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Original article

Prevalence and clinical characteristics of degenerative mitral stenosis

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ABSTRACT

Background: Degenerative mitral stenosis (DMS) is found in the elderly population. However, there are a few reports regarding the prevalence rate of DMS and, its clinical characteristics. The aim of this study was to determine the relationship between age, gender, and the prevalence rate of DMS.
Methods: Patients with DMS and rheumatic mitral stenosis (RMS) were searched retrospectively in consecutive patients who underwent echocardiography from January 2011 to December 2013 in a community hospital. DMS was defined as presence of both turbulent antegrade flow with a mean transmitral pressure gradient (PG) of ≥2 mmHg and mitral annular calcification without restriction of leaflets tip motion.
Results: We identified 19 patients (17 female and 2 male) with DMS (0.22%) and 19 patients with RMS in 8683 patients. The prevalence rate of DMS significantly increased with aging, especially in patients >90 years old. There was no significant difference in the prevalence rates of RMS among the age groups. Patients with DMS were older (86 ± 8 years vs. 73 ± 10 years, $p < 0.01$) and had higher rates of hypertension and aortic stenosis, larger left ventricular mass index, and mean PG of aortic valve, smaller aortic valve area, less degree of left atrial dilatation, and lower rate of atrial fibrillation, compared with those values in patients with RMS.
Conclusions: DMS is rare (0.22%) and almost exclusively found in females in routine echocardiography. The prevalence of DMS increases with aging to 2.5% in patients >90 years of age, and DMS is often associated with aortic valve stenosis.

Introduction

Degenerative aortic stenosis (AS) and mitral annular calcification (MAC), which are degenerative calcific processes of the aortic valve and mitral annulus, are found with increasing frequency in the elderly population [1–3]. Some of such patients show increased transmitral valve pressure gradient (i.e. mitral stenosis (MS)) due to the extension of calcification to the mitral valve leaflets, which is variously termed calcific MS, non-rheumatic MS, or degenerative MS (DMS) [4–12]. DMS is often found in patients with cardiovascular risk factors [6]. Hence, the frequency of DMS is expected to rise with increasing elderly subjects in whom multiple cardiovascular risk factors accumulate. However, there are only a few reports regarding the prevalence rate [6] and clinical characteristics of DMS [6,12]. Furthermore, the relationship between the prevalence rate of DMS and age or gender remains unclear. In the present study, we aimed to assess the prevalence rate of DMS in patients undergoing routine echocardiography and its difference depending on age and gender.

Methods

Study patients

This was a single-center study conducted at Kushiro Kojinkai Memorial Hospital which is the largest tertiary referral hospital for

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patients with cerebral and cardiovascular diseases in the East area of Hokkaido prefecture, including Kushiro city with a population of 300,000. Patients with DMS and rheumatic MS (RMS) were searched retrospectively in consecutive in- and out-patients who were referred to the echocardiographic laboratory at Kushiro Kojinkai Memorial Hospital for diagnostic examination from January 1, 2011 to December 31, 2013. MAC was defined as an echogenic structure located at mitral annulus [2,4]. MS was defined as presence of a turbulent antegrade flow with a mean transmitral pressure gradient (PG) of $\geq$2 mmHg assessed by continuous wave Doppler echocardiography, according to previous reports [6,12] (Fig. 1B and D). Of the patients with MS, presence of MAC with normal mitral leaflets without restriction of leaflets tip motion was defined as DMS (Fig. 1A) [6] and presence of thickening and calcification of mitral leaflets with decreased leaflet tip motion was defined as RMS (Fig. 1C) [5,6]. Exclusion criteria were poor echocardiographic image, hemodialysis treatment, history of mitral valve repair or mitral valve replacement. Patients with moderate or severe mitral regurgitation and RMS were included, according to the previous report [6].

Clinical, echocardiographic, and laboratory test data of patients were collected retrospectively using hospital charts, and data collected within 7 days before or after the echocardiographic examinations were used for the present correlation analyses. The plasma brain natriuretic peptide (BNP) levels were measured using a highly sensitive immunoradiometric assay (Shionogi, Osaka, Japan). Follow-up data were obtained by reviewing hospital charts of each patient. All-cause mortality during the follow-up was selected as the endpoint.

