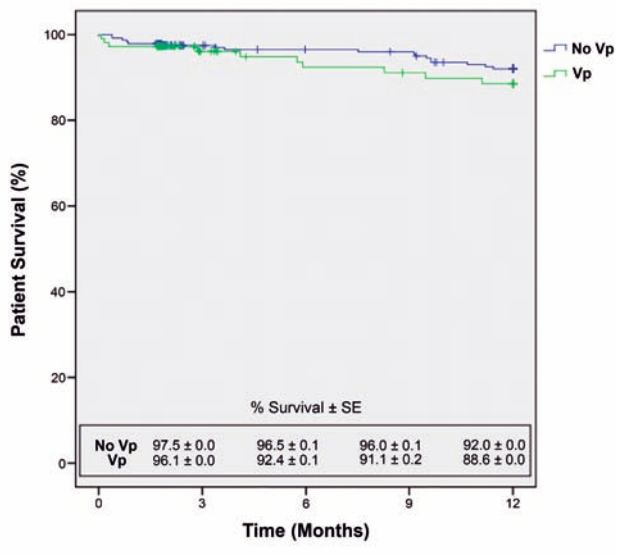

Figure 1. Kaplan-Meier survival curve

In the perioperative period, we observed several characteristics unique to the vasoplegia population. Longer cardiopulmonary bypass and ischaemic times were found to be a strong predictor for developing vasoplegia syndrome. Unsurprisingly, perioperative blood transfusion requirements were greater in the vasoplegia cohort, potentially due to the increased difficulty in obtaining surgical haemostasis. These patients also experienced longer intubation times as well as greater overall hospital, and ICU-specific, lengths of stays. Of interest, despite the increased incidence of several morbid factors in the immediate perioperative period, we were unable to demonstrate a statistically-significant difference in survival at one-year post transplantation. Additionally, transplant allografts subjected to vasoplegia syndrome did not experience an increase in the rate of rejection. These findings suggest that because vasoplegia syndrome is generally a transient condition, no persistent effects on extended outcomes are apparent, assuming the initial hemodynamic disturbance is successfully overcome.

While this study characterises the intermediate outcomes of heart transplant recipients who experienced vasoplegia syndrome in their postoperative course, namely that: one, vasoplegia is not an infrequent process; two, patients with vasoplegia are often subjected to a number of morbid events during their hospitalisation; and three, no significant impact appears to be present in terms of patient mortality and allograft rejection at one-year, further evaluation with extended monitoring to five or ten years post-transplantation may garner additional understanding on this challenging condition.

Cardiac | Rapid Response | An update on mitral valve interventions

Reoperation for mitral paravalvular leak: a single centre experience with 200 patients

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Paravalvular leak (PVL) after mitral valve (MV) replacement is not uncommon. It has an estimated incidence of 0.2-1.4% per year and, despite the advances in valve replacement techniques, PVL continues to be a serious problem that leads to increased morbidity and mortality. Patient presentations range from asymptomatic with mild PVL, to haemolysis and heart failure in the presence of severe leak. While percutaneous device closure has emerged as an alternate to surgery in selected patient populations, surgery is still considered the gold standard. Yet there is limited data on long-term outcomes after reoperation for mitral PVL.

We conducted a retrospective review of a prospectively-collected database to identify all patients who underwent surgery for mitral PVL at our institution. Between January 1995 and December 2012, 206 patients (118 males [57%]) underwent reoperation due to mitral PVL. Mean age was 64±11 years, and all patients had at least moderate PVL. Haemolytic anaemia was present in 85 patients (41%), while 137 patients (67%) were in NYHA class III or IV. Transcatheter device closure was attempted in 21 patients (10%) (Figure 1 A&B). The majority of patients (127, 62%) had one episode of PVL, while recurrent PVL occurred in the remaining 79 (38%) patients (48 patients had two PVL, 23 patients had three PVL, six patients had four PVL, and two patients had five PVL). The most common location of the PVL was at the aorto-mitral curtain (82 patients, 40%).

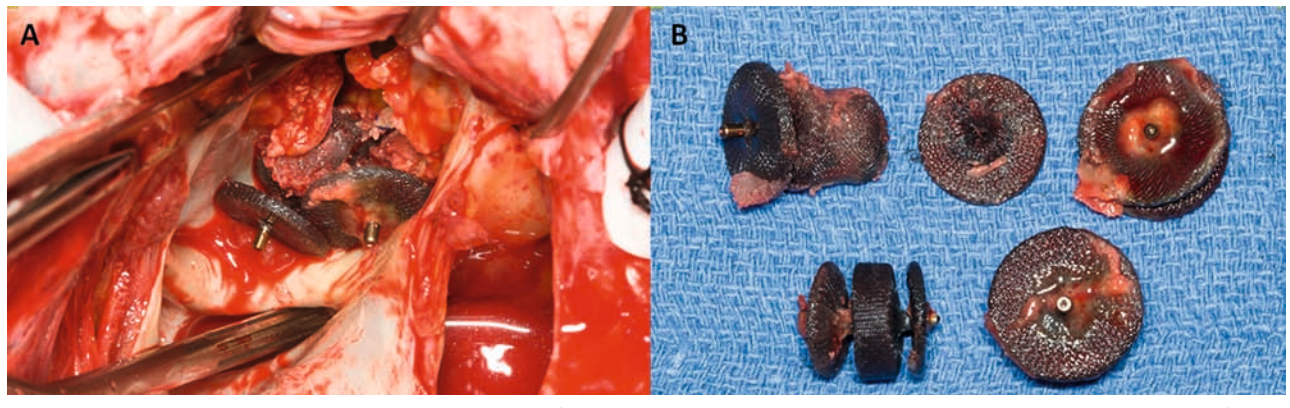


Figure 1: Intraoperative photos showing: A) multiple Amplatzer devices to close mitral paraprosthetic leak; B) after explantation of the devices, a total of five devices were placed in this patient

Repair of the PVL was possible in 105 patients (51%), with early mortality at 5%. In follow-up (mean 5 years, max 19 years) overall survival at 1-, 5-, and 15-years was 83%, 62%, and 16%, respectively (Figure 2), and death due to heart failure or cardiogenic shock occurred in 39 patients (19%). Recurrence of PVL occurred in 43 patients (21%), and transcatheter device closure was performed in 14 patients (6%). In the multivariate analysis, residual PVL (p<0.0001) and late reoperation due to recurrent PVL (p=0.019) were significant predictors for mortality. Other predictors were advanced NYHA class (p < 0.0001), active endocarditis (p =0.013), chronic steroids (p =0.022), previous CABG (p=0.026), baseline creatinine above 1.5 (p= 0.001), concomitant tricuspid valve surgery (p=0.03), and postoperative need for dialysis (p=0.036). Active endocarditis (p= 0.0004) and chronic steroids (p=0.002) were significant predictors for paravalvular leak recurrence. Freedom from reoperation due to paravalvular leak recurrence was 93%, 89%, 84% and 84%, while freedom from late intervention was 97%, 94%, 86%, and 61 % at 1-, 5-, 10- and 15-year respectively (Figure 3 A&B).

Several unanswered questions remain including: which group of patients should be referred for surgery and which one should be offered device closure? And should patients be referred for surgery sooner? We do believe that PVL after MVR remains associated with increased morbidity and mortality and it should be aggressively addressed. To ensure good outcomes, referral of the patient to the surgeon should not be delayed. Re-repair is possible but recurrent paravalvular leak is a risk factor for late mortality and reoperation should be performed prior to the onset of advanced heart failure.

Figure 2: Notice the overall poor survival of these patients

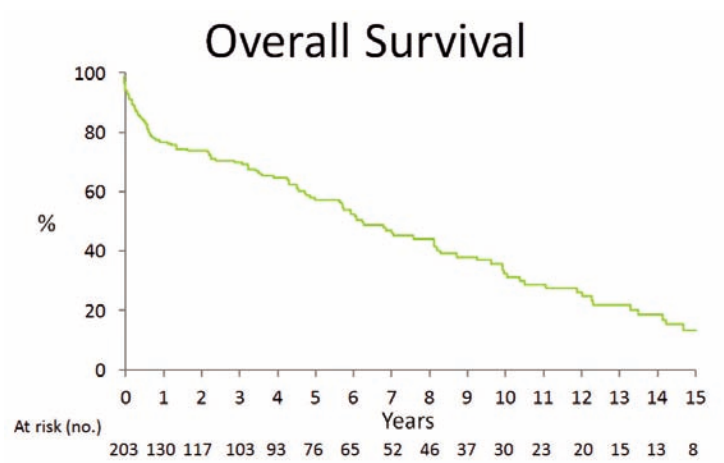
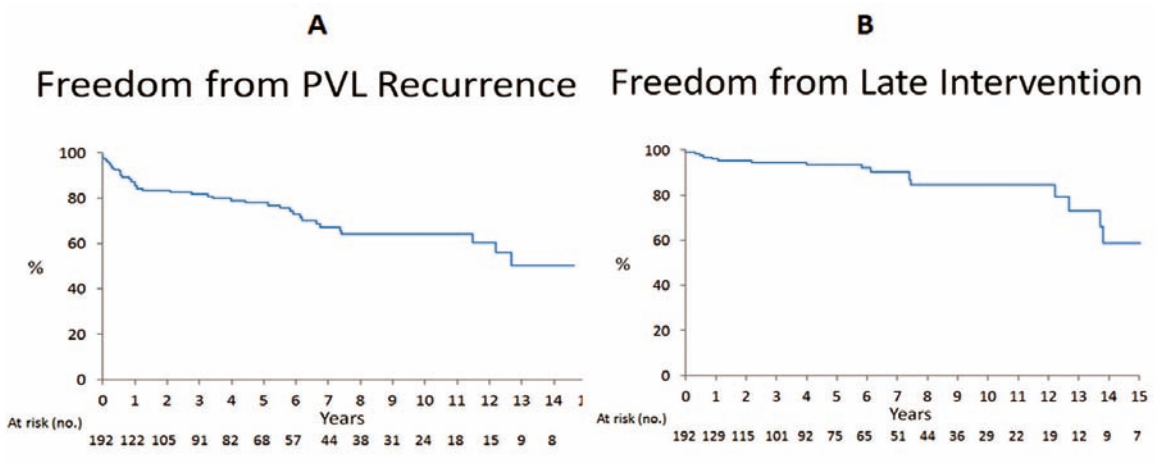


Figure 3. A) Freedom from recurrence of paravalvular leak, and B) freedom from late intervention



Congenital | Abstract Session | Hypoplastic left heart syndrome

Long-term results of hybrid stage I vs primary Norwood procedure for hypoplastic left heart syndrome: Analysis of Japan Congenital Cardiovascular Surgery Database

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The hybrid approach emerged as an attractive initial procedural option for hypoplastic left heart syndrome (HLHS), and centres have now reported excellent survival. However, there is still controversy. We aimed to describe the results of hybrid use, the preoperative risk factors and the long-term outcomes compared with a primary Norwood procedure.

The Japan Congenital Cardiovascular Surgery Database (JCCVSD) was used for this study. As of December 2015, the database contains de-identified data on more than 54,000 surgeries conducted since 2008. JCCVSD started with seven institutions, and the number of the institutions rapidly increased to 119 as of December 2015, representing almost all Japanese centres performing congenital heart surgery. The database includes demographic information, cardiac and noncardiac anomalies, comorbid conditions, surgical type and outcomes. The JCCVSD has developed a web-based data collection software system through which the data manager of each participating hospital can electronically submit data to the central office.

Infants who underwent bilateral pulmonary artery banding or the Norwood procedure as an initial palliation for HLHS between January 2008 and December 2012 listed in JCCVSD were included. The total number of patients with the diagnosis of HLHS was 334. Bilateral PABs were selected for 256 patients and primary Norwood procedures for 78 patients as an initial procedure. Actuarial five-year survival was 59.0% (95%CI, 53.1-64.3; Figure 1). In Japan, 90.9% of the institutions used at least one bilateral PAB during this period and 61.8% used bilateral PAB in all of the cases (Figure 2). The primary Norwood procedure group had better five-year survival than the bilateral PAB group (75.5% vs 54.0%, p<0.001). However, bilateral PAB group had more significant risk factors compared to primary Norwood procedure group. The five-year survival difference was less conspicuous (77.3% vs 65.9%, p=0.06) when performed at higher HLHS volume institutions although the preoperative risk was higher in bilateral PAB group (Figure 3).

Considering the fact that the result is comparable when performed at higher HLHS volume institutions, the proper patient selection is important in achieving good long-term result.

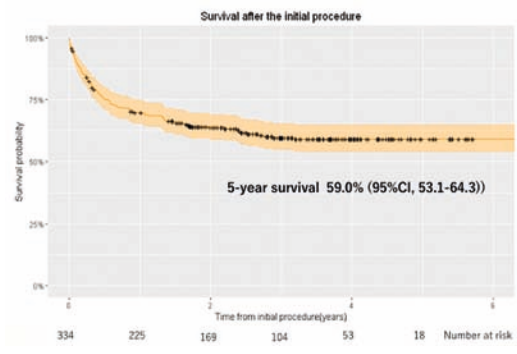


Figure 1

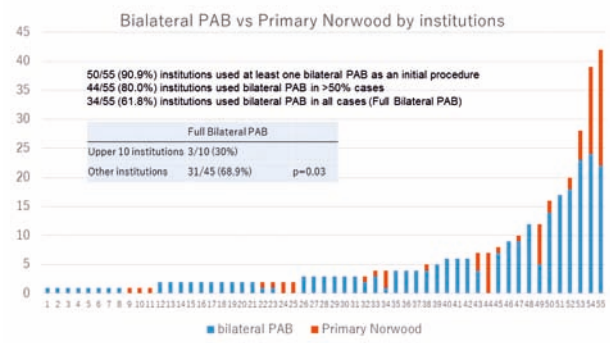
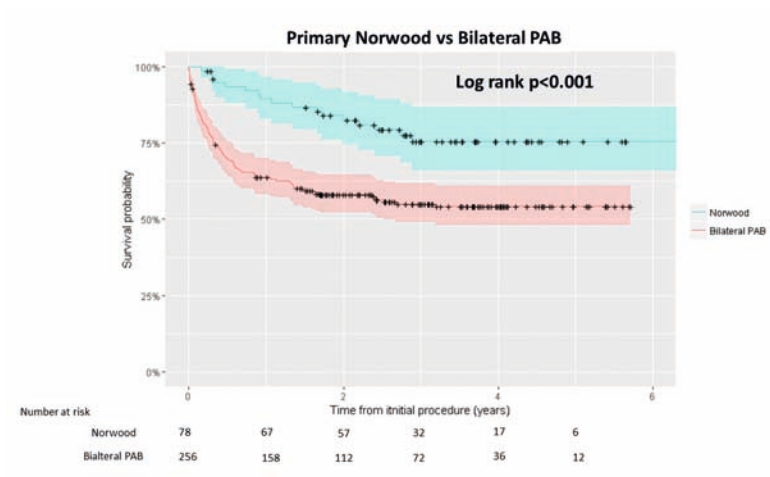
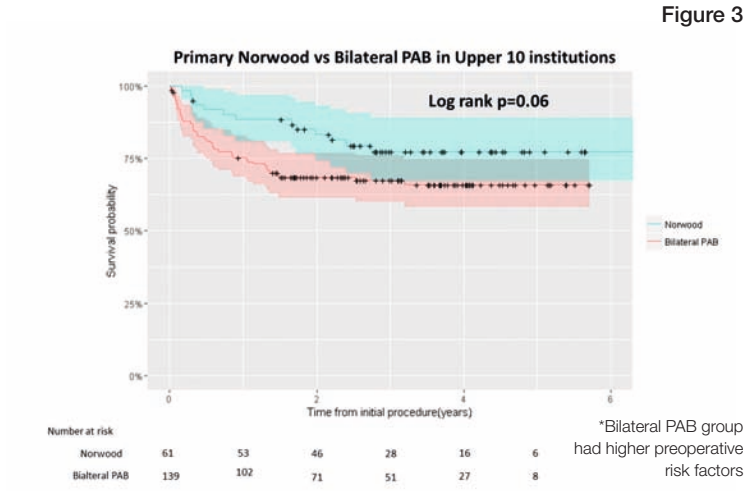


Figure 2

Figure 3





*Bilateral PAB group had higher preoperative risk factors

LivaNova

LivaNova Tackles Acute Kidney Injury with Innovative Valves and Perfusion Systems

Acute kidney injury (AKI) has been reported in up to 30 percent of patients undergoing cardiac surgery.[1,2] AKI is generally associated with longer duration of cardiopulmonary bypass (CPB) and severe hemodilution, and the literature indicates that homologous transfusions may even worsen renal function.[3,4] Sutureless valves and perfusion systems from LivaNova are designed to reduce hemodilution and homologous transfusions, helping patients avoid AKI and other renal complications.

