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A hospital-based survey of patients with severe valvular heart disease in China

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ABSTRACT

Objectives: Due to increasing aging, the epidemiology of VHD may have changed in China. This study aimed to provide contemporary information on the prevalence, distribution patterns, and etiology of severe VHD in China.
Methods: This was a retrospective survey at Second Affiliated Hospital of Zhejiang University, which included all consecutive patients between 2010 and 2015.
Results: In all, 139,496 patients were enrolled. Among severe valve diseases, MR was the most frequent ($n = 946$, 0.68%) followed by MS ($n = 524$, 0.38%), AS ($n = 392$, 0.28%), and AR ($n = 371$, 0.27%). Severe MR and AS prevalence rates increased strikingly with age. Rheumatic heart disease had an prevalence of 1.56% ($n = 2179$), and remained one of the most common causes of severe VHD in patients younger than 65 years old (99.5% of MS with rheumatic; 27.6% of MR with rheumatic; 25.7% of AS with rheumatic; 31.6% of AR with rheumatic). Aortic valve calcification was the predominant AS etiology, and its prevalence greatly increased with age. In severe AR, rheumatic fever was the most common etiology in patients below 65; in those above 65, etiology was mostly degenerative. In severe primary MR, mitral valve prolapse was the most common cause. Prevalence of secondary MR increased with age, from 16.4% in 18–44 years old to 51.7% in individuals ≥75.
Conclusions: Severe valvular diseases are very common; rheumatic fever and degenerative valvular changes remain predominant causes in patients below 65 and older ones, respectively. Young adults present mainly with primary MR, while secondary MR is more common in elderly ones.

1. Introduction

Compared with hypertension, coronary heart disease, and heart failure, valvular heart diseases (VHD) are not usually considered a common public-health problem, and their contributions to heart dysfunction and death might be ignored. Large-scale epidemiological investigations of VHD are particularly scarce in developing countries, especially in China. In the past, rheumatic valve disease was the most common cause of VHD. Due to the socio-economic development and an increasing population aging, the epidemiology of VHD may have changed in China. Because of the slow and progressive nature of valvular heart diseases, the patients may not recognize symptoms, and many severe valve lesions remain undiagnosed. Thus, survey of severe VHD has become an increasingly important issue. This study aimed to provide contemporary information on the prevalence, distribution patterns, and etiology of severe VHD in China.

2. Methods

2.1. Patients

This was a retrospective survey based on the database of Second Affiliated Hospital of Zhejiang University, a tertiary and high-volume center in China. It was designed to include all consecutive patients between January 2010 and December 2015. The patients were ≥18 year old individuals admitted to our hospital as well as those visiting outpatient clinics. Only transthoracic echocardiography was selected for analysis, and poor echocardiograms were excluded. The first examination recording was selected, when the patients underwent multiple echocardiography sessions during this period. This study was approved by the institutional review board and carried out according to the principles of the Declaration of Helsinki.

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Table 1
Prevalence rates of severe valvular heart diseases in hospital-based studies.

	Age (years)					*p* value for trend
	18–44	45–54	55–64	65–74	≥75	
Patients, n	27,526	24,872	34,161	29,582	23,355	–
Male, n (%)	13,545 (49.2)	11,676 (46.9)	17,135 (50.2)	16,016 (54.1)	13,391 (57.3)	–
MR, n (%)	110 (0.40)	155 (0.62)	220 (0.64)	254 (0.86)	207 (0.89)	<0.001
Female, n (%)	50 (0.36)	74 (0.56)	96 (0.56)	125 (0.92)	84 (0.84)	<0.001
Male, n (%)	60 (0.44)	81 (0.69)	124 (0.72)	129 (0.81)	123 (0.92)	<0.001
MS, n (%)	111(0.40)	159 (0.64)	153 (0.45)	72 (0.24)	29 (0.12)	<0.001
Female, n (%)	81 (0.58)*	114 (0.86)*	112 (0.66)*	51 (0.38)*	14 (0.14)	<0.001
Male, n (%)	30 (0.22)	45 (0.39)	41 (0.24)	21 (0.13)	15 (0.11)	<0.001
AS, n (%)	19 (0.07)	44 (0.18)	77 (0.23)	121 (0.41)	131 (0.56)	<0.001
Female, n (%)	10 (0.07)	23 (0.17)	41 (0.24)	53 (0.39)	53 (0.53)	<0.001
Male, n (%)	9 (0.07)	21 (0.18)	36 (0.21)	68 (0.42)	78 (0.58)	<0.001
AR, n (%)	69 (0.25)	68 (0.27)	94 (0.28)	74 (0.25)	66 (0.28)	0.73
Female, n (%)	21 (0.15)*	19 (0.14)*	31 (0.18)*	16 (0.12)*	15 (0.15)*	0.78
Male, n (%)	48 (0.35)	49 (0.42)	63 (0.37)	58 (0.36)	51 (0.38)	0.98

MR, mitral regurgitation; MS, mitral stenosis; AS, aortic stenosis; AR, aortic regurgitation.
* Versus with male, $P < 0.05$.

