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Latest developments mean continuing progress for TAVI

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As we transition from summer to autumn, the first half of 2011 will be considered as a crucial time in the history of TAVI and Edwards Lifesciences. Along the way we have met a number of important milestones for our company and for TAVI patients.

In the first quarter of 2011, we had the very exciting results from The PARTNER Trial. More recently, the FDA Medical Devices Advisory Committee voted to recommend approval of the Edwards SAPIEN transcatheter heart valve for the pre-market approval application in the United States.

We are also encouraged by the introduction of the 29 mm Edwards SAPIEN XT THV and the new NovaFlex+ delivery system. The feedback on these changes are, as reported elsewhere in this edition of TAVItalk, very positive. The introduction of the eSheath is especially impactful thanks to its lower profile, allowing for easier introduction, potentially resulting in improved patient outcomes.

In this issue we feature articles ranging from case reviews and the importance of follow-up to the most recently published data, which was also presented at EuroPCR 2011.

Finally, I would like to thank all those who have contributed to this edition of TAVItalk; without their support it would not be possible to publish this newsletter.

New Edwards NovaFlex+ Delivery System & eSheath: Early experience and observations

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Our centre was amongst the first to start working with the next-generation Edwards SAPIEN XT transcatheter heart valve (THV), NovaFlex+ transfemoral delivery system and the eSheath shortly after their market release.

To put this into perspective, over the last year we treated about 100 patients in our centre with Edwards THVs. Of these, 50 were treated transversally with the NovaFlex+ delivery system, achieving a 98% procedural success rate, precise valve positioning and very low vascular complication rates (one out of the 50 patients in our centre). Our centre’s results are being compiled and analysed for future publication. The new transfemoral system kit incorporates three major components that make the procedure, in my view, easier to use.

The eSheath (16 Fr for the 23 mm valve and 18 Fr for the 26 mm valve) is easy to introduce because of its lower profile, allowing for improved patient outcomes.

In this issue we feature articles ranging from case reviews and the importance of follow-up to the most recently published data, which was also presented at EuroPCR 2011.

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(continued on page 2)
The PARTNER Trial

Highlights and lessons: What have we learned?

The significant positive results of The PARTNER Trial have electrified the cardiology community. Among the many take-home messages from this landmark trial is the importance of the Heart Team approach, whose creation and acceptance within individual hospitals and clinics has had positive implications for improved patient care far beyond TAVI* procedures themselves.

The PARTNER Trial represents the first multi-centre, randomised, controlled trial in the field of TAVI, with endpoints subjected to corelab analyses and CEC adjudication. Dr. Martin Leon pointed out at EuroPCR that The PARTNER Trial further illustrates “the dire prognosis” of inoperable severe symptomatic aortic stenosis (50% mortality in one year), while pointing toward a valid treatment modality with surprisingly low 30-day mortality in both the inoperable (5%) and high-risk (3.4%) TAVI cohorts. There is a “striking reduction in mortality at one year in the inoperable cohort with TAVI compared with standard therapy (NNT = 5), with similar 30-day and 1-year mortality with TAVI and surgical AVR in the high-risk cohort.” When we look at the high-risk cohort of pooled and TF patients, point estimation of mortality favoured TAVI versus AVR.

TAVI and AVR are associated with different periprocedural hazards—increased neurological events and vascular complications with TAVI, and increased and new-onset AF with AVR. These events, when put in the overall context of procedural results, are still relatively low. Both TAVI and AVR are accepted and relatively safe procedures. Seen in perspective, when attributable mortality is considered at one year, the impact of increased major strokes with TAVI was less significant than increased major bleeding with AVR. Over time, certain complications with TAVI appear to be decreasing, suggesting a learning curve effect.

Dr. Leon went on to say that TAVI has an equally impressive impact on other clinical benefit measures, including symptom status, walking distance, and formal quality of life (QOL) assessments. Despite significant higher in-hospital costs, TAVI was found to be a cost-effective strategy compared with standard therapy in the inoperable cohort.

