

The percutaneous approach to mitral valve repair

Surgery is the gold standard for most patients with mitral regurgitation but advances in percutaneous techniques are increasing less invasive procedures

Percutaneous mitral valve repair is a rapidly evolving area, with new technologies on the horizon. Currently, the MitraClip for edge-to-edge repair is the only device which is CE marked and available for use in Europe.



In the USA, the MitraClip is still considered an investigational device, under continued access policy, following the completion of the EVEREST II (Endovascular Valve Edge-to-Edge REpair Study) randomized control trial comparing mitral valve repair using the MitraClip vs. surgery.¹

About 50 centres in Europe have been using the technique since September 2008, and 2 years later, 1000 procedures have been performed. The rate of implants in Europe is accelerating, and in September 2010, around 100 patients were being treated per month.

The issue now is how to incorporate the MitraClip technique alongside the standard treatment of mitral disease, which is surgical valve repair or replacement.



Francesco Maisano

As a surgeon, Francesco Maisano, associate professor of surgery at San Raffaele Hospital in Milan, Italy, has hands-on experience of both surgical and transcatheter procedures.

Almost every day he faces the challenge of finding the right candidates for the MitraClip at a time when the procedure holds great promise but surgery remains the gold standard.

Despite the reliable results achieved with surgery, the European Society of Cardiology's EuroHeart Survey shows that up to 50% of the patients with mitral disease are not referred for surgical treatment. Such patients are usually elderly and have co-morbidities.

'Surgery carries a risk which is felt to be too high for the majority of these patients', says Maisano. 'So minimally invasive procedures are developed to overcome these risks, and MitraClip is probably the first option which is available'.

Just one randomized trial has been completed on the use of the MitraClip to treat mitral regurgitation (MR). The results from the EVEREST II trial, conducted in the USA, were reported at the American College of Cardiology meeting last year. They showed that the MitraClip is not inferior in terms of efficacy and superior in terms of safety when compared with surgery.

The limitation of applying these findings to clinical practice is that the trial was performed in patients, who were surgical candidates, and most of them had degenerative MR. In Europe, patients eligible for surgery are usually not treated with the MitraClip; the device is mainly used in selected patients who are at high risk for surgery.

Maisano says: 'Although the data support the hypothesis which was designed by the trialists, [it is not] convincing enough to support a wide adoption of this technique in patients at low risk for surgery. There is a need for more contemporary data, since the EVEREST data reflect the initial learning curve. Today, results are improving due to improvement in the learning curve and to more experience in patient selection and perioperative care'.

Today, most patients treated with the MitraClip in Europe and the USA have heart failure. Initially, the device was primarily devoted to treating degenerative MR, a pathology where chordal elongation or rupture is the main issue, and surgery is very effective.

There has been a shift of indication for the MitraClip to heart failure patients with functional (secondary) MR, in which the anatomy is normal but function is impaired. Surgery has not

been widely accepted for these patients because it carries a high mortality risk of 5–15%. 'In these patients MitraClip looks to be a very interesting alternative', says Maisano.

He is a co-principal investigator of the ACCESS European registry which is comparing the MitraClip to surgery and medical therapy in heart failure patients with functional MR. Preliminary results show that the MitraClip is a low-risk procedure that improves symptoms. Effectiveness is higher than that found in the EVEREST trial, a finding Maisano attributes to the learning curve. The MitraClip technique was in an early stage of its development when patients were treated in EVEREST, and today, there is almost 5 years of experience worldwide. MitraClip implants are now faster, and procedural success is obtained in more than 95% of the cases.

Around 30 centres in Europe are participating in the ACCESS registry, which is still enrolling. All 50 European centres performing the MitraClip procedure were invited to take part, and submissions for ethical approval are ongoing.

ACCESS was designed to understand, in a large-scale multicentre registry, if and to what degree the MitraClip offers an advantage over current treatment both clinically and to the health economy. Information will be collected to support decision makers on reimbursement.

The procedure is less invasive and therefore creates fewer burdens to the health economy because unlike surgery, patients do not require post-operative care in rehabilitation centres. And for heart failure patients, several studies have suggested that treatment with the MitraClip leads to decreased hospitalizations compared with medical therapy.

