

Right Bundle Branch Block in Patients Undergoing Transcatheter Aortic Valve Implantation: Are There Clinical Implications?

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Over the past decade, transcatheter aortic valve implantation (TAVI) has become the standard of care for patients with severe aortic stenosis and high surgical risk [1]. Clinical trials have demonstrated that TAVI was not inferior to surgical aortic valve replacement even in intermediate risk patients [2,3] and recently it was proven to have a role even in low-risk patients [4,5]. Thus, TAVI treatment is developing towards treating patients with lower surgical risk and greater life expectancy. Many initial obstacles with TAVI have been largely overcome, including frequent access site complications and concerns about strokes and paravalvular leaks. Using a multidisciplinary heart team approach, patient selection, procedural planning, and device implantation have been refined and optimized such that clinical outcomes are generally predictable and reproducible.

The development of new transcatheter valves has led to a reduction in significant perivalvular leaks, but had a milder impact on the rate of permanent pacemaker implantation (PPI) post-TAVI due to post-procedural cardiac conduction system abnormalities. Thus, the incidence of conduction disturbances remains a major factor for patient comorbidity, even in the era of newer generation TAVI prostheses [2,6].

The significance of conduction disturbances increases even more as TAVI is performed on younger patients and the prevalence of the procedure expands. This complication stems from the close proximity of the aortic valve to the conduction system and the subacute mechanical insult to the conduction system during the procedure (edema, hematoma, inflammation, and ischemia) in conjunction with a subacute process of healing, or because of an association between aortic stenosis and conduction disturbances in patients with senile calcium depositions [7].

The overall rate of PPI post-TAVI ranges from 2% to 51% in a meta-analysis including 41 studies [8]. The incidence differs in types of prostheses used and it varies among different studies since indications to PPI are not uniform because observation periods post-TAVI are different and because some studies included patients with prior implant of pacemakers [9]. Long-term right ventricular (RV) pacing might have a deleterious effect on left and right ventricular function due to electrical asynchrony that causes interventricular and intraventricular dyssynchrony and chronic left ventricular remodeling [10].

Patients with baseline right bundle branch block (RBBB) comprise 10% to 13% of TAVI recipients [11–13]. RBBB is repeatedly shown to be one of the significant predictors for a post-TAVI need for PPI [11,14,15]. It is probably the strongest, most consistent predictor of PPI, and has been identified in most of the studies evaluating multivariate predictors of PPI [9,16]. The presence of RBBB after TAVI was

also shown to be one of the predictors for delayed atrioventricular block (AVB) (> 24 hours after TAVI) [12].

Data regarding the impact of pre-TAVI RBBB on long-term clinical outcomes is limited. Recent studies found that baseline RBBB in TAVI patients is independently associated with higher cardiovascular mortality and all-cause mortality [11,15]. Watanabe et al. [15] found in a multicenter registry of 749 balloon-expandable TAVI patients, that cardiovascular survival probability was significantly lower in the RBBB group than the non-RBBB group. Patients with RBBB and without PPI were at higher risk for cardiovascular mortality in the early phase after discharge (within one month after TAVI), and patients with RBBB and pacemakers had higher cardiovascular mortality at mid-term follow-up.

Auffret et al. [11] evaluated a total of 3527 TAVI patients, grouped according to the presence of RBBB on baseline ECG. PPI was performed if third-degree or advanced second-degree AVB occurred and was not expected to resolve; in the presence of symptomatic sinus node dysfunction or bradycardia; and at the physician's discretion in cases of new onset LBBB with PR prolongation or wide QRS > 150 ms not expected to normalize. Pre-existing RBBB was associated with a higher risk for all-cause and cardiovascular mortality, especially among patients without pacemakers at hospital discharge. Patients with pre-existing RBBB and no PPI at discharge had the highest 2-year risk for cardiovascular death (27.8%). In a sub-analysis of 1245 patients without PPI at hospital discharge

and with complete follow-up regarding the need for PPI, pre-existing RBBB was independently associated with more than a twofold risk for the composite of sudden cardiac death and PPI. Thus, the management of patients with pre-procedural RBBB is unclear and the role of prophylactic PPI in this group needs to be evaluated as part of the treatment algorithm.

In this issue of the *Israel Medical Association Journal (IMAJ)*, Tovia-Brodie et al. [13] retrospectively evaluated the outcomes of prophylactic PPI in 40 patients with baseline pre-TAVI RBBB, and compared them to 50 patients with baseline RBBB and post-TAVI PPI based on standard post-procedural indications. The decision regarding prophylactic PPI was at the discretion of the attending physician. They found that during long-term follow-up of 848 ± 56 days, there was no difference in overall survival, composite event free survival of mortality and hospitalizations, or mortality and syncope between patients who received a prophylactic PPI and patients who were implanted post-TAVI according to guideline indications. During follow-up, 32.4% of the patients in the prophylactic PPI group and 44% in the post-TAVI PPI group had < 1% ventricular pacing. No difference in short-term complication rate was reported. However, the prophylactic group had a trend toward shorter hospitalization duration. On multivariate analysis, independent predictors for the need of pacing included baseline PR prolongation and the use of new generation valves.

When evaluating outcomes of PPI post-TAVI, data should be interpreted in light of several issues. First, the negative effects of chronic RV pacing may be difficult to demonstrate in the ailing TAVI population with a reduced life expectancy and could have prognostic implications in patients with reduced ejection fraction alone. Second, the impact of RV pacing on left ventricular ejection fraction is dependent on the percentage of pacing and on the pacing modal-

ity. Last, the negative effect of chronic RV pacing is counterbalanced by the protective effect of PPI post-TAVI against the risk of sudden cardiac death, probably due to the development of AVB [7].

The fact that there is no difference in long-term outcomes between PPI pre- or post-TAVI in RBBB patients renders both approaches valid. Meanwhile, prolonged monitoring may be considered in patients with pre-existing RBBB, to detect fatal arrhythmic events post-TAVI and new conduction disturbances.

CONCLUSIONS

There is a need for larger prospective studies to investigate the optimal timing for PPI post-TAVI, factors associated with recovery of conduction system abnormalities, factors that may predict the usefulness of prophylactic PPI in the RBBB patient group (for example RBBB with baseline PR prolongation), and strategies aimed at early detection of patients at risk for late development of high degree AVB (such as internal loop recorder, electrophysiological study, and 30 days ECG monitoring). Although guidelines remain vague and there are no clear indications for pre-TAVI PPI, many multicenter and literature-based decisional algorithms exist [9] and are useful until more data is available.

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“Do unto those downstream as you would have those upstream do unto you”

Wendell Berry (born 1934), American novelist, poet, essayist, environmental activist, cultural critic, and farmer