Todd Michael Dewey, MD, cardiothoracic surgeon from Dallas, Texas, also spoke at EuroPCR, underlining the conclusions from The PARTNER Trial, in which TAVI met its primary endpoint of non-inferiority to conventional AVR in a high-risk patient cohort. AVR outcomes were superior to expected outcomes based on STS risk modelling (O/E mortality of 0.68) and, although the overall incidence was low, stroke remains a concern with an increased prevalence of neurological events in the TA arm of the trial.

These risks were seen in a group that had a higher incidence of peripheral and cerebral vascular disease, as well as previous CABG, and there was no difference in the incidence of events in this arm between TA-TAVI and AVR, suggesting that these events were principally patient-related rather than procedure-related. It is clear that directed efforts need to be made to reduce the risk of neurological events for both TAVI and AVR patients.

SUMMARY OF KEY MESSAGES

- A multidisciplinary Heart Valve Team approach benefits patients and is recommended for all current and future valve centres.
- TAVI has already become the standard-of-care for inoperable patients with severe aortic stenosis.
- These results indicate that TAVI is an acceptable alternative to AVR in selected high-risk operable patients.
- Future randomised studies should focus on lower risk patients who are candidates for operation.

ALBERT MARKUS KASEL

(continued from page 1)

The motion of the valve through the eSheath can be compared to that of a mouse being swallowed whole by a snake. The eSheath returns to a lower profile once the valve has passed through.

The new NovaFlex+ delivery system has a new pusher tip (the 360° Flex Tip) and a shorter balloon nose cone to further aid valve alignment, even in situations where the aorta is tortuous. The tighter balloon shaft support also aids in accurate valve deployment. The shorter balloon nose cone is also advantageous in patients with a small hypertrophied ventricle.

The NovaFlex+ kit includes a 4 cm balloon catheter which is easier to stabilise than the 5 cm balloon during valvuloplasty of TAVI patients.

Overall, while we are at the very beginning of this new experience with the NovaFlex+, we can say that the changes are significant and positive. With the new eSheath, coupled with careful patient screening, we continue to expect excellent results for our patients.
From Son to Father

A tale of two Andersens

Henning Andersen with Jørgen Andersen after TAVI

In our winter issue of TAVItalk, we reviewed the early pioneering history of the First-in-Animal (FIA) and First-in-Man (FIM) evolution of transcatheter heart valves (THV). Here we report on how, recently, Henning Andersen’s father was ultimately able to benefit from his son’s invention.

Henning first envisioned the idea of replacing a diseased aortic valve with a stented biological valve without opening the chest during a 1989 interventional meeting he attended in Scottsdale, Arizona, USA. He arrived back home in Denmark and took on his first challenge for proof of concept. A mere 2 ½ months later, he performed the First-in-Animal (FIA) implantations using home-made valve-stents made from metal wire and native porcine valves obtained from the local butcher shop. During the following two years, he further improved the technique and performed more than 40 implantations in animals to provide evidence for the new paradigm.

Henning did not let go of this idea, nor did he let doubt get in his way. A dreamer, not a naysayer, it still took many years for people to accept this concept, which was further sparked by the success of a First-in-Man (FIM) percutaneous pulmonic valve implant (Bonhoeffer, 2000) and the FIM aortic valve implant (Criber, 2002).

SON TO FATHER Henning’s father, Jørgen Andersen, is 86-years-old, very much a salt-of-the-earth, self-made man. Very active until he was approximately 75-years-old, Jørgen developed spinal stenosis which compromised his ability to walk.

He had spinal surgery in 2004 which didn’t work. Refusing to give up, he demanded a second operation in 2005 which still didn’t work. In addition, he started to develop symptoms of aortic stenosis—primarily dyspnea/syncpe. Henning, not wanting to get too closely involved with his father’s diagnosis and treatment plans, suggested his father talk to his GP. Soon his father became severely symptomatic and was first referred to his local hospital for diagnosis, and then transferred to the Heart Team at Aarhus University Hospital where Henning works as an Consultant Cardiologist.