In the USA, REALISM is a follow on to EVEREST II and is enrolling patients with similar characteristics to the ACCESS registry. The challenge will be to get Federal Drug Administration (FDA) approval for use of the MitraClip when there is enough data to support its use in patients with degenerative MR who are good surgical candidates.

The message for cardiologists, says Maisano, is that the MitraClip procedure looks very promising and is already addressing unmet needs. 'Specifically, if we think about the patients who are not referred for surgery because of high risk, I think cardiologists should consider the option of treating these patients with this therapy'.

However, a word of caution is warranted for the lower risk populations, given the quality and quantity of data available on which to make treatment decisions.

Ultimately, he believes that transcatheter valve interventions have the potential to become the principal method for treating patients, but more evidence is required before this can become a reality.

It is important to distinguish the comparison between percutaneous and surgical treatments for mitral valve disease and the percutaneous coronary intervention vs. coronary artery bypass grafting story. The latter compares two different procedures, a bridging procedure to a reopening or enlarging of stenotic plaques with a stent.

The mitral valve disease discussion is about the same procedure (mitral valve repair) delivered in two different ways, one open heart and the other closed heart. Most percutaneous procedures for mitral valve disease are designed upon a very solid surgical

background. MitraClip, for example, is the evolution of a surgical technique into a transcatheter technique.

Surgery provides the advantage of a clear image of the procedure, but progress in imaging will improve the percutaneous situation. In particular, transcatheter techniques benefit from being performed on the beating heart, using echocardiography guidance; an advantage over conventional surgery, where procedures are performed during cardioplegia 'I think imaging will be part of the components for the success of these therapies', says Maisano.

Today, most of the imaging is echocardiography but he expects the computed tomographic scan and advanced fluoroscopy to be incorporated into transcatheter procedures.

Another limitation of transcatheter interventions for mitral valve disease is that the MitraClip is still the only device available. Up to two-thirds of the patients, particularly those with degenerative MR are turned down because they do not have the required anatomical characteristics (see Box 1). The enrolment rate is, however, higher in heart failure patients with functional MR.

Box 1. Anatomical indications include

Mitral regurgitation should originate from the middle of the valve (the so-called A2–P2 region).

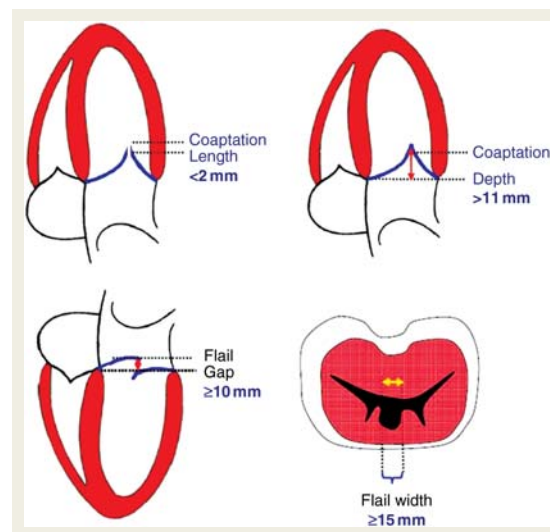
Baseline valve area should be $>4\text{ cm}^2$.

Leaflets should be free from calcifications.

In degenerative MR, the distance of the leaflets free edges (flail gap) should be $<1\text{ cm}$.

The procedure is indicated for degenerative and functional MR.

It is contraindicated for rheumatic and acute endocarditis.



Mitral valve specifications

New devices are expected in future that will increase the possibilities for treating mitral valve disease using a catheter. As in surgery, mitral valve repair is a combination of leaflet repair (such as edge-to-edge repair using the MitraClip) and annulus repair. Annular devices will be available in the future that should increase

the ability to treat patients effectively and the number of patients who are eligible for transcatheter procedures.

The MitraClip is less effective than surgery in reducing the degree of MR but registries show that the ability to treat MR with the device is improving with better imaging and increased understanding of the procedure. However, it is unlikely that the MitraClip will become superior to surgery in reducing MR; most patients leave the hospital with some residual MR. Percutaneous procedures may become more effective than surgery when annuloplasty is available.

