Original Article

Aortic Stenosis Diagnosis and Management Approach

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Abstract

Background: Aortic stenosis (AS) is defined as an obstruction of the blood flow across aortic valve. It's a common global medical problem that affects elderly population which has hemodynamic consequences and high mortality that reaches 25% in the first year for the symptomatic patients with moderate AS and 50% in two years. It results in the use of significant healthcare resources, with high morbidity particularly in cases of delayed diagnosis and proper management. **Objective:** In this study, we aimed to evaluate the diagnostic and management strategies of Aortic stenosis. **Methods:** PubMed database was used for articles' selection using the following keywords: Aortic Stenosis, its Evaluation, Management, and Diagnosis. **Conclusion:** When aortic stenosis is diagnosed, the clinician should educate their patients about the disease and explain different approaches for its treatment to aid the patient in choosing a suitable SAVR or TAVR approach. This would best be done when considering the multiple factors of stenosis severity, medical and surgical history and co-morbid diseases.

Keywords: aortic stenosis, evaluation, valvular disease

Introduction

Aortic stenosis is a global cause of morbidity and mortality particularly in cases of delayed proper management. It results in considerable health care expenditures used for its medical and surgical treatments. The clinical presentation depends on severity of the valvular stenosis. The severest form of the disease manifests in syncope due to reduction in the cardiac output; however, aortic stenosis may pass unnoticed in its mild form. Patients would often present after a latent stage of one to two decades where no or only mild symptoms are present. Certain clinical presentations are implicated in the presentation of symptomatic aortic stenosis including anginal chest pain following exercise and alleviated by rest, paroxysmal nocturnal dyspnoea, orthopnea and other symptoms of underlying heart failure, and syncopal attack due to generalized vasodilation with restricted stroke volume due to the stenosis causing arterial pressure to decline.

Methodology

PubMed database was used for articles' selection using the keywords Aortic Stenosis, and its Evaluation, Management, Diagnosis. With regard to the inclusion criteria, the articles were selected based on the inclusion of one of the mentioned keywords. Exclusion criteria were all other articles, which did not have one of these topics as their primary endpoint, or repeated studies, and systematic reviews or meta-analyses.

Discussion

Approaching valvular diseases is important in the emergency setting as the physician should maintain adequate history and physical examination skill before proceeding to investigative modalities. It is worth noting that coronary Artery disease which is a life-threatening condition is not only an important

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differential but it might also co-exist with AS. Other differential diagnoses include Hypovolaemic state which is easy to diagnose clinically, mitral valvular regurgitations, stenosis and prolapse. Electrocardiogram is the initial test for cardiac diseases. Moreover, we utilize chest X-ray, serum urea and electrolytes and full blood count to further support the diagnosis. Cardiac biomarkers are an essential part of the approach as they could help in excluding acute myocardial infarction.

Table 1. The Criteria for Determining the Severity of Aortic Stenosis

Severity	Mean Gradient (mmHg)	Aortic valve area cm2
Mild	< 25	>1.5
Moderate	25-40	1-1.5
Severe	>40	< 1 (or < 0.5 cm^2/m^2 body surface area)
Critical	>80	< 0.5

A study was conducted using transthoracic echocardiography and (natriuretic peptides) NT-proBNP for two hundred and fifty patients with symptomatic aortic stenosis and concluded that they are both significantly correlated with the diagnosis, except in obese subjects, yet not affected by previous bypass surgery [1]. Another study tested one hundred and eighty patients with moderate aortic stenosis along with co-morbidities studied with dynamic echocardiography and laboratory BNP levels and he reported a correlation with sensitivity and specificity of 77% and 100%. Respectively [2]. Gulic TG et al. conducted a research in two hundred patients with systolic murmurs comparing the standard echocardiography and a pocket-size imaging device done by non-cardiologists and found no significant difference between them [3].

Other researchers elaborated on patients with severe aortic stenosis, staged according to their extravalvular damage by echocardiography, from 0 to four whereas zero regards those with no extravalvular cardiac damage (Stage 0), left ventricular damage (Stage 1), left atrial or mitral valve damage (Stage 2), pulmonary vasculature or tricuspid valve damage (Stage 3), or right ventricular damage (Stage 4) that Stage 4 were patients with right ventricular damage. He illustrated a significant incremental pattern in mortality with statistically significant increase between each stage and the next (see Table 1) [4].

In patients with asymptomatic aortic valve stenosis, men were more likely to have moderate to severe disease, as well as an elevated c-reactive protein level. This moderate to severe level of stenosis was associated with higher all-cause mortality in men [5]. In addition, asymptomatic patients with low blood pressure had increased risk for all-cause mortality in moderately diseased participants [6]. Another study found that OxPL on apolipoprotein B-100 had higher risk for eventual aortic valve replacement and death in aortic stenosis patients, as it hastened their disease clinical progression [7].