THE TAVI DECISION Technically, Henning’s father was a good surgical candidate in terms of his risk score and general health. However, his dependence on crutches or a rollator, which require significant upper body strength, meant that he was not an ideal surgical candidate. Eventually, the Heart Team advised him to consider TAVI. On May 24, 2011, he received a fully percutaneous transfemoral TAVI using a 26 mm Edwards SAPIEN XT THV. The result was perfect, without any PV leak and all symptoms resolved. Dr. Leif Thuesen was the primary operator leading the Heart Team and, for this case, Dr. Lars Krussell was by his side. Henning promised to remain calm and not interfere, watching from the control room. Leif, a colleague and research collaborator of Henning’s for more than 25 years, considered Jørgen Andersen as a close “member of the family”. In spite of having done more than 150 cases, he spent the night reviewing all the clinical information and replaying the case information over and over.

Leif admits having been a bit nervous—given the situation and the responsibility he felt towards his close friend. After achieving a perfect implantation and result, Leif and Lars gave each other a ‘high-five.’ When Leif emerged from the cathlab, covered in sweat, he was warmly greeted by Henning with a hug and congratulations.

HAPPILY EVER AFTER At the hospital, Jørgen was soon bossing the nurses around, refusing oxygen and ordering his own food. His wife now claims he needs to slow down! He’s back to chopping trees and riding on his tractor.

In 2009, the couple celebrated their diamond (60th) anniversary. When asked, Henning responded that he is glad his father is doing well. Throughout the entire process, Henning remained at a distance from any diagnoses or recommendations for his care.

When asked if his father had an impact on his becoming a doctor, Henning responded: “No way!” His father had wanted Henning to continue in the family business, but the son was rebellious, even planting all the onions upside down (so they took a bit longer to grow!) He moved away to find himself and pursue new ideas. After being a hippie for some time, he decided to go back to university and finally medical school, the first academic in his family.

REFERENCES
1. TAVItalk 5, January 2011; Special Issue The PARTNER Trial, Cohort B, Pages 10,11
A European perspective on the meeting of the Medical Device Advisory Panel to the FDA

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I was among a group of physicians who attended the July 20th meeting of the advisory panel to the FDA reviewing the Edwards SAPIEN transcatheter heart valve for use in inoperable patients.

I was invited by Edwards Lifesciences in order to provide the panel with the European perspective of TAVI, 4 years into the commercial roll-out of this technology in Europe. The meeting gave me a fascinating insight into the workings of the FDA and the US regulatory system.

There were 10 voting members of the panel, plus a panel chairman, who only votes if needed to break a tie. The voting members of the panel included nine MDs and one PhD. The FDA asks the panel to consider a series of questions posed by the FDA in advance. In order to answer those questions, the panel hears testimony, asks questions, and ultimately votes on whether they believe that the medical device in question is safe and effective. The FDA considers the panel’s recommendations, but is not bound by them; ultimate authority to approve or deny an application rests with the FDA.

The day followed a very structured agenda that included presentations by clinicians, statisticians, patient advocates, medical society representatives, and representatives from industry. There was also a 1-hour open public hearing.

Much of the day was spent discussing the relative efficacy and safety of the procedure. The efficacy of TAVI is best assessed by mortality and quality of life (QOL) improvements in the TAVI arm. There was a general recognition for most of the day that TAVI extended life compared to medical therapy in patients who were unsuitable for surgical AVR. However, the panel appeared to have some misconceptions. One panelist commented that TAVI only extended life by 18 months to 2 years and asked, “was this really important to patients in their mid 80s?” My first thought was that perhaps someone should ask such patients.

The panelist’s second comment was that although the therapy extended life, “nearly all the patients had died within 2 years” and, therefore, QOL is much more important. However, this statement is not true; 66% of patients in The SOURCE Registry are still alive at 2 years, and similar data were presented to the panel from the Canadian Registry. The primary endpoint in The PARTNER Trial was mortality at 12 months; The PARTNER Trial investigators have neither presented nor published data for patients beyond 12 months. However, the investigators did present data showing that—of those Cohort B patients who have been followed out to 24 months—approximately 60% were alive at 24 months, which was a dramatic improvement in mortality over the best medical therapy arm of the study.