But residual MR does not appear to be a significant clinical issue. An abstract presented by the EVEREST investigators at the Transcatheter Cardiovascular Therapeutics meeting in Washington in September showed that low degrees of residual MR (up to 2+ on a scale of 0–4) have minimal impact on clinical outcomes.

The scenario in percutaneous approaches to mitral valve disease is a fast changing one and Maisano advises cardiologists to stay tuned. He says: 'We need to be ready for these changes and we need to be balanced in accepting the novelty while avoiding discarding surgery, which remains the gold standard for most patients with mitral regurgitation'.

J Taylor, MPhil medical journalist

Reference

1. Mauri L, Garg P, Massaro JM, Foster E, Glower D, Mehoudar P, Powell F, Komtebedde J, McDermott E, Feldman T. The EVEREST II Trial: design and rationale for a randomized study of the Evalve MitraClip system compared with mitral valve surgery for mitral regurgitation. *Am Heart J* 2010;**160**:23–29.

The future treatment of most cardiovascular diseases lies in percutaneous interventional techniques

Rüdiger Lange discusses the changes that are occurring in this new treatment technology that is developing rapidly and requires accurate imaging techniques

Today, the gold standard for mitral valve disease and other cardiovascular diseases requiring an invasive treatment is conventional surgical repair, especially if it is done in a minimal invasive fashion. However, the future may see transcatheter repair and replacement techniques to stepwise replace open surgical techniques. It is a strong statement coming from the director of the Department of Cardiovascular Surgery at the German Heart Centre in Munich, Professor Rüdiger Lange. 'Although I am a surgeon, I absolutely see the future of cardiovascular disease treatment in interventional or percutaneous techniques'.

He believes that the experienced surgeons have acquired over the last 20 years in mitral valve repair, starting with the Carpentier technique and moving on to new developments, combined with the many devices that will be developed in the future will make transcatheter repair 'a very feasible option'.

Not all of the devices that are on the market right now are in their final versions and many techniques will be improved in the future. 'For example I'm not sure whether the MitraClip (Figure 1), [for percutaneous edge-to-edge repair] is really the best option to repair a mitral valve because this technique has

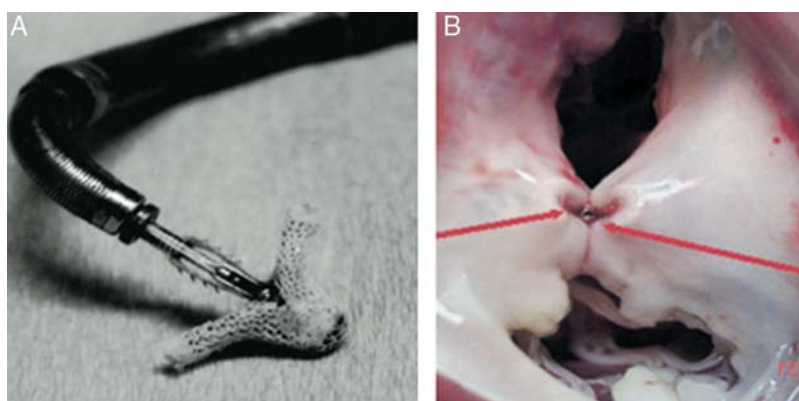


Figure 1 (A) MitraClip device (Abbott, Park, IL, USA). (A) Deliver catheter with MitraClip arms in open position. (B) Animal mitral valve pathology specimen showing edge-to-edge clip *in situ* creating a double-orificed mitral valve.

been avoided in surgery for many years already now', says Lange. In fact, there was enthusiasm for the Alfieri edge-to-edge technique in the early 2000s, but in the last 5–6 years, most surgeons have avoided it because it creates a double orifice mitral valve with an unphysiological inflow. Furthermore, the long-term outcomes were inferior to those achieved using other repair methods such as chordal replacement in conjunction with mitral ring annuloplasty which has a very low reoperation rate.

Unfortunately, to date, the minimal invasive surgical approach to the mitral valve is not yet widely accepted in the European surgical community; in Germany, for example, it is chosen for just 33% of the patients. In the USA, the proportion is even lower. Lange speculates that it is unpopular because the techniques are more complicated.

