FREQUENCY OF ANOMALIES ASSOCIATED WITH CHEST DEFORMITY IN PHYSICALLY FIT MALE CANDIDATES REPORTING FOR MILITARY RECRUITMENT

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ABSTRACT

Objective: To identify the frequency of anomalies associated with chest deformity in physical fit male candidates reporting for military recruitment.

Study Design: Observational.

Place and Duration of Study: Department of Thoracic Surgery, CMH Rawalpindi from 1st Jan 2008 to 31 Dec 2011.

Patients and Methods: Normal healthy physically fit young adolescents being recruited for army were scrolled and those exhibiting chest deformity were isolated and subjected to evaluation. Convenience sampling was carried out. All candidates of chest wall deformity thereafter underwent a thorough physical checkup, pulmonary function tests and echocardiography.

Results: A total of 3735 candidates of chest deformity reported at our center for evaluation over this duration. Single deformity patients 3380 (90.5%), mixed deformity patients 355 (9.5%). We found that none of the candidates had any derangement of the lung function tests or electrocardiographic abnormality despite their deformity. However echocardiography detected an abnormality in 161 (4.3%) individuals who were otherwise asymptomatic.

Conclusion: Chest deformity should be excluded before physical tests, in all the male candidates reporting for enrolment. If slightest of doubt exists that a candidate has chest deformity then he should be evaluated with echocardiography to exclude cardiac abnormality. Although the associated frequency is only 4.3% but this can subsequently result in a grave event like death.

Keywords: Chest wall deformity, Pectus excavatum, Pectus carinatum.

INTRODUCTION

A broad spectrum of congenital chest wall deformities occurs and the prevalence of pectus deformities is noted to be (1-1.95%)[1]. The severe life-threatening deformities of ectopia cordis and asphyxiating thoracic dystrophy are rare in comparison with the more frequent and milder pectus excavatum and carinatum. Pectus excavatum, the concave depression of the breast bone, comprises most chest wall anomalies[2]. The cause of these conditions is thought to be abnormal elongation of the costal cartilages. Collagen, as a major structural component of rib cartilage, is implicated as causative factor by genetic and histologic analysis[3]. These deformities are usually compatible with normal life and only a subset of population requires operative correction for either cosmetic reasons or compressive effects caused by the pectus. The cardiopulmonary functional consequences are insignificant in the protrusional deformities and inconsistent in pectus excavatum and the indications for surgery are mainly cosmetic[4].

In the military setup a critical evaluation of these deformities gains precedence because of all three reasons i.e. to say cosmetic reasons for a soldier to look good, the compressive effect to evaluate the physical limitations caused and thirdly the associated abnormalities of spinal deformity and cardiac abnormality. Therefore a candidate may be physically fit and cosmetically acceptable but still may have a cardiac abnormality. On the other hand a cosmetically disfiguring deformity may be absolutely fit physically. Thus the decision to declare them unfit may be unjustified and affect the career of the candidate very badly. Moreover the assessment of pulmonary function tests in children aged 7–14 years indicate that more than half of the children with pectus deformity do not have any physical

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complaints and do not have statistically significant differences in their PFT parameters[5]. No such study has been conducted so far in Adolescents and teenagers.

During the study period we have evaluated various types of chest deformities in adolescent candidates presenting for military recruitment. We have also analyzed various associated anomalies encountered in these candidates. The stimulus for this study was an unexplained death in such a candidate when he underwent the physical challenge of two mile run in 14 minutes. We found that amongst these physically fit candidates were also those who had certain degree of chest deformity and in this subset some had potentially life threatening severe anomaly. In the study that follows we have elucidated the details of our work.

PATIENTS AND METHODS

This observational study was done at Department of Thoracic Surgery CMH Rawalpindi which is a tertiary care center. Non probability consecutive sampling was carried out. The study was conducted in collaboration with the Army recruitment center Rawalpindi from Jan 2008 to Dec 2011. Male candidates of age range 16-22 years from all races were considered for the study. All candidates had their demographic data recorded and there after were subjected to a complete physical examination. In the examination they were stripped and all their deformities noted. We isolated the candidates who had even the slightest hint of a chest deformity. The Deformity was then categorized and recorded separately. All candidates underwent chest X-Rays anteroposterior and lateral views, electrocardiography (ECG), Peak expiratory flow rates (PEFR) and two dimensional echocardiography (2D Echo) done for all cases. Dysfunction was categorized to be major if the Ejection Fraction was reduced to less than 50% by the anomaly. Any associated deformity was also noted. The data was then processed with Microsoft excel.

RESULTS

A total of 3735 male candidates of chest deformity reported at our center for evaluation over this duration. The male candidates were from all over Pakistan from all races. Isolated Deformity patients 3380 (90.5%), Mixed deformity patients 355 (9.5%). A further detail is given in table -1.

Table-1: Various forms of pectus deformities encountered during recruitment examination of male candidates n=3735.

Deformity	Mixed Variety	Isolated
	355	3380
Costal flaring	251	14
Pectus excavatum	267	1861
Pectus carinatum	194	1585
Chondromanubrial		573
Chondrogladiolar Symmetric		752
Chondrogladiolar Asymmetric		310

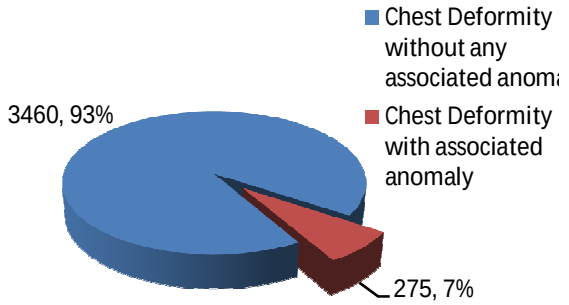

Figure-1: Association of chest wall deformity patients and association of non-chest wall anomalies.

Costal flaring was one of frequent cause of cosmetic disfigurement and creates a bell like chest cage. It was only seen in candidates having pectus excavatum, only 14 candidates of costal flaring had it in isolation. The rest of the 251 candidates of costal flaring had it in association with pectus excavatum. No candidate of isolated deformity of pectus carinatum exhibited costal flaring. Most of the mixed deformity was association of pectus excavatum with pectus carinatum chondromanubrial variety. This was followed by incidence of pectus carinatum asymmetric chondrogladiolar variety. The 4 patients of

symmetric pectus carinatum chondrogladiolar variety had association with a mild costal and for which the causative genes are known, etiology of isolated chest wall deformities is still

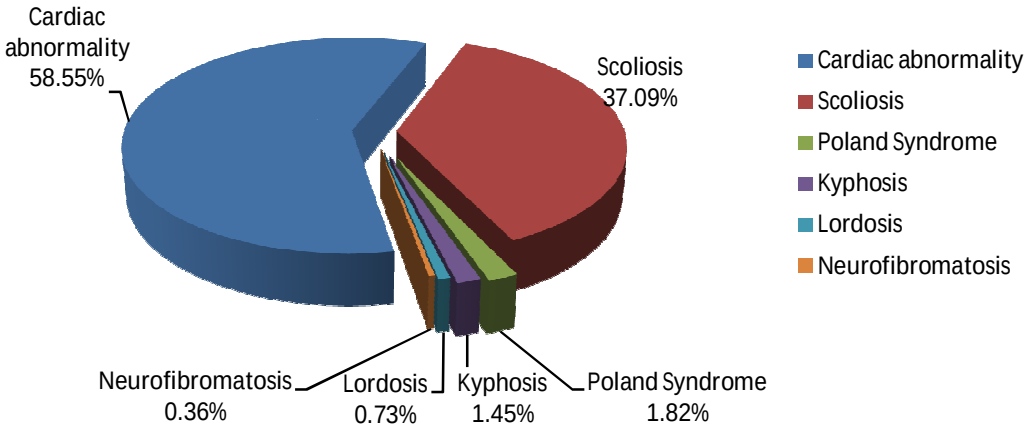

Figure-2: Details of non-chest wall anomalies associated with chest wall deformity candidates.

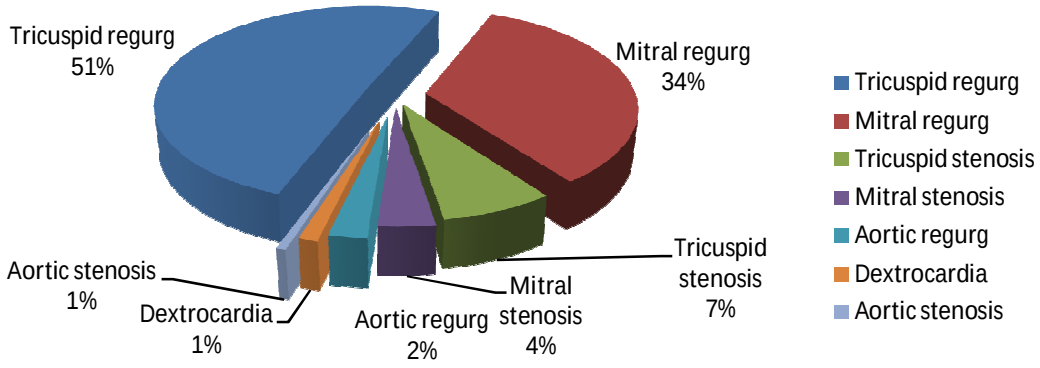

Figure-3: Details of cardiac anomalies associate with chest wall deformity candidates n =161.

flaring and no excavatum. Strangely enough but we found that none of the candidates had any derangement of the lung function tests or electrocardiographic abnormality despite their deformity. Other associated anomalies are assessed in Fig 1-3.

DISCUSSION

Chest wall deformities such as pectus excavatum, pectus carinatum, and cleft sternum can also be isolated malformations or dysmorphic features of genetic associations, monogenic disorders, and various numeric and structural chromosomal aberrations. In contrast to the most important syndromes such as Marfan syndrome or Noonan syndrome that can be associated with a chest wall deformity a matter of research[6]. The milder forms may be having severe associated anomalies. Since the milder forms of deformity are hidden by the clothes worn, it places a candidate at a life threatening risk if he is subjected to a physical challenge. One such incident happened at Faisalabad in 2008, when candidates for enrolment in police were to clear the physical tests and one of the successful candidate fainted and died after completion of 2 mile run. This was one of the triggering factors that strengthened our conviction in assembling and analyzing the data of the candidates presenting for recruitment in army.

In our military recruitment centers of Pakistan Army all candidates presenting for enrollment undergo a 2 mile test in which they

have to run a distance of 2miles (3.2 km) in a time period of 16 minutes. This itself is a very strenuous exercise giving a huge psychological and physical challenge of endurance and stamina. This eliminates candidates having any major cardiovascular and skeletal deformitites and filters the physically challenged. This is also the reason that our sample population was not suffering from severe associations of chest wall deformities mentioned in the literature. These include pulmonary stenosis, advanced cardiac anomalies, myopathy, Marfan's syndrome, Pierre Robin syndrome, Prune-Belly syndrome, cerebral palsy, tuberous sclerosis and congenital diaphragmatic hernia[7] So the scope of this study is limited to patients of chest wall deformity who can over the passage of time build themselves up to a level of good physical fitness. All these male candidates who accomplish the challenge of a two mile test exhibited a normal lung function test and a normal exercise tolerance test irrespective of any associated abnormality.

Other varieties that cleared the screening test included candidates suffering from Poland syndrome, situs inversus and neurofibromatosis. These were indeed rare accompaniments and were declared unfit for enrollment at our clinic. Moreover the degree of deformity also requires categorization into mild, moderate and severe forms. We worked hard but could not develop any criteria to divide the deformity so far. However we are still working on it to develop such a classification.

At our center we have found that the pectus excavatum is more commoner than any other deformity of the chest wall and is consistent with the reports of Coskun ZK et al[5]. We have noted in particular the requirement / necessity of echocardiography in these candidates. The cardiac abnormality if at all present was of only a grade I nature. We did not record any grade II regurgitation in these candidates. The ECG tracings of all these individuals was normal. We had 3 patients of dextrocardia amongst which 1 patient had situs inversus. A systolic ejection murmur is frequently identified in patients with pectus excavatum and is magnified by a short interval of exercise. It is attributed to the close proximity between the sternum and the pulmonary artery, which results in transmission of a flow murmur[7]. Candidates exhibiting a flow murmur had invariably an excessively decreased retrosternal space resulting in a gross cosmetic deformity. Overall frequency of cardiac abnormality associated with chest wall deformity in healthy candidates recorded in this study to be 4.3%.

Costal flaring was one of frequent cause of cosmetic disfigurement and creates a bell like chest cage. It was only seen in candidates having pectus excavatum, only 14 candidates of costal flaring had it in isolation. The rest of the 251 candidates of costal flaring had it in association with pectus excavatum. No candidate of isolated deformity of pectus carinatum exhibited costal flaring. Most of the mixed deformity was association of pectus excavatum with pectus carinatum chondromanubrial variety. This was followed by incidence of pectus carinatum asymmetric chondrogladiolar variety. The 4 patients of symmetric pectus carinatum chondrogladiolar variety had association with a mild costal flaring and no excavatum. 0.03% of candidates of chest deformity also had a spinal deformity, this made 37.09% of the group of candidates having anomaly associated with chest deformity and in 93% of this subset the spinal deformity was of structural nature. Although dyspnea, endurance, tachypnea, and tachycardia can improve in almost all patients within 5 months after repair of an excavatum[8] but they still remain unfit for active military service.

CONCLUSION

Chest deformity should be excluded before physical tests, in all the male candidates reporting for enrolment. If slightest of doubt exists that a candidate has chest deformity then his cardiac status should be evaluated satisfactorily before subjecting him to a physical test. Although the associated incidence is only 4.3% but this can subsequently result in a grave event like death.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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