Prolonged cross-clamp and bypass times associated with aortic valve surgery often result in renal function deterioration.[5] The PERCEVAL™ sutureless, collapsible aortic valve enables the cardiac surgeon to implement a quick and reproducible technique,[6-9] thus saving operative time and lowering AKI risk through decreased CPB times, regardless of the approach used.[6,7,9,10]

AKI risk is impacted as well by perfusion practice: minimizing hemodilution plays a pivotal role in this view. LivaNova approaches this complex clinical topic at a system level, combining disposable and hardware features. The S5™ Heart-Lung Machine's innovative retrograde autologous priming (RAP) feature improves blood conservation, while Goal-Directed Perfusion therapy (applied through LivaNova's GDP Monitor™) is aimed at reducing the occurrence of Acute Kidney Injury by respecting the metabolic needs of each patient during cardiac procedures.[23,24]

The S5™ features highly customizable pump configurations. Four different pump models can be mounted on the masts and various swivel arms. The integration of the CP5™ centrifugal pump enables the possibility of retrograde autologous priming (RAP) to reduce the priming volume to a minimum. The B-CARE5, the first in-line blood monitor fully integrated into a heart-lung machine, facilitates easy and accurate monitoring for hematocrit (Hct), SvO_2 and venous blood temperature. The accurate monitoring of Hct and blood flow is essential to further lowering the need for transfusions and reducing the risk of AKI.[11,12]

The INSPIRE™ oxygenator from LivaNova features a unique combination of low dynamic operating volume and consistent performance up to flow rates of either 6 or 8 LPM, depending on the model. This performance was achieved through an innovative design that treats the oxygenator as a system composed of modules and reservoirs, both important for advanced perfusion performance. This approach allows Inspire to effectively minimize hemodilution in a broad patient population, thereby reducing the risk of RBC transfusions and postoperative AKI.[11,12]

Autotransfusion during cardiopulmonary bypass is an effective means of reducing homologous transfusions and associated complications, including AKI.[13,14,15] The innovative XTRA™ autotransfusion system (ATS) from LivaNova is designed for fast, safe and easy re-transfusion of highly concentrated, autologous, washed RBCs.[16,17] XTRA™ features an intuitive setup, a fully automated processing mode, refined ergonomics and advanced data management for immediate access to clinical information.

Acute hemodilution and reduction in oxygen delivery are associated with an increased risk of renal failure, stroke and mortality; therefore, during cardiac surgery, minimizing hemodilution is a critical objective.[3,18,19] To meet this challenge, LivaNova has developed the CONNECT™perfusion charting system, intelligently designed to keep hemodilution under control through optimal monitoring of blood components and hematocrit levels. CONNECT also delivers two powerful benefits of an automated perfusion management system: minimization of transcription errors and removal of biased observer recording.[20]

Maintaining optimal perfusion adequacy during cardiopulmonary bypass is an essential requirement in avoiding renal ischemia and hypoxia leading to AKI.[21,22] A new, optional functionality in CONNECT GDP Monitor enables continuous single-screen monitoring of critical metabolic parameters in order to apply Goal-Directed Perfusion (GDP), a set of guidelines that guarantees oxygen delivery to ensure the patient remains above critical metabolic threshold levels. Goal-Directed Perfusion therapy is aimed at reducing the occurrence of Acute Kidney Injury by shortening ICU, hospital length-of-stay and potentially decrease blood transfusions.23,24

Focused on reducing Acute Kidney Injury during cardiac surgery and CPB, LivaNova is cutting through complexity with simplified procedures and better outcomes.

Find out more at LivaNova Booth No. 111.

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Cardiac | Abstract Session | Tricuspid valve - repair and replacement

New treatment option for diseases of the 'forgotten valve'

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Tricuspid valve regurgitation (TVR) has been described as a common finding in routine echocardiography, and moderate to severe degree of TVR is associated with a high morbidity and mortality. To date, surgical correction remains the only treatment for TVR, but the results are not satisfactory. The true incidence of clinically-relevant TVR remains uncertain, but its coexistence with left-sided heart disease is known to be high, as data from patients scheduled for surgical or interventional mitral valve treatment indicates.

Several devices for interventional therapy of TVR have been introduced into the clinical setting, albeit so far only in very few patients. This interventional approach has proven to be challenging due to various obstacles, mostly anatomical, such as the large dimensions of the annulus, the absence of calcifications and proximity of the atrioventricular node and coronary sinus. Recently, an innovative device for catheter-based treatment of TVR has been developed. A newly designed stent-graft prosthesis with a lateral valve is utilised for heterotopic implantation into the right atrium, thus respecting vortical right atrial flow and avoiding the described anatomical difficulties encountered with correction at the annular level, or in the vicinity (Figures 1 and 2).

The initial experimental experience in-vitro has shown the device to be haemodynamically effective and durable. In an acute animal model, the device could be successfully implanted and anchored into the caval veins via a femoral venous access in seven sheep. Also in the absence of TVR, complete sealing of the stent and correct function of the valve segment could be demonstrated with both angiography and echocardiography. No vascular or cardiac complications were encountered during the procedures. Using a squeeze-to-release implantation catheter, implantation could be completed by a single operator in an average of less than 10 min. Necropsy confirmed correct placement of the device with correct orientation of the valve segment (Figure 3).

Although there is confidence after the proof-of-concept of the device, the remaining issues of haemodynamic performance in the presence of severe tricuspid regurgitation, haemocompatibility and long-term function have not yet been addressed and need to be investigated in a chronic experimental model as the next step. However, we believe that this valved stent graft has great potential to become a clinical treatment option for patients with severe TVR in the near future.

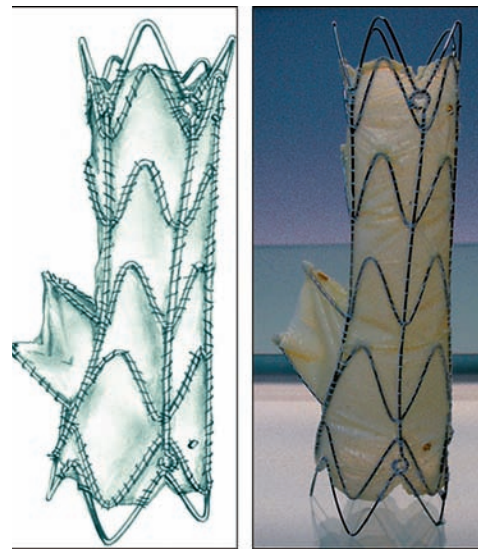

Figure 1: Stent graft design

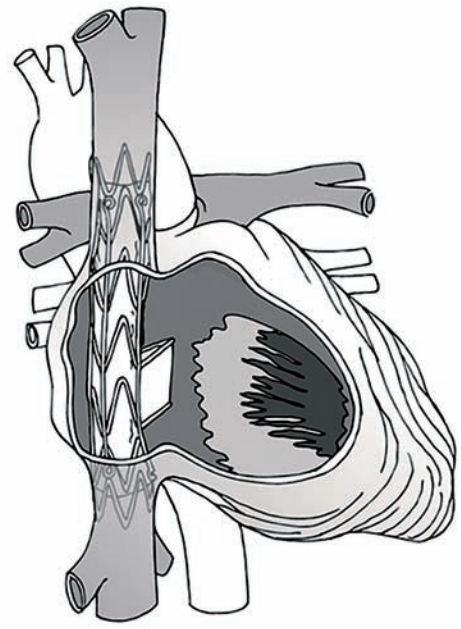

Figure 2: Anatomical position of the device

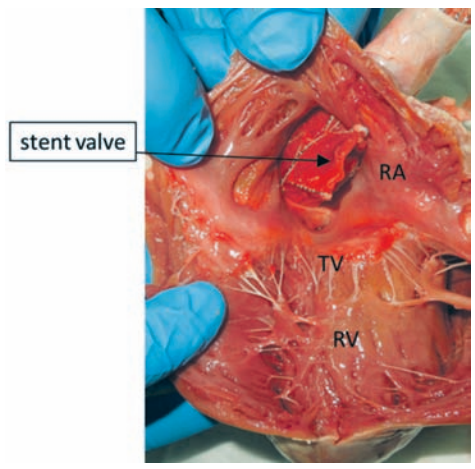

Figure 3: Necropsy specimen demonstrating device position (RA: right atrium, TV: native tricuspid valve, RV: right ventricle)

Cardiac | Abstract | Improving outcomes in hypertrophic obstructive cardiomyopathy

Hypertrophic cardiomyopathy: an old concept for a new surgical approach

Jean François Obadia (right) and Matteo Pozzi Department of Cardiac Surgery, "Louis Pradel" Cardiologic Hospital, "Claude Bernard" University, Lyon, France

The prevalence of hypertrophic cardiomyopathy (HCM) in the general population is high, and the disease is an autosomal dominant trait in up to 60% of cases caused by mutations in cardiac sarcomere protein genes. HCM represents a public health concern, as it is the most common cause of sudden cardiac death in young patients.

Left ventricular hypertrophy, mainly localised in the interventricular septum, is the leading diagnostic feature of HCM, but different morphologic anomalies of the mitral valve apparatus have been described in these patients over time, mainly dynamic but also organic with leaflets elongation and anterior displacement or anomalous insertion of the anterolateral papillary muscle. So septal hypertrophy, aorto-mitral angle and mitral valve abnormalities contribute overall in the development of the systolic anterior motion (SAM) of the mitral valve, which determines left ventricular outflow tract obstruction in one third of the HCM population.

From a surgical standpoint ventricular septal myectomy using the Morrow procedure is the technique of choice for HCM and often enough to restore a normal motion of the anterior leaflet when the origin of the SAM is mainly dynamic. However, in case of organic mitral valve anomalies involving the leaflets or the subvalvular apparatus, the surgical management of associated mitral valve lesions is still matter of debate. Many surgical techniques (anterior mitral leaflet plication or extension, chordal cutting, papillary muscle reorientation) have been described to treat mitral regurgitation associated with HCM, which were sometimes contradictory and probably illustrated confusion in the interpretation of the disease.

The edge-to-edge technique was introduced

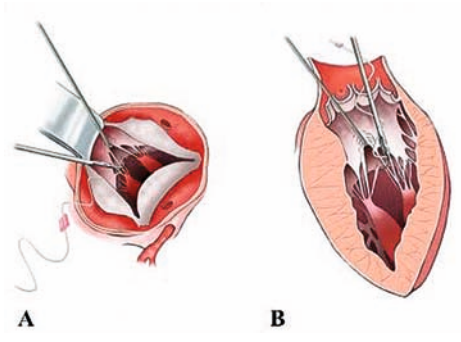

Figure 1. The edge-to-edge U suture is placed in the central portion of the leaflets (A2 and P2) on either side. A) View from the aortic orifice; B) sagittal view

in the 1990s as an attractive option in the setting of mitral valve repair. It provides satisfactory long-term results especially for degenerative mitral regurgitation with anterior leaflet or bi-leaflet prolapse. However, to the best of our knowledge, there is a paucity of data about its application in the context of HCM and we herein propose its application in case of mitral anomalies associated with HCM.

Between January 2009 and March 2016, we operated on 22 symptomatic HCM patients, combining an enlarged Morrow procedure and an edge-to-edge mitral valve repair. The enlarged Morrow procedure significantly reduced the septal thickness and resting intraventricular gradient after a mean follow-up of 26 months. The edge-to-edge technique allowed for a complete resolution of the SAM in the whole population and the proportion of grade 3 or 4 mitral regurgitation decreased from 50% preoperatively to 0% at last follow-up control. As a consequence, the study population experienced a significant clinical improvement as 100% were in class I-II at follow-up.

In conclusion, septal hypertrophy and SAM of the anterior mitral leaflet are the leading morphologic features of HCM. The enlarged Morrow procedure remains the first step of any surgery for HCM owing to its good clinical and echocardiographic long-term validated results. The edge-to-edge technique performed through the aortic orifice is a simple, reproducible and fast technique that is helpful to secure the coaptation between the two leaflets of the mitral valve, particularly in the presence of organic mitral valve lesions.

Thoracic | Abstract | Session Oncology I

Gender differences in the recurrence timing of patients undergoing resection for non-small cell lung cancer

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Lung cancer is the leading cause of cancer-related death in men and women in Japan and Western countries. A number of studies have reported that female patients with non-small-cell lung cancer (NSCLC) live significantly longer than male patients after surgical or non-surgical treatment. At present, however, the reasons for the better survival of women with NSCLC are not completely understood, and few studies have focused on gender-related disparities in the timing of recurrence. Our study was designed to visually represent recurrence patterns after surgery for NSCLC and to analyse sex-related differences in the timing of recurrence.

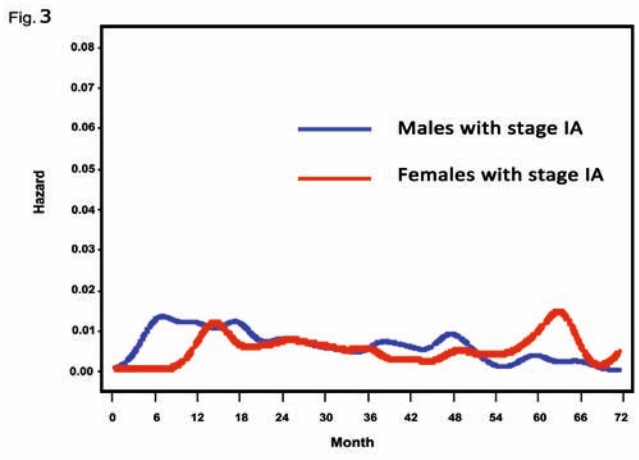
We studied 829 patients (538 men, 291 women) with NSCLC who underwent complete pulmonary resection in nine hospitals affiliated with the Yokohama Consortium of Thoracic Surgeons (Yokohama City University Hospital and affiliated hospitals). Event dynamics using a kernel-like smoothing procedure were evaluated, and only first events (distant metastases or local recurrence) were considered. The effects of sex, histological type, pathological stage, and smoking history were studied.

