

# Innovations in Cardiovascular Patient Care: Transcatheter Aortic Valve Replacement



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## KEYWORDS

• TAVR • SAVR • Aortic valve stenosis • Bicuspid aortic valve • Heart failure

## KEY POINTS

- Aortic valve disease is one of the most common and serious valvular disorders and is not reversible through medicinal intervention.
- Aortic valve disease includes bicuspid valve disease and calcific valve disease which progresses on a continuum.
- The option of the transcatheter aortic valve replacement (TAVR/TAVI) offers the high risk surgical patient a treatment for critical aortic stenosis where there used to be none.
- In order for long term success and to lessen complications of the inpatient stay; a multi-disciplinary approach that includes nursing is critical.

## INTRODUCTION

Heart disease is the leading cause of death in men and women, killing about 610,000 people in the United States annually, which represents 1 in 4 deaths.<sup>1</sup> Although coronary disease is the most common type of heart disease, valvular disease is increasing, especially in individuals more than the age of 65 years because of the predominance of degenerative conditions in this age group. Aortic stenosis (AS) and mitral regurgitation account for 3 in 4 cases of valvular disease, which makes the estimated overall prevalence of valvular disease 2.5%.<sup>2</sup>

Aortic valve disease is one of the most common and most serious of the valvular disorders. No medications can reverse aortic valve disease but medications can be used for symptom management. When medications fail to manage aortic valve disease, other procedural options are explored. These procedural treatment options for aortic valve disease include balloon valvuloplasty, aortic valve replacement, and transcatheter aortic valve replacement (TAVR). The TAVR option has increased in popularity. It is important for nurses to have knowledge of this treatment option in order to ensure the best patient outcomes.

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## ANATOMIC REVIEW

The aortic valve is one of the four heart valves and sits between the left ventricular outflow tract and the ascending aorta. From the left ventricular outlet to the junction with the ascending aortic portion is called the aortic root.<sup>3</sup> This entire structure is anatomically the aortic valve. The normal aortic valve has 3 leaflets that attach to the ventricular and aortic walls. These half-moon-shaped cusps are semilunar in appearance. In a closed position the valve shows triradiating lines of apposition. This position also exposes small dilatations of the proximal aorta, which are 3 sinuses. Two sinuses are origins for the coronary arteries (the anterior or right coronary artery and the posterior or left coronary artery), and the third is the noncoronary aortic sinus. With the aortic valve in the open position, these sinus openings are protected from the pressure of ventricular ejection by the 3 leaflets. The 3 aortic valve cusps vary in size, with the left and right cusps being more equal in size and the posterior cusp slightly larger in two-thirds of the population.

Outward edges of each cusp attach it to the aortic wall. Attachment occurs at the supraaortic ridge, which is composed of a thickened aortic wall structure, called the sinotubular junction, which is the functional level of the aortic valve junction. Small spaces called commissures occur between each cusp. The 3 equally spaced commissures surround the aortic trunk. At the location of the right posterior aspect of the aortic root lie the commissures between the left and posterior cusps. The commissure located at the right anterior aspect of the aortic root is between the right and noncoronary cusp. Physiologically valve structure allows diversion of valve stress to be reflected to the aortic wall.<sup>4</sup>

## AORTIC VALVE DISEASE

The aortic valve normally has 3 leaflets or cusps. The valve can have altered functioning through 2 mechanisms: (1) stenosis, and (2) insufficiency. A stenotic valve is narrowed and does not fully open. This condition causes obstruction to the outflow of blood from the left ventricle through the aorta during systole. An insufficient valve leaks blood and allows backflow of blood during diastole. An insufficient valve is the most common alteration of aortic valve functioning. Two common causes of AS in the United States are degenerative calcification and a congenital bicuspid aortic valve. Degenerative calcification of the aortic valve occurs with aging. Calcium and scar tissue buildup from rheumatic valve disease are apparent with increasing age. This buildup is called senile degenerative stenosis.<sup>5</sup> Obstruction to outflow causes left ventricular hypertrophy. This hypertrophy results from increased left ventricular workload. Three classic symptoms of AS are dyspnea, angina, and syncope. In order to prevent sudden death, which has a high probability in untreated AS, surgical intervention is required.

## AORTIC STENOSIS

AS is not a disease that occurs in 1 stage. It can be viewed on a progressive continuum. The continuum is initiated by aortic sclerosis and moves to severe AS in approximately 10% of patients.<sup>6</sup> Progression of the disease results in thickening and calcium nodules that further promote stress-related damage between the fibrosa and ventricularis.<sup>7,8</sup> These nodules are located within layers of the leaflet bulge that causes restricted leaflet motion during ventricular systole, which causes obstructed left ventricular systolic outflow (**Fig. 1**).

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