There was vigorous debate on how one defines an “inoperable” patient and also about which patients should not have TAVI. It was widely agreed that some patients have too many comorbidities and should be turned down for both surgical AVR and TAVI. The discussion indicates that patient selection is probably one of the most difficult aspects of TAVI. In Europe, multiple registries are actively trying to develop a “TAVI risk score,” which should facilitate patient selection and further improve 1-year mortality.

My contribution to this section of the panel discussion was to discuss the patient populations being treated in Europe today. There is obviously a major concern in the US about

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**TAVI at EuroPCR**

TAVI was a significant feature at EuroPCR 2011, with more than 200 presentations included in 23 sessions. For Edwards, it marked the formal launch of the 29 mm Edwards SAPIEN XT THV (transapical approach*), as well as the new Edwards NovaFlex+ Delivery System & eSheath.

The Edwards symposium, chaired by Dr. Olaf Wendler and Prof. Stephan Windecker, included highlights on The PARTNER Trial presented by Principal Investigator Dr. Martin Leon, and Dr. Todd Dewey. Prof. Helmut Baumgartner presented implications for daily clinical practice and Dr. Antonio Colombo spoke about the impact of recent valve iterations on clinical performance. The presentations can be seen on www.pcronline.com.

There was also an Edwards-sponsored ‘TNT’ session that included two live cases from St. Thomas’ Hospital featuring these new products. Chaired by Profs. Hermann Reichenspurner and Alec Vahanian, it included presentations by Drs. Eulogio Garcia, Jürgen Kämpfert, Hélène Eltchaninoff, and Giambattista Isabella. A video of the entire 2-hour session and live cases is available on the PCRonline website: www.pcronline.com/EuroPCR/EuroPCR-2011/Advancing-TAVI-for-optimal-patient-outcomes-new-product-advancements-tips-tricks

* Transfemoral delivery system under development.
potential “risk creep” toward lower-risk surgical patients. I pointed out that the indication for TAVI in Europe was severe symptomatic aortic stenosis in high-risk surgical patients, generally with a logistic EuroSCORE greater than 20. I also pointed out that there has been very little obvious change in risk scores between Cohort 1 and Cohort 2 of The SOURCE Registry and that the average EuroSCORE level of the European registries was well over 20. On this basis, I could see no major evidence of “risk creep” in Europe. A crucial element in ensuring that appropriate patients receive TAVI is to ensure that programs are delivered by Heart Teams, within which surgeons play an important role. At my own institution, the surgeon is the “gatekeeper” of the technology and any change in the demographics of the TAVI patients will be driven principally by the cardiothoracic surgeon.

The debate with regard to stroke was particularly challenging and robust. An important secondary endpoint was a composite safety endpoint of death, MI, stroke, and renal failure. It is important to note that Edwards presented data demonstrating that the majority of patients who survived with a stroke had improved QOL at 1 year. One of my own contributions was to briefly discuss the potential causes of stroke and potential ways in which stroke could be reduced in the future. A significant number of strokes occur more than 5 days after the procedure and, therefore, are obviously not “procedural.” Therefore, it is likely that neurological events occurring in TAVI patients are multifactorial and no single intervention is likely to solve the problem. Potential strategies to reduce intraprocedural stroke include: minimising the catheter French size to limit injury while traversing the aortic arch; careful control of blood pressure during anaesthesia; limitation of rapid pacing; careful control of wires to avoid the carotid circulation; the use of embolic protection devices; and optimisation of pharmacotherapy during and after the procedure.

Having started at 8 am, the big moment of voting arrived at just after 6 pm. The FDA posed three questions to the panel regarding the safety and efficacy of the device. A drama then ensued as the electronic voting system failed to work and the panel had to revert to paper!

The final votes gave a resounding vote of confidence in TAVI from the panel to the FDA. The panel voted 7-3 for safety, 9-1 for efficacy, and 9-0 (with one abstention) that procedure benefits outweighed the risks.

