Size, position, and timing: A mixture of success

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The incidence of pacemaker (PM) implantation after aortic valve replacement with a sutured prosthetic valve ranges between 6% and 10%.^{1,2} The most common contributing factor for PM implantation is mechanical trauma to the conduction system, which is often due to extensive debridement of a calcified aortic annulus or to the insertion of deep stitches that cause a direct injury to the atrioventricular bundle. A surgeon may take steps to pay more attention to these causes, but other potential risk factors may increase the risk for PM implantation. Specifically, a disturbance of the preoperative cardiac rhythm, such as right bundle branch block, bifascicular block, left bundle block, and atrial fibrillation, may be associated with a high incidence of permanent postoperative atrioventricular block.³ In addition, older age, poor left ventricular ejection fraction, left ventricular septum hypertrophy, redo surgery, valve size, prolonged operative times, and postoperative events such as electrolyte imbalance myocardial infarction or systemic hypoperfusion may contribute to conduction failure.^{4,5} In other words, the risk of PM implantation is multifactorial and cannot be related only to the type of valve implanted. Nevertheless, in recent years, there has been increasing evidence that sutureless aortic valves are associated with higher incidence of PM implantation compared with conventional surgical aortic valve replacement.⁶

Yanagawa and colleagues⁷ describe a simple technical modification of Perceval (Livanova, Italy) device insertion resulting in lower rate of conduction disturbance rhythm necessitating temporary and permanent PM implantation. Specifically, rate of PM implantation went from 28% to 0% after the technical modification.

The users' instructions for the Perceval device recommend placing the guiding sutures 3 mm below the nadir of the annulus. However, after a careful echocardiographic evaluation of these patients, some authors⁸ have realized that the lower the position of the valve in respect to the aortic annulus, the higher the chance of PM insertion. We are the first group reporting a low rate of PM implantation

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Central Message

The correct position and size of a sutureless valve and the appropriate timing for the observation of rhythm disturbance may reduce the risk of pacemaker implantation after aortic valve surgery.

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(4.8%)⁸ and now at Istituto Clinico Sant'Ambrogio (data not published), our rate is identical to that found by Yanagawa and colleagues,⁷ who report 0% PM implantation in almost 80 patients undergoing aortic valve replacement. To have a perfect sealing of this valve into the aortic annulus is necessary so that the prosthetic annular gown covers thoroughly the native aortic annulus. If the Perceval is positioned some millimeters lower, the self-expanded nitinol stent may compress the conduction bundles and cause atrioventricular block. In addition, this might reduce the rate of paravalvular leakage. Sizing is another crucial aspect to avoid PM insertion. The authors⁷ show in their report that patients receiving extra-large valves had higher rates of temporary and permanent pacing. This presupposes that in case of incorrect sizing, the risk of PM may be higher if a larger valve is chosen. Mazine and colleagues⁹ reported an incremental increase of PM implantation with increasing prosthesis size.

Finally, the propensity of the local electrophysiology cardiologists may affect the rate of PM implantation in the presence of cardiac rhythm disturbances.¹⁰ According to American College of Cardiology/American Heart Association guidelines,¹¹ the decision to implant a PM, as well as timing, is left to the treating physician's discretion. Nevertheless, the most recent European guidelines¹² recommend a period of clinical observation up to 7 days to assess whether the rhythm disturbance is transient and resolves.

Previously we have described some rules for a successful implantation of a Perceval valve,¹³ and this article⁷ adds evidence that if the valve is correctly sized and well positioned, complications may not occur. However, the sample size is relatively low and some rhythm conduction disturbances after surgical procedure might happen in the future. Finally, there is another aspect that is yet to be addressed but that we think it might lower the risk of PM implantation. Livanova, the manufacturer of the Perceval device, recommends ballooning the implanted valve for 30 seconds at a pressure of 4 mBar. We strongly believe that this additional procedure might create an injury of the conduction system. The simple use of warm saline solution is all that is necessary to set the new prosthesis in its position.

CONCLUSIONS

Pacemaker implantation is multifactorial and Yanagawa and colleagues⁷ have shown that in the absence of other potential risk factors, the use of sutureless valves may not be associated with conduction disturbance. The identification of preoperative rhythm disturbance, the correct sizing of valves, and a proper implantation may help surgeons avoid this postoperative complication.

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