Evaluation before transcatheter aortic valve implantation

Quel bilan avant implantation d’une valve aortique percutanée?

By March 2010, more than 14,000 patients had been treated with transcatheter aortic valve implantation (TAVI), 8 years after the first-in-man implantation performed in France in April 2002 [1]. Since then, after a long period of doubt, the technique has spread worldwide with an enthusiastic response from cardiologists and surgeons and is being established in clinical practice. The devices and techniques have improved significantly over the past 4 years, leading to a clear-cut decrease in complications, and the short- and mid-term results appear excellent and comparable to surgery in a very selected population at high surgical risk [2—9]. Since 2007, two devices have become commercially available in Europe, the Edwards balloon-expandable bovine pericardium bioprosthesis (23 and 26 mm sizes) (Edwards Lifesciences, Irvine, CA, USA) and the Corevalve self-expandable porcine pericardium bioprosthesis (26 and 29 mm sizes) (Medtronic, Irvine, CA, USA). Both valves can be implanted using the transfemoral arterial approach, whereas the transapical (Edwards) and subclavian (Corevalve) routes are selected in cases of poor iliofemoral access. Reimbursement for TAVI, available in France since January 2010, has opened the door to a greater number of procedures in our country, with subsequent investigations for optimal screening.

The screening process is the key for a successful and safe TAVI procedure and has the greatest impact upon the results. This process includes careful selection of patients on a clinical basis and the use of a number of imaging procedures aimed at evaluating the technical feasibility of TAVI and selecting the best and safer approach. These elements constitute a fundamental aspect of the training programmes offered by both companies supplying the devices to each catheter valve team, which includes interventional cardiologists, cardiac and vascular surgeons, anaesthesiologists, radiologists and echocardiographers.

The clinical indications for TAVI have been identified clearly in the European Association of Cardio-Thoracic Surgery and European Society of Cardiology position statement in 2008 [10], which gives clear recommendations on the current indication and application of this emerging technique, and was recently reinforced in France by the Haute Autorité de santé. To date, in view of the missing knowledge on long-term results, TAVI should be restricted to patients with severe (< 1 cm² or < 0.6 cm²/m²) and symptomatic (NYHA functional class ≥ 2) aortic stenosis who either have contraindications to conventional aortic valve replacement by cardiac surgeons (i.e. porcelain aorta, hostile thorax, multiple repeat surgery) or are considered at too high risk for surgery because of associated comorbidities. This is mainly assessed by objective scoring to assess individual risk, such as the EuroScore (> 20%) and/or the STS (Society of Thoracic Surgeons) risk score (> 10%), and requires a multidisciplinary consensus. Other clinical parameters...
can be taken into account in particular cases, including age, clinical fragility, comorbidity-related life expectancy, quality of life, autonomy and psychological status. The physician’s good clinical sense plays here an important role in the final decision to undertake the procedure and the participation of a geriatrician can be helpful in very old patients.

Once the clinical indication has been confirmed, the next steps consist of evaluating the feasibility of the procedure, taking into account the aortic valve anatomy, the coronary artery and left ventricular structure, then selecting the best approach. In this regard, several imaging techniques play a crucial role, and reinforce the need for excellent cooperation between echocardiographers and radiologists. In addition to echocardiography, the role of computed tomography (CT) scanning is currently considered essential. Echocardiography, besides assessing the severity of aortic stenosis, the anatomy of the valve, the distribution of calcium over the leaflets and the left ventricular function, is crucial for determining the diameter of the aortic annulus and hence the optimal valve size (annulus diameter between 18 and 24 mm for the Edwards, between 20 and 27 for the CoreValve). Appropriate valve sizing is crucial to limit the risk of valve embolization, annulus rupture or severe paravalvular leak. This information can be obtained easily from transthoracic echocardiography and from transesophageal echocardiography in the case of poor echogenicity, using the longitudinal view and measuring the distance separating the valvular insertion sites. CT scan evaluation of the thoracic aorta is also important for assessment of the aorta anatomy (angulation, diameters and wall calcification) but in general it overestimates the diameter of the aortic annulus, and is not considered an optimal tool for valve sizing.

On the other hand, the CT scan is mandatory for assessment of the iliofemoral access, and must be obtained in all cases after simple preliminary evaluation of the same by angiography. Three-dimensional reconstruction of the arterial access provides a better way to document tortuositities and external calcification, whereas contrasted or non-contrasted cross-sectional views are mandatory to calculate the internal diameters of the femoral and iliac arteries as well as the intraluminal distribution of calcium. Interestingly, only a few additional millilitres of contrast medium are needed to permit visualization of the entire aorta, the take-off of the coronary arteries and the distance from the coronary ostia to the aortic annulus, thus providing additional important information before TAVI.

Once the patient is selected and planned for the procedure, further evaluation may still be needed at the time of valve implantation. Several supra-aortic angiograms may be necessary to select the reference view that will be used at the time of valve deployment, showing the aortic annulus perpendicular to the screen. This is crucial to visualize the strip of calcium that will be used as a landmark for valve positioning. Angiography combined with balloon inflation at the time of preimplantation valvotomy can be a key for accurate valve sizing in cases of unsatisfactory annulus measurement by echocardiography.

In summary, careful evaluation of patients is crucial before TAVI and is now quite a standardized process. It requires close cooperation between the different special-

ists, starting with the referring cardiologist responsible for the diagnosis and the timing for intervention, then the medicosurgical team to evaluate the risk of surgical AVR, and finally the echocardiographers and radiologists to ensure optimal screening of the patient and selection of the ideal route. This process is time-consuming but essential to achieve a successful and safe procedure. A dedicated coordinator is warranted to optimize this phase. Training and supervision are needed to educate each new team and to help them start their programme with the best possible chance of success.

References


