Primary Care Respiratory Journal (2006) **15**, 342—345

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PRIMARY CARE RESPIRATORY JOURNAL

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ORIGINAL RESEARCH

Prevalence of mitral valve prolapse in primary spontaneous pneumothorax

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Received 25 November 2005; accepted 20 August 2006

KEYWORDS
Mitral valve prolapse;
Pneumothorax

Summary
Background: Mitral valve prolapse (MVP) has been described as a common diagnosis and has been reported in 50% of patients with primary spontaneous pneumothorax (PSP). The purpose of this study was to determine the prevalence of MVP — as diagnosed by 2D-echocardiography criteria — in spontaneous pneumothorax.
Method: A case-control study of 24 patients with PSP, and 40 age-matched controls. All cases underwent 2D echocardiography by a certified cardiologist. Echocardiography and demographic features of both groups were compared and analyzed using Fisher's exact test. Classic MVP was defined as superior displacement of the mitral leaflets of more than 2 mm during systole and as a maximal leaflet thickness of at least 5 mm during diastasis, and non-classic prolapse was defined as displacement of more than 2 mm with a maximal thickness of less than 5 mm.
Results: MVP was found in 9 of the 24 patients (37.5%) who suffered PSP, compared to 3 out of the 40 (7.5%) age-matched controls ($P = 0.008$). The body mass index (BMI) (weight/height2) was lower in the group with pneumothorax ($P = 0.001$).
Conclusion: In this study, applying an updated definition of MVP, the prevalence of MVP in PSP was lower than previously reported, but was still significantly higher than in the control group.

Introduction

The incidence of primary spontaneous pneumothorax (PSP) in male Arabs is 8.8 per 100,000 per year and it is predominantly a disease of young men [1]. PSP occurs mostly through the rupture of a sub-pleural bleb or bullae [2]. Mitral valve prolapse (MVP) has been described as a common disorder, with prevalence estimates ranging from 5% up to 35% [3—5]. In a community-based sample of the population, however, prevalence of MVP was 2.4% [6], lower than previously reported. Echocardiographic MVP has been found in 50% of patients with PSP

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doi:10.1016/j.pcrj.2006.08.011

[7]. Studies describing the three-dimensional shape of the mitral annulus [8,9] have allowed the two-dimensional (2D-) echocardiographic characterization of the prolapse to be refined, thus minimizing false positive diagnoses [10,11].

We used current 2D- echocardiographic criteria to determine the prevalence of MVP in patients with PSP admitted to Adan teaching hospital in the Ahmadi Governorate in Kuwait.

Methods

Patients

The study was carried out in the medical department of Adan teaching hospital. Twenty-four consecutive patients were included during a two-year period from November 2002 to November 2004. Patients diagnosed with PSP, in the absence of underlying traumatic and intrinsic pleuropulmonary disease on clinical examination and imaging technique, were included. The control group consisted of forty age-matched asymptomatic Kuwaiti health care workers residing in the same drainage area who were seen consecutively when undergoing routine employment medical examinations. All subjects were physically examined. The physical examination included measurement of body mass index (BMI - the weight in kilograms divided by a square of the height in meters) and blood pressure, and assessment for chest deformities, stigmata of Marfan's syndrome, and the presence of a mitral systolic murmur and mid-systolic click. Patients in both groups were referred for chest X-ray and echocardiography.

Echocardiographic methods

All subjects underwent standard 2D-echocardiography with a commercially available system, Vivid 7 General Electric, which used a 2.5 MHz transducer. Images were recorded on a CD, including complete parasternal, apical and subscostal views, and colour Doppler assessment of the valvular regurgitation. We measured the displacement of the anterior and posterior mitral leaflets in the parasternal and apical long axis views, scanned by tilting the transducer to visualize all the three scallops of the posterior leaflets [8,9,12]. The thickness of the mitral leaflets during diastasis was measured from the leading to the trailing edge of the thickest area of the mid-portion of the leaflet, excluding focal areas of thickness and the chordae [13,14]. Each leaflet was measured and categorized according to the maximal thickness.

Figure 1 Two-Dimensional Echocardiographic Parasternal Long-Axis View of the Left Ventricle (LV), Showing Prolapse of anterior Mitral Leaflet into the Left Atrium (LA).

The echocardiograms were classified as showing classic MVP if the mitral valve leaflet displacement exceeded 2 mm and maximal thickness was at least 5 mm, and showing non-classic prolapse if displacement exceeded 2 mm but the maximal thickness was less than 5 mm. Borderline degrees of displacement (<2 mm) not associated with increased leaflet thickness, mitral regurgitation, left atrial enlargement and valve-related complication were not included in the definition of prolapse [10] — see Figure 1.

Statistical analysis

Statistical significance of the difference between the two groups was determined by Fisher's exact test. A *P*-value of <0.05 was considered to be significant.