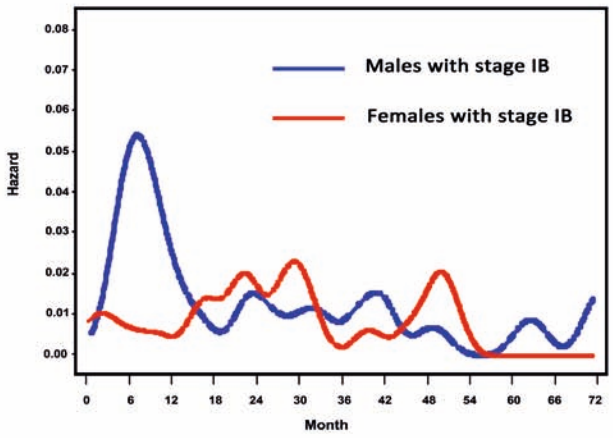
The resulting hazard rate curve displayed an initial sharp, high peak at six to eight months after surgery in men. In women, several small peaks were noted during the first year, and the highest peak occurred 22 to 24 months after surgery (Figure 1). As for pathological stage, the peaks of the hazard rate curves displayed increasing height with increasing pathological stage as expected (Figure 2).

When comparing the curves between men and women (Figure 3), the hazard rate in the stage IA group remained low during the follow-up period in both sexes. In the stage IB group, and IIA to IIIA group, the times with the highest risks of recurrence after surgery were suggested to differ between men and women, with a sharp peak in the first year in men, and a broad peak from two to three years after surgery in women. These sex-dependent findings were also confirmed in the analyses according to histological type (squamous cell carcinoma versus adenocarcinoma) and smoking history (current / ex-smoker versus never-smoker).

Another remarkable result of our study was that despite the similar hazard rate curves of smokers and non-smokers among women, the peak timing of recurrence was about six months earlier for smokers than for non-smokers.

The present study showed that the hazard rate and the peak times of recurrence after resection of NSCLC differed considerably between men and women. New evidence from our study suggests that the reason why women have good outcomes is not necessarily attributed to the high rates of adenocarcinoma or stage IA disease among women. The delayed time of peak recurrence in women, as represented by women having a longer disease-free interval (DFI) than men within subsets of the same disease stage, histological type, and smoking status, might account for the better survival in women. Differences in the timing of recurrence in women may again suggest that lung cancer in never-smokers had a longer DFI than lung cancer in smokers.





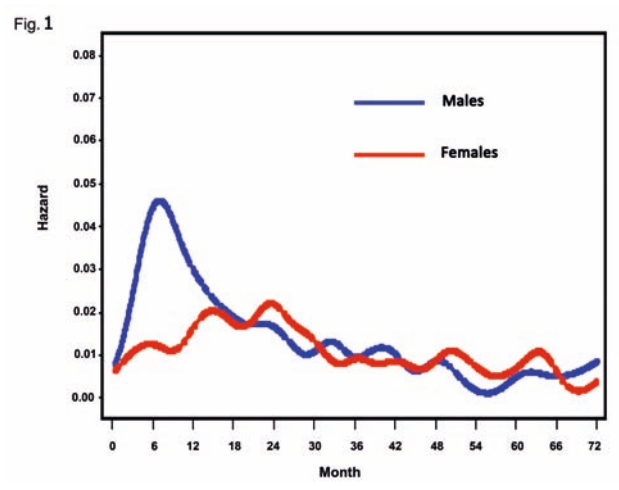


Figure 1. Smoothed hazard rate estimates for first event according to sex

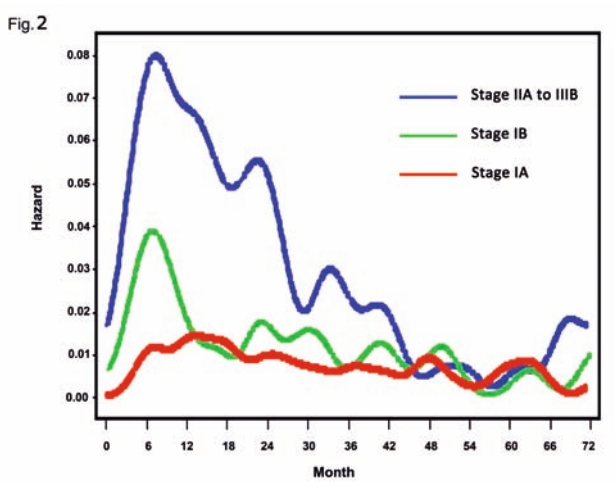


Figure 2. Smoothed hazard rate estimates for first event according to pathological stage

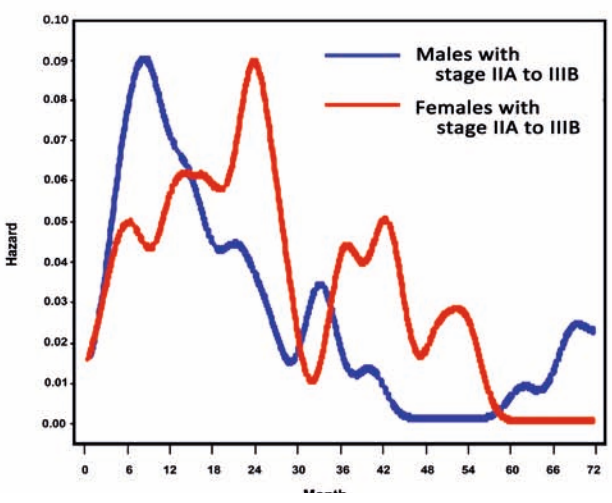


Figure 3. Smoothed hazard rate estimates for first event by sex in pathological stage

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Cardiac | Rapid Reponse | Adult Cardiac

Comparative Analysis of Aortic Valve Reoperation Following Stentless Versus Stented Xenograft Bioprostheses: Short and Long-term Outcomes

Bo Yang[1], Himanshu J. Patel[1], Christina Debenedictus[2], Elizabeth Norton[3], Kevin He[4], Whitney E. Hornsby[3], Xiaoting Wu[1], Donald S. Likosky[1] and G. Michael Deeb[1] 1. Department of Cardiac Surgery, University of Michigan Health System, Ann Arbor, Michigan, USA. 2. University of Michigan, Medical School, Ann Arbor, Michigan, USA. 3. Department of Internal Medicine, University of Michigan Health System, Ann Arbor, Michigan, USA. 4. Department of Biostatistics, University of Michigan, Ann Arbor, Michigan, USA

Xenograft stentless valves were developed in the early 1990s to replicate the haemodynamics of a native human valve – in contrast to the haemodynamic function of the traditional stented valve. There was a postulated survival benefit associated with stentless valves, when compared to stented bioprostheses, secondary to durability and improved haemodynamic performance with low transvalvular gradients, left ventricular function with sustained decreases in left ventricular mass, as well as haemodynamics at rest and during exercise. Moreover, considerable enthusiasm existed within the surgical community due to the reduction in patient-prosthesis mismatch.

However, the overall benefit is controversial given high reoperative mortality rates between 11 – 21% in patients with initial implantation of stentless valves. Nonetheless, despite this continuing debate, few studies have focused on stentless compared to stented valves in terms of short- and long-term survival after aortic valve reoperation.

At our centre, 2,176 patients have received stentless aortic valves (Freestyle porcine aortic root, Medtronic, Inc., USA) in the past two decades. As expected, patients have returned for aortic valve reoperations, and thus, we evaluated perioperative outcomes, 30-day and long-term survival following aortic valve reoperation with initial implantation of either a stentless or stented valve. We hypothesised that short and long-term survival would be similar during the same time period.

We reviewed 250 patients who had received a reoperative AVR or aortic root replacement between 1997 and 2013. Ninety-six patients were excluded based on the absence of a xenograft bioprosthesis at the time of the initial operation, including mechanical valves, homografts, or autografts (i.e. Ross procedures). Eligible patients (n=154) underwent an initial AVR or aortic root replacement with a stentless or stented valve followed by a subsequent reoperative AVR or aortic root replacement. The selection of bioprosthesis (stented vs stentless) at the initial operation was based on surgeon preference. Long-term survival was obtained through linkage with the National Death Index database through December 31st, 2013.

The mean age of the cohort was 60 years old. Compared to the stented group, the stentless group was significantly younger (58 years vs 63 years), less likely to have comorbidities (including diabetes, coronary artery disease, and atrial fibrillation) but more likely to undergo ascending/arch aneurysm repairs (p values < 0.05). Thirty-five percent of patients had active endocarditis and 20% had root abscess with no significant group differences (p>0.05). There were no significant differences for 30-day mortality (stentless 1% vs stented 6%, p>0.05). Long-term survival was significantly enhanced in the stentless group (10-year KM survival 69% vs stented 42%, log-rank test p=0.015). This difference was more attributed to patients with stented valve endocarditis (10-year KM survival 13% vs stentless 60%, log-rank test p=0.0009). In patients without endocarditis, long-term survival after reoperation was not significantly different between groups (10-year KM survival 56 % vs stentless 92.5 %, log-rank test p=0.22). Among patients with endocarditis, the adjusted hazard of death in the stented group was 3.65 fold (HR=3.65, 95% CI: (1.33, 9.99)) higher than the stentless group.

We conclude that for patients with prosthetic valve endocarditis, long-term survival appears enhanced with initial implantation of a stentless valve, and therefore, a stentless valve may be a better option for patients with an increased risk of endocarditis.

Cardiac | Abstract Session | Translational vascular biology

Does perivascular tissue of human radial artery release factor with anticontractile/vasorelaxing properties?

Karolina Kociszewska, Marek Andrzej Deja and Marcin Malinowski Medical University of Silesia, Cardiac Surgery Department, Katowice, Poland

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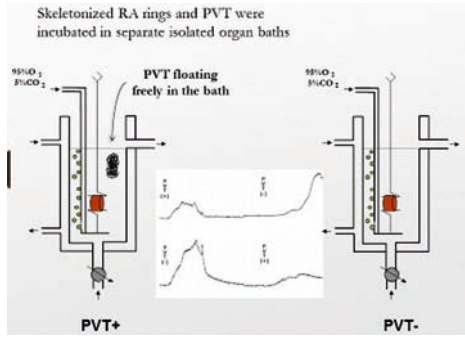
In grafting of the internal thoracic artery (ITA) – a first choice in coronary artery bypass gratfing (CABG) procedures – the role of the surrounding perivascular tissue (PVT) is not fully recognised. However, our previous studies have confirmed an anti-contractile effect on the underlying vascular wall, associated – in all likelihood – with adipose tissue or adipocyte-derived relaxing factor (ADRF). Therefore, we concluded that harvesting ITA as pedicle could be more beneficial than skeletonised in terms of releasing potent vasorelaxing factor. Tempted by that discovery, we decided to check if PVT of the radial artery (RA) – another relevant arterial graft in surgical revascularisation of the myocardium – also possess such anti-contractile/vasorelaxing properties.

Despite a few encouraging advantages apparent when harvesting RA as a conduit in CABG, one major concern should also be kept in mind, namely its tendency for strong contraction, especially due to the well-developed muscular layer. The nature of perivascular fat, circumfluent the radial artery, as a source of ADRF still remains elusive and hasn't yet been described in the literature. The preservation of perivascular tissue could be especially relevant in preventing radial artery spasm soon following surgery. Thus, it could indicate the necessity for pedicle- rather than skeletonised-harvesting of RA grafts, similar to human ITA.

Our study was performed on isolated segments of human pedicled RA, discarded after the conduit had been trimmed to the length necessary for coronary bypass grafting. The discarded RA fragments were next placed in the Krebs–Henseleit solution and then skeletonized free of the surrounding PVT. In the first part of the experiment the arteries were



gradually contracted with serotonin (from 10 -9M and rising in negative logarithm half molar cumulative steps up to 10 -4,5M) to establish the concentration-effect relationship in the presence/absence of PVT. In the second part, skeletonised RA segments were pre-contracted with a single dose of 10-6 serotonin (EC80). The 5 ml PVT aliquots were next transferred to the RA tissue bath resulting in its relaxation.

We obtained following results: radial artery without PVT contracted stronger to serotonin in comparison to RA with concomitant PVT and PVT relaxed pre-contracted with serotonin radial artery rings.

For the first time, we confirmed that perivascular tissue of human radial artery exhibits anti-contractile/vasorelaxant properties, since transfer of an aliquot from the PVT incubation solution into the organ chamber containing the RA resulted in relaxation of the vessel and simultaneously the radial artery without PVT contracted stronger to serotonin in comparison to RA with concomitant PVT. ADRF/PVRF is the mediator of that vasorelaxing/anti-contractile pathway, as is being released by PVT of human RA, similarly to human ITA.

As far as we are aware, there were previously no such studies in the literature confirming vasorelaxing/anti-contractile properties of human RA pedicle related to the secretion of ADRF. One should keep in mind that harvesting human RA as a pedicle could be more beneficial than a skeletonised one. The disclosure of whole metabolic pathway involving perivascular tissue of radial artery might give new insight in possibilities of preventing postoperative vasospasm and graft failure.

Thoracic | Abstract Session | Oesophagus

Weekday effect: Is it a factor affecting surgical outcomes after oesophagostomy?

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The effect of surgeon fatigue on patient outcomes is always an interesting topic both in the West and East. In China, patients always want to be scheduled early for surgery as they believe surgeons will be at their best. On the other hand, with social development, it is more convenient for patients to travel a long way for better medical treatment in large cities, for example, Beijing, Shanghai, and Guangzhou, which are called the 'first-tier' cities in China, making it is obvious for the trend of market concentration in recent years. Oesophagectomy is among the most time-consuming surgeries with high incidences of surgical complications. Hence, it is important to clarify the role of surgeon fatigue on surgical outcomes. Large studies are needed on the topic, however published research has previously included hospitals with differing patient volumes and levels of surgeon training, as well as bias and a lack of outcome verification.

Fudan University Shanghai Cancer Center is one of the high-volume centres for oesophagectomy in China, with the McKeown and Ivor Lewis procedures being the two main surgical techniques. To evaluate the surgeon fatigue on surgery outcomes, we chose anastomotic leak to be the primary outcome for this study, as technical error is an important reason for its occurrence. We hypothesised that if surgeon fatigue does have an impact on patient outcome, incidence of the leak would be increased later in the week and later in the workday, thus there would be a "weekday effect".

From 2006 to 2014, a total of 3,236 patients were reviewed for this retrospective study. However, we failed to observe the incidence of anastomotic leak increasing from Monday to Friday, neither in subgroup analysis of different time periods, nor surgery types. While it is difficult to explain the results, we presume that surgical experience, achieved through each surgeon's training with large surgery cases, compensates for the negative effect of fatigue. With regard to the fatigue during a single workday, although there was no significance difference, compared with surgeries early in the workday, we found that the incidence of anastomotic leak reduced later in the workday. Here we presume that a surgeon's medical ability actually peaks after several hours of work.

In contrast to previous research, this study focused on the surgeons' most preferred surgical technique to evaluate the "weekday effect". We don't encourage overwork, but we believe fatigue from daily work does not affect surgical outcomes. During a workday, although there is no significant difference, our result indicated that easy and low-risk surgeries could be scheduled before oesophageal surgeries. Given the current trend of centralisation for oesophageal surgeries, to fewer centres, it is possible that our results might be generalizable to a surgeon's preferred approach.