Percutaneous equivalents to many of the good surgical repair techniques are either available or on the way. The NeoChord device, *Figure 2* for example, is used to implant artificial chordae via the apex of the left ventricle, a technique Lange has performed with very good results. Future developments with this technique will probably see a true percutaneous device. New devices for transcatheter placement of mitral rings are expected to come on the market in 2011. GDS has developed a truly percutaneous device for posterior ring annuloplasty. Valtech will come with an adjustable ring, placed via the left atrium. Other companies, such as ReCor or QuantumHeart, offer techniques for mitral annulus reduction by applying different energy sources to shrink the fibrous tissue. Transcatheter valve replacements will be possible in 2–3 years predicts Lange, although some start-up companies are planning their first implant for 2011.

'In the treatment of heart disease you will see not only a fusion between disciplines, that is between surgery and cardiology, but you will also see a subspecialisation', says Lange.

Cardiovascular disease specialists will work in high volume heart centres within one 'Heart Team' which will comprise interventional cardiologists, non-invasive cardiologists, surgeons, imaging specialists, intensive care specialists, and anaesthesiologists. The heart team as a whole will be able to offer all treatment options that are available. Patient safety associated with the best possible treatment effect will become a primary goal.

Surgical and percutaneous therapies are set to become more and more complex in the future. This will make it impossible for one person to learn and apply all the available techniques. Treatment will be delivered by a cardiovascular disease specialist (or 'proceduralist') who is trained in one of a number of fields like valve reconstruction, coronary artery disease, paediatric heart disease, congenital heart disease, rhythm disease, or artificial heart and transplantation.

In order to take out treatment bias, centres will have diagnostic teams and treatment teams. Patients will visit the imaging centre first, where a diagnostic team of surgeons, imaging specialists, and cardiologists (non-invasive and invasive) will examine the options and come up with a recommended treatment. The patient will then go to the treatment unit, where the treatment team will implement the recommendation.

Accurate imaging will be the key to the entire future of cardiovascular disease treatment. 'One of the most important prerequisites for all nonsurgical procedures is imaging', says Lange. 'There

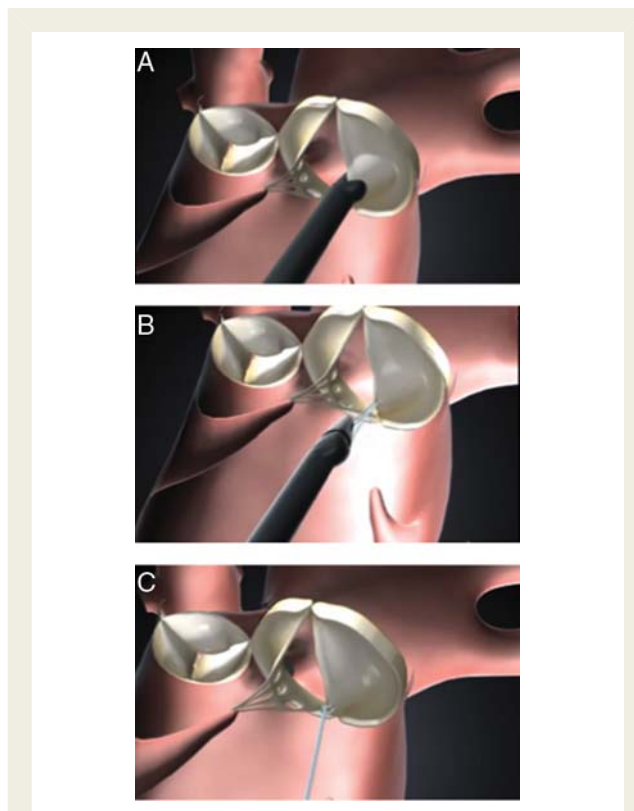


Figure 2 NeoChord device (Neochord, Inc., MN, USA). The NeoChord device can be used for the treatment of mitral regurgitation from ruptured or elongated chordae. (A) The catheter delivery system is introduced via a left lateral thoracotomy through the left ventricular apex to capture the free edge of the posterior mitral valve leaflet under transoesophageal echocardiographic guidance. (B) After capturing the prolapsing leaflet, the device attaches artificial chords to the leaflet. (C) The delivery catheter and artificial chord are pulled back through the left ventricle to the outside of the heart. Under transoesophageal echocardiographic guidance, the surgeon can adjust the tension of the artificial chord to allow for appropriate leaflet coaptation and reduction of the mitral regurgitation. Once satisfied, the suture is cut off and sutured to the apex of the heart.

are so many different modalities and the development in imaging is so fast that a lot of things that we may not think possible today will develop in the future'.

