

# Evaluation of Diastolic Function in Patients with Aortic Stenosis

Szabados Cs<sup>1</sup>, Frigy A<sup>1</sup>, Baricz Emőke<sup>1</sup>, Szabados Imola<sup>1</sup>, Vecsei Boglárka<sup>2</sup>, Incze A<sup>1</sup>

<sup>1</sup> IV. Medical Clinic, University of Medicine and Pharmacy, Targu Mureş

<sup>2</sup> Medical Student, University of Medicine and Pharmacy, Targu Mureş

**Introduction:** Diastolic dysfunction is characterized by an increased resistance to filling with increased diastolic filling pressures. Aortic stenosis has become the most frequent type of valvular heart disease. Aortic stenosis increases diastolic filling pressures due left ventricular hypertrophy.

**Material and methods:** Our study is a retrospective one, and includes the IV. th Medical Clinic patients discharged in years 2009–2010. Thirty-four patients with severe aortic stenosis (group A), and 21 patients with moderate aortic stenosis (group B) underwent complete paraclinical evaluation.

**Results:** The mean age in the group A was 70 years, versus 67 years in group B. The left atrium anteroposterior diameter was 46 mm in group A, and 43 mm in group B. In group A, the mean left ventricular thickness index was 0.51, versus 0.46 in group B. Severe diastolic dysfunction was present in 35% in group A, and in 19% in group B. The most frequent associated pathology was hypertension (35% in group A, 47% in group B). The most common complications were mitral insufficiency (31 patients in group A, 16 patients in group B), pulmonary hypertension (16 patients versus 9 patients).

**Conclusions:** The severe aortic stenosis was more frequent in advanced ages. The left atrium enlargement, the severe diastolic dysfunction, and a greater left ventricular wall thickness index were more common in patients with severe aortic stenosis. The most common associated risk factors in both groups were hypertension. The mitral regurgitation was more frequent in the severe aortic stenosis group.

**Keywords:** aortic stenosis, diastolic dysfunction, risk factors, thickness index

## Introduction

Diastolic dysfunction is characterized by an increased resistance to filling with increased diastolic filling pressures. It has three severity levels: delayed relaxation, pseudonormal and restrictive filling pattern. A variety of disorders are associated with diastolic dysfunction, such as hypertrophy, structural alterations of the myocardium with increased fibrosis, myocardial scarring, or infiltrative processes. In addition to these changes, physiological abnormalities of the left ventricle with impaired relaxation, decreased diastolic filling, and increased stiffness of the myocardium can be observed [1]. Heart failure (HF) represents a major health concern with a severe outcome despite modern therapies. In 40% of cases left ventricular (LV) systolic function is preserved [2]. Diastolic dysfunction is common in hypertension. Hypertension, age, obesity, and diabetes mellitus are the most important risk factors for the development of diastolic heart failure [3]. Few data are available about diastolic heart failure, and these suggest that this has a severe prognosis [4].

Aortic stenosis (AS) has become the most frequent type of VHD in Europe and North America [5]. It primarily presents as calcific AS in adults of advanced age (2–7% of the population .65 years). The second most frequent aetiology, which dominates in the younger age group, is congenital, whereas rheumatic AS has become rare [6].

In patients with aortic stenosis, the most common cause for diastolic dysfunction is left ventricular hypertrophy. Diastolic dysfunction is found in approximately 50%

of the patients with normal systolic ejection performance and in 100% of the patients with depressed function. Diastolic function appears either to be more sensitive for detection of abnormal left ventricular function in patients with aortic stenosis or to precede systolic dysfunction or both [7]. Treatment of diastolic dysfunction is usually achieved by aortic valve replacement with regression of left ventricular hypertrophy, but in patients with decompensated aortic stenosis, a reduction of circulating blood volume to reduce diastolic filling pressures, and thus dyspnea, is often indicated. Prognosis of patients with diastolic dysfunction is usually better than that of patients with systolic dysfunction but is clearly worse than that of normal patients [8].

## Material and method

We made a retrospective analysis of the patients with aortic stenosis discharged between January 2009 – December 2010. We have enrolled the patients in two groups: group A, patients with severe aortic stenosis – peak transaortic gradient more than 80 mmHg, group B, patients with moderate aortic stenosis – peak transaortic gradient between 50 and 79 mmHg. All patients underwent physical examination, paraclinical investigation and complete echocardiographic study. We have noted the associated risk factors, and the most severe complications. To evaluate the severity of diastolic dysfunction, we used the transmitral filling pattern and the medial mitral annulus tissue Doppler curve. For the statistical analysis we used the Graphpad 3 software.