Ren X et al. enrolled one hundred patients with symptomatic bicuspid aortic stenosis(AS), for aortic stenosis calcium score (AVCS) using echocardiography and Quantitative CT. AVCS was positively related to severe AS with sensitivity of 86.7% and specificity of 72.2% . He reported no significant difference between echocardiography and CT in terms of AVCS and hence severity of aortic stenosis in bicuspid aortic valve. Khalil et al. reported the major cardiac adverse events (MCAES) after Trans-catheter aortic valve replacement (TAVR), in two hundred and eighty five patients, with the median of American thoracic association score of nine and found a significant relationship between all-cause mortality and neutrophil to lymphocyte ratio (NLR) [8].

Management

Aortic valve replacement is the definitive treatment for an aortic stenotic valve. While patients presenting with heart failure symptoms would be managed according to emergency protocols with adequate resuscitation including pharmacological management with diuretics, ACE inhibitors, and vasodilators, with persistent disease would be better managed with surgery. The American Heart Association guidelines on surgical indications for aortic stenosis include symptomatic patients with severe stenosis, asymptomatic patients with severe stenosis undergoing bypass or aortic or valvular surgery, and asymptomatic patients with severe stenosis with a left ventricular ejection fraction of less than 0.5 [9].

A multi-center randomized controlled trial was conducted and assigned high risk patients, almost half for surgical aortic valve replacement (SAVR) or trans-catheter aortic valve replacement (TAVR) through either trans-femoral approach or trans- apical aortic valve replacement and concluded that the mortality rate is significantly increased in TAVR compared to SAVR approach [10]. While Kapadia SR et al. found the reverse form when he reported all-cause mortality of 71.8% in TAVR compared to all-cause mortality of 93.3% in the standard treatment [11], taking into consideration a smaller sample size in his study compared to the sample size in MAC MJ study. However, another study found no significant difference in all-cause mortality, stroke and myocardial infarction in patients with severe aortic stenosis with no coronary artery disease in a multi-center study that compared SAVR and TAVR [12]. This claim is supported by a large multi-center elaboration that compared TAVR and SAVR, with the end point of all-cause mortality and found no significant difference between the two groups, also he illustrated no difference in terms of post-surgery structural valve deterioration [13].

One major trial identified predictors of mortality in surgically treated aortic stenosis [14]. In TAVR this included larger left ventricular volumes and decreased ejection fraction, larger orifice area and presence of higher aortic regurgitation. In SAVR treated patients, the predictors were smaller left ventricular volumes and stroke volumes, smaller orifice area and a mismatch between prosthesis and patient.

Sondergaard et al. also showed that in a follow-up study no difference was found between TVAR AND SVAR in all-cause mortality as well as the composite, like stroke and myocardial infarction in both low risk and intermediate risk when the patients were categorized according to Society of Thoracic Surgeons Predicted Risk of Mortality (STS-PROM), in-spite of the finding that the valve area is better with TAVR compared to SAVR [15]. Greve AM et al. focused on lipid lowering medications and its effects in halting progression of mild and moderate aortic stenosis in an observational study. He studied 1873 patients with mild and moderate AS, and concluded that it holds true for the mild AS with low peak jet velocity and higher low density lipoprotein (LDL) level but it does not apply for moderate AS [16]. Sondergaard et al. illustrated no difference exerted by lipid lowering medications on progression of aortic stenosis except in low velocity jet AS with higher levels of LDL [15], which supports the research conducted by Greve et al. [16]. Another study conducted with 789 high-risk patients for surgery reported significant difference between TVAR and SAVR in terms of all-cause mortality and hemodynamics favouring TAVR over SAVR. And when he fractionated the components of all-cause mortality to stroke and myocardial infarction, all were found to be significantly low in TAVR compared to SAVR [17].

A study demonstrated no difference in the preoperative compared to postoperative left ventricular stroke volume by using cardiovascular magnetic resonance imaging (CMR) in ten patients who underwent AVB surgery for severe aortic stenosis [18]. Another group had studied the histological sum-score in the jet-sample and the angle between the LV outflow axis and the aortic root in patients undergoing BAV and demonstrated a significant relationship between them, while he found the relationship between proximal aortic diameter and the angle between systolic flow-jet and ascending aortic wall to be linear [19].

Not all patients will be suitable for surgical intervention and some would be in critical condition, increasing their risk of mortality from operation. In such a category, the percutaneous balloon valvuloplasty could be used as a palliative modality [20]. Valvuloplasty is beneficial in patients who are in critical care, with multiple co-morbidities, with organ failure such as heart failure, and pregnant patients with severe symptomatic stenosis.

Conclusion

It is essential for the physician to be aware of valvular diseases, their clinical progression and proper approach to evaluation. A discussion with the cardiologist or cardiothoracic surgeon for case consultation would be appropriate. Thereafter, the clinician should educate their patients on the disease, and explain the different approaches to treatment to aid the patient in choosing a suitable SAVR or TAVR approach. This would best be done when considering the multiple factors of stenosis severity, medical and surgical history and co-morbid diseases.

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