He is confident that in some years from now imaging will make it possible to close a perimembranous ventricular septal defect safely—'not as is done in some instances today where it's still very hazardous'. Interventional treatment of heart disease will be performed as percutaneous beating heart procedures using imaging modalities that make the structures and the pathological morphology visible as in open heart procedures.

There will always be a place for conventional surgery, particularly in emergency situations (e.g. ventricular rupture or aortic dissection), trauma, bail-out for device perforations and misplacements, congenital malformations, and artificial heart transplant. Surgeons will also be needed for very complex cases, where

the percutaneous treatment did not succeed, or where patients have had multiple procedures and only surgery can remove devices or reconstruct vital structures of the heart.

The question is whether there will be surgeons in 15 or 20 years from now who are able to do this kind of complex surgery. Their skills will be needed on rare occasions and, like playing a musical instrument, if they are not constantly practising their skill will deteriorate.

'That will be a problem', says Lange. 'Where do we find the experienced surgeons 15 or 20 years from now, or will we not need surgeons altogether anymore, I don't know'.

Surgeons should accept and get involved with interventional percutaneous approaches if the surgical profession is to survive in the future. Young surgeons have to define their role in this whole new 'transcatheter beating heart treatment' business.

And surgeons must learn from their past experiences (e.g. coronary artery bypass surgery vs. percutaneous coronary interventions). Patients will always prefer a lesser invasive treatment option that is associated with less morbidity and mortality—even if efficacy may be compromised. Surgeons should not fight new developments but make themselves an integral part of the development and application.

Today, all device implantations need to preserve the option for surgery. In future, this requirement will depend on how safe the devices and operators become. In Lange's centre, it took 300

transcatheter aortic valve cases before there was a significant and considerable improvement in survival and the onset of complications. Having done more than 500 cases now and with improvements in the devices, they could easily offer the procedure to younger and less diseased patients.

Proctoring will be used to spread knowledge of techniques, which means there will be special centres where doctors can go and learn new techniques and experts from those centres will also visit other hospitals and teach colleagues there. Proctoring is already taking place. The German Heart Centre in Munich has training units dedicated to teaching minimal invasive mitral valve, transcatheter aortic valve, and endoscopic graft harvesting.

In the heart teams of the future, the question will not be whether it is the interventional cardiologist or the surgeon who performs the procedure, they will do it together and in that way deliver the best outcome.

Research is needed to improve existing devices and to develop new ones that are simpler and therefore lead to fewer complications. But the main focus for research should be imaging, which is central to progress in percutaneous techniques. Lange says: 'You can have the best devices [but] if you're not guided by good imaging you will fail'.

J. Taylor, MPhil

Information for all: the American Heart Association

Voluntary health agency the American Heart Association is known by patients worldwide as a trusted source of information on heart disease. But the association also offers research funding and services for scientists and clinicians, all as part of its mission to build healthier lives free of cardiovascular diseases and stroke. Helen Jaques finds out more

In the twenty-first century, with widespread access to the Internet and 24 h television news channels, it is hard to imagine any American ever not having enough information. But it was a paucity of information that led to the foundation in 1915 of what was to eventually become the American Heart Association (AHA).



AHA Logo

A group of physicians and social workers in New York City were concerned over the 'almost unbelievable ignorance about heart disease', according to Dr Paul Dudley White, one of the founders. These individuals banded together to conduct studies under the banner of the Association for the Prevention and Relief of Heart Disease. Word spread and in about 10 years the national AHA was founded. As the association grew, so did its remit. By the 1940s, members were looking to expand the AHA's activities beyond simply gathering information through research studies and decided to move into disseminating this information by educating the general public about heart disease. In 1948, the association transitioned from a scientific society into a voluntary health agency.

