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CLINICAL BRIEFS

The Prevalence and Effects of Pectus Excavatum and Pectus Carinatum on the Respiratory Function in Children between 7–14 Years Old

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Abstract The study involved 1342 primary school students aged 7–14 years who applied to Ankara, a primary care center for general health check-up between 2006 and 2007. Forty-three students, 35 of whom had PE and 8 of whom had PC, were subjected to thorax measurement. All 43 students underwent pulmonary function tests (PFT).The prevalence rate of PC was 0.6%, and of PE, 2.6%. The thorax widths of the groups were similar (P=0.273). The thorax circumference and depth of PE group were lower than those of the controls (P<0.05). The probability rate of abnormality in PFT scores of PE group was statistically significantly higher than that of the controls (P=0.022) whereas absence of normal PFT scores the difference between PC group and the controls was not statistically significant (p=0.095). The results indicate that more than half of the individuals with pectus deformity do not have any physical complaints and do not have statistically significant differences in their PFT parameters.

Keywords Pectus excavatum · Pectus carinatum · Chest deformities

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Introduction

Pectus Excavatum (PE) is the most common form of chest wall deformity which is more common among males and rarely regresses on its own [1].

Protrusion deformity of the chest wall, which has been termed as Pectus Carinatum (PC), is vaguely evident at birth and progresses in early childhood and adolescence [2]. PC is more common among males, like PE; however, its prevalence in general population is lower than that of PE [2]. Like PE, the cause of PC is not clearly known. Primarily, overgrowth of the costal cartilages has been held responsible [3].

Material and Methods

This study involved 1342 primary school students aged 7–14 yrs without any specific complaints, who applied to Ankara Eryaman Primary Care Center-no: 4, Turkey for general health check-up in 2006–2007. After general health check-up, a particular form, including personal details, for this investigation was filled. Plain visual examination of the thorax area revealed the students with PE and PC deformities (Fig. 1a, b).

The width and depth of the thorax of the students with these deformities were measured by a pelvimeter and the thorax circumference was measured by a measuring tape. For thorax width measurements, both ends of the pelvimeter were placed on the ribs at the level of the mesosternum, where thorax is the largest, while making sure that neither end of the pelvimeter corresponded to the intercostal space [4].

For the thorax depth measurements one end of the pelvimeter was placed on the mesosternal point, while the

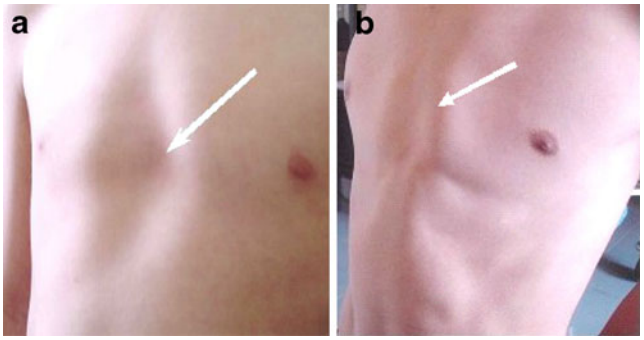

Fig. 1 **a** Pectus excavatum. **b** Pectus carinatum

other end was placed horizontally on the spinous process of the corresponding thoracic vertebra. The thorax circumference was measured at the level of the nipple with a measuring tape [4].

Age and gender matched patients with deformities and the controls without deformities were instructed verbally and visually. PFT was conducted with a Spirometer (micro lab ML 3500, Micro Medical Ltd, UK).

Statistical Analysis

Data were analyzed with SPSS, version 11.5. One Way ANOVA was used to determine statistical differences between control, PE (+) and PC (+) groups for thorax and PFT. While age-corrected co-variance analysis (ANCOVA) was used to determine correlations between age and intergroup differences, TUKEY multiple comparison analysis was employed to determine the source of the differences. Pearson exact *chi-square* test was used in categorical comparisons. $P<0.05$ was considered as statistically significant.

Results

The study involved 1342 [665 male, (49.6%) and 677 female, (50.4%)] children of 7–14 years of age. Of all these subjects, 35 (2.6%) had PE, and 8 (0.6%) had PC deformity. Of 35 cases with PE deformity, 9 (25.7%) were female and 26 (74.3%) were male. The prevalence rate of PE in the males was 3.1 times higher than in the females. All PC deformity cases were male.