This was an extraordinary event to witness; it was like being in a court room. However, my thoughts kept returning to the patient. The panel was discussing the introduction of an early generation, large-French system compared to the latest-generation, small-calibre device we use in Europe. In addition, in Europe we also have multiple vascular access site options that improve the results of the transfemoral approach by limiting the need to “push the envelope” of transfemoral access. What would an American patient really think? This trial demonstrated a huge net clinical benefit despite potential complications of the procedure. The discussions of the panel, however, concentrated on the defensive elements for both the FDA and the panel. Is this process really protecting American patients from inappropriate therapy or is it limiting their access to the latest devices?

It is anticipated to be 2014 before any US citizen will be able to access the devices currently available in Europe. I really believe that TAVI is a breakthrough technology that is changing the face of the treatment of valvular heart disease in the world. It seems tragic that systems that were put in place to ensure US patients receive optimal healthcare are actually resulting in the opposite effect.

My last comment would be: “give the patients the information and let them decide....they will get it right”.

On cerebral embolisation

Recent cerebral MRI studies have shown that TAVI is associated with a high rate of clinically silent embolic lesions. Further research using transcranial Doppler ultrasound monitoring during the TAVI procedure now reveals that clinically silent cerebral emboli are observed in every TAVI patient, mainly as a result of extensive manipulation of the calcified aortic valve during positioning and implantation of the valve. This calls for strategies to reduce the risk of embolisation. It will be interesting to monitor the effects of recently introduced embolic protection devices on the frequency of intraprocedural embolic signals on transcranial Doppler and of new lesions on postprocedural MRI.

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New data from The SOURCE Registry

INTRODUCTION

Olaf Wendler gave a presentation at EuroPCR 2011 of the final one-year outcomes from more than 2,300 patients enrolled in The SOURCE Registry. These results have also been published recently1,2. This is a summary of his presentation.

The SOURCE Registry began in 2007 to monitor procedural results with the commercialised Edwards SAPIEN valve. The registry has two Cohorts: Cohort 1, consisting of consecutive patients enrolled at 32 centres across Europe from November 2007 to January 2009; and Cohort 2, consisting of consecutive patients at 37 European centres followed from February 2009 to December 2009.

All centres were required to provide complete data sets on consecutive patients; the strict criteria for inclusion in the registry. At EuroPCR 2011, the complete 1-year data from 2,307 patients in both cohorts were presented. The primary aim was to generate scientifically robust and comprehensive data on patient results as well as to identify predictors of outcome. Early publication of 30-day data showed survival of 92.5% in patients who underwent TAVI via a transfemoral (TF) approach and 89.1% in those who underwent TAVI via the transapical (TA) approach.

ADVANCES IN PATIENT SELECTION

Patients selected for either the TF or TA approach continue to be at high-risk for conventional AVR. While the European learning curve has had some influence on the range of patients’ logistic EuroSCOREs, the overall EuroSCOREs remain high. Compared with the TF route, patients undergoing TAVI via the TA approach still have a higher incidence of comorbidities, particularly extra-cardiac, such as pulmonary, peripheral vascular and carotid artery disease. This explains their 74.2% survival at 1-year compared with 80.1% for the TF approach. One-year mortality was significantly higher in patients with vascular access complications. Not unexpectedly, causes of death were mainly non-cardiac related. Interestingly, there was no significant improvement in terms of 1-year mortality between Cohorts 1 and 2. It will therefore be interesting to see what impact the new generation Edwards SAPIEN XT valves and delivery devices will have on patient outcomes.

TAVI AND CABG

An interesting sub-analysis of The SOURCE Registry data focused on patients who subsequently underwent TAVI after they previously received coronary bypass surgery (CABG). Early reports on TAVI from North America demonstrated inferior outcomes of TAVI in patients with previous CABG or percutaneous coronary intervention. In The SOURCE Registry, however, previous CABG was shown not to be a risk factor for TAVI 1-year mortality.

