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ANALISYS OF PECTUS EXCAVATUM REPAIR RESULTS IN CHILDREN

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ABSTRACT

This report presents the results of the operative correction of the PE in 15 children aged from 5 to 18 years. In relation to the SCC elasticity degree and age of the patient there was performed the PE repair using D. Nuss procedure and it's modifications with application of a metal plate of the own construction. The obtained results show that thoracoplasty by D. Nuss due