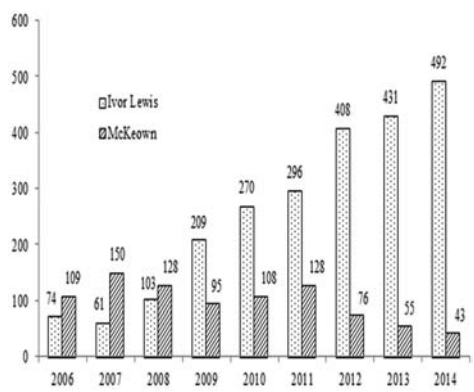

Figure 1. McKeown and Ivor Lewis Procedures from 2006 to 2014 in the Shanghai Cancer Center

INSIDE BARCELONA

Where to go? What to do?

CULTURE

PICASSO MUSEUM

Spain's own Cubist painter, Pablo Picasso, is one of the most famous artists of the modern era. Head down to the dedicated museum to see how Barcelona influenced his life, taking in over 4,000 unique works.

TIP: Free entry after 15:00 on Sundays!

BARRIO GOTICO

Barcelona's gothic quarter is the old, medieval part of the city ('Barcino'), and is well worth a stroll. Expect a myriad of preserved museums, courtyards, churches and markets.

EATING

SENYOR PARELLADA

A real Catalan powerhouse, this charming restaurant in the trendy 'El Born' district is steeped in 150 years of history. Dishes found on their menu are both varied and classic.

TRY: Croquetes de l'àvia (Grandma's croquettes!) or cod casserole

LA MAR SALADA

Nestled among other seafood eateries, you'd be forgiven for thinking this is just another fish in a very large pond. But its creative style and affordable prices gives La Mar Salada the edge. The produce comes mainly from the fishing quay directly opposite: you can't get much fresher than that.

BARS

Let's talk about wine! Whether you like red, white, pink or bubbles, Barcelona has a range of places ready to dazzle you. We heard about these 'through the grapevine'.

CASA MARIOL WINE BAR

Just up the road from the Sagrada Família, this boutique is as friendly as it is knowledgeable, focussing on family and cask wines that are as important as the little tasty plates you can eat alongside them

TRY: If you don't fancy wine, they also are famed for their vermut (vermouth)

ZONA D'OMBRA

In the gothic quarter, this well-renowned haven is a must for lovers of wine. Affordable and extensive selections are served with whatever level of information you would like. Want to know more? They'll happily explain. Want to just have some wine in peace? No problem!

ALTERNATIVELY...

BAR MENDIZÁBAL

This small and colourful stop-off is all about fresh fruit juices, bolstered with herbs, spices and a touch of loving care. Take a seat and replenish your vitamins for another big day at the conference!

Congenital | Abstract Session | Univentricular heart – Fontan

Bidirectional cavopulmonary anastomosis with additional pulmonary blood flow: good or bad pre-Fontan strategy?

Nataliya Nichay, Yuriy Gorbatykh, Alexander Bogachev-Prokofiev and Igor Kornilov Research Institute of Circulation Pathology; Novosibirsk, Russian Federation

Although the results of single ventricle surgery have improved dramatically during recent years, there are still unresolved issues. One of the controversial aspects is whether bidirectional cavopulmonary shunt (BCPS) should or shouldn't be accompanied by additional pulmonary blood flow (APBF), as APBF has both pros and cons.

The first benefit is that APBF prevents endothelial dysfunction. Second, according to several studies, it decreases pulmonary blood pressure and vascular resistance. Third, it prevents development of pulmonary arteriovenous malformations. On the other hand, APBF may worsen the results of BCPS by causing unbalanced and non-symmetric pulmonary flow. Moreover, it increases the volume load on single ventricle, which may affect the function of systemic ventricle as well as atrioventricular valve, though it is controversial whether APBF has a negative effect on survival rates.

We've reviewed our experience in single ventricle surgery. The goal of our study was to evaluate the influence of preserved APBF on survival after BCPS and Fontan completion. We retrospectively reviewed the medical records of 156 patients who underwent BCPS in our institution during the last 12 years (between 2003 and 2015). They were assigned into two groups: the APBF group (n=55; 35.3%) and the non-APBF group (n=101; 64.7%). We used a propensity score matching to reduce the effect of selection bias and potential confounding. So 50 patients from the APBF group were paired with 50 patients from the non-APBF group. Baseline characteristics were similar in both groups: age (p=0.90), sex (p=0.57), weight (p=0.75), single ventricle morphology (p=0.87), the type of neonatal palliative procedure (p=0.52); saturation (p=0.35); ejection fraction (p=0.90); Nakata index (p=0.70); mean pulmonary artery pressure (p=0.72).

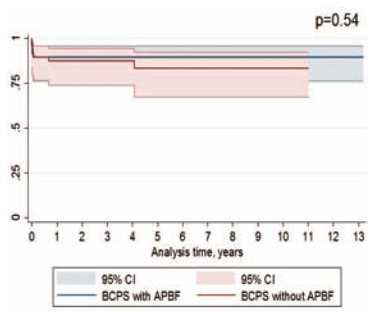

Figure 1

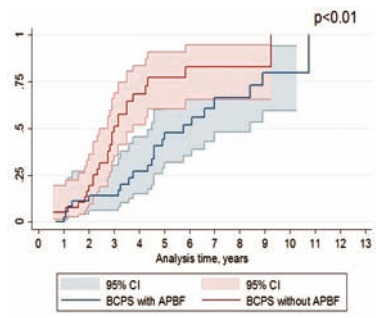

Figure 2

We observed higher blood oxygen saturation in patients with APBF during the entire follow-up period (p<0.01), while other parameters were similar between the groups including hospital mortality (p>0.99) and interstage mortality (p=0.25). No significant survival difference between groups was demonstrated (p=0.54; see Figure 1). In the APBF group, survival rate was 89% for 1- and 4-year periods. In the non-APBF group survival rate was 87% for 1-year and 83% for 4-years, respectively. We also did not reveal significant difference between groups in Fontan completion rates (p=0.24). However, Fontan completion occurred significantly earlier in the non-APBF group (- <0.01). In this group, Fontan procedure was performed before 36 months in 46% of cases, while in the APBF group – only in 13% of cases (Figure 2).

Our study demonstrated that APBF does not affect survival after BCPS and Fontan completion rate. Furthermore, APBF allows postponing Fontan procedure without negative influence on clinical condition. We suggest that the results of our study are helpful for understanding the impact of APBF on BCPS results. However, further studies with larger number of patients and longer follow-up are still required to evaluate the impact of APBF on pre-Fontan and Fontan circulation.

Cardiac | Rapid Response | Developments in assist devices and transplantation

Four-dimensional magnetic resonance imaging flow analysis of right ventricular assist device outflow graft banding in a mock circulation

David Reineke University Hospital Bern, Switzerland

The Department of Cardiovascular Surgery (T. Carrel) and the Institute of Diagnostic, Interventional and Paediatric Radiology (J. Heverhagen) at the University Hospital Bern, Switzerland joined forces to analyse banding techniques used to reduce flow in assist devices. Under the lead of David Reineke and Michael Ith the groups asked, whether the banding techniques advised by opinion leaders where wise to adopt.

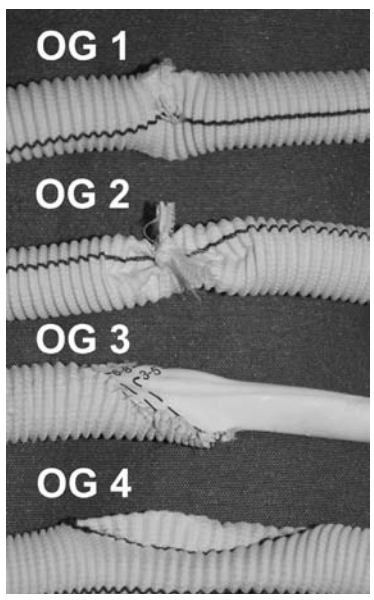

Figure 1. Outflow grafts used in the study

The absence of a reasonable continuous flow right ventricular assist device (RVAD) significantly reduces long-term treatment options for patients with biventricular heart failure. Current biventricular assist devices are designed for extra/paracorporeal use only and not designed for the outpatient setting.

The HVAD ® Heartware device has now for quite some time been used by multiple centres as both left ventricular assist device (LVAD) and RVAD to treat end-stage heart failure with satisfying results. The off-label implantation of a second rotary LVAD for right ventricular support was thought to be a superior solution to other existing options.[1]

Technical challenges occur when current devices have to be adapted to the lower pressures required for the pulmonary circulation. RVAD "over-pumping" may result in pulmonary congestion or RV collapse, while RVAD "under-pumping" may lead to multi organ failure or left ventricular collapse.[2,3] The haemodynamic adaption can be achieved by either reducing the rotational speed of the right pump impeller or by reducing the diameter of the right outflow graft using a restricting band.

The latest generation of hydrodynamic levitated impellers requires sufficient rotational speed to maintain their non-contact suspensions,[4] and to prevent pump thrombosis. To avoid these pitfalls, a band or mechanical restrictor can instead be placed on the outflow graft during the implantation to increase RVAD afterload. While this technique has been proven to be clinically effective, setting the optimal banding diameter for each individual patient remains a challenge, and is often performed subjectively.[5] The banding technique itself has been theoretically approached but never been visualised through imaging tools.

The aim of this study was to use four-dimensional magnetic resonance imaging (4-D MRI) to visualise changes in flow, and flow patterns, of various banding techniques within a specially-designed mock circuit. Four differently-banded outflow grafts (OG) were investigated; the banding was used to reduce the original outflow graft to 50% in luminal diameter (Figure 1).

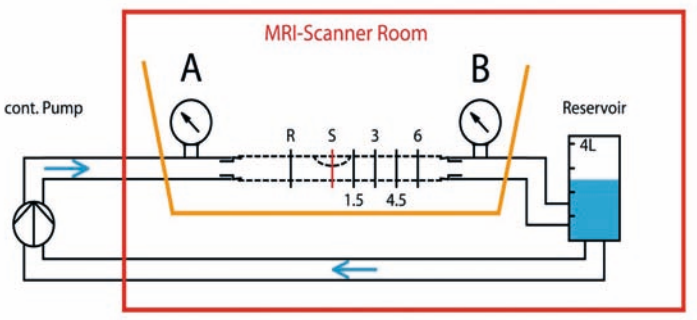

Figure 2. Phantom setup

Figure 3. Axial and vertical velocity maps

The grafts were incorporated in a phantom setup, simulating continuous flow with a DeltaStream DP2 centrifugal pump (Xenios AG;Heilbronn;Germany) located outside the scanner room (Figure 2).

Axial and vertical velcocity maps (Figure 3) showed that the type of outflow graft banding has a great influence on flow character and turbulence. Simple banding techniques as shown in OG1 and OG2 tended to normalise faster and showed less turbulences than banding methods which are advised in practice (OG4).

The location of the banding is of paramount importance and should be placed at a certain distance from the pulmonary artery inflow in order to avoid further turbulence. Areas of low flow, as seen in the banding method advocated by opinion leaders (OG4), should be avoided, as this may potentiate the thrombogenicity of the RVAD.

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Cardiac | Rapid Response | Developments in assist devices and transplantation

Quality of Life with LVAD Destination Therapy

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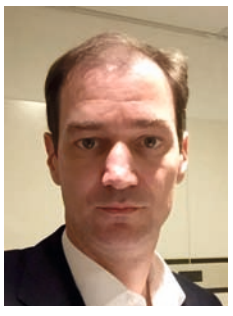

Left ventricular assist device (LVAD) implantation has become an effective treatment for end-stage heart failure patients. Due to the organ shortage, LVAD Destination Therapy (DT) is an accepted standard in non-transplantable heart failure patients. The clinical benefit in this patient group is tremendous. However, the potential gain in quality of life (QOL) with LVAD support in this elderly population is not fully evaluated. For this presentation we studied the QOL in LVAD DT patients pre- and post-LVAD therapy. We chose LVAD-DT patients with an INTERMACS level of 2 to 5. We evaluated these pre- and post-operatively with two different QOL questionnaires: the EQ-5D-5L of the EuroQol Group, and the Nürnberger QOL Questionnaire (NLQ). The EQ-5D-5L is a standardized measure of health status for clinical and economic appraisal. It has a descriptive system and a visual analogue scale (EQ-VAS from 0 to 100). The NLQ is a standardized measure of QOL with 39 questions and 4 dimensions.

Altogether, 60 patients were evaluated with the test battery. We evaluated them in an average of 8.7±11.4 days pre-operatively, and every 6 month post-operatively (mean of 19.4±18.1 months; range of 1 month – 6 years). The average age at implant was 67±8 years. 84% were male and 77.7% had ischemic cardiomyopathy as their main diagnosis. The values of the EQ-5D-5L and NLQ are displayed in Figure 1.

The average pre-operative QOL in LVAD DT patients is worse. All values showed a severely reduced QOL in all items except pain and self-care. All QOL items could be significantly improved post-LVAD, showing a better QOL with mechanical assist device support. The values of the EQ-5D-5L showed significant improvement in mobility, usual activities and anxiety. All items were steady over the first two years of LVAD DT.

In conclusion, LVAD DT leads to a significant improvement in health status and QOL shortly after implantation and is persistent over the first two years. In the older population, LVAD DT is a therapeutic option in heart failure patients to significantly improve QOL.

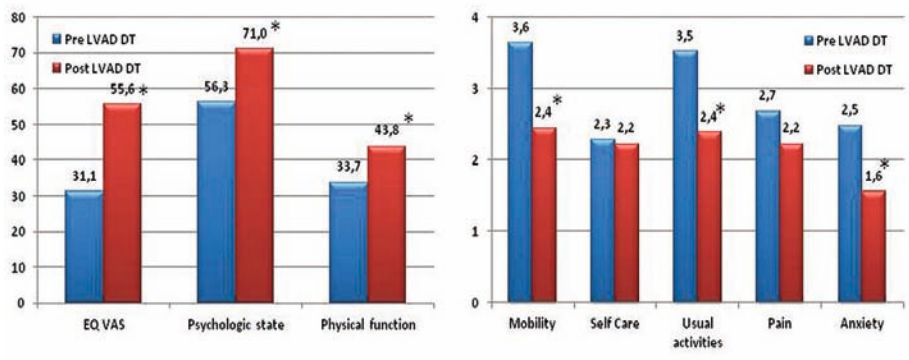

Figure 1. Left: Significant increase in all dimensions in NLQ post-LVAD DT (where higher value equates to better QOL). Right: Significant QOL improvement evidenced by EQ-5D-5L, except in self-care and pain (lower value equates to better QOL). *p<0.05.

Thoracic | Abstract Session | Oncology I

Exhaustive pre-operative staging increase survival in resected adrenal oligometastatic non-small cell lung cancer: A multicentric study

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The previous decade ended up with a general feeling that surgery only has a place for lung-localised non-small cell lung cancer (NSCLC). Indeed, studies argue against surgery on IIIA-N2 disease.[1,2] However, in 2013, the American College of Chest Physicians recommended (grade 1A) treatment by induction chemotherapy followed by surgery or chemoradiotherapy in the advanced N2 population.

The concept 'oligometastatic' corresponds to a limited number of metastatic lesions, whose locations enable a radical curative treatment. Metastasis encountered at the diagnosis time or occurring in the first six months is called synchronous. When it occurs after this delay, metastasis is called metachronous. Unlike in metachronous disease (discussed as single adrenal metastases), synchronous adrenal oligometastatic presentation is discussed as a true bifocal lung cancer disease. But synchronous adrenal oligometastatic NSCLCs are rare, and surgical management is still controversial.

