

Chapter 23

Aortic Valvular Disease

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ABSTRACT

Broadly speaking, pathology is categorized as being primarily related to valvular stenosis (AS) or regurgitation (AR), but a diseased valve may often exhibit both. The predilection of degenerative disease of the aortic valve, particularly stenosis, for the elderly has resulted in a steadily increasing prevalence as the population ages. As general life expectancy increases in the United States and other western countries, surgery to correct aortic valve disease will increase. As more elderly patients with more comorbidities present for surgery their intraoperative and perioperative care will become more complex. This chapter discusses ways for the practicing intensivist to facilitate identification and treatment in the immediate peri-operative period.

INTRODUCTION

Surgery to repair a dysfunctional aortic valve remains the most common indication for valvular heart surgery. Broadly speaking, pathology is categorized as being primarily related to valvular stenosis (AS) or regurgitation (AR), but a diseased valve may often exhibit both. The predilection of degenerative disease of the aortic valve, particularly stenosis, for the elderly has resulted in a steadily increasing prevalence as the population ages. As general life expectancy increases in the United States and other western countries, surgery to correct aortic valve disease will increase. As more elderly patients with more comorbidities present for surgery their intraoperative and perioperative care will become more complex.

In general, symptomatic patients should be offered surgical correction. However, many elderly patients with severe AS have significant medical comorbidities. In the past, this has resulted in a significant minority of patients not being referred for surgery. The advent of transcatheter aortic valve replacement (TAVR) has offered promise as a durable therapeutic option for those patients previously considered to be at increased risk for traditional surgery.

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The goal of this chapter is to provide an overview of the epidemiology and pathophysiology of adult aortic valve disease followed by a discussion of the operative procedures performed to correct this pathology. Emphasis will be placed on potential complications and their manifestations in the immediate peri-operative period to facilitate identification and treatment for the practicing intensivist.

Aortic Stenosis (AS)

AS is the result of gradual thickening and calcification of the aortic leaflets over time. As the leaflets subsequently become less pliable and resist normal movement, a transvalvular gradient develops. This process is multifactorial and influenced by clinical factors (age, gender, hypertension) patient habits (smoking), and genetic factors (Boon, Cheriex, Lodder, & Kessels, 1997; Stewart et al., 1997; Thanassoulis et al., 2013). A congenitally bicuspid aortic valve, which is found in approximately 1.4% of the population, is the most common cause of symptomatic AS in patients less than 70 years of age (Go et al., 2013; Roberts & Ko, 2005). The mechanical stress on the bicuspid valve predisposes these patients to earlier calcific degeneration. In a population based study, bicuspid aortic valve patients were far more likely to progress to valve replacement (24.4% in 20 years) than the general population (Michelen et al., 2008).

Progression of stenosis is reflected by a reduction of aortic valve area (AVA) and an increase in transvalvular gradients and flow velocities. This process is typically slow with an average annual decrease in AVA of 0.1cm/yr and an increase mean gradient of 5-8 mmHg (Brener, Duffy, Thomas, & Stewart, 1995; Nassimiha, Aronow, Ahn, & Goldman, 2001; Otto et al., 1997). Over time, the increase in left ventricular systolic pressure needed to overcome the stenotic valve increases left ventricular wall stress with resultant left ventricular hypertrophy. When left untreated the left ventricle eventually decompensates with resultant heart failure symptoms. Guidelines for operative intervention in the setting of aortic stenosis are listed in the accompanying table.

The natural history of aortic stenosis was classically described by Ross and Braunwald in 1968 (Ross & Braunwald, 1968). The authors defined the symptom triad of angina, syncope, and heart failure as harbingers of advanced disease with well-defined associated morbidity and mortality. Expected survival after the development of these symptoms is dismal and has been subsequently corroborated by multiple authors (Cheitlin et al., 1979; Davies, Gershlick, & Balcon, 1991; Otto, Pearlman, & Gardner, 1989; Turina, Hess, Sepulcri, & Krayenbuehl, 1987). Despite pathophysiologic similarities to atherosclerosis, attempts to curb AS progression with statin therapy have been unsuccessful in randomized trials (Cowell et al., 2005; Rossebo et al., 2008) and at present, no effective medical therapies exist. The only definitive therapy remains relief of the mechanical obstruction with valve replacement.

The prevalence of AS mirrors the aging population. An often cited study by Nkomo and colleagues pooled results of four large population based studies in the United States. The authors found AS in less than 0.2% of patients under age 65, in 1.3% of those between age 65 and 74, and in 2.8% of those 75 and older (Nkomo et al., 2006). This correlation with age is consistent across industrialized nations and has been confirmed by other authors (Eveborn, Schirmer, Heggelund, Lunde, & Rasmussen, 2013; Lindroos, Kupari, Heikkila, & Tilvis, 1993; Nkomo et al., 2006; Stewart et al., 1997).

This fact coupled with increasing life expectancies across the Western world has led to some startling projections. In the United State alone, there will be an estimated 72 million people over age 65 by 2030 (Iung & Vahanian, 2014). Similar population-based increases are being projected in France and the United Kingdom as well.

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