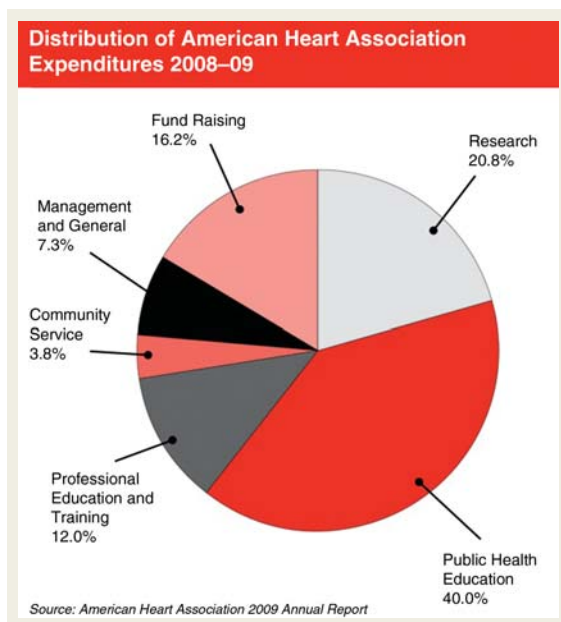
The mission of the modern AHA is 'building healthier lives, free of cardiovascular diseases and stroke'. The association measures its progress via very clear and quantitative goals, the major one being to reduce coronary heart disease and stroke by 25% by 2010. And

they have made a good job of achieving this goal too. By 2009, national death rates for coronary heart disease and stroke in the USA had fallen by 36.5 and 32.5%, respectively.

What the AHA is perhaps most well known for is its patient outreach and consumer health campaigns. The AHA distributed more than 5.4 million pieces of patient education information in the 2009 financial year, whereas its HeartHub patient web site reaches more than 30 000 new visitors a month. Information plays a key part in the AHA with regard to its activities for professionals too, largely through the generation of information by the research arm of the organization and the dissemination of this information by the speciality membership councils.

Research

The AHA funds research in clinical and basic sciences, bioengineering, biotechnology, and public health. The association is second only to the National Heart, Lung, and Blood Institute in funding research in the USA. Since 1949, it has spent more than \$3.2 billion on research into cardiovascular diseases and stroke. The winners of 11 Nobel Prizes received funding from the AHA, and the association has had a role in breakthroughs such as the first artificial heart valve, implantable pacemakers, and drug-eluting stents.



The majority of the money allocated to fund research goes into Scientist Development Grants, which help highly promising young scientists get started as independent investigators. In fact, more than 70% of the AHA's research dollars go towards young investigators, a total of \$100.8 million in 2008–09.

Richard T. Lee, an associate professor of medicine at Brigham and Women's Hospital and Harvard Medical School in Boston, received funding both at the start of his career and to support his lab's research into the protein ST2, a biomarker that could potentially be used to judge prognosis after myocardial infarction. 'I practiced cardiology full time for ten years before I started my laboratory', says Lee. 'And so because I had been a full time clinical cardiologist

it was much more difficult for me to start my research. Getting AHA support to make that transition was extremely helpful'.



Richard Lee

The emphasis that the AHA places on young investigators and new projects is often crucial in getting promising research off the drawing board and into the lab. 'When projects start brand new, quite often you need some support from organisations like the AHA to help reveal that they have potential', he says.

The association receives a huge number of applications for research grants, but sadly has to turn down a considerable proportion. Although the AHA funded 1021 projects in 2008–09, it had to turn down a further 1000 applications. However, the association works with several private foundations and corporations to stretch the number of projects they can fund. For example, the association receives funding from pharmaceutical companies via the AHA Pharmaceutical Round Table, a coalition of 10 pharmaceutical companies including Bristol–Myers Squibb and AstraZeneca. This group donated \$14.5 million in 2008 to found four Pharmaceutical Foundation Outcome Research Centres that allow the association and industry to investigate jointly what interventions, environments, and patient factors most influence outcomes for patients with heart disease or stroke.

Scientific councils

Of course, all this fabulous research doesn't do the association, or the American public, much good if it's left to languish in drawers or on scientists' computers. To make sure this doesn't happen, the AHA runs membership councils for scientists and clinicians that are aimed largely at promoting and disseminating research.

