International Journal of
Health Systems and Medical Sciences

ISSN: 2833-7433
Volume 2 | No 6 | Jun -2023

Discussion of the Results of the Analysis of Patients with the Diagnosis of Funnel-Shaped Chest Deformation

Sh. K. Khakimov [1]

[1] Buchara State Medical Institute, Bukhara Regional Children Multidisciplinary Medical Center, Bukhara city

Abstract:

Purpose. To study the results of the indicators of pectus excavatum (PE) area elasticity parameters in children of various age.

Materials and methods of investigation. The research work was realized on bases of study of the data of 70 children of various age with PE, which are analyzed in condition of RSSPMCTO and Bukhara Regional Children Multidisciplinary Medical Center during the period from 2015 to 2020 y.

Results of analysis are showed, that children with high elasticity degree of PE area are and good results by offered our parameters predominately more in younger age group and is noted the reduction the number of patient's at age gradations. Patients with poor elasticity of PE area are by majority fixed in the third age group with tendency to increase the number of patients in age gradations.14

Conclusion. The basis of thorough study of PE area and important to realize the individual approach for choice of correction methods are taking into account the results of offered parameters of PE area elasticity, which are once more proved the mechanism of the changes of PE area at age periods.

Keywords: age, pectus excavatum, elasticity, children.

Relevance. Funnel-shaped deformity of the chest (PE) is one of the most common types of deformities among all congenital pathologies of the chest of childhood, which is 91% and occupies from 0.06 to 2.3% of the population [1, 2].

As we know, the child's body grows at a diverse pace and character in the stages of the child's growth, including the chest with gradual maturation in relation to the anatomical and functional features of the body [3, 4]. The presence of unbalanced growth in the bone-cartilaginous structure of the sternocostal complex (SSC) leads to the formation of different - symmetrical and asymmetric types of deformities on the anterior chest wall, complication of surgical intervention and the appearance of various complications, the proportion of which is very high, reaching 30-40% [4, 5, 6]. In our opinion, the cause of possible complications after surgical interventions is the lack of consideration of the features of age-related structural-anatomical and physiological changes in the area of the funnel-shaped defect itself when developing indications and choosing an individual method of correction.

This is put forward for conducting research work aimed at studying structural changes in the area of VDGK in children of different ages by developing the necessary parameters to establish the degree of elasticity of the defect area.

The aim of the study was to study the results of the parameters of elasticity parameters of the funnel-shaped defect area in children of different ages.

Materials and methods of research. The material of the study was the data of 70 patients with VDGK of varying severity, aged from 6 to 18 years, treated in the departments of Pediatric traumatology, chest deformities and spinal pathology of the RSNPMCTO and pediatric orthopedics and neurosurgery of the Regional Children's Multidisciplinary Medical Center of the Bukhara region, for the period from 2015 to 2020, there were 44 boys among them (62.8%) and girls – 26 (37.2%). Children are distributed by age according to the classification of L.A. Isaeva (1987), the data of the age division of children are given in Table 1.

Table 1. Distribution of children depending on age and by sex

	Age n=70			Total
Sex	6 - 11 y n=28 (40%)	11 - 15 y n=23 (32,8%)	15 - 18 y n=19 (27,2%)	
	abs (%)	abs (%)	abs (%)	abs (%)
Boys	20 (28,6%)	12 (17,1%)	12 (17,1%)	44 (62,8%)
Girls	8 (11,4%)	11 (15,7%)	7 (10,1%)	26 (37,2%)

From the data in Table 1, it can be seen that PE was predominantly greater among boys by a ratio of almost 2:1 and in children of the 1st age group - 20 against equal numbers of children of 12 in the 2nd and 3rd age groups.

The state of elasticity of the PE region was assessed by our analysis of all the parameters of elasticity of the PE region developed in the clinic (computer program No. DGU 02466 in AIS, RUz – to assess the elasticity of the sternocostal complex in PE). The program included 4 parameters, such as "auto-correction test", "state of the chest excursion", "angle of rotation of the sternum" and "angle of steepness of deformed ribs".

Of these, the first two parameters were subjective – the severity of which depended on the degree of physical development of the child's body and the last two parameters were objective, the state of the angular values of the sternum and deformed ribs was associated with the severity of the dysplastic process of the children's body. The evaluation of the developed parameters was carried out by calculating the analyzed parameters in point scales as "0", "1" and "2" points.