Results

The demographic characteristics of the study participants are shown in Table 1. All the patients were male.

Nine patients (37.5%) with PSP had MVP, of whom three (12.5%) showed classical MVP and six patients (25%) had non-classical MVP. The prevalence of MVP among the control group was 7.5%, with two patients (5%) showing classical prolapse and one patient (2.5%) non-classical prolapse—Table 2.

The BMI was lower ($P = 0.001$) in patients with PSP. Median BMI for the PSP patients was

Table 1 Demographic characteristics of the Pneumothorax and Control groups

Characteristics	Pneumothorax *N* = 24	Control group *N* = 40	95%CI**
Age(years)	24.8(+5.6)	22.3(+3.2)	(0.289 to 4.7)
Smokers(%)	18(75)	34(85)	(0.498 to0.518)
Body mass index median (Kg/sqm)	19.1* (15.8 to 21.6)	23.4(20 to 29.3)	

* *p* value<0.001.
** CI: confidence interval.

Table 2 Prevalence of mitral valve prolapse in subjects with spontaneuos pneumothorax and control subjects

Mitral valve prolapse	Pneumothorax *N* = 24	Control group *N* = 40	95% CI
No prolapse (%)	15 (62.5)	37 (92.5)	.005 (.004—.007)
Classical prolapse (%)	3 (12.5)*	2 (5)	.012(.01—.014)
Non classical (%)	6 (25)**	1 (2.5)	.082 (.001—.003)

* *p* value = 0.008.
** *p* value = 0.002.

Table 3 Smoking status in relation to mitral valve prolapse in subjects with spontaneous pneumothorax and in control subjects

	Degree of Mitral valve prolapse	Smoking		Total
		no	yes	
Pneumothorax	no prolapse	3	12	15
	classical prolapse		3	3
	non classical prolapse	3	3	6
Total		6	18	24
Control group	no prolapse	5	32	37
	classical prolapse		2	2
	non classical prolapse	1		1
Total		6	34	40

P value >0.05.

19.1 Kg/sqm (range; 15.8 to 21.6 Kg/sqm). Median BMI for the control group was 23.4 Kg/sqm (range; 20 to 29.3 Kg/sq).

Eighteen (75%) of the PSP subjects were smokers, six of them having MVP, compared to twenty eight (70%) non-smokers in the control group, three of them having MVP. The difference in incidence of MVP between smokers and non-smokers is not statistically significant — see Table 3.

Discussion

The association between PSP and MVP has previously been reported in two studies [7,15]. Brear et al. [15] reported an 80% incidence of MVP in patients with PSP. This high incidence was probably due to using M-mode echocardiographic criteria alone in diagnosing MVP — a method which generally exaggerates the diagnosis of MVP. In the second study, Margolite et al. [7] reported an incidence of 50% after including 2D-echocardiographic criteria, but still the definition of MVP was less specific. They defined MVP as >3 mm of mitral valve displacement, at least 2 mm of prolapse, and any prolapse. The definition of ''any prolapse'' left the diagnosis to observer bias.

The incidence of MVP in PSP in our study is less than has been reported previously. This difference appears to be related to the greater specificity of our criteria together with no loss in sensitivity for the detection of complications [6,16].

Smoking has been shown to increase the risk of contracting PSP [17] and might have a role in the pathogenesis of MVP [18]. Our study did not show a statistically significant difference between the smoking and non-smoking groups in the incidence of MVP in patients with PSP. There were no female patients in our study, in keeping with other studies, since PSP is more prevalent in men and is extremely rare in female Arabs [1].

An abnormal collagen type has been a concomitant finding with MVP in many patients with

PSP [7] and it has been suggested that PSP and MVP might be a further manifestation of a generalized connective tissue abnormality [19]. Pathological studies have shown disruption of collagen bundles in the leaflets and chordae tendinae of prolapsed mitral valves [20]. Biochemical studies have shown a spectrum of collagen abnormalities in the prolapsed valves. However, MVP is not associated with genetic abnormalities for collagen types I, III, and V. According to echocardiographic evaluation, MVP was noted in 57% of patients with Marfan's syndrome [21]. It also occurs in types I and II of Ehlers-Danlos syndrome, pseudoxanthoma elasticum, and osteogenesis imperfecta. Pulmonary complications are described in cases of Ehlers-Danlos syndrome type IV, as established by studies of collage biosynthesis. Reviews of other reported series indicate that pulmonary complications do occur in patients with Ehlers-Danlos syndrome type IV, but they have not resulted directly in patient mortality [22].

Conclusion

MVP is common in patients with PSP. In this study, the prevalence of MVP in patients with PSP is less than has been reported before, but is still significantly higher than in controls. The prevalence was higher in patients with a low BMI. There is no association between smoking and MVP in patients with PSP.

Conflicts of interest

There are no conflicts of interest to be declared.

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