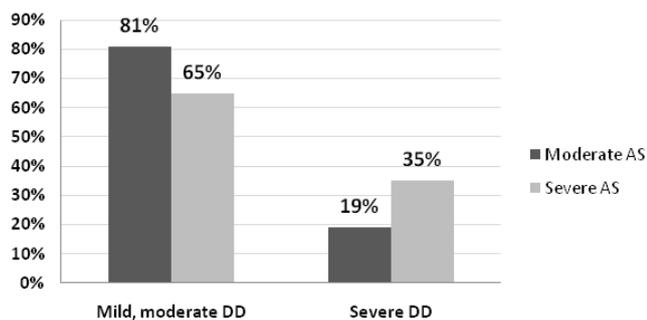


Fig. 1. DD severity in AS

### Results

The mean age of the patient in the group of severe aortic stenosis was 70 years, in the group of patients with moderate aortic stenosis was 67 years ( $p = 0.42$ ). The left atrium anteroposterior diameter was 46 mm in severe aortic stenosis, and 43 mm in moderate aortic stenosis ( $p = 0.15$ ). In the severe aortic stenosis group, the mean left ventricular thickness index was 0.51, versus 0.46 in the group of patients with moderate aortic stenosis ( $p = 0.22$ ). Severe diastolic dysfunction was present in 35% in severe aortic stenosis group, and in 19% in the moderate aortic stenosis group, while non severe diastolic dysfunction was present in 81% of patients with severe aortic stenosis, and in 65% of patients with moderate aortic stenosis ( $p = 0.23$ ) (Fig. 1). The most frequent associated pathology was hypertension (35% in group A, 47% in group B,  $p = 0.45$ ), coronary heart disease (52% versus 35%,  $p = 0.27$ ), obesity (33% versus 26%,  $p = 0.34$ ), and diabetes (19% versus 20%,  $p = 0.57$ ) (Fig. 2). The most common complications presented in figure 3 were mitral insufficiency (31 patients in group A, 16 patients in group B,  $p = 0.39$ ), pulmonary hypertension (16 patients versus 9 patients,  $p = 0.78$ ), and atrial fibrillation (11 patients versus 10 patients,  $p = 0.23$ ).

### Discussion

We observed a greater prevalence of advanced age in the severe aortic stenosis group. In the literature, the atherosclerotic aetiology is the most frequent described [5,6,8]. In our study, all patients with severe aortic stenosis had a degenerative aetiology. The left ventricular (LV) hypertrophy and the consecutive increase in LV filling pressures, cause

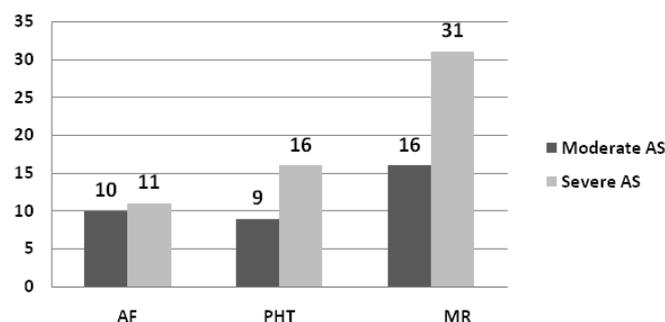


Fig. 3. Complications

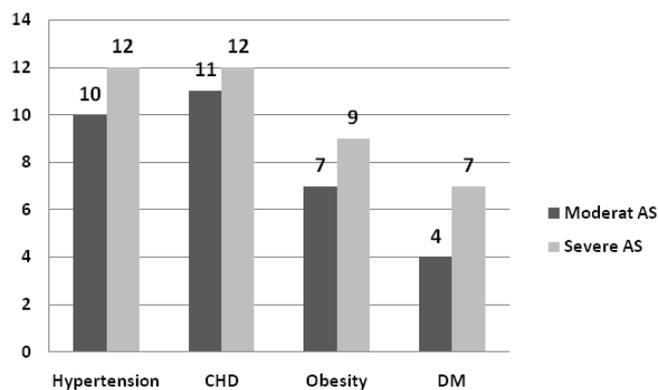


Fig. 2. Associated pathologies

left atrium enlargement and a more frequent prevalence of atrial fibrillation [1,5]. Our patients with severe aortic stenosis had a prominent left ventricular hypertrophy, and a more left atrium enlargement. The severe diastolic dysfunction is more common in patients with chronic pressure overload, and consecutive myocardium fibrosis [2]. In our studygroup the severe diastolic dysfunction was more frequent in severe aortic stenosis. The main risk factors for diastolic dysfunction is hypertension and age [1]. Our patients with severe diastolic dysfunction and severe aortic stenosis had lower blood pressure values, this is because of severe obstruction in the aortic root [4–6]. Because of the increased LV pressures, a mild/moderate mitral regurgitation in the patients with severe aortic stenosis, is a common finding.

### Conclusions

1. Severe aortic stenosis was more frequent in advanced ages.
2. The left atrium enlargement, the severe diastolic dysfunction, and a greater left ventricular wall thickness index were more common in patients with severe aortic stenosis.
3. The most common associated risk factors in both groups were hypertension.
4. The mitral regurgitation was more frequent in the severe aortic stenosis group.

### References

1. Otto A. Smiseth, Michal Tendera – Diastolic Heart Failure, Springer – Verlag, London, 2008, 21 – 41, 53 – 71, 263 – 271
2. Sherif F. Naguech, Christopher P. Appleton, Thyerri C. Gillebert, et al – Recommendations for the evaluation of left ventricular diastolic function by echocardiography, J Echo 2009, 11023: 111 - 128
3. Walter J. Paulus, Carsten Tschope, John E. Sanderson, et al – How to diagnose diastolic heart failure: a consensus statement on the diagnosis of heart failure with normal left ventricular ejection fraction by the Heart Failure and Echocardiography Associations of the European Society of Cardiology, European Heart Journal (2007) 28: 2539–2550
4. Carmen Ginghină, Bogdan A. Popescu, Ruxandra Jurcuț – Esențialul în ecocardiografie, Antaeus, Bucuresti, 2005, 39 -59
5. Alec Vahanian, Helmut Baumgartner, Jeroen Bax – Guidelines on the management of valvular heart disease, European Heart Journal (2007) 28, 230–268
6. Helmut Baumgartner, Judy Hung, Javier Bermejo – Echocardiographic Assessment of Valve Stenosis: EAE/ASE Recommendations for Clinical Practice, j.echo.2009; 22: 1–11
7. Hess OM, Villari B, Krayernbuehl HP – Diastolic dysfunction and aortic stenosis, Circulation 1993 May;87(5 Suppl):73 - 86
8. Peter Libby, Robert Bonow, Douglas Mann, Douglas Zipes – Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine, Saunders – Elsevier, New York, 2007, 1450–1476