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EDITORIAL COMMENT

Left Bundle Branch Block and New Permanent Pacemaker Implantation After Transcatheter Aortic Valve Replacement

Are They Benign?*

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This year marks the 15th anniversary of transcatheter aortic valve replacement (TAVR). Over this time, the procedure has improved; with dramatic reductions in adverse procedural outcomes such as death, stroke, vascular complications, and paravalvular leak (1). It now seems justified to look further to issues such as morbidity, resource use, quality of life, and longer-term implications of the procedure. These issues become increasingly important as TAVR is more widely considered an option for younger and lower-risk patients with the potential for longevity.

New-onset left bundle branch block (LBBB) has been reported in 4% to 65% of patients following TAVR (2). Of concern, LBBB has been associated with an increased risk of cardiac death, as well as a tendency to increased all-cause mortality (2,3). Concerns about progression to complete atrioventricular block often lead to temporary pacemakers, delayed mobilization, and extended monitoring, with implications for hospital stay, resource use, and cost. Not surprisingly, LBBB also leads to an increased likelihood of new permanent pacemaker implantation (PPI) early after TAVR (4). Interestingly, it is also a predictor of late PPI after hospital discharge (2,3).

Pacemakers are often considered a relatively benign complication of TAVR, but perhaps this needs to change. In this issue of *JACC: Cardiovascular Interventions*, Chamandi et al. (5) evaluated the long-term prognostic implications of PPI after TAVR. At a mean of 4 years post-TAVR, PPI was associated with a lack of improvement in left ventricular ejection fraction and a significant increase in the combined endpoint of mortality or heart failure rehospitalization.

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It seems reasonable to suggest that, over the short-term pacemakers may have a protective effect against arrhythmic death. However, controversy surrounds whether PPI actually increases late mortality (3). In the current study, PPI was associated with a statistically nonsignificant 5.6% higher rate of mortality at late follow-up. However, assessment of LBBB and pacemaker-associated late mortality is typically confounded by the limited life expectancy of the high-risk patients being studied.

Similarly, we might anticipate the well-known deleterious effects (reduced left ventricular function and heart failure) commonly associated with long-term right ventricular pacing might be a concern. Although it has been documented that in some cases pacemakers are never actually used, Chamandi et al. (6). documented pacemaker activity in most patients at late follow-up. Although heart failure rehospitalization was more frequent, this may not be readily apparent in high-risk TAVR patients who often have other reasons for heart failure and limited survival. The implications of adverse effects on left ventricular function, heart

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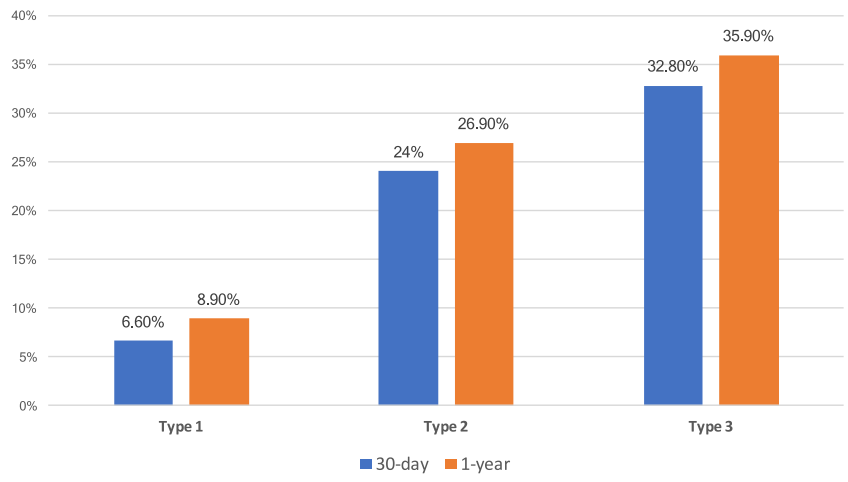
FIGURE 1 New PPI (%) by THV Device Type at 30-Day and 1-Year Follow-Up Post-TAVR



30-day and 1-year follow-up. Type 1 denotes a balloon-expandable valve, Type 2 denotes a self-expandable valve and Type 3 denotes a mechanically expandable valve. PPI = permanent pacemaker implantation; TAVR = transcatheter aortic valve replacement; THV = transcatheter heart valve.

failure, and late mortality may be more relevant in lower-risk patients with the potential for longevity.

As TAVR expands to lower-risk patient populations, attention to patient, procedural, and device factors is increasingly relevant. Perhaps the most important patient factors are pre-existing right bundle branch block (RBBB), pre-existing pacemakers, and anticipated longevity. RBBB is a strong predictor of both PPI and sudden cardiac death post-TAVR (6). It would seem reasonable that the presence of RBBB should prompt procedural strategies and device selection to mitigate risk; the corollary is that other factors (ease of implantation, access, cost) should determine device selection in patients with pre-existing pacemakers or limited survival.

The best documented procedural factor is the depth of transcatheter heart valve (THV) implantation within the left ventricular outflow tract. More speculative factors include repositioning, late radial expansion, shortening, etc. Techniques and technology intended to improve prosthesis positioning and reduce implant depth have been demonstrated to reduce PPI rates, regardless of whether the prosthesis is balloon-, self-, or mechanically expandable. Nevertheless, device factors are clearly a major determinant of LBBB and PPI. Certain specific valves are associated with markedly higher rates of these complications than other valves. Our own data from British Columbia found significant differences in PPI 30-day rates between 3 different prosthesis types: ranging from a low of 5.8% to 24.8%, to a high of 37.5% (**Figure 1**). Moreover, PPI rates continued to diverge over the subsequent year.

Although the mechanism of transcatheter valve expansion has often been faulted as a determinant of higher PPI rates, this is not necessarily the case. Low PPI rates have been reported with newer self- and mechanically expandable valves that facilitate more accurate and higher positioning. New transcatheter valve systems and new versions of existing THV systems will need to be independently assessed for their impact on LBBB and PPI rates.

IMPLICATIONS

Increasingly attention needs to be paid to documenting and reducing the risks of new LBBB and the need for new pacemakers. These complications become more important in lower-risk patients with the potential for longevity. Other patient factors, such as pre-existing RBBB may be important considerations as well. Where these concerns are important

special attention should be paid to modifiable procedural (technique) and device (valve selection) factors. The right valve, for the right patient, with the right implantation technique will lead to a reduction in PPI rates.

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