The distribution of the age and gender corrected thorax measurements is shown in Table 1. According to these results, the thorax widths of the groups, PE ($n=35$), PC ($n=8$) and control ($n=58$), were similar ($p=0.273$). However, the thorax circumferences of the groups were significantly different ($p=0.008$). The thorax circumferences of both PC ($p=0.574$) and PE ($p=0.006$) groups were lower than those of the controls. The thorax depths of the groups significantly differed ($p=0.003$): PC group measurements were lower than those of the controls ($p=1.00$) and PE group measurements were significantly lower than those of the controls ($p=0.002$).

Table 1 Age and gender corrected results of thorax measurements of the groups

n	Mean	SD	*P*-value
Width (cm)			0.273
Control 58	21.6	2.0	
PC 8	21.6	1.5	
PE 35	21.0	1.7	
Circumference (cm)			0.008
Control 58	69.7[a]	6.75	
PC 8	67.0[ab]	4.94	
PE 35	65.6[b]	5.63	
Depth (cm)			0.003
Control 58	16.1[a]	2.22	
PC 8	15.6 [ab]	1.63	
PE 35	14.6[b]	1.86	

PC pectus carinatum *PE* pectus excavatum

Different letters indicate differences between the groups ($p<0.05$)

PFT results of the groups, demonstrated in Table 2, were normal in 87.9% of the control, in 62.5% of the PC, and in 68.6% of the PE groups. Although PFT results of the groups were within normal limits, there were statistically significant differences between the groups for PFT results ($p=0.040$). Accordingly, the probability of abnormal results in PFT of PE group was statistically significantly higher than in the control group ($p=0.022$). Contrarily, the difference between PC group and the controls was statistically insignificant ($p=0.095$).

Discussion

In this study, the prevalence rates of PE and PC deformities among children aged 7–14 yrs and effects of these deformities on respiratory functions and their potential physical effects were investigated.

Berktas et al. [5] determined a prevalence rate of 0.283–7.3% for PE and 0.094–2.75 of PC in 3784 individuals, who were evaluated for pectus deformities in 1994–1996. In the present study, the prevalence rates of PE and PC were 2.6% and 0.6%, respectively.

Koumbourlis et al. [6] determined a prevalence rate of 5% for restrictive lung disease and 41% for obstructive lung disease in 103 individuals with PE, of which 73 were male and 30 were female, within the age group of 5–19 years. None of the patients had any symptoms at rest. The values of forced expiratory volume in the first second (FEV_1) were within normal limits. In the present study, results of PFT showed mild restriction in 25.7% and mild obstruction in

Table 2 The interpretation of pulmonary function test results of the study groups

	Control		PC		PE		Total
	Frequency	%	Frequency	%	Frequency	%	Frequency
Normal	51	87.9	5	62.5	24	68.6	79.2
Abnormal	7	12.1	3	37.5	11	31.4	20.8
Mild restriction	5	8.6	2	25.0	9	25.7	15.8
Moderate obstruction	1	1.7	0	0.0	0	0.0	1.0
Severe restriction	1	1.7	0	0.0	0	0.0	1.0
Mild obstruction	0	0.0	1	12.5	2	5.7	3.0
Total	58	100.0	8	100.0	35	101	100

PC pectus carinatum

PE pectus excavatum

5.7% of the children with the deformities. However, none with PE deformity had any symptoms at rest, and none had any statistically significant increase or decrease in FEV_1 values. The findings are compatible with those of Koumbourlis et al. [6]; but, the rate of restrictive lung disease in the present study is higher and the rate of obstructive lung disease is lower than the rates reported by them.

Kaguraoka et al. [7] evaluated 138 patients with PE deformity and reported no significant differences for the obstructive type, which is in accordance with present results.

Schoenmakers et al. [8] reported normal PFT results in 75% of 16 PE patients. Similarly, the PFT results of 68.6% of the children with PE deformity in the present study were normal. The rate of normal PFT results of this study is also similar.

Matos et al. [9] operated 77 individuals (4–39 years) with PE (n=53) and PC (n=24) and reported that 74.2% of the patients showed symptoms afterwards. In the present study, 82.9% and 75.0% of the children with PE and PC, respectively, had no complaint, which is very similar to the findings of Matos et al. [9] and Davis et al. [10] showed that 60% of 69 patients operated according to a pectus deformity, had psychosocial reasons for the procedure.

Conclusions

The results indicate that more than half of the individuals with pectus deformity neither had any physical complaints nor showed statistically significant differences in their PFT parameters.

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