In the course of studying all the parameters, different Pearson correlations (r=-1/1) were noted between the severity of parameter indicators and the age gradation of children.

Results and their discussions

All parameters were studied in children distributed in 3 groups according to age gradations of division as 6-11, 11-15 and 15-18 years. A brief definition and a detailed description of the parameters we have developed are given in the published scientific article of the scientific and practical journal "Traumatology and Orthopedics of Russia", No. 3, 2013.

The auto–correction test was evaluated in qualitative and quantitative terms and as a percentage, as a good result – 2 points, correction of the defect area is equal to or greater than 80%, satisfactory – 1 point, correction within 60-80% and unsatisfactory - 0 points, below 60%. Data on the evaluation of the auto-correction test and Pearson correlation of 70 patients are presented in Fig. 1.

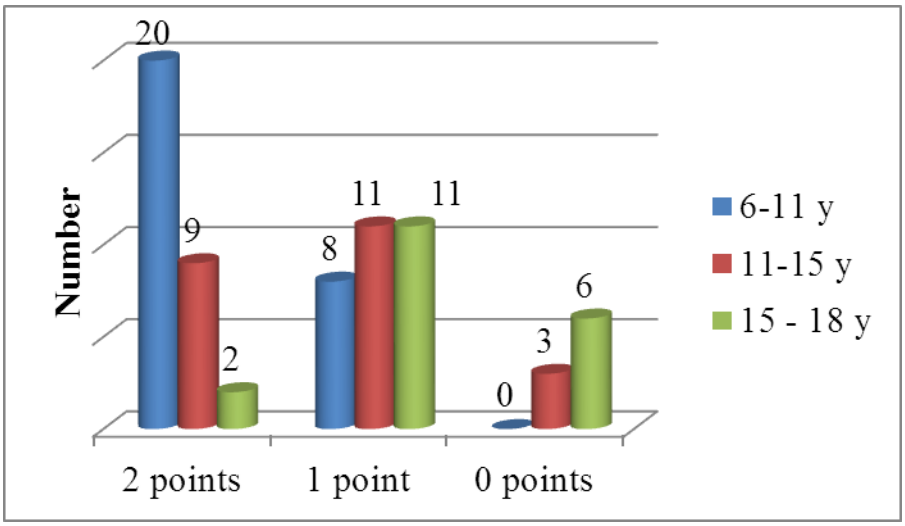

Fig. 1. Diagram of the results of studying the data of the autocorrection test in children with PE.

As can be seen from Fig. 1, a good result in the evaluation of the autocorrection test with a 2-point score was noted in 31 (44.3%) patients out of all 70 children, and in age gradations was mainly higher in the 1st age group in 20 (28.6%) cases versus 9 (12.8%) and 2 (2.9%) of cases of the 2nd and 3rd age groups. This indicates the strengthening of the PE region as the child grows, which is proved by the high Pearson inverse correlation – r= -0.99.

A satisfactory result with a score of 1 (one) point was found in 8 (11.4%) children of the 1st age group against equal numbers of 11 (15.7%) children of the 2nd and 3rd age groups. The PE region in these patients was less mobile, which was confirmed by a high positive Pearson correlation – r= +0.92.

An unsatisfactory result for this parameter of "0" points was noted in children of the 2nd age group in 3 (4.3%) and the 3rd age group in 6 (8.6%) cases. There were no children with an unsatisfactory result in any case in children of the 1st age group. The results obtained are confirmed by a high positive Pearson correlation – r= +0.99.

Thus, the data on the study of the first parameter showed that the area of PE in age gradations becomes rigid. The second parameter for determining the degree of elasticity of the SCC was the measurement of the chest excursion in all patients, which was also evaluated in qualitative (good, satisfactory and unsatisfactory), quantitative (2 points, 1 point and 0 points) expressions and in degrees (<15, 16-30° and >30°), the data are presented in diagram 2.