The membership programme is made up of 16 scientific councils, such as the Council for High Blood Pressure Research and the Council on Clinical Cardiology. Lawrence L. Rudel, professor of biochemistry and comparative medicine at Wake Forest University School of Medicine in North Carolina, is a chair of the Council on Arteriosclerosis, Thrombosis and Vascular Biology (ATVB). 'There are approximately 4,000 members of the ATVB council', he says. 'What we do is promote basic research among all those individuals and encourage them to participate with other scientists

in the AHA, with the goal of encouraging research into the prevention of heart disease'.

Just like the research arm of the AHA, supporting young investigators is a key goal of the specialty councils. The ATVB council annual conference, which was attended by more than 1000 delegates this spring, is deliberately aimed at bringing together young investigators, who submit posters or do oral presentations, and senior scientists, who give plenary lectures. Networking opportunities like this and the chances they provide to set up exciting new research collaborations are the primary benefit of joining an AHA council, according to Rudel. The councils also present awards that recognize investigators in the formative years of their careers. The Council on Basic Cardiovascular Sciences, for example, gives out four awards a year to young investigators, as well as travel grants to ensure early career investigators can actually get to the annual meeting and make the most of the networking opportunities there.

You might be wondering what all this has to do with researchers or clinicians in Europe. The AHA scientific councils all accept members from outside the USA and encourage international delegates to attend the council conferences and the huge AHA multidisciplinary conference each autumn (the AHA Scientific Sessions, to be held 13–17 November this year). 'We pride ourselves in the fact that at the ATVB conference, for example, every year if there are a thousand people we'll have 200 international delegates', says Rudel.

Europeans are also represented on the editorial boards and as the authors of papers in the five AHA journals: *Arteriosclerosis*,

Thrombosis, and Vascular Biology; *Circulation*; *Circulation Research*; *Hypertension*; and *Stroke*. Approximately 30–40% of the papers in *Arteriosclerosis, Thrombosis, and Vascular Biology* come from researchers in Europe. The AHA's commitment to supporting young researchers also extends overseas: the association has established an international mentoring programme that pairs young physicians and scientists outside the USA with senior members of the AHA.

The future

So, what does the future hold for the AHA? The overall aim for 2010 onwards is to focus on lifestyle changes and prevention of heart disease, with the target of a 20% improvement in the cardiovascular health of all Americans by 2020 being added on to the already tough goal of a 20% reduction in deaths from cardiovascular disease and stroke by this date. The research strategic plan for up until 2016 will see the AHA continuing to fund highly meritorious research and support early career investigators, as well as putting new focus on clinical and population health research and on translating research into practice.

The association will no doubt use its centenary in 2015 to reassess and further push towards these goals. Given its successes in preventing and treating heart disease to date though, it seems like the association will have much to celebrate too.

Helen Jaques is a British freelance medical writer and editor.

People's corner

The People's Corner Box is about cardiologists: promotions, new positions, prizes won, awards given, retirements, and obituaries. Please submit news of yourself or of a colleague (maximum 400 words) to Dr Andros Tofield at docandros@bluewin.ch

CardioPulse announces a new series: the personal experiences of émigré cardiologists

CardioPulse is starting a new series about the personal experiences of cardiologists who have moved to practice in another country/culture. Their views and feelings on confronting another language, another healthcare system, different lifestyle habits, how their families cope, and adjust to the new environment.

Should you wish to contribute, please contact Dr Andros Tofield at docandros@bluewin.ch

Personal experiences of émigré cardiologist: Johannes Waltenberger

Working abroad: Professor Johannes Waltenberger, chair of invasive cardiology at Maastricht University Medical Centre, talks to Emma Wilkinson about the career advantages of moving between countries



Johannes Waltenberger

Having worked in Germany, Sweden and the Netherlands, as well as short training stints in Scotland and the USA, Prof. Johannes Waltenberger, who is also principal investigator at the Cardiovascular Research Institute Maastricht, is well placed to advise on the pros and cons of moving between countries to further your career.