Contemporary management of NSCLCs is guided by molecular biology, such as EGFR and ALK mutations in adenocarcinoma subtype. Furthermore, in the actual "molecular" era, mutations are not only helpful for treating patients, but also for follow-up. Indeed, as recently demonstrated by Luo et al., patients with EGFR mutations were more likely to present brain metastasis.[3] As it became hard to treat patients through "general" guidelines, treatment decisions – made by multidisciplinary staff – were made for every single patient based on their own cancer status.

In advanced NSCLC, careful selection with extensive pre-operative imaging including 18FDGPET and brain MRI should be performed before proposing surgery as part of a multimodal aggressive management. Also a systematic mediastinal lymph node evaluation through EBUS or mediastinoscopy has to be realised.

We believe that synchronous adrenal NSCLC oligometastatic presentation should be evaluated in light of induction chemotherapy, and more particularly, in light of tumour responsiveness. Chemotherapy as first step in multimodal treatment is also a way to select candidates for bifocal resections. Indeed, this strategy has the great potential to let time take its course, thus distinguishing highly aggressive tumours (which will never be able to be surgically treated) from others which would be suitable for an aggressive multimodal treatment.

In a 10-year French multicentric retrospective study, we showed that with a stringent selection process, a patient with even adrenal oligometastatic NSCLC could have a five-year overall survival up to 50%. We believe patients with advanced NSCLC deserve to be evaluated through induction chemotherapy as the last step before multimodal surgical treatment in advanced NSCLC.

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Cardiac | Abstract Session | Translational vascular biology

The effects of haemodynamics and shear stress on the inner layers of the aortic wall in patients with a bicuspid aortic valve: a histopathology grading study

Nimrat Grewal et al. Leids Universitair Medisch Centrum, the Netherlands

A bicuspid aortic valve (BAV) is the most common congenital cardiac malformation and is associated with ascending aortic dilation in 60-80% of patients. Structural differences in aortic wall architecture have earlier been noted between patients with BAV and a tricuspid aortic valve (TAV). The purpose of this study was to analyse a possible correlation between haemodynamics and shear stress in aortopathy in BAV patients.

BAV (n=36) and tricuspid aortic valve (TAV) (n=17) patients undergoing aortic valve replacement underwent pre-operative flow MRI assessment to detect the area of maximal flow-induced stress in the proximal aorta. Based on these MRI data, paired aortic wall samples (i.e. area of maximal shear stress (jet sample) and the opposite aortic wall (control sample)) were collected during surgery. The jet and control samples were graded for seven histopathologic features, referred to as pathology score.

In our results, comparing the jet and control samples in both BAV and TAV, regions of maximal shear stress did not show any difference in the pathology score in the adventitia, middle and outer media even if corrected for aortic stenosis/regurgitation, aortic dilation and raphe position. In the jet samples, the inner media however showed loss of actin expression in both BAV (p<0.0001) and the TAV (p=0.0074) and the intima thickness was significantly enlarged (BAV p=0,0005, TAV p=0,0041).

We conclude that increased wall shear stress leads to activation of the inner layers of the aortic wall in all patients of both BAV and TAV groups.

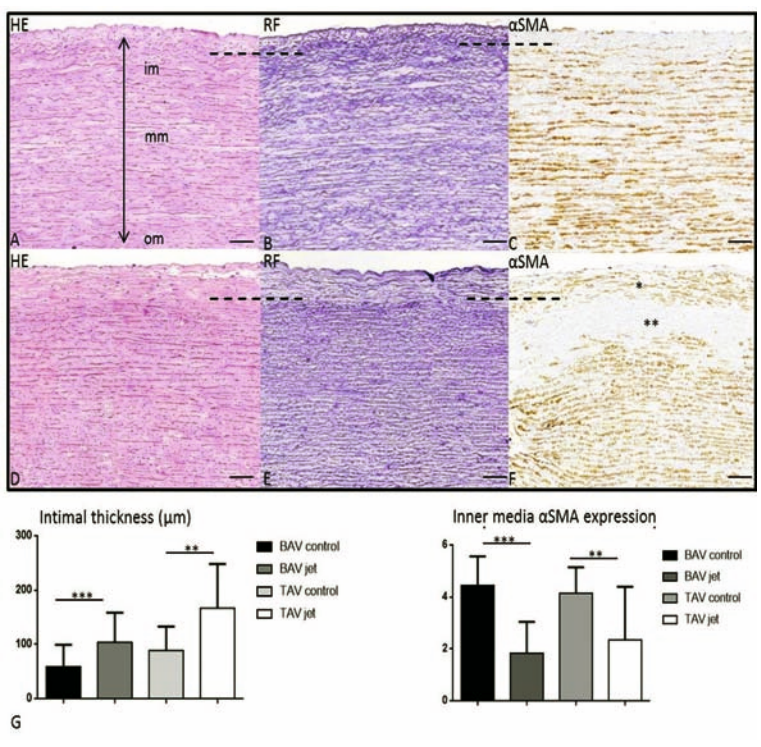

Figure 1. Transverse histologic sections (5μm) of the ascending aortic wall in a dilated BAV comparing the control (A-C) and the jet side (D-F). The sections are stained for hematoxylin eosin (HE) (A,D), resorcin fuchsin (RF) (B,E) and αsmooth muscle actin (αSMA) (C,F). The borderline of intima and inner media is indicated by the dashed line, showing a significantly thicker in the jet as compared to the control side (graph G). At the jet side an increase in αSMA expression is seen in the outer thickened intima (F, indicated with *). At the jet side there is significant decrease of αSMA expression in the inner media (F, indicated with **), graph H), which is however not accompanied by loss of elastic lamellae (E) or VSMC nuclei (D) in the inner media. Scale bar 100μm.

Thoracic | Abstract Session | VATS lobectomy

Clinical outcomes of thoracoscopic lobectomy in patients with moderate or severe comorbidity

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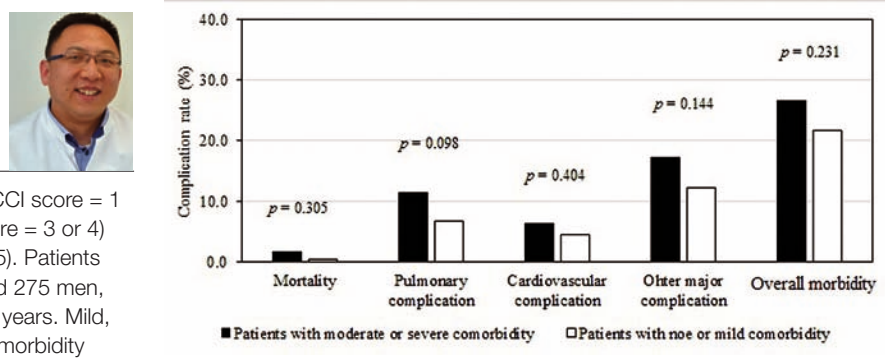

Figure 1: The rates of postoperative complication after thoracoscopic lobectomy stratified by comorbidity severity (moderate or severe vs. none or mild).

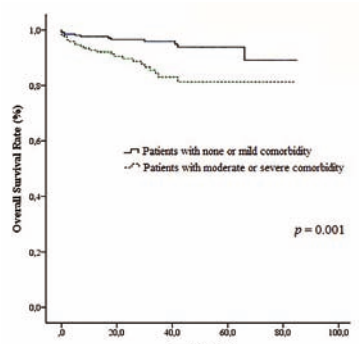

Figure 2: Actuarial overall survival rates stratified by comorbidity severity (moderate or severe vs. none or mild).

Comorbidity is increasingly common in lung cancer patients, and is associated with higher postoperative complication rates and adverse long-term survival after open lobectomy. In the last decade, thoracoscopic lobectomy has been increasingly adopted for treatment of early-stage non-small cell lung cancer (NSCLC). Evidence demonstrates reduced postoperative complications after thoracoscopic lobectomy in high-risk patients compared with thoracotomy, but so far, very few studies have investigated the impact of increased comorbidity on clinical outcomes, when lobectomy is performed via a thoracoscopic approach.

We performed a retrospective study using our institutional database of 490 patients undergoing thoracoscopic lobectomy for NSCLC or benign disease from 2009 to March 2016. Comorbidity was asessed through the Charlson comorbidity index (CCI). Severity of comorbidity was classified into three grades: mild (CCI score = 1 or 2), moderate (CCI score = 3 or 4) and severe (CCI score ≥5). Patients included 215 women and 275 men, and mean age was 66.1 years. Mild, moderate and severe comorbidity were found in 239 (48.8%), 138 (28.2%) and 55 patients (11.2%), with the remainder of patients have none comorbidity (n=58, 11.8%). The most common comorbid conditions were hypertension and chronic pulmonary disease, followed by cardiac disease.

Our results demonstrate that thoracoscopic lobectomy was associated with low postoperative mortality, and reasonable morbidity, in patients with moderate or severe comorbidity. More interestingly, albeit exposure to other risk factors such as increased age, male gender, poorer performance status and lower pulmonary function, the postoperative complication rates in patients with moderate or severe comorbidity were not significantly higher than those in patients with none or mild comorbidity (Figure 1). In addition, both univariate and multivariate logistic regression analyses revealed no significant relationship between moderate or severe comorbidity and postoperative complication rates. While these favourable outcomes in patients with moderate or severe comorbidity might be attributed to careful patient selection, it is thought to be due, at least in part, to the thoracoscopic approach, which results in less postoperative pain and better preservation of pulmonary fucntion. In this respect, it is reasonable to speculate that moderate or severe comorbidity should not be considered predictive of increased postoperative complications, when lobectomy is performed thoracoscopically.

In a follow-up period of 31.4±21.8 months, moderate or severe comorbidity was associated with significantly lower five-year overall survival than none or mild comorbidity (Figure 2). On a multivariate Cox regression analysis, moderate or severe comorbidity emerged as an independent predictor of overall survival. Compared to none or mild comorbidity, moderate or severe comorbidity was associated with 2.6-fold higher harzard for death. Thus, these findings suggest that reducing postoperative complications by employing thoracoscopic approach does not translate into a survival benefit in lung cancer patients with comorbidity. In this context, concern about limited life expectancy remains justified, when patients amenable to thoracoscopic lobectomy present with moderate or severe comorbidity.

Based on our results, we believe that moderate or severe comorbidity is not an independent predictor of postoperative mortality and morbidity, but still an independent prognostic factor for long-term survival in lung cancer patients, when lobectomy is performed via a thoracoscopic approach.

Cardiac | Abstract Session | Translational vascular biology

Effect of carbon dioxide insufflation on structural and functional viability of human saphenous vein endothelium – Role of calcium mobilisation and nitric oxide production

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An ideal vein harvesting technique is the one which causes the least degree of endothelial damage, and achieves the best cosmetic results. While basic science research and randomised controlled trials on clinical outcomes are encouraged for fulfillment of such a goal, it is essential that vein grafts should be handled with extreme care. Carbon dioxide (CO_2) is a naturally-occurring colourless and odourless gas, used in many endoscopic vein harvesting systems to facilitate dissection by creating a subcutaneous tunnel. CO_2 is easily soluble in tissues and blood, noncombustible and readily discarded through pulmonary ventilation.

Many studies have investigated systemic absorption of CO_2 but no previous study has addressed the effect of CO_2 insufflation (either CO_2 itself or its pressure) on the quality of saphenous vein graft. Apart from endothelium, the outermost perivascular fat is a rich source of nitric oxide (NO), which maintains graft patency by its antithrombotic and vasodilatory properties. The "No Touch" open vein harvesting (NT-OVH) approach has gained popularity as it preserves the surrounding fatty tissue, which not only provides support to the vein graft but also protects network of vasa vasorum supplying blood to the vessel wall. We have utilised NT-OVH technique for our ex-vivo study, to investigate the true effect of CO_2 on HSV graft by eliminating excessive handling related injury during endoscopic and open conventional methods. NO is synthesized in a pulsatile manner by increasing eNOS activity in presence of abundant intracellular calcium. NO is not only a potent vasodilator but also inhibits platelet aggregation and suppresses adherence of leukocytes to the endothelium. Lack of NO release from the endothelium results in vasospasm, leukocyte adhesion, intimal hyperplasia, thrombosis and eventually graft failure. We have demonstrated in our ex vivo model that CO_2 insufflation used routinely as an aid in EVH has no detrimental effect on the structural viability of HSV endothelium and did not result in accelerated endothelial damage or cell death (Figures 1 and 2).

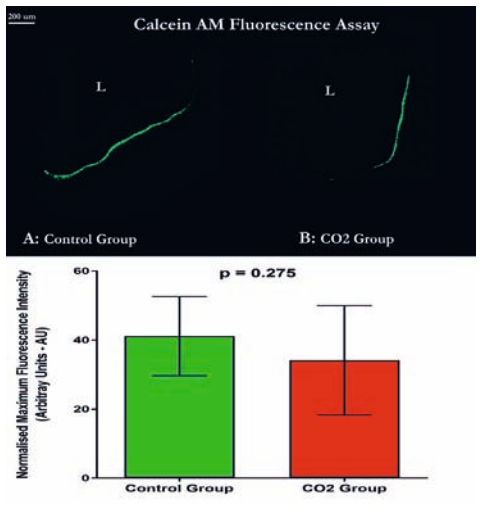

Figure 1

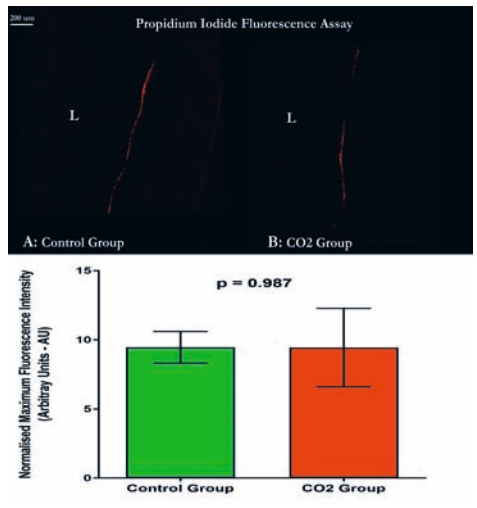

Figure 2

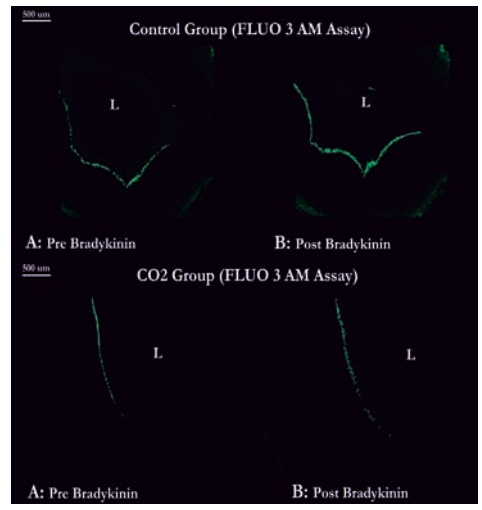

Figure 3

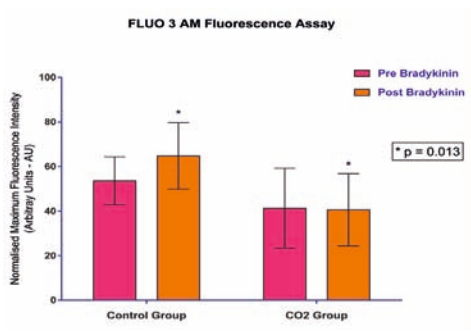

Figure 4

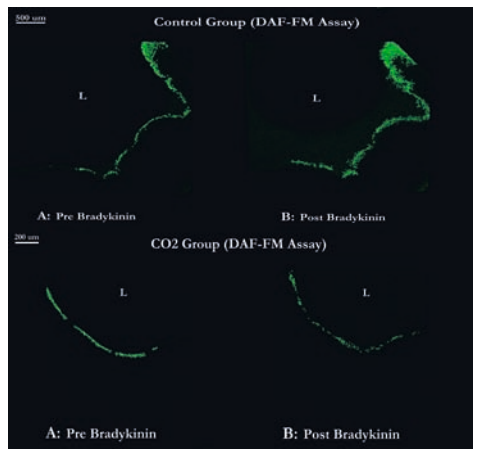

Figure 5

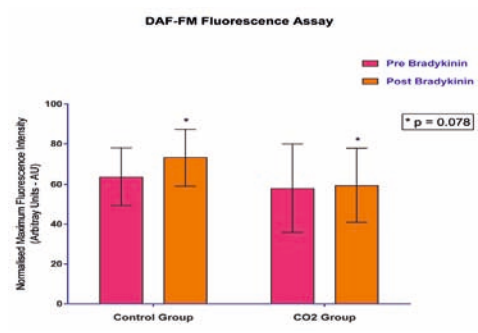

Figure 6

However, our study became first of its kind to highlight CO_2 as an independent risk factor, which significantly attenuates endothelial calcium mobilisation (p=0.013, Figure 3 and 4) and reduces eNOS related NO production (p=0.078, Figure 5 and 6), hence impairing the vasomotor function. Historically, saphenous veins used to receive extreme structural and functional stress during harvesting. We have come a long way from treating it as a "lifeless tube", now recognising its more complex vascular structure, complete with sophisticated physiological function such as retrograde blood flow from periadventitial vasavasroum and eNOS-mediated NO release. We believe that there is an inevitable risk of damage to the segments of vein grafts, no matter the extraction method, but by mastering less traumatic techniques, and by maintaining normal physiological processes during harvesting, better graft survival can be achieved. However, more research is required to establish whether these functional changes are transient in nature or they have long-term implications on graft survival and clinical outcome.