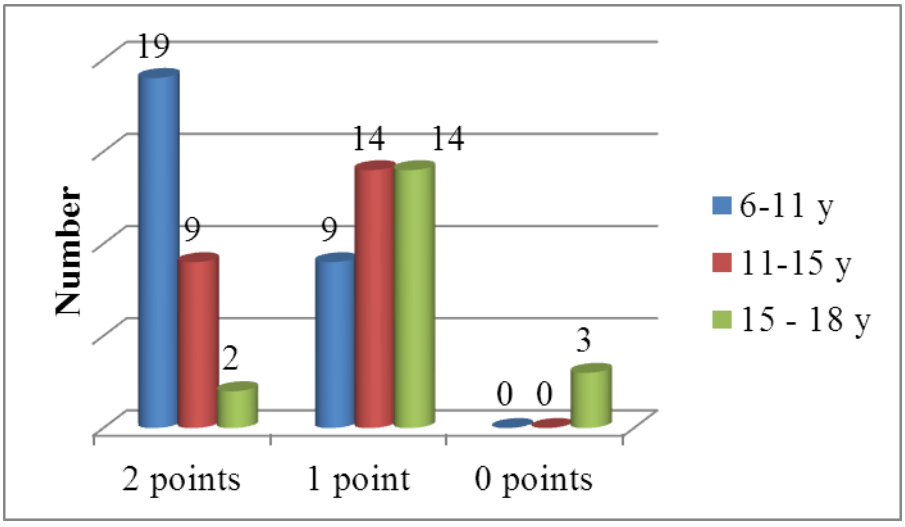

Figure 2. Diagram of the results of the study of chest excursion data in children with PE.

As the results of diagram 2 show, good results with a score of 2 points were observed in 30 (42.9%) children, of which 19 (27.2%) children of the 1st age group prevailed against 9 (12.8%) - 2nd and 2 (2.9%) children of the 3rd age group groups. Analysis of the results obtained for this parameter also revealed a high inverse relationship (r= -0.99).

A satisfactory result of 1 point was obtained in only 37 (52.8%) children, of which 9 (12.8%) children of the 1st age group against equal numbers of 14 (20%) children of the 2nd and 3rd-her age groups, which is confirmed by a high positive Pearson correlation - r = +0.92.

An unsatisfactory result of "0" points was estimated only in 3 (4.3%) adolescent children, the chest of children in this group was much "rigid" and therefore the difference in the chest excursion between inhalation and exhalation was insignificant, less than 5% of the circumference at the maximum of inspiration and they had a high positive Pearson correlation - r= +0.8.

The results of the analysis of the state of the chest excursion in children with PE proved the conclusion obtained by studying the indicators of the first parameter that in the stages of the child's growth, the chest frame becomes rigid or strong. In assessing the elasticity properties of the PE region, the data of two objective parameters developed by us (the angle of rotation of the sternum and the steepness of deformed ribs) were also important, as negative factors in the self-correction of the congenital defect area, i.e., as far as these angular parameters are expressed, it is so difficult and difficult to correct the funnel-shaped depression.

As the third parameter for determining the degree of elasticity of the area of the birth defect, the measurement of the degree of rotation (torsion) of the sternum by the tomogram of the axial section was used. As our observations have shown, there was not a single child without rotation of the sternum by one degree or another, although externally the deformity seemed symmetrical. Data on the analysis of the sternum rotation angle parameter are shown in diagram 3.

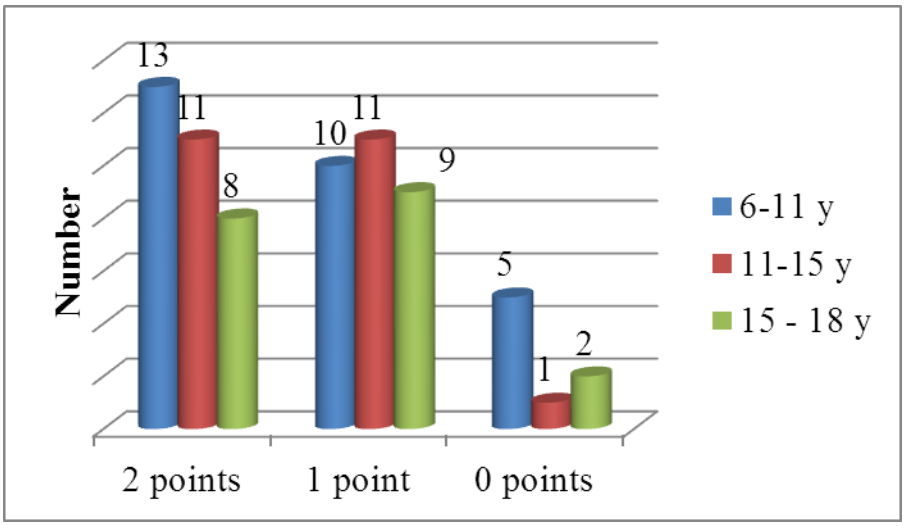

Figure 3. Diagram of the results of the study of the data of the angle of rotation of the sternum in children with PE.

