

Insight Into Aortic Stenosis, Surgical Aortic Valve Replacement, Transcatheter Aortic Valve Replacement, and Newly Developed Bundle Branch Block

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Abstract: Background: Valvular aortic stenosis culminates in restriction of left ventricular outflow, which leads to reduced exercise capacity, inadequate cardiac output, heart failure, and cardiovascular mortality. Transcatheter aortic valve implantation has emerged as an alternative to surgical aortic valve replacement for the treatment of patients with symptomatic severe aortic stenosis who are not candidates for surgery or those considered to be at high risk for adverse postsurgical outcome. **Objectives:** The current review aimed to highlight on aortic stenosis, surgical aortic valve replacement, transcatheter aortic valve replacement, and newly developed bundle branch block. 30 to 50% of patients with severe aortic stenosis are denied surgical replacement attributed to a number of reasons, including advanced age, frailty, depressed left ventricular function, other organ dysfunction, or other conditions that deem those patients at high/prohibitive risk for surgical aortic valve replacement. The indication for Transcatheter aortic valve implantation (TAVI) is now extending to intermediate and low surgical-risk patients. Despite these benefits, a growing clinical experience with TAVI has revealed several intra- and post-procedure complications. The occurrence of post-operative conduction disturbances: the most relevant and common are His' bundle branch blocks, atrioventricular blocks, and the need for permanent pacemaker implantation. 34.8% occurring in hospital discharge patients, and with left bundle branch block being the most common significant conduction disturbance after TAVI (10.5%). New-onset left bundle branch block is the most frequent conduction alteration associated with transcatheter aortic valve implantation. **Conclusion:** It can be concluded that transcatheter aortic valve implantation is alternative to surgical aortic valve replacement due to a number of reasons, including advanced age, frailty, depressed left ventricular function, other organ dysfunction, or other conditions that deem those patients at high/prohibitive risk for surgical aortic valve replacement. The most post-operative conduction disturbances are His' bundle branch blocks, atrioventricular blocks, and the need for permanent pacemaker implantation.

Keywords: Severe aortic stenosis, Surgical aortic valve replacement, Transcatheter valve replacement, Bundle branch block. New-onset conduction disturbances

1. Introduction

Transcatheter aortic valve implantation (TAVI) has emerged as an alternative to surgical aortic valve replacement (SAVR) for the treatment of patients with symptomatic severe aortic stenosis (AS) who are not candidates for surgery or those considered to be at high risk for adverse postsurgical outcome (Vahanian et al., 2007, and Bonow et al., 2015).

Severe symptomatic stenosis of the aortic valve (aortic stenosis; AS) is associated with mortality of up to 50% at 1 year if left untreated (Leon et al., 2010 and Bonow et al., 2015).

2. Objectives

The current review aimed to highlight on aortic stenosis, surgical aortic valve replacement, transcatheter aortic valve replacement, and newly developed bundle branch block.

3. Aortic stenosis

A progressive condition, valvular aortic stenosis culminates in restriction of left ventricular outflow, which leads to reduced exercise capacity, inadequate cardiac output, heart failure, and cardiovascular mortality. According to Stewart et al. (1997) and Otto & Prendergast (2014), the prevalence of aortic stenosis is just 0.2% in persons between the ages of 50 and 59, but rises to 9.8% in octogenarians. The prevalence in adults over 75 is 2.8% overall. Among the etiologies are rheumatic, calcific, and congenital conditions. Exertion dyspnea and weariness are examples of symptoms that progressively emerge after an extended, asymptomatic latent phase lasting roughly ten to twenty years. Later on, the patients develop chest discomfort, syncope, and cardiac failure (Pujari & Agasthi, 2020).

The left ventricle becomes blocked due to valve stenosis, increasing the left ventricle's systolic pressure. In addition, it results in an increase in LV ejection time (LVET), a decrease in aortic pressure, and a rise in LV end-diastolic pressure. The larger afterload leads to an increase in LV mass as well as an increase in LV volume overload, which ultimately causes LV dysfunction and failure. Myocardial oxygen consumption rises with elevations in left ventricular mass, systolic pressure, and LVET, but myocardial perfusion time decreases with an increase in LVET. Accordingly, left ventricular performance continues to deteriorate when cardiac oxygen consumption rises and cardiac oxygen delivery decreases (Ross and Braunwald, 1968; Pujari & Agasthi, 2020).

4. Surgical aortic valve replacement

For decades, surgical aortic valve replacement (SAVR) has been the gold standard therapy for symptomatic patients with severe AS. In patients with no serious comorbidities, SAVR usually carries a low operative risk of mortality (Cribier *et al.*, 2002).

However, in clinical practice, almost 30 to 50% of patients with severe AS are denied surgical replacement (Thaden *et al.*, 2014). This is attributed to a number of reasons, including advanced age, frailty, depressed left ventricular function, other organ dysfunction, or other conditions that deem those patients at high/prohibitive risk for SAVR. For decades, a less invasive treatment modality that is equally safe and effective as SAVR remained an unmet need (Cribier *et al.*, 2002).

5. Transcatheter aortic valve implantation

Transcatheter aortic valve implantation (TAVI) has become a well-established modality for the treatment of severe AS. Initially introduced for patients with high or prohibitive risk for surgery, the indication for TAVI is now extending to intermediate and low surgical-risk patients (Mack *et al.*, 2019, and Popma *et al.*, 2019).

Since its first in man in 2002, TAVI has seen exponential growth being implanted in more than 300,000 patients, with an annual increase of 40% by the year 2016 (Cribier, 2016).

Despite these benefits, a growing clinical experience with TAVI has revealed several intra- and post-procedure complications. One of these complications is the occurrence of post-operative conduction disturbances: the most relevant and common are His' bundle branch blocks, atrioventricular blocks, and the need for permanent pacemaker implantation. With the frequency at 10% to even 50%, conduction abnormalities are among the most important TAVI-related adverse events (Urena *et al.*, 2014).

6. New-onset conduction disturbances

New-onset conduction disturbances are common after TAVI, occurring in as much as 34.8% of patients at hospital discharge (Nazif *et al.*, 2014), and with left bundle branch block (LBBB) being the most common significant conduction disturbance after TAVI (10.5%) (van der Boon *et al.*, 2012 and Nazif *et al.*, 2014).

New-onset left bundle branch block (LBBB) is the most frequent conduction alteration associated with transcatheter aortic valve implantation (TAVI) (Roten *et al.*, 2010). Several studies have evaluated the predictive factors of new-onset LBBB following TAVI, but most of them have focused on patients undergoing TAVI with the self-expandable system (CoreValve, Medtronic Inc, Minneapolis, Minnesota) (Fraccaro *et al.*, 2011). Furthermore, all studies to date have included patients with conduction disturbances prior to TAVI (including patients with a prior pacemaker in some), which may indeed lead to a more difficult interpretation of the exact role of TAVI on the development of new conduction disturbances and its predictors (Calvi, *et al.*, 2012).

7. Conclusion:

It can be concluded that transcatheter aortic valve implantation is alternative to surgical aortic valve replacement due to a number of reasons, including advanced age, frailty, depressed left ventricular function, other organ dysfunction, or other conditions that deem those patients at high/prohibitive risk for surgical aortic valve replacement. The most post-operative conduction disturbances are His' bundle branch blocks, atrioventricular blocks, and the need for permanent pacemaker implantation.

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