Congenital | Abstract Session | Congenital miscellaneous 2

A small, unrepaired ventricular septal defect – not just an innocent bystander?

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Adults living with an isolated, small ventricular septal defect (VSD) are considered to have excellent prognoses, and consequently most of them remain unrepaired. Nevertheless, studies are reporting of late cardiac adverse effects that can possibly impact the functional capacity. Our group has recently investigated the functional capacity of these adults with small, unrepaired VSDs and found a nearly 20%-reduced peak exercise capacity compared with their healthy peers – without any apparent explanations for the findings.

The reduced functional capacity in patients with small, open VSDs was previously mirrored in adult patients born with a large VSD that had been closed surgically early in life. These patients were discovered to both have a disrupted ventricular contraction as well as an abnormal ventilatory pattern during exercise. Our present patient group had, however, not undergone any surgical intervention that could explain the lower functional capacity and an apparent theory could instead be linked to the persisting VSD. Therefore, we invited the same cohort of patients with small, unrepaired VSDs, previously found to have poorer functional capacity, to undergo MRI in order to determine shunt size (QpQs ratio) and investigate whether a possible relationship exists between the size of the shunt ratio and the functional capacity. Moreover, the size of the pulmonary trunk and ascending aorta were determined in patients and compared with the same group of controls.

In total, 29 patients with unrepaired VSDs (26.5±6 years) and 25 controls (26.9±5 years) completed both the bicycle test and the MRI study. Previously-found peak oxygen uptake was nearly 20% lower in patients compared with controls (p=0.002). All of the adult patients had shunt ratios below 1.5, with mean QpQs of 1.2±0.1. As seen on the figure, a negative correlations exists between the size of the VSD and peak oxygen uptake, r=-0.44 (p=0.020). Compared with the healthy controls, patients had increased forward and retrograde flow in the pulmonary trunk, but comparable flows in the ascending aorta. Pulmonary diameter was also increased in patients; 30.3±4mm, compared with controls; 28.2±3 (p=0.041), whereas aortic dimensions were comparable.

This larger retrograde flow combined with the elevated mean blood flow through the pulmonary trunk could perhaps help explain the previously found lower functional capacity in our adult patients. The small, open shunt may have an effect on the pulmonary vasculature, resulting in the secondary findings of larger vessel area and retrograde flow. These results indicate that not all small, unrepaired VSDs are without haemodynamic influence, as previously thought, and a closer follow-up routine in the health care system should be carefully considered as the pathophysiological mechanisms behind the small defects are far from understood.

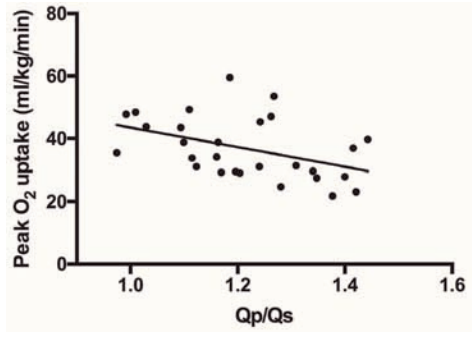

Figure 1

Congenital | Abstract Session | Congenital miscellaneous 1

Granulocyte colony stimulating factor (G-CSF) ameliorates apoptosis-mediated damage in a model of ischaemic neonatal brain injury

Peter Pastuszko[1], Gregory J. Schears[2], Joanna Kubin[3], David F. Wilson[3] and Anna Pastuszko[3]
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3. University of Pennsylvania, Philadelphia, PA, USA.

Despite enormous improvements in the operative and perioperative management of patients with congenital heart disease (CHD), hypoxic-ischaemic brain injury continues to occur, often resulting in significant long-term neuropsychological dysfunction. The patients most often at risk for these negative sequelae are the neonates. G-CSF is a glycoprotein growth factor which acts via a specific cell membrane receptor (G-CSFR), and its best known and understood role is in the proliferation and differentiation of hematopoietic progenitor cells into neutrophils. As such, G-CSF has been used for decades to treat neutropenia in patients receiving myelosuppression cancer drugs and in recovery after bone marrow transplantation. G-CSF has been used extensively in the clinical setting and has a well-known safety profile. In addition to the hematopoietic tissue, G-CSF/G-CSFR complex has been shown to be present in other cell lines, specifically the central nervous system (CNS). There, it has an anti-inflammatory and anti-apoptotic effect, and the mechanism has been studied in a variety of brain injury models with very promising results.

For a number of years now, we have been looking at the effect of G-CSF on the extent of injury in different brain regions. We have used a neonatal piglet model of hypoxic-ischaemic injury related to cardiopulmonary bypass and cerebral hypoperfusion (DHCA – deep hypothermic circulatory arrest). Since apoptosis is known to be the main mechanism of injury in the neonatal brain, the regions with highest degree of apoptotic activity, specifically hippocampus and striatum, are considered the most vulnerable. Those are the regions we've primarily focused on. Our results show that administration of G-CSF prior to DHCA decreases apoptotic and inflammatory activity in the striatum and hippocampus of newborn piglets and increases anti-apoptotic and anti-inflammatory activity, suggesting it may have a protective effect against DHCA-related injury. In the present study, we evaluated the ability of the G-CSF to decrease caspase-3-positive cells in the hippocampus of the ischemic neonatal brain. Caspase-3 is a cellular protease controlling the final step of apoptosis, hence a marker of cell death.

In our experimental protocol, newborn piglets were placed on cardiopulmonary bypass and subjected to prolonged DHCA (60 min). They were then rewarmed, weaned from cardiopulmonary bypass and recovered for eight to nine hours. The study animals received G-CSF two hours prior to the DHCA. At the end of each experiment, the hippocampus was extracted, cryoprotected and immunoprocessed for activated caspase-3.

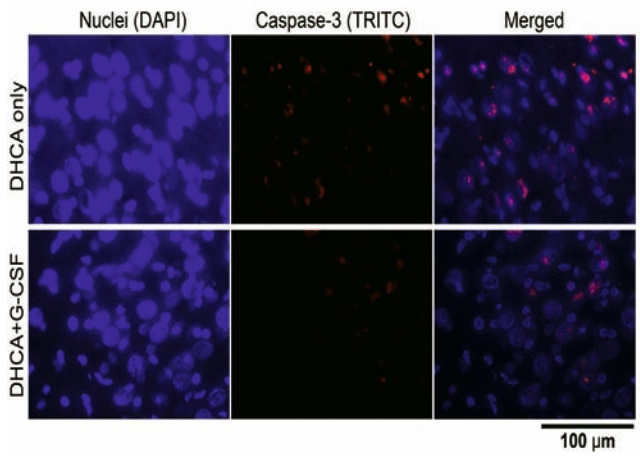

Figure 1. Comparison of caspase-3 immunoreactivity in the distal CA3 region of the hippocampus of a piglet subjected to cardiopulmonary bypass with deep hypothermic cardiac arrest (DHCA) (top), and a piglet pretreated with G-CSF prior to DHCA (bottom). The three panels for each case successively show blue nuclear DNA staining (DAPI), red caspase-3 immunostaining (TRITC), and a superimposition of both images (Merged). In the animal pretreated with G-CSF (bottom), caspase-3 immunostaining is less extensive and occurs in fewer neurons than in the animal subjected to DHCA without pretreatment (top).

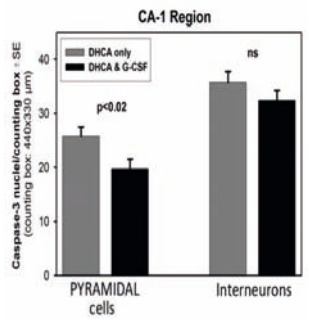

Figure 2. In the CA1 region, there were significantly fewer caspase-3-positive pyramidal neurons in the G-CSF group than in the DHCA group (20±1.8 vs. 26±1.6), and there was also a trend for lower interneuronal counts in the G-CSF group.

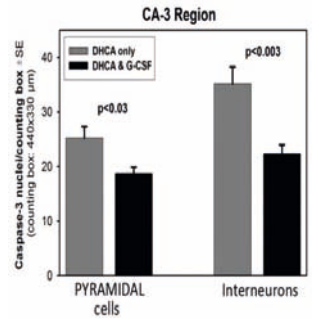

Figure 3. In the CA3 region, the counts of both cell types were significantly lower in the G-CSF group than in the DHCA group (19±1 vs. 25±2 for pyramidal neurons, and 22±1.6 vs. 35±3 for interneurons, respectively).

The results were highly encouraging. When the hippocampal sections were examined, as expected, those from the control animals contained negligible numbers of caspase-3 positive nuclei. In the DHCA group, sizable numbers of cells contained caspase-3 in both the CA-1 and CA-3 hippocampal regions (the two regions studied). However, the group treated with G-CSF showed significant decrease in the number of caspase-3 positive cells.

Our findings show that G-CSF ameliorates apoptotic cell death in the neonatal brain, therefore it may have a therapeutic role in the treatment of ischaemic/hypoxic injury. Clearly, much additional work is necessary to evaluate the efficacy of G-CSF, including long-term recovery studies in an animal model and eventual clinical trial. However, with its well-known safety profile and already extensive clinical use, G-CSF may be an ideal adjuvant treatment in the management of neonatal ischemic brain injury.

Cardiac | Focus Session | Robotics revisited

Robotic lung resection: a fifteen-year experience

Sara Ricciardi, Franca M.A. Melfi, Gaetano Romano, Federico Davini, Carmelina C. Zirafa and Alfredo Mussi Division of thoracic surgery, University Hospital of Pisa, Pisa, Italy

Robotic technology is an evolution of video-assisted thoracic surgery (VATS), developed to overcome the restrictions of manual videothoracoscopy while maintaining the advantages related to minimal invasiveness. The high definition three-dimensional vision, along with greater flexibility and tremor filtration, are the greatest advantages of robotic approaches compared to VATS. Since 2002[1], when the first series of robotic lobectomies with a three-arms-technique were reported, several studies have shown that robotic lung resections are feasible and safe with long-term outcomes analogous to open/VATS approaches.[2-4] Despite the profound changes and improvements which have taken place during the years, at the current time robotic lung resection is still considered a challenging operation for the treatment of lung cancer.

We focussed our attention on the technological aspects – and on the evolution – of robotic major lung resection performed by one surgeon over fifteen years of experience. We retrospectively reviewed all patients who had undergone anatomical resection (segmentectomy, lobectomy, bilobectomy or pneumonectomy) for non-small cell lung cancer (NSCLC) by using the da Vinci Surgical system. Of the 764 robotic procedures performed between 2001 and 2015, 330 NSCLC patients who underwent major lung resection were selected for this study.

Those consecutive patients were divided into three groups:

1. group I: 23 patients between Jan 2001 and Dec 2005
2. group II: 108 patients between Jan 2006 and Dec 2010
3. group III: 199 patients between Jan 2011 and Dec 2015

We have compared age, comorbidities, diagnosis, gender, type and duration of surgery, conversion rate, duration of stay, early and late complications of the three groups.

Analysing our data, it is clear that in the third phase of activity we are able to treat, by the robotic approach, the same patients of whom we could not operate on in the early years of experience. During the first phase, which we have called "feasibility", we proposed robotic resection only to a small number of stage I selected patients and we treated all of them with lobectomy (23/23). In the second phase, the "evolution", we have expanded our inclusion criteria to an increased number of patients with a different stage from the first group (24/108 stage II; 11/108 stage III). Lastly in the third phase, the "standardisation", we have treated a large number of advanced stages of lung cancer (41/199 stage II; 23/199 stage III and 2/199 stage IV) and some patients with several comorbidities. Moreover, we have performed, between 2011 and 2015, 20 segmentectomies, three extended lobectomies and one bilobectomy (contrary to only lobectomies executed during the previous years). Nevertheless, our conversion rate has decreased compared to the previous phases (8% group 1, 8% group 2, 5% group 3).

Table 1. Clinical and demographic information

	Group I (2001-2005)	Group II (2006-2010)	Group III (2011-2015)
Number of patients	23	108	199
Mean age (years and range)	64,4 (41-78)	62,6 (30-76)	66,9 (35.82)
Gender (Male:Female)	15:8	79:29	116:83
Mean ACE score	1,3 (SD 1,2)	1,7 (SD 1,1)	2,15 (SD 1,2)

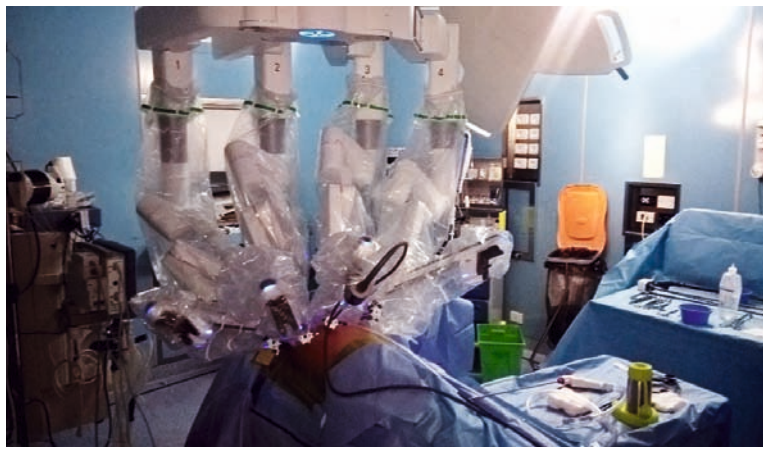

Figure 1: The da Vinci Xi

In conclusion, we can say that the technological development, the acquired skills, the long-term experience and the standardisation of the technique permitted us to perform a large number of challenging operations with a totally endoscopic, robot-assisted approach.