It should be noted that this parameter did not have a clear dependence on age. As can be seen from the data in diagram 3, only 32 (45.7%) children had a slight rotation of the sternum of 2 points.

The analysis of the structure of good results with a slight rotation of the sternum less than <15° in 2 points was in 13 (18.6%) children of the 1st age group versus 11 (15.7%) - 2nd and 8 (11.4%) children of the 3rd age groups, which proved a high negative correlation of Pearson - r= - 0.97. It should also be noted that in children of the 1st and 2nd age groups, such a slight rotation was easily corrected some time after primary thoracoplasty, however, in patients of the 3rd age group (15-18 years), it was quite difficult to achieve the desired result and not in all adolescents due to the "rigidity" of the SCC area and ossification of the cartilaginous parts of the ribs. The average degree with a rotation angle of 16°-30° and a score of 1 point was noted in 30 (42.8%) children, the age distribution of patients was almost comparable: 10 (14.3%) children of the 1st age group, 11 (15.7%)

- 2nd and 9 (12.8%) - 3 age groups, which is proved by the average negative Pearson correlation - r= - 0.39.

Pronounced rotation of the sternum with an angle of more than 30° and a quantitative score of "0" points was observed in 8 (11.5%) children from 70 patients, including 5 (7.2%) children from the 1st age group, 1 (1.4%) patient from the 2nd and 2 (2.8%) patients of the 3rd age groups, with the installation of a high Pearson inverse correlation - r= - 0.79. Summarizing the analysis of the data of the third parameter, we can say that the severity of the angular values of the rotation of the sternum in the structure of the PE has no connection with the age of the child, i.e., it is possible to observe children with pronounced rotation of the sternum in the younger age group or vice versa, with a slight degree of severity of this parameter among adolescents.

The last fourth parameter developed by us in the clinic to assess the degree of elasticity of the PE region was the determination of the angular values of the edge of the deformation of the ribs, which was calculated according to the tomogram data. It should be noted that even a slight rotation of the sternum is accompanied by deformation of the ribs with their tops protruding forward. Such curvature of the ribs is clearly visualized on the tomogram of the axial section, it is also noted that the deformed ribs serve as the boundaries of the funnel. As the volume and depth of the funnel increases with pronounced rotation of the sternum and angular deformations of the funnel edges also sharpen, which is much more difficult to fix such deformations just like that. In addition, the indicators of rotation of the sternum and angular values of deformed ribs do not always correspond to each other.

The analysis of data on the study of the angle of steepness of deformed edges is carried out in diagram 4.

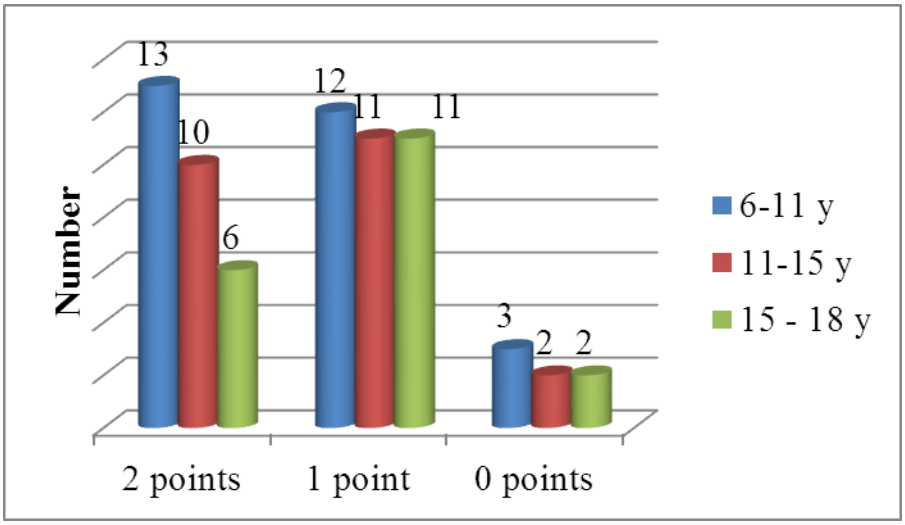

Figure 4. Diagram of the results of studying the data of the angle of deformed ribs in children with PE.