Interestingly, there was no significant difference in mortality between the TF and TA approach, although the incidence of comorbidities in the TA group was again higher. One contributing factor to these outstanding results may be the elimination of apical complications in the TA group, which again demonstrates that reliable closure techniques for the left ventricular apex after TA-TAVI would potentially improve outcomes even more.

REFERENCES

The 29 mm Edwards SAPIEN XT THV: A first look

INTRODUCTION
This case demonstrates the first post-CE mark case with the newest member of the Edwards SAPIEN valve family, the SAPIEN XT 29 mm THV.

COMMENTARY
As in any other medical branch, decision making in cardiac surgery can be affected by many factors, including surgical experience, patient profile, and the availability of medical products. Since beginning our TAVI program 3 years ago, we focused on patients with high-risk profiles and have experienced very favourable outcomes, especially for the transapical approach. In our patient referrals, we noticed that among patients older than 80 years who needed biological aortic valve replacement, 25% of these patients had a ring diameter of 25 mm or more. For these patients who require a larger prosthesis, the Edwards SAPIEN XT 29 mm THV is now a viable treatment option.

PATIENT PROFILE
An 86-year-old man with known severe aortic valve stenosis, approached his cardiologist to be considered for a TAVI procedure. After careful review by our Heart Team, he was deemed appropriate for the 29 mm transapical approach, which had only just received CE mark approval. He was chosen to be the first patient to receive the new 29 mm Edwards SAPIEN XT THV in our institution.

PATIENT DATA
- 86-year-old patient
- Hypertension
- Pulmonary hypertension
- Moderate mitral valve regurgitation
- Mild tricuspid valve regurgitation
- Moderate renal insufficiency
- Chronic obstructive pulmonary disease
- Moderate stenosis of internal carotid artery
- No other comorbidity that would preclude quality-of-life or life expectancy

CLINICAL DATA
Upon admission: dyspnea by minimal effort, no chest pain
TTE: AVA = 0.8 cm²; LVEF = 45%; mean gradient = 50 mm Hg; SPAP = 40 mm Hg; annulus diameter=25 mm
No severe coronary artery stenosis on coronary angiography

LOGISTIC EUROSORE SCORE EQUIVALENT = 35.7%
STS RISK CALCULATION
Risk of mortality: 26.2%
Morbidity or mortality: 71.8%
Long length of stay: 52%
Short length of stay: 3.2%
Permanent stroke: 6.7%
Prolonged ventilation: 56.9%
Renal failure: 59.7%
Re-operation: 23.3%

DEcision Taken for TA-TAVI
The procedure went well without any complications. The final result was excellent with no aortic regurgitation or paravalvular leakage. After an uneventful stay, the patient was discharged. After returning home, he was able to enjoy his daily garden work. After 3 months he is still doing well, with NYHA II. The echocardiographic follow-up shows normal function of the aortic valve prosthesis without any paravalvular leakage.

The importance of follow-up

We would like to emphasise the importance of close follow-up with our TAVI patients after hospital discharge. We have learned that the valve should be examined regularly (e.g., 4 and 12 weeks after implantation). While rare, the following complications that we observed can be avoided if proactive care is taken. Of our 200 patients, we saw one early severe thrombotic restenosis that we were able to treat successfully by putting the patient on warfarin with an INR of 3-0 to 3-5. In two other patients, we diagnosed endocarditis at 6 and 12 weeks after TAVI and started early treatment with intravenous antibiotics. Both patients were able to be managed medically, without further intervention.

Some of our TAVI patients have had additional cardiac problems, such as paroxysmal atrial fibrillation, some degree of mitral regurgitation or pulmonary hypertension. These conditions need to be recognised and patients need to be treated as soon as possible as well as being followed with care. Our older patients (aged 78 to 94 years) have several comorbidities and they need to be supported in many ways. Therefore, close contact with their general practitioners is mandatory for best care. At our outpatient clinic we see very grateful patients, who come in with their partners and are happy to have more years together.

