Archives of Cardiovascular Disease (2012) **105**, 181—186

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CLINICAL RESEARCH

Transcatheter aortic valve implantation: Our vision of the future

Implantation valvulaire aortique par cathéter : le futur

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Received 24 January 2012; accepted 30 January 2012
Available online 16 March 2012

KEYWORDS
Future;
Heart Team;
Imaging;
Selection;
Technology;
Transcatheter aortic valve implantation

Summary Transcatheter aortic valve implantation (TAVI), introduced 10 years ago by Alain Cribier, has now been performed in more than 50,000 patients worldwide. Our vision of the main directions for the future are fourfold. Firstly, the 'Heart Team' is and will remain, essential for patient selection and the performance of the procedure. Careful training and controlled diffusion of the technique to medico-surgical centres are also keys to success. Secondly, patient selection must be refined, in order to predict the risk of surgery and that of TAVI. The technique is currently limited to very high-risk patients or those with contraindications to surgery. It will be extended to include lower risk patients once there are adequate trial data, the safety of the procedure has been improved and better knowledge of long-term outcomes from the procedure has been obtained. Thirdly, the procedure will be simplified, and should also be safer with an expected decrease in the occurrence of strokes, vascular complications and perivalvular regurgitation. Fourthly, the devices will also improve, with the addition of the potential for repositioning and improvement in durability. The role of imaging with the use of multimodality techniques will no doubt increase and ease the efficacy and safety of the procedure. Overall, the use of TAVI will undoubtedly increase over time, enabling a larger number of patients with severe aortic stenosis to be treated in an effective and safe way, in complement to surgical aortic valve replacement.

Abbreviations: CT, computed tomography; EAPCI, European Association of Percutaneous Cardiovascular Interventions; MRI, magnetic resonance imaging; PCI, percutaneous coronary intervention; PROM, Predicted Risk Of Mortality; STS, Society of Thoracic Surgeons; TAVI, transcatheter aortic valve implantation; VARC, Valve Academic Research Consortium.

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1875-2136
doi:10.1016/j.acvd.2012.01.004

MOTS CLÉS
Futur ;
Heart Team ;
Imagerie ;
Implantation valvulaire aortique par cathéter ;
Sélection ;
Technologie

Résumé L'implantation valvulaire aortique par cathéter (TAVI), qui a été introduite par Alain Cribier il y a dix ans, a été réalisée chez plus de 50 000 patients dans le monde. Les principales directions dans le futur pourraient être les suivantes : la « Heart Team » est et restera essentielle pour la sélection des patients et la réalisation de la procédure. L'entraînement soigneux et la diffusion contrôlée de la technique à des centres médicochirurgicaux sont aussi des clés du succès ; la sélection des patients doit être améliorée, tant en ce qui concerne la prédiction du risque chirurgical que celui du TAVI. Actuellement, la technique est limitée aux patients à très haut risque et à ceux ayant une contre-indication à la chirurgie. Elle sera étendue à des patients à plus faible risque après la réalisation des essais adéquats, lorsque la sécurité de la procédure sera améliorée et son évolution à long terme mieux connue ; la procédure va se simplifier et devrait devenir plus sûre, avec une probable diminution du risque d'accident vasculaire cérébral, de complication vasculaire et de fuite péri-valvulaire ; les dispositifs s'amélioreront aussi grâce à la capacité de repositionnement et à la prolongation de leur durabilité. Avec l'utilisation de techniques multimodales, le rôle de l'imagerie augmentera certainement la simplicité et la sécurité de la procédure. Globalement, avec le temps, l'utilisation du TAVI va croître sans aucun doute, permettant à un plus grand nombre de patients porteurs d'un rétrécissement aortique sévère d'être traités de façon efficace et sûre, en complément de la chirurgie de remplacement valvulaire aortique.

Background

Transcatheter aortic valve implantation (TAVI) was introduced by Alain Cribier 10 years ago [1] and is now an accepted treatment for high-risk patients with severe aortic stenosis. Since the approval of both the Edwards SAPIEN and the Medtronic CoreValve in Europe in 2007, TAVI has been performed in more than 50,000 patients worldwide [2—6]. The current results of the technique are described in the other articles of this issue.

Today, TAVI has become the standard of care for inoperable patients with aortic stenosis and acceptable life expectancy. TAVI is also an alternative to aortic valve replacement in selected high-risk operable patients [7,8]. The aim of this review is to forecast what may happen in the future, starting with patient selection and then examining technical aspects.

Patient selection

First of all, it should be stressed that today and in the future, the TAVI Heart Team approach is and will remain, essential for the management of patients with severe aortic stenosis and TAVI should be restricted to high-risk patients [9]. This will apply at each step of the procedure: patient selection, performance of the procedure, post-procedural care and evaluation of the results.

The Heart Team is comprised of clinical cardiologists, interventionists, surgeons, anaesthetists and imaging specialists, all with expertise in the treatment of valve disease. The participation of other specialists, such as geriatricians, will be increasingly sought.

It is essential to assess both the risk of surgery and the risk of TAVI. Firstly, we need better scores to assess the risk of surgery. The current scoring systems, EuroSCORE or Society of Thoracic Surgeons Predicted Risk Of Mortality (STS PROM) [10,11], are limited in their prediction of outcomes in high-risk patients. New scoring systems should be based on a limited number of variables; aimed at the specific evaluation of valvular patients; elaborated from a broad spectrum of operative risk; externally validated in high- and low-volume centres; and updated on a regular basis. Besides evaluating cardiac and extracardiac factors, it is mandatory to include indices of functional and/or cognitive capacity and frailty. We need better definition and further evaluation of this last parameter [12].

Secondly, we need scoring systems that predict the outcome of TAVI, both in the immediate and the long term. Even with refined scoring systems it is likely that it will never be 'magic numbers'. Assessment by the Heart Team, based primarily on clinical judgment, will remain critical, but will be supported by a certain degree of quantification using better scores.

The use of TAVI is limited to patients at high risk or with contraindication(s) to surgery. In this category, a number of subgroups require more-precise evaluation:

- associated coronary artery disease: only data from retrospective studies involving a limited number of patients exist; we therefore lack the solid evidence necessary to guide our strategy. It is likely that randomized studies will be the best way to decide when percutaneous coronary intervention (PCI) should be performed and the timing of the procedure [13] ;
- bicuspid valves are a classic contraindication for TAVI. Here again, we have very limited data to guide us, but this feature will but this feature will become increasingly important with the consideration of lower-risk patients (i.e. younger patients). It may be that a specific valve design is needed in patients with bicuspid valves [14] ;
- the strategy in patients with severe left ventricular dysfunction is also a matter of debate. We should identify those patients unlikely to benefit from TAVI because of their low likelihood of a good outcome and in those we are willing to treat, we should compare a strategy of balloon aortic valvuloplasty as a bridge versus TAVI as a first intervention ;
- transcatheter 'valve in a valve' is an attractive alternative in bioprosthesis failure. Preliminary results have