Transthoracic echocardiography

Conventional transthoracic echocardiography was performed using a commercially available ultrasound imaging system (iE33, Phillips Medical Systems, Andover, MA, USA) equipped with an S5-1 transducer. Two-dimensional echocardiography was performed using the standard echocardiographic views, including parasternal long-axis and apical four-, three-, two-chamber views from a left lateral decubitus position. Standard two-dimensional measurements [left ventricular (LV) end-diastolic dimension (mm), and septal and posterior wall thicknesses at end-diastole (mm)] were determined. The LV ejection fraction (%) was calculated using the biplane disk summation method, and the LV mass (g/m^2) was calculated according to the recommendations of the American Society of Echocardiography and normalized to the body surface area [13]. The left atrial (LA) volume (mL/m^2) was also measured using the biplane disk summation method and was also normalized to the body surface area [13]. Peak velocity of transmitral flow during early diastole (E) was determined by pulsed wave Doppler echocardiography. The inferior vena cava dimension was measured at end-expiration and just proximal to the junction of the hepatic vein. The PG of tricuspid regurgitation was calculated by applying the simplified Bernoulli equation: $4v^2$ (v = peak velocity of tricuspid regurgitation, m/s) [14]. Mitral and aortic regurgitations were assessed semi-quantitatively and graded as none, mild, moderate, and severe [15]. Mean PG of mitral valve was calculated by tracing the continuous wave signal across the mitral valve in apical four-chamber views. Mitral valve area (MVA) in patients with DMS was calculated using the continuous equation [16]. MVA in patients with RMS was calculated using the pressure half time method and severe RMS was defined as MVA $<$1.0 cm^2 [16]. Mean PG and max PG of aortic valve were determined by continuous wave Doppler echocardiography and aortic valve area (AVA) was calculated using the continuous equation [16].

Statistical analysis

All continuous variables are expressed as the means $\pm$ SD. Differences in continuous variables between two groups were assessed by the unpaired t-test. Categorical variables were analyzed by the chi-square test, and Fisher's exact test was used when appropriate. A data analysis was performed using commercially

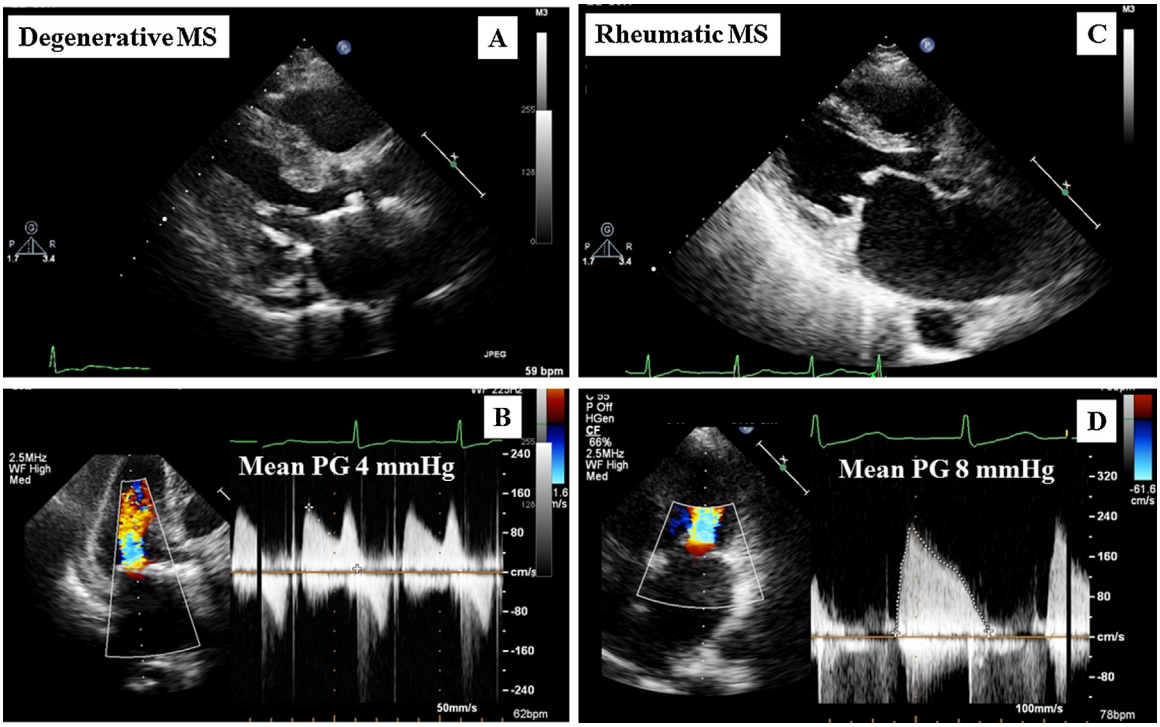

Fig. 1. Images of two-dimensional echocardiography and continuous wave Doppler echocardiography in a patient with degenerative mitral stenosis (MS) (left) and a patient with rheumatic MS (right). PG, pressure gradient.