QUOTABLE

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PROF DR. THOMAS HEITZER
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A new population of patients may now have access to the less-invasive TAVI procedure to correct severe aortic stenosis. The PARTNER Trial Cohort A confirmed TAVI as a correct and reasonable option for high-risk surgical patients. TAVI was superior in MACE at 30 days with a very low rate of events, which was lower than those seen with surgical valve replacement. At 1-year follow-up, the two approaches were comparable, confirming, at least in the short-term, the durability of the percutaneous treatment option.

Key concepts include that the technology is feasible, durable, and safe: AF and bleeding were lower in the TAVI group. Although there is still room for improvement in vascular complications, this is likely to come with the advent of smaller valves and delivery systems, as well as with the potential prevention of neurologic complications by using embolic protection devices.

The data in The PARTNER Trial Cohort A were obtained using the bulkier, first-generation devices compared with those that are currently available in Europe. The cardiac surgeons that participated in The PARTNER Trial were exceptionally skilled experts in their field and the Heart Teams had minimal experience with TAVI prior to starting the trial, further highlighting the potential for improved results, when there is no longer a learning curve impact and, when there is widespread access to later-generation devices.

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The panel voted 9-0 (with one abstention) that in patients deemed to be at too high risk for surgery, the benefits of the Edwards SAPIEN transcatheter heart valve outweigh the risks. The committee expressed some concern about the increased risk of stroke; however, it voted 7-3 that data show the valve is safe for its intended patients. The panel recommendations included continued post-approval studies to monitor results and longer term patient follow-up.

The Edwards SAPIEN THV is an investigational device and is not yet commercially available in the United States. However, it received CE mark approval for European commercial sale in late 2007.

For use outside The United States only | Not intended for general distribution.
Transcatheter aortic valve implantation (TAVI) has been a major therapeutic breakthrough of the last decade. The results from the inoperable cohort of The PARTNER Trial have demonstrated a significant survival benefit in patients who received a transcatheter aortic valve compared to those who were medically treated. Accurate selection of high-risk surgical patients, procedural approach evaluation, and procedural guidance are crucial to ensure the success of TAVI. Selection of the most appropriate transcatheter prosthesis size and procedural approach relies on imaging technologies that permit accurate assessment of the aortic valve annular size and the dimensions and morphology of the peripheral arteries. In particular, the aortic valve annular size is commonly measured with 2-dimensional echocardiography. However, 3-dimensional imaging techniques provide more comprehensive characterisation and accurate measurements of the aortic annulus and permit assessment of other important aspects in relation to the peripheral arteries. The implementation of 3-dimensional imaging techniques in the work-up of candidates for TAVI will require standardisation of aortic valve annular measurements and evaluation of peripheral arteries.

References
An inside look at the Edwards SAPIEN and Edwards SAPIEN XT Transcatheter Heart Valves (THVs)

LAKSEN SIRIMANNE
Vice-President, Research & Development, THV, Edwards Lifesciences

The results of The PARTNER Trial Cohorts A and B support the balloon-expandable Edwards SAPIEN transcatheter heart valve released in Europe in late 2007. Since its release, our team of engineers has continued to advance the design of the Edwards’ line of balloon-expandable valves. Utilising clinical feedback and R&D advancements, the Edwards SAPIEN XT THV was released in early 2010.

The Edwards SAPIEN THV product line is based upon four key design elements: proven leaflet design, optimal frame height, high radial strength, and predictable valve deployment. These elements went into the original design of the Edwards SAPIEN THV, and were also the core criteria evolving the Edwards SAPIEN XT THV.

**PROVEN LEAFLET DESIGN**

The Edwards line of transcatheter heart valves shares many features that are core to Edwards’ long history of tissue valve design. The leaflets are made of bovine pericardial tissue, which has clinically proven long-term durability. The leaflets undergo the Carpentier-Edwards ThermaFix treatment process which is intended to minimise the risk of calcification. All leaflets are matched for thickness and elasticity to promote consistent leaflet function and coaptation.