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Congenital | Abstract Session | Univentricular heart – Fontan

Creation of the Fontan circulation in sheep: A survival model

Joeri Van Puyvelde University Hospitals Leuven, Belgium

The Fontan circulation is associated with distinctly abnormal haemodynamics and a significant risk of progressive failure, with an incidence of 30%.[1] A better understanding of the pathophysiological processes behind Fontan failure might give us the opportunity to adopt early intervention strategies and prevent failure of the Fontan circulation. In recent years there is also an increasing interest in developing mechanical support systems specific for the failing Fontan configuration.[2-5] To validate these new therapeutic options we developed a chronic Fontan model in sheep.

A Fontan circulation was surgically created in 26 sheep, through a right lateral thoracotomy in the third intercostal space, without the use of cardiopulmonary bypass. The superior vena cava was anastomosed end-to-side to the pulmonary artery, subsequently the inferior vena cava was connected to the pulmonary artery by an ePTFE conduit and the inferior vena cava-right atrium junction was ligated (Figure 1). Haemodynamic parameters were recorded at baseline and after Fontan completion. All animals developed significant pleural effusions and ascites, therefore they were placed on diuretics and if indicated thoracentesis or paracentesis was performed. A pre-operative exercise test had been performed by 12 sheep, four had a postoperative exercise test and three had MRI scans after recovery from the operation. After nine months, or at the moment of progressive failure of the Fontan circulation, the animals were sacrificed.

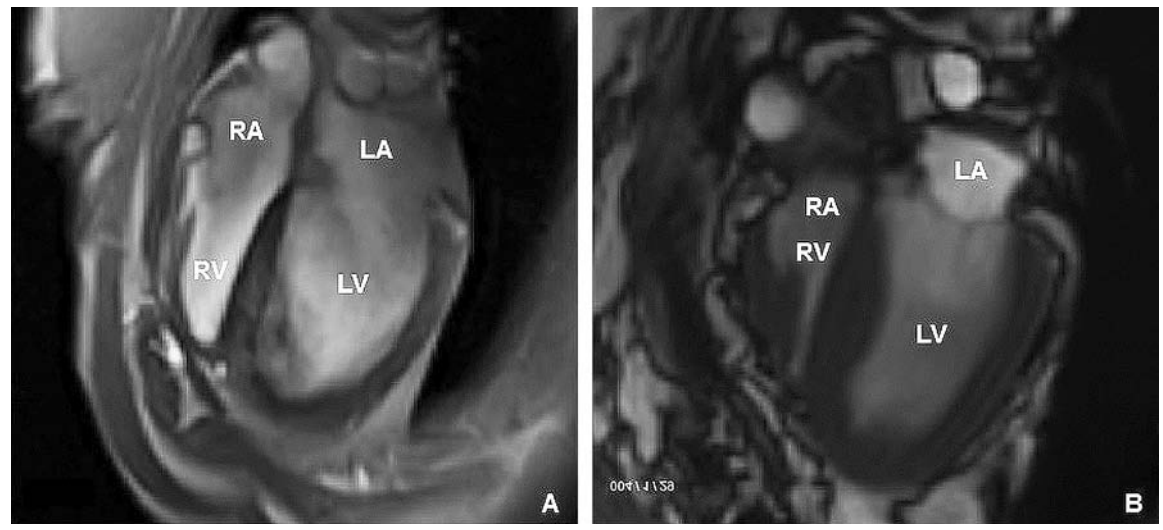

Figure 2. Long-axis MRI images from a normal control (A) and a chronic Fontan animal (B). Note the virtual residual right ventricular cavity after total cavopulmonary diversion in the animal with chronic Fontan circulation

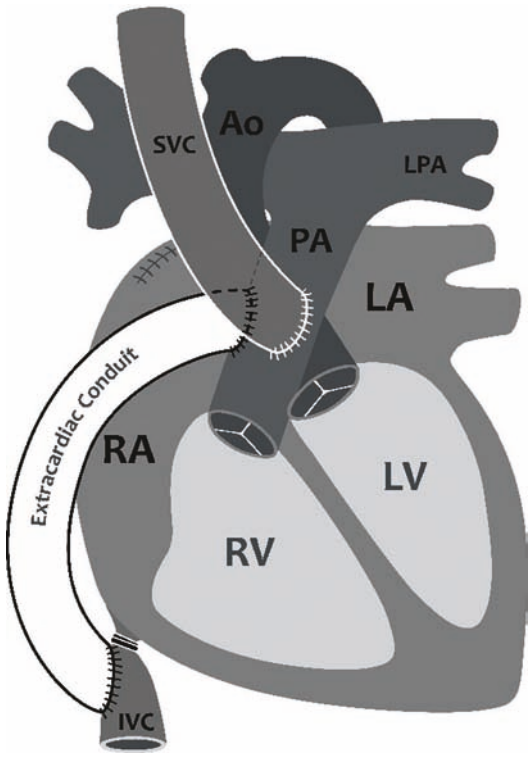

Figure 1: Schematic illustration of the experimental technique

Immediately after the Fontan circulation was established we saw a decrease in the arterial blood pressure and in cardiac output but an increase in central venous pressure.

Despite the fact that all animals survived the procedure, there was a high mortality postoperatively, especially during the first 24 hours, and the animals remained in very precarious condition during follow-up. This was also demonstrated by the high mortality during induction (40%) when an MRI was performed 2-6 weeks after the procedure. MRI showed preserved left ventricular volumes and function and significant decreased right ventricular volumes and output (Figure 2). The exercise test showed no significant difference in maximum heart rate compared to baseline. However, before the procedure, all animals could complete the entire exercise protocol, while all of the Fontan animals stopped the exercise prematurely because of exhaustion.

This study demonstrated the feasibility of a chronic Fontan animal model with a total cavopulmonary connection. Moreover, the Fontan circulation in our study provided all hallmarks of a failing Fontan physiology (chronic venous congestion, impaired exercise capacity, ascites and pleural effusions) and was associated with a significant risk of progressive failure and death. This experimental model can facilitate studies on the pathophysiology of the failing Fontan circulation and might play a crucial role in the development of advanced approaches, like cavopulmonary assist devices, to treat patients with a failing Fontan circulation.

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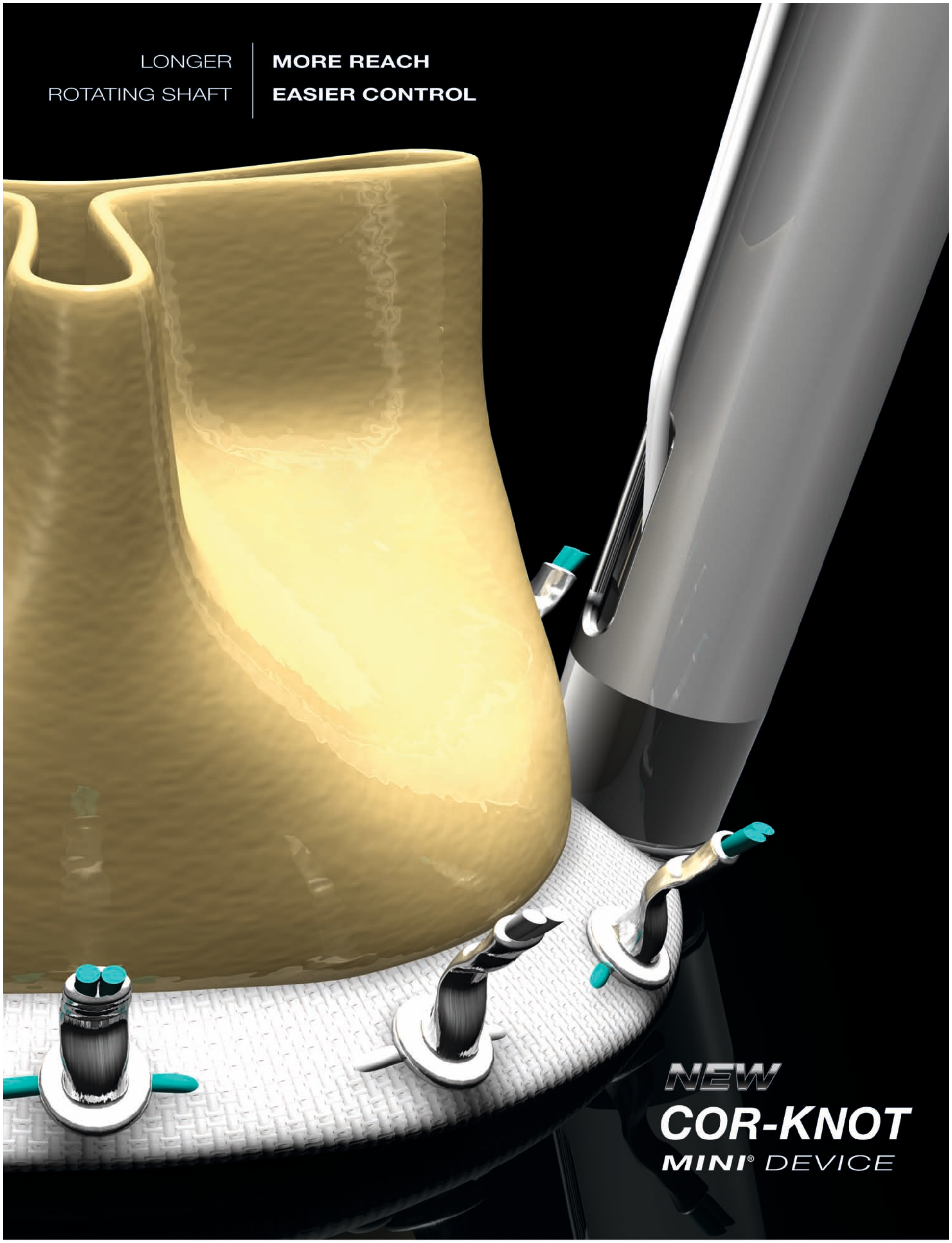

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Cardiac | Abstract Session | Regeneration – Preservation

Synergistic cardioprotective effects of remote perconditioning in conjunction with the terminal blood cardioplegia against reperfusion induced myocardial dysfunction: An *in vivo* piglet model of prolonged single-dose cardioplegic arrest

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Remote perconditioning (rPerC) was first proposed in 2007 by Schmidt et al. as a novel endogenous cardioprotective strategy. In contrast to local post-conditioning, in which repetitive ischaemic stimulus is applied to the target organ itself during reperfusion, rPerC may avoid the disadvantage of inducing additional ischaemia to an already unstable target organ.

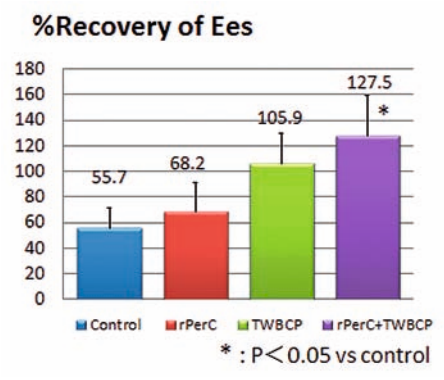
More recently, rPerC has been adapted to clinical studies in cardiac surgery, and its benefits on troponin release have been demonstrated. However, its effects on myocardial function – other than the anti-necrotic effect (reduced biomarker release) – has not been evaluated at all in previous investigations, and the real clinical role of rPerC during standard open heart surgery in conjunction with standard blood cardioplegic strategies has yet to be elucidated.

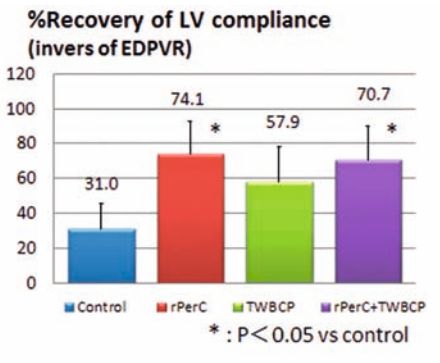
This study tests the hypothesis that rPerC, applied in addition to terminal warm blood cardioplegia (TWBCP), has synergistic cardioprotective effects on LV functional recovery and biochemical injury in an *in vivo* piglet model of prolonged single-dose cardioplegic arrest.

We studied 20 piglets, using *in vivo* CPB model incorporated with a cardioplegic delivery system.

Animals were subjected to 120 min cardioplegic arrest with single dose crystalloid cardioplegia, followed by 30 min of reperfusion and observation after the termination of bypass. Piglets were divided into four groups on the basis of the method of reperfusion: Control (simple aortic unclamp); rPerC; TWBCP; or rPerC+TWBCP.

The rPerC technique consisted of four cycles, 5 min each, of I/R in the lower limb, performed 40 min before reperfusion using a digital tourniquet. TWBCP was performed five minutes prior to the onset of aortic unclamping, with LV function being assessed by P-V loop analysis using a conductance catheter. A series of P-V loops was obtained through transient occlusion of the inferior vena cava at baseline and after 60 minutes of reperfusion. LV contractility was assessed by Ees(end-systolic elastance) as the slope of the end-systolic P-V relationship, and preload recruitable stroke work index (PRSWI). Diastolic compliance was assessed as the inverse of the slope of the end-diastolic P-V relationship (EDPVR). The functional recovery after reperfusion was assessed as a percentage of these respective baseline values. As a biomarker of myocardia injury, plasma Troponin-T was measured before CPB, just after reperfusion, and after 10, 30 and 60 minutes of reperfusion.





In our results, the control group showed marked decreases in Ees, which were modestly reduced in the rPerC and TWBCP groups. In contrast, significantly better recovery of Ees was seen in the rPerC+TWBCP group, and similar results were shown in PRSW. In LV compliance, the control group showed severe depression. In both rPerC alone and rPerC+TWBCP groups, percentage recovery of LV compliance was significantly better compared to the control group.

A significant increase in troponin-T was identified 30-60 min after starting reperfusion in all groups. Although the post-reperfusion increase in troponin-T was slightly lower in groups treated with either rPerC or TWBCP, there was no distinct synergistic effect of rPerC and TWBCP.

Remote perconditioning was demonstrated to offer synergistic cardioprotection in addition to TWBCP against myocardial dysfunction induced by prolonged cardioplegic arrest, leading to prompt LV systolic and diastolic function recovery, associated with modest reductions in biochemical injury.

Since no distinct adverse effect on the myocardium has been demonstrated in this intervention, unlike local ischaemic conditioning, remote perconditioning can be safely applied as a supplemental reperfusion strategy to the standard clinical BCP strategy to enhance post-bypass myocardial function recovery, thus contributing to reductions in postoperative morbidity.

Cardiac | Abstract Session | Transcatheter aortic valve implantation

Antiplatelet therapy after transcatheter aortic valve implantation – Benefit or risk during mid-term follow-up

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Postoperative antiplatelet therapy after transcatheter aortic valve implantation (TAVI) is still discussed controversially. Current guidelines recommend acetylsalicylic acid (ASA) 75-100 mg/day (lifelong), and clopidogrel 75 mg/day for six months (Class IIb, Level of Evidence C).[1] But since the first TAVI procedure, only a few studies compared the benefits and risks of different antiplatelet therapy strategies. Bleeding and stroke are severe complications in high-risk patients after TAVI associated with increased morbidity and mortality.[2,3] Therefore, the adequate antiplatelet regimen should be identified. The aim of this study was to compare the incidence of neurological and bleeding events as well as mid-term survival in patients with dual compared to single antiplatelet therapy.