Severe valvular heart disease was defined as follows [1].

1) Severe aortic stenosis[1] (AS) with a maximal jet velocity ≥ 4 m/s or mean
2) ΔP ≥ 40 mmHg
3) Severe mitral stenosis (MS) with a valve area ≤ 1.5 cm^2
4) Severe mitral regurgitation (MR) with a grade ≥ 3/4
5) Severe aortic regurgitation (AR) with a grade ≥ 3/4

2.2. Statistical analysis

Gender-specific and age-specific frequencies of severe valvular heart diseases in the study population were assessed. Categorical data were presented as number (percentage) of patients. Gender-specific severe valve disease rates were compared between groups by Pearson's χ^2 test. Trends across age groups were assessed by the Mann-Whitney *U* test. A two-sided $P < 0.05$ was considered statistically significant. SPSS for Windows version 20.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analyses.

3. Results

From January 2010 to December 2015, a total of 139,496 patients were enrolled. Prevalence rates of severe valvular heart disease across different age and gender groups are shown in Table 1. Among the severe valve diseases, MR was the most frequent ($n = 946$, 0.68%) followed by MS ($n = 524$, 0.38%), AS ($n = 392$, 0.28%), and AR ($n = 371$, 0.27%). Prevalence rates of severe MR and AS increased strikingly with age (Table 1). However, a marked decrease in MS prevalence was observed in patients with advanced age. AR prevalence had no relationship with age. No gender differences were found in prevalence of severe VHD in relation with aging. AR prevalence was significantly higher in males than females, and MS frequency was strikingly lower in males than females (Table 1).

Among the 139,496 patients, 928 suffering from severe aortic valve disease, with only 179 (19.3%) had previously underwent an intervention. In addition, the number of patients with severe mitral valve disease was 1709, and only 265 (15.5%) had previously underwent an intervention. The prevalence of severe aortic valve disease (severe mitral valve disease) needed intervention increased with age, from 69.6% (79.7%) in 18–44 year old to 97.0% (96.3%) in people ≥75 years old.

Etiology and classification of severe VHD were carried out according to the 2014 AHA/ACC Guidelines [1] and EAE/ASE recommendations [2]. The most common cause of severe MS remained rheumatic fever ($n = 520$, 99.2% of those with MS). Etiologies of severe AS, AR and MR are shown in Tables 2–4. Aortic valve calcification (AVC), the predominant etiology of AS, was greatly increased with age (Table 2). Another common cause of severe AS was BAV, especially in young patients (Table 2). Rheumatic fever was one of the most common causes of severe AS in patients below 65. In severe AR, rheumatic fever was also the most common etiology in patients younger than 65 years old (Table 3). In patients ≥65 years severe AR etiology was mostly degenerative, and markedly increased prevalence of degenerative AR was observed with increasing age (Table 3). The etiology of severe MR was divided into primary ($n = 574$, 60.7%) and secondary ($n = 372$, 39.3%) types, as shown in Table 4. In severe primary MR, mitral valve prolapse ($n = 287$, 50.0%) was most common, followed by rheumatic disease ($n = 177$, 30.8%). The prevalence of severe secondary MR increased significantly with age (Table 4).

4. Discussion

This survey showed considerable prevalence of severe VHD in China. As for the distribution of severe valve diseases, MR (0.68%) was the most frequent followed by MS (0.38%), while AS (0.28%) and AR (0.27%) were observed with similar frequencies. Moderate or severe valve diseases are moderately common in the United States (MR, 1.7%; MS 0.1%; AS, 0.4%; AR, 0.5%) [3]. The relationship between severe VHD and advanced age varies with valve disease types. This study provides information on gender differences in the prevalence of severe VHD. We also presented unique contemporary data on severe VHD etiology in Chinese patients.

Aortic stenosis is one of the most common valvular diseases in developed countries, and its prevalence is expected to increase with population aging [3,4]. In agreement with previous studies, we found that severe AS prevalence increased strikingly with age. Previous studies assessing AS prevalence are scarce and provide disparate data (3% to 23%) [5,6]. A meta-analysis of population based research showed a prevalence of severe AS among elderly of 3.4% (95% CI: 1.1% to 5.7%) [7]. The burden of severe AS among elderly patients (≥75 years) in this study was 0.56%, corroborating another Chinese survey [8]. Symptomatic, untreated severe AS is associated with 50% of risk of death within 1 or 2 years [9–11]. Previous findings revealed that patients with severe asymptomatic AS have approximately 3.5-fold higher rate of all-cause death with conservative strategy compared with those with aortic valve replacement [12]. As shown above, a large number of patients (80.7%) with severe AS needed intervention, and the percentage of such patients greatly increased with age. However, our clinical

[1] For patients with low-flow/low-gradient AS, dobutamine stress echocardiography was performed.

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