He initially trained as a medical student close to his home town in Heidelberg, with some additional months of education at the Universities of Glasgow, Boston and Harvard. The Ruprecht-Karl-University in Heidelberg was also where he did his internship. But then came a move that kick-started a career combining work at the bedside with studies in the laboratory. In 1990, he moved to the Ludwig Institute for Cancer Research in Uppsala, Sweden, to undertake postdoctoral training looking at vascular growth factors. It was then back to Germany, this time at the University of Ulm, to complete his residency while at the same time setting up a research programme on vascular growth factors and angiogenesis. His move in 2003 was to Maastricht in the Netherlands.

It was, he says, never his intention to move abroad — it was his desire to see his career progress in a certain way that led him to make those choices. But it is certainly an option he would recommend to other young medics. 'What I have always wanted to do and this became very clear during my medical studies is to have a good grounding in scientific work. I had several options in the USA but then the Sweden opportunity came up as a very interesting one. I enjoyed the idea of a European way. After that Scandinavian experience my plan was to move back to Germany'.

By the time he was offered the position in Maastricht, Waltenberger had a young family, with children in school, making decisions to move more complicated. But fortunately there was a nice compromise available. He decided to move to Aachen in Germany near the Dutch border. It meant a 30 km commute to work, but it enabled the children to stay in the German education system.

'Moving at a younger age is much easier because there is not so much involved, but if you are 40 or above there are also considerations like pension plans and you have family so things become different. It can be solved but one has to overcome some bureaucratic steps. In the case of Maastricht it involved moving to another city but not another country; but again, it opened another view across European borders'.

Of course, moving to any new country involves a degree of culture shock but the major differences that Waltenberger had to come to grips with were not to be found in the laboratory but in navigating very different health systems.

'The Dutch healthcare system is rather centralized and many decisions are made by national policy makers,' he says. This is very different from his experience in Germany where patients have far more independence over choice of provider and access to specialists and doctors have more independence over procedures—especially newer and experimental treatments.

'For example, if you want to perform high-end procedures like percutaneous aortic valve replacement in the Dutch system your hospital needs permission from the ministry to do that. About three years after the procedure was introduced in the Netherlands, the authorities did a national investigation into all the centres performing this and only five of 12 received permission to continue; including ours in Maastricht. In many other countries, there are much fewer centralised limitations—I don't think it is better or inferior, just different; and requiring different strategies to succeed'.

There are certain skills, or personality traits, which may ensure greater success in fitting in to a new country or culture, he says, but really, you just have to be aware that it takes time to socialise yourself. 'Working successfully in another country requires curiosity and sensitivity for the real differences underneath the surface. Take the centralised Dutch health care system and its progressive reform in 2006. Differences and changes can only be appreciated if one understands the whole picture, not just single aspects at a given moment of time. The medical world is currently undergoing major changes almost everywhere, often budget-driven. It is

therefore extremely valuable to gather empirical experiences oneself to help understand which changes are successful—and why—and, even more importantly, which aspects cannot stand the test of time—and again—why’.

Working abroad requires other skills, and learning the language is all part of the game. ‘When I got my contract for the Netherlands it said I had to learn the Dutch language and I was sent on a two-week course. One needs to be prepared to go through that. My department was very supportive, especially in the beginning. During my first year they completely refused to speak to me in English or German because they said this was the only way to really help me, otherwise, I would end up with a low school level of the language.’

He adds: ‘What is also important is that the most challenging aspect of language is not dealing with the patients, for example older patients who have had a stroke or who have no teeth or a very strong dialect, because you almost always have the chance to ask again. The real challenges are professional discussions and

negotiations with management, because you cannot ask them very often, to repeat what is said’.

All these difficulties can be overcome with time he says. What is needed and what is important, is having an interest and vision in your subject or area of expertise. With that in place, it makes it easier to overcome any hurdles associated with being in a foreign environment. In the case of Waltenberger, his drive to combine basic science with his clinical work has been at the forefront of all his career decisions rather than where he was based.

‘I have felt very comfortable in every place I have worked—the education and clinical training in Germany was great, the research environment in Sweden was fantastic, and I was given the chance to set up my own clinical and research programme in the Netherlands. The three stages came with different goals and opportunities and I would not have wanted to miss any of them’.

Emma Wilkinson MA, freelance medical journalist