Analysis of the results presented in Diagram 4 revealed a negative Pearson relationship between different values of angular curvature of the ribs and the age of children. A slight degree of curvature of the ribs (>120°) with a score of 2 points was noted in only 29 (41.4%) children, of which 13 (18.6%) children of the 1st, 10 (14.2%) - 2nd and 6 (8.6%) - 3rd age groups, which was confirmed The high inverse Pearson correlation is r= -0.98. In these children, the funnel-shaped defect was not deep, respectively, the ribs were not pronounced and the angle of curvature was no more than 120°, and the rotation of the sternum was also not pronounced. Results with an average score of 1 point were noted in half of the observed patients – 34 (48.6%) cases. Of these, 12 (17.2%) children of the 1st age group against equal numbers of 11 (15.7%) children of the 2nd and 3rd age groups, which marked a high inverse Pearson correlation - r= -0,92.

The data obtained on the study of the fourth parameter, as the angle of steepness of deformed ribs, we have once again confirmed that the complexity of the deformation does not depend to a greater extent on the age of the child.

After studying all the proposed parameters and summing up the score scales, the degree of elasticity of the PE region is established, which is shown in Table 2.

Table 2. Results of the degree of elasticity of PE region in children

1 age group n=28			2 age group n=23			3 age group n=19		
High elasticity.	Moderate elasticity	Mild elasticity	High elasticity.	Moderate elasticity	Mild elasticity	High elasticity.	Moderate elasticity	Mild elasticity
8-6 points	5-4 points	≤3 points	8-6 points	5-4 points	≤3 points	8-6 points	5-4 points	≤3 Points
24 (85,7%)	4 (14,3%)	0	14 (60,9%)	6 (26,1%)	3 (13%)	2 (10,5%)	5 (26,3%)	12 (63,2%)

As can be seen from Table 2, the high degree of elasticity of the PE region was mainly greater in children of the 1st age group 24 (85.7%), and in age gradations there was a tendency to decrease with the establishment of the 2nd and 2nd (10.5%) 3rd age groups in 14 (60.9%) cases.

This trend, but in the opposite direction, was fixed in children with a low degree of elasticity of the PE region, which was established more in children of the 3rd age group at 12 (63.2%). In age gradations, there was a tendency to increase from 0 to 3 (13%) of the 1st and 2nd and 12 (63.2%) of the 3rd age groups. The data obtained proved once again that with age, the area of PE becomes much more rigid and at the same time surgical intervention is carried out somewhat traumatically with the possibility of various complications.

Conclusions

1. For a thorough study of the PE area and the implementation of an individual operative correction, it is important to take into account the results of the parameters of elasticity of the PE area that we have developed.
2. Subjective parameters such as the auto-correction test and the state of the chest excursion as convincingly show the true degree of elasticity of the PE area, however, we consider it important to take into account two more objective parameters, the severity of which directly negatively affects the degree of elasticity.
3. The high degree of elasticity of the PE region was mainly greater in children of the 1st age group, with a decrease in age gradations. Children with a low degree of elasticity of the PE region were larger in the 3rd age group, due to the rigidity of the anterior chest wall, with which the regularity of age-related changes in the PE region was proved.

References:

1. Abdrakhmanov A.Zh., Tazhin K.B., Anashev T.S. / Congenital deformities of the chest and their treatment. // Traumatology and orthopedics. 2010; No. 1: -pp. 3-7.
2. Aghajanyan V.V., Sinitsa N.S., Kornev A.N. / Our experience in the diagnosis and surgical treatment of congenital funnel-shaped deformity of the chest in children and adolescents. // "Topical issues of pediatric traumatology and orthopedics". St. Petersburg. 2002; -pp. 176-178.
3. Jalilov P.S., Abdumazhidov A.S. / Analysis of the results of surgical correction in children with PE. // Pediatrics. 2000; No. 1: - pp. 102-104.
4. Isaeva L.S. / Children's diseases. // Educational literature. M., 1987; 592 p.
5. Alex Haller J., I.R. Scherer, Charles S. Turner et al. / Evolving Management of Pectus Excavatum Based on a Single Institutional Experience of 664 Patients. //Ann. Surg. May 1989;Vol. 209;5:578-582.
6. Daniel C. Aronson, Remko P. Bosograf, Eva-Maria Merz. /Lung Function after the Minimal Invasive Pectus Excavatum Repair (Nuss Procedure). //World J Surg 2007.31:1518–22.