Data from 578 patients who had undergone transfemoral, transapical or transaortic TAVI between August 2008 and December 2013 were collected prospectively and analysed retrospectively. Patients who received vitamin K antagonists or new oral anticoagulants after the procedure were excluded. 274 received single antiplatelet therapy (SAPT) with either ASA or clopidogrel, and 116 received both as dual antiplatelet therapy (DAPT), respectively. Matched pair analysis to exclude possible confounding factors, based on preoperative variables (valve type, age, EuroSCORE, and sex) identified 91 pairs. The effect of antiplatelet therapy on risk of stroke, bleeding events, and mortality was examined. Clinical and echocardiographic follow up was performed up to five years.

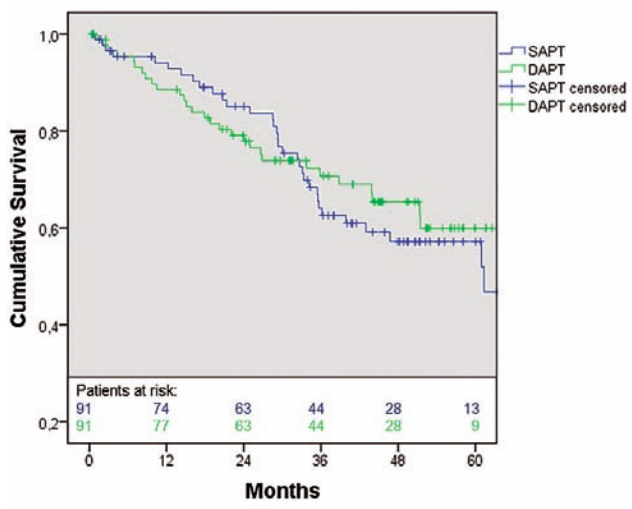

Figure 1: Kaplan Meier curve for survival for matched patients (p=0.520).

Preoperative characteristics were similar in both groups after matching. Bleeding events did not differ (access site related bleeding events: SAPT 3.3 vs. DAPT 8.8%, p=0.212; death or rehospitalisation because of bleeding events: SAPT 4.4 vs. DAPT 4.4%, p>0.999). The incidence of neurological events during (5.5% each, p>0.999) and after the initial 90 days (2.2 vs. 1.1%, p>0.999) showed no differences, too. There were two deaths during the first 30 days, both in the SAPT group (2.2 vs. 0.0%; p=0.497). One-year survival rate for matched data was 92.8% (95% CI: 89.0 – 99.2%) for the SAPT group and 88.5% (95% CI: 81.8 – 95.2%) for the DAPT group. Five-year survival was 57.2% (95% CI: 45.4 – 69.0%) versus 59.9% (95% CI: 47.6 – 72.2%) (figure 1). Therefore, survival did not differ between the two groups (p=0.520).

Overall, in high risk patients undergoing TAVI bleeding, neurological incidences as well as mid-term survival did not differ between DAPT and SAPT. Therefore, the strategy of adding clopidogrel to ASA for six months after TAVI provides no additional protection against thromboembolic complications. ASA or clopidogrel as monotherapy is an adequate therapy, as it is already recommended for conventional biological aortic valve replacement.

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Cardiac | Rapid Reponse | An update on mitral valve interventions

Mitral valve surgery using minimally invasive versus sternotomy approach: A propensity matched comparison

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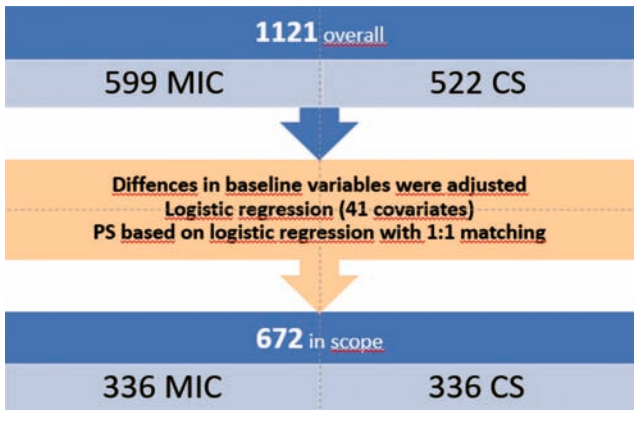
Mitral valve disease is the second most common disease seen in heart valves. In 2015, 50% of German patients with mitral valve disease were treated using a minimally-invasive approach. Potential benefits of a minimally-invasive approach are low postoperative pain, fast postoperative recovery and the obvious cosmetic benefit. But essential considerations about the technical feasibility of repairing complex mitral valve disease via MIS, and the effects on postoperative outcome, are still open for discussion.

In the absence of a prospective, randomised clinical study comparing conventional sternotomy (CS) and minimally-invasive mitral valve surgery (MIC) approaches, we performed a propensity score matched analyses to evaluate both methods. Propensity matching was able to rule out come cofounders.

A total of 1,121 patients underwent mitral valve (MV) surgery



(522 CS and 599 MIC) between January 2005 and December 2014. Propensity scores were generated with a 1:1 matching leading to 336 CS and 336 MIC patients. Mean patient age in all comers was 65.7 years (CS) versus 63.5 years (MIC; p<0.05), and 47.4% (CS) versus 43.0% (MIC) were female (p=n.s) Aortic cross-clamp time was 77.5 ±27.4 min (CS) versus 84.3 ±35.2 min (MIC), p<0.001. Re-thoracotomy rate was 6.6% (CS) versus 3.0% (MIC). 30-day mortality was 3.0% (CS) vs 1.4% (MIC).

After PS matching, mean patient age was 64.1 years (CS) vs 64.4 years (MIC; p=n.s) and patients were female in 44.0% (CS) versus 45.5% (MIC; p=n.s). Aortic cross-clamp time was 75.4±26.0 min (CS) versus 87.2±38.2 min (MIC; p<0.001), re-thoracotomy rate was 10.4% (CS) vs 7.4% (MIC; p=n.s). 30 day mortality was 4.5% (CS) vs 3.6% (MIC). Mitral valve repair rate was 98.2% (CS) vs 99.3% (MIC; p=n.s).

The results of this study are important for further clinical practice because they nicely demonstrate that a modern, minimally-invasive approach can be safely implemented "step by step" in a large cardiac surgical unit where a conventional sternotomy approach was, for many years, the standard of care to treat mitral valve disease. Thus our results clearly show that the use of minimally-invasive techniques leads to a direct benefit for the patients. Further investigation with long-term survival and long-term results of MV should be conducted.

In conclusion, MIC is as safe as CS leading to excellent outcomes and high repair rates. It follows that MIC should be the standard approach for all patients.

Cardiac | Rapid Response | Minimizing sternal wound complication

Use of an allogeneic bone tissue in the treatment of severe post-sternotomy massive bone loss defects – six-year experience

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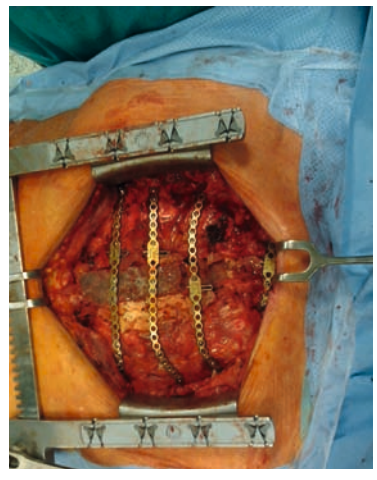
Deep sternal wound infection poses a serious problem in cardiac surgery, with an up to 40% risk of mortality. Massive loss of sternum bone tissue and adjacent ribs results in major chest wall instability, causing respiratory insufficiency and defects of soft tissue healing. Proposals for managing the situation have been published, but the complexity of the issue precludes unequivocal resolution. Based on orthopaedic experience, we used allogeneic bone grafts as a viable option.

During the period 2011-2015 we performed the transplantation of allogeneic bone grafts in 13 patients. An allograft of the sternum was used in 10 cases, an allograft of calva bone in one case, and in two cases crushed spongy bone only. Vacuum wound drainage and antibiotic therapy were applied in the treatment of all patients. The aim of therapy is to achieve three consecutive negative results when using microbiological tests on the wound. Negative results of these microbiological tests are the main criteria for timing the chest wall reconstruction.

Bone allografts were prepared by the official Tissue Centre. An allogeneic graft must meet the legislative criteria of the Czech Republic and the European Association of Tissue Banks. Prior to performing an allogeneic bone-graft transplant, informed consent of the patient is always required. Sternal bone recovery is performed as multi-tissue procurement, and limited to viable cases of sternum bone-graft harvesting before the autopsy. All deceased donors treated for infectious disease, sepsis, malignant tumours or systemic and autoimmune diseases at the time of death were withdrawn from the donor list. Donor blood serum samples are tested for antibodies and HIV types 1 and 2, hepatitis B surface antigen (HbsAg), hepatitis C antibodies (anti-HCV) and human T-cell lymphotropic virus I and II antibodies.

Prior to the transplantation of allogeneic graft, it is necessary to perform bilateral release of pectoral musculocutaneous flaps. The resection of residual edges of the sternum and the ribs is then performed within the precautionary line reaching 1–2 cm into the healthy tissue. To fix the allogeneic bone graft and simultaneously stabilise the whole chest wall, transversal two-way malleable titanium plates are used. Crushed allogeneic spongy bone is applied to reinforce the line of contact of the graft and the edges of residual skeleton. The closure of soft tissue can be performed by direct suture of bilaterally resected pectoral flaps.



Reconstruction of the chest wall using the allogeneic graft of sternum

In eight cases, healing of the reconstructed chest wall occurred without further complications. In four cases, additional re-suture of soft tissues and skin in the lower pole of the wound was necessary. Median follow-up of all patients in the series was 21 months (1-36 range). Five patients with proven complete wound healing were removed from follow-up after 36 months.

During the subsequent follow-up, whole-body planar and SPECT/CT bone scintigraphic examination of the chest wall were performed in five cooperating patients. High healing activity of the graft was proven in all cases, both after the operation and during the check-up. In one case, there was actually a reduction of osteopaenic defect by 42%.

Our existing results show that allogeneic bone-graft transplantation is a promising and easily applied method in the management of serious tissue loss in sternal dehiscence, with favourable functional and cosmetic effects.

Thoracic | Rapid Response | Thoracic

Recurrences following staple line coverage after bullectomy for idiopathic spontaneous pneumothorax: the role of oxidised regenerated cellulose sheet.

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Objectives

We aim to identify the feasibility of the oxidised regenerated cellulose (ORC) sheet coverage after stapler bullectomy for idiopathic spontaneous pneumothorax (ISP).

Methods

Medical records of 280 patients less than 40 years old with ISP undergoing stapler bullectomy without pleurodesis at our institution from 2009 to 2016 were reviewed. There were three types of procedures used during the study: wedge resection alone (WR), WR with local coverage (WR+L), and WR with widespread coverage (WR+W). Applicable intraoperative videos at reoperation evaluated features of regenerative bulla.

Results

The overall pneumothorax recurrence rate was 14.3%. The recurrence rate in the under 18-years-old (U-18) group was significantly higher than the over 19-years-old group (23.0% vs 9.44%, p=0.002). In the U-18 group, the widespread coverage significantly reduced the relapse rate (15.7%, p=0.042) and shorten the postoperative drainage duration (WR; 2.6±1.4 days, WR+L; 2.0±1.1 days: p=0.003, WR+W; 1.8±1.3 days: p<0.001). The maximum cyst size was relatively small in the covering group when compared to the non-covering group (11.0±4.1 mm vs 27.1±23.3 mm, p=0.073). Intraoperative videos showed the white pleural thickening with histological elastic fibrous hyperplasia within the covering area. Pleural changes in the covering group were significantly higher than those in the non-covering group (90% vs 0%, p<0.001).

Conclusions

Staple line coverage after bullectomy for ISP decreased the postoperative recurrence significantly in those under 18 years old, and shortened the postoperative drainage duration by pleural reinforcing and inhibition effect of bulla.

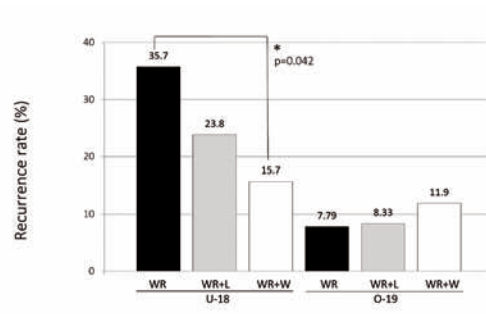

Figure 1. Procedure attribution to relapse of spontaneous pneumothorax. In U-18 group, the recurrence rate was significantly lower in the wedge resection with widespread covering group than in wedge resection alone group. Abbreviations: U-18, under 18 years old; O-19, over 19 years old; WR, wedge resection; WR+L, wedge resection with local covering; WR+W, wedge resection with widespread covering.

EACTS 2016 Floor Plan

Exhibition opening times:

Sunday 2 October	**15.00 – 19.00**
Monday 3 October	**09.00 – 17.00**
Tuesday 4 October	**09.00 – 17.00**

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092	Dendrite Clinical Systems Ltd
009	EACTS-Euromacs and QUIP Programme
113	EACTS-The European Association For Cardio-Thoracic Surgery
114 & Training Village Unit 8	Edwards Lifesciences
120	Eurosets SRL
016-017	Fehling Instruments GmbH & Co. KG
028	Genesee BioMedical Inc
110	Getinge Group
008	Hamamatsu Photonics Deutschland GmbH
065	Heart and Health Foundation of Turkey
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116D	JOMDD Inc
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032	Labcor Laboratorios Ltda
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115 & Training Village Unit 4	St Jude Medical
082	stroke2prevent
010	STS-The Society Of Thoracic Surgeons
051	Sunoptic Technologies
127	Symetis SA
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039	Tianjin Plastics Research Institute Co Ltd (TPRI)
107	Tianjin Welcome Medical Equipment Co Ltd
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116A	VGS-Vascular Graft Solutions Ltd
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AtriClip PRO2™ Device	Sacha Salzberg, MD	Monday, October 3	10:30-12:00
cryoFORM™ Probe	Thorsten Hanke, MD	Monday, October 3	15:30-17:00
EPi-Sense® Coagulation Device	Chris Blauth, MD	Monday, October 3	15:30-17:00

SPOTLIGHT ON SURGICAL ABLATION & APPENDAGE MANAGEMENT SERIES

Freezing Equals Freezing? Efficacious and Efficient Cryoablation Techniques	Nicolas Doll, MD	Monday, October 3	10:00-10:30
Staged Hybrid Approach: A New Opportunity	Sir Malcom Dimple-Hay, MD; Guy Haywood, MD	Monday, October 3	15:45-16:15
The Endoscopic Approach: How to Ablate Efficaciously AND Safely	Mark LaMeir, MD	Tuesday, October 4	10:00-10:30
Isolation of the Posterior Atrial Wall: A Concomitant Treatment Strategy	Mohamed Bentala, MD	Tuesday, October 4	15:45-16:15
Our Most Lethal Attachment: How to Manage the Left Atrial Appendage	Steven Hunter, MD	Tuesday, October 4	16:30-17:00

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