One new feature of the Edwards SAPIEN XT transcatheter heart valve, compared to the original Edwards SAPIEN THV, is the new leaflet design. This design features a proprietary surgical leaflet shape based upon Edwards’ surgical valves and has been enhanced for stress distribution, to support valve durability.

**OPTIMAL FRAME HEIGHT**

A significant design criterion for the Edwards transcatheter heart valves is to have a frame height that is designed for proper placement and non-interference with the surrounding anatomy. The Edwards SAPIEN THV frame is 14 mm (in the 23 mm valve), or 16 mm (26 mm valve) tall. It is designed to fit within the native annulus, minimising the risk of atrioventricular (AV) block and disruption of mitral leaflet function. It is also designed for placement below coronary arteries, allowing clear access for future percutaneous coronary interventions (PCIs).

The Edwards SAPIEN XT THV frame had the same design requirement. The Edwards SAPIEN XT THV frame is 14 mm (23 mm valve), 17 mm (26 mm valve) and 19 mm (29 mm valve) tall.

**Edwards eSheath**

The new low profile 16 Fr Edwards eSheath* (introducer sheath) has been designed to minimise vascular trauma. It features the innovative Dynamic Expansion Mechanism (DEM) that allows for transient sheath expansion during valve delivery. Immediately after the Edwards SAPIEN XT THV passes through the sheath, the DEM allows the sheath to return to a low profile diameter thereby reducing the amount of time the access vessel is expanded. An additional benefit of the DEM is that it enables retrieval of the valve prior to valve deployment and reduces the push force through the shaft by up to 40%.

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*16 Fr eSheath is indicated for use with the 23 mm SAPIEN XT THV, the 18 Fr eSheath is indicated for use with the 26 mm SAPIEN XT THV.
THE EDWARDS TRANSCATHETER HEART VALVES

**HIGH RADIAL STRENGTH**

The Edwards transcatheter heart valves established a new paradigm in valve delivery; one key feature of this was the fact they possess a strong supportive frame with high radial strength. The Edwards SAPIEN THV frame strength has shown, throughout its high volume of implants, to result in a large effective orifice area, even in heavily calcified annuli. It was designed for reliable deployment with nominal diameter which is necessary for proper leaflet coaptation. This high radial strength results in proper haemodynamics and valve durability.

The Edwards SAPIEN XT THV frame offers comparable radial strength to the original Edwards SAPIEN THV frame. This was one of the key design criteria. The new feature of this frame is that it also allows for low profile crimping. In order to combine radial strength with low profile crimping, the Edwards SAPIEN XT frame geometry features fewer rows than the Edwards SAPIEN frame and is made from cobalt chromium rather than stainless steel.

**PREDICTABLE VALVE DEPLOYMENT**

The Edwards SAPIEN THV is delivered transapically with the Ascendra delivery system and transfemorally with the RetroFlex 3 delivery system. The delivery systems were designed for their means of access and featured balloon-expandable delivery engineered for predictably accurate valve placement. These are the products used in The PARTNER and The PARTNER II Trials.

The Edwards SAPIEN XT THV is delivered transapically with the Ascendra2 delivery system and transfemorally with the NovaFlex+ delivery system. Both systems were designed to take advantage of the low-profile crimping frame design to decrease their sheath sizes while maintaining predictable valve placement, which represent significant steps forward in design evolution.

**NEW!**

The Edwards SAPIEN XT THV treats an annulus size range of 18 to 27 mm.

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**Expanded treatment options: valve diameters**

The Edwards SAPIEN XT THV treats an annulus size range of 18 to 27 mm.

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**The Edwards NovaFlex+ Delivery System** has further improved on the NovaFlex design by incorporating the 360° Flex Tip design which provides tighter balloon shaft support for accurate deployment and easier valve alignment.

Left: Edwards NovaFlex Flex Tip
Right: Edwards NovaFlex+ 360° Flex Tip
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Upcoming Interventional Cardiology/Cardiac Surgery meetings 2011–2012

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For professional use. For additional information, indications, contraindications, warnings, precautions and adverse events, please refer to the Instructions For Use provided with the products.

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