Variations in the normal ratio of the anteroposterior and transverse diameter of the chest wall

M. Ovia¹, K. Yuvaraj Babu²*, Karthik Ganesh Mohanraj²

ABSTRACT

Introduction: Respiratory disorders such as asthma and acute respiratory distress syndrome are more prevalent diseases affecting people. People whose normal ratio of the anteroposterior and transverse diameter varies may develop chest wall deformities such as kyphoscoliosis, emphysema, and thoracic kyphoscoliosis which are all caused mainly because of changes in the spinal curvature. Barrel chest most commonly relates to osteoarthritis as the age increases. Emphysema may later lead to barrel chest, which is due to the variations in the normal ratio of the anteroposterior and transverse diameter of the chest wall. Materials and Methods: Methods: After getting proper informed consent, the anteroposterior and transverse diameter of the chest wall (in cm) of randomly chosen 30 male subjects were taken using cardboards and ruler. For measuring the anteroposterior diameter, cardboards were placed in dorsal and ventral position. For transverse diameter, cardboards were placed in lateral position. Result: The normal ratio of the anteroposterior and transverse diameter of the chest wall should be in the ratio 5:7 in humans for the proper maintenance of normal respiration. Normal ratio of 30 men’s was measured and nearly, 73% of them have normal and near normal ratio of the anteroposterior and transverse diameter of the chest wall. 27% have altered ratio of the same, indicating the presence of an underlying respiratory or cardiac disease and should be evaluated for the same. Conclusion: 22 of the participants have normal ratio of the anteroposterior and transverse diameter of the chest wall. Remaining 8 have variations in the chest wall indicating the presence of an underlying respiratory or cardiac disease and should be evaluated for the same.

KEY WORDS: Emphysema, Kyphoscoliosis, Osteoarthritis, Spinal curvature, Thoracic kyphoscoliosis

INTRODUCTION

The deformities of the anterior chest wall commonly known as funnel chest, pigeon breast, and Harrison’s grooves for which the author has suggested that the terms congenital chondrosternal depression, congenital chondrosternal prominence, and congenital chondrocostal grooves, respectively, are discussed as a related group of congenital deformities of the anterior chest wall. The present concepts of the etiology of these deformities, such as rickets, upper respiratory obstructions, and severe cough and dyspnea are analyzed and refuted. It is acknowledged that these conditions do aggravate the extent of these deformities.

Congenital chondrosternal depression (funnel chest) is a deformity, which consists of a depression of the chondrosternal area with its deepest point at the gladiolus-xiphoid junction has been described in the literature since the 16th century. It has been referred to by numerous names, the most common of which are funnel chest, pectus excavatum, trichterbrust, chonechondrosternon, etc. The author¹,² proposed the name congenital chondrosternal depression because it is more descriptive and relates to its congenital character. Ochsner and De Bakey³-⁵ have reported an incidence of this deformity in 28 cases found in 46,708 persons examined or 0.06%. The author two has reported a similar incidence of 25 cases in 41,963 Newark school children.

There is a great deal of variation in the configuration of the anterior chest wall.⁶⁻⁷ In a recent study, researchers found that 1/3⁶ of the participants show some variation in the anterior chest wall.¹⁷ These variations included asymmetric findings such as tilted sternum, prominent asymmetric costal cartilage, parachondral nodules, or

¹Department of Anatomy, Saveetha Dental College, Saveetha University, Chennai, Tamil Nadu, India, ²Department of Anatomy, Saveetha Dental College, Saveetha University, Chennai, Tamil Nadu, India

*Corresponding author: K. Yuvaraj Babu, Department of Anatomy, Saveetha Dental College and Hospitals, Saveetha University, 162, Poonamallee High Road, Chennai, Tamil Nadu, India. E-mail: yuvarajkbabu@gmail.com

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mild degrees of pectus excavatum, or carinatum.\[1,2\] Most problems that are caused due to these deformities are cosmetic, pectus deformities can cause chest pain, fatigability, dyspnea on exertion palpitation, and restrictive lung disease.\[7\]

Through the years each of these three deformities has been described under a large variety of names for which the author has suggested the following:

1. Congenital chondrosternal depression for the “funnel chest,” etc.
2. Congenital chondrosternal prominence for the “pigeon chest,” etc.
3. Congenital chondrocostal grooves for Harrison’s grooves.

The bony thorax provides a structural framework for the thorax on which the function of the pulmonary system is dependent.\[8\] The association between deformities of the thorax and development of respiratory dysfunction is well described.\[9\] In children with small lung contusions, compliance of the chest wall can result in a rim of nonopacified lung between the consolidated contusion and the adjacent ribs.\[8\] Metastatic involvement by neuroblastoma, lymphoma, or leukemia is more common. This study aims in analyzing abnormal chest wall anatomy and deformities in the general population.

**MATERIALS AND METHODS**

After getting proper informed consent, the anteroposterior and transverse diameter of the chest wall of randomly chosen 30 male subjects were taken using cardboards and ruler.

For measuring the anteroposterior diameter, cardboards were placed in dorsal and ventral position.

For transverse diameter, cardboards were placed in lateral position.

<table>
<thead>
<tr>
<th>Transverse diameter of the chest wall</th>
<th>Mean</th>
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<tbody>
<tr>
<td>26–27</td>
<td>26.01</td>
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<td>30–31</td>
<td>30.41</td>
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<td>31–32</td>
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<thead>
<tr>
<th>Anteroposterior diameter of the chest wall</th>
<th>Mean</th>
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<tbody>
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<td>20–21</td>
<td>20.4</td>
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<td>21–22</td>
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<td>24.35</td>
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<td>25–26</td>
<td>25.67</td>
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**RESULTS**

22 of the participants have normal ratio (5:7) of the anteroposterior and transverse diameter of the chest wall. Remaining 8 have variations (in the ratio of 1:1) in the chest wall indicating the presence of an underlying respiratory or cardiac disease and should be evaluated for the same.

**DISCUSSION**

Renal hypoplasia, certain leukemia, and the Mobius syndrome have also been described in association with the chest wall defects.\[10\] Poland’s anomaly, described almost 150 years ago by Alfred Poland, is an uncommon congenital aberration of the chest wall.\[11,12\] Confined unilaterally to the thorax and upper extremity, the deformity has come to include a constellation of hypoplastic components, the most consistent of which is a partial or total absence of the pectoralis major muscle. In its severest configuration, there may be partial agenesis of the ribs and sternum; scoliosis; brachysyndactyly; mammary aplasia; and absence of the latissimus dorsi, serratus anterior, and other nearby structures.\[13-17\]

In previous publications\[18-20\] existing beliefs concerning the etiology of these deformities have been challenged, and the diaphragmatic theory as the cause for all three of these related conditions has been suggested. The chest wall has a number of functions that when altered can result in a variety of pathologic processes. Because the chest wall provides a structural framework that is the underlying support for a physiologic motion of the pulmonary system. Deformity of the chest wall can lead to both restrictive and obstructive lung diseases. The chest wall functions to protect intrathoracic structures, so trauma can result in extrathoracic injury. Finally, the numerous tissues and vasculature of the chest wall can be involved in focal processes, such as tumor or infection, or can show manifestations of systemic illness, such as metabolic diseases.

**CONCLUSION**

This study is to conclude the amplitude of abnormal chest wall anatomy and deformities in the general population so that the hidden respiratory and cardiac diseases can be suspected and evaluated.

**REFERENCES**


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