The Comparison Of Measurements On Chest X-Ray For Patients With Pectus Deformity

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Citation

Abstract
Purpose: Various parameters have been proposed to measure of severity of pectus deformities. We performed some different measurements on the chest x-ray for the patients who underwent an operation for pectus deformity to determine a reasonable parameter for preoperative and postoperative assessment.

Methods: A hundred patients, who don't have scoliosis and kyphosis, were selected for this study. Fifty of these patients had a pectus excavatum deformity and remaining 50 had a pectus carinatum deformity. The measurements on postero-anterior (PA) and lateral (L) chest X-rays were performed preoperatively and postoperatively and compared statistically.

Results: Only the parameters, which are measured on, lateral chest x-ray for patients in both groups are statistically meaningful.

Conclusions: The three parameters (lateral dimension of cardiac silhouette, sternovertebral distance, the lateral transverse dimension of chest), which are measured on lateral chest x-ray, can be used for preoperative and postoperative assessment of both groups of patients.

INTRODUCTION

Pectus excavatum and carinatum are the most common types of congenital anterior chest wall deformities. There is no doubt that only a few patients have pulmonary or cardiac problems because of severe pectus deformities. The patients usually undergo an operation because of cosmetic reasons. Various parameters have been proposed to measure of severity of these deformities (1,2). We performed some different measurements on the chest X-ray for the patients who underwent an operation for pectus deformity. The measurements were performed preoperatively and postoperatively and compared statistically.

MATERIALS AND METHODS

Between October 1997 to March 2002, 261 patients with pectus deformities underwent repair operations. Hundred patients, who don't have scoliosis and kyphosis, were selected for this study. Fifty of these patients had a pectus excavatum deformity and remaining 50 had a pectus carinatum deformity. All of patients were male and between 14–23 years of ages. The average age was 20.

Postero-anterior (PA) and lateral (L) chest X-rays were taken preoperatively and third month postoperatively. The same machine, distance (180 cm), dose (80 kVp-6.4 mAS, 3.15 A-220 V) and the film dimension (35 cm x 35 cm) were used for standardization of measurements. The measurements were compared statistically by using paired t-test. The parameters, which were measured on chest x-ray, were shown below (fig 1 and 2).
The Comparison Of Measurements On Chest X-Ray For Patients With Pectus Deformity

Figure 1
Figure 1: The measurements on postero-anterior (PA) chest X-ray; 1: transverse dimension of cardiac silhouette, 2: the distance between the right edge of cardiac silhouette and the internal edge of thoracic wall, 3: the distance between the left edge of cardiac silhouette and the internal edge of thoracic wall, 4: the distance between the dome of the right diaphragm and right apex, 5: the distance between the dome of the left diaphragm and left apex, 6: the external transverse dimension of chest.

Figure 2
Figure 2: The measurements on lateral (L) chest X-ray; 1: lateral dimension of cardiac silhouette, 2: The distance between the most prominent and the recessed point of sternum and the anterior edge of vertebral body, 3: the lateral transverse dimension of chest.

MEASURED PARAMETERS (IN CM)

1. In PA chest x-ray
   a. Transverse dimension of cardiac silhouette
   b. The distance between the right edge of cardiac silhouette and the internal edge of thoracic wall
   c. The distance between the left edge of cardiac silhouette and the internal edge of thoracic wall
   d. The distance between the dome of the right diaphragm and right apex
   e. The distance between the dome of the left diaphragm and left apex
   f. The external transverse dimension of
chest

3. In Lateral chest x-ray

a. Lateral dimension of cardiac silhouette

b. The distance between the most prominent and the recessed point of sternum and the anterior edge of vertebral body

c. The lateral transverse dimension of chest

The measurements were performed between the same points in patients with pectus excavatum and chondrogladioler type of pectus carinatum. In lateral chest x-ray, the sternovertebral distance was measured in two different points (from the most prominent and the recessed point of sternum to the anterior edge of vertebral body) in patients with chondromanubriel type of pectus carinatum.

RESULTS

The average values of preoperative and postoperative measurements on PA chest x-ray of patients with pectus excavatum and statistical analyze are shown on table 1. There is no statistically meaningful value on those parameters. The same parameters for patients with pectus carinatum are shown in table 2. There is also no statistically meaningful value on those parameters. The parameters, which are measured on lateral chest x-ray for patients with pectus excavatum and carinatum, are shown on table 3 and 4 respectively.

Figure 3

Table 1: The average values of preoperative and postoperative measurements on postero-anterior chest x-ray of patients with pectus excavatum and statistical analyze

PA = Postero-anterior

Figure 4

Table 2: The average values of preoperative and postoperative measurements on PA chest x-ray of patients with pectus carinatum and statistical analyze

PA = Postero-anterior

Figure 5

Table 3: The average values of preoperative and postoperative measurements on Lateral chest x-ray of patients with pectus carinatum and statistical analyze

PA = Postero-anterior

Figure 6

Table 4: The average values of preoperative and postoperative measurements on Lateral chest x-ray of patients with pectus carinatum and statistical analyze

PA = Postero-anterior

The comparisons of preoperative and postoperative measurements of all three parameters on lateral chest x-ray are statistically meaningful.

DISCUSSION

Pectus deformities usually cause a marked cosmetic defect associated with a psychological trauma. Various parameters have been proposed to measure of severity of these deformities before operation. Plain chest x-ray, computed tomography, pulmonary function tests and cardiac investigations can be used for preoperative and postoperative assessment of patients with pectus deformities. It is widely accepted that the repair of pectus deformities has a limited
impact on cardiac and pulmonary functions \( \left( \frac{1}{2}, \frac{3}{4}, \frac{5}{6} \right) \). We also cannot use these two parameters for patients who undergo an operation for only cosmetic reasons.

It is possible to make a preoperative and postoperative assessment by using a simple chest x-ray. Some authors have mentioned radiological measurements, constructing a variety of indices and ratios based on the relationships of distance between the surface of the sternum and the anterior surface of the vertebral bodies to the total anteroposterior or transverse diameter of the chest such as Welch index, cardiothoracic index or chest index \( \left( \frac{1}{4} \right) \).

Because of the specialty of our center, we have a large number of patients with pectus deformities and all of our patients are adults. We tried to determine appropriate parameters, which can be used for preoperative and postoperative assessment of those patients.

Ravitch have proposed a method to bring the depression in sharp radiological relief in the lateral view. A stripe of barium paste is applied to the anterior midline and is taken a lateral chest x-ray. X-ray shows that there is a substantial distance between the skin and the depth of the funnel. At operation, this space is found to be occupied by fat, so that the deformity is, in fact, deeper than it appears \( \left( \frac{1}{4} \right) \). So we can say that it is more realistic to use some standard measurements on chest x-ray.

Certainly, the main effect of pectus repair operation on the anatomy of chest cavity, is an anteroposterior effect rather than a transverse effect \( \left( \frac{1}{4} \right) \). Because of this reality, one can expect that the lateral chest x-ray measurements will be more valuable than PA x-ray.

In our series, the parameters, which are measured on PA chest x-ray for both pectus excavatum and carinatum group, are not statistically valuable.

On lateral chest x-ray, all three parameters have an statistic value. There is a considerably difference between the preoperative and postoperative measurements of the lateral transverse dimension of chest and the sternovertebral distance. But the interesting point is that, the pectus repair operation has also a certain effect on lateral dimension of cardiac silhouette. In severe and some moderate deformities, the hearth is partially imprisoned in the left hemithorax, lifting it with each beat of the heart. This condition usually disappears after operative correction. We can explain that the considerable increase of the lateral dimension of cardiac silhouette after operation, by this mechanism.

**CONCLUSIONS**

In conclusion, we can use all three parameters, which are measured on lateral chest x-ray for preoperative and postoperative assessment of both patients with pectus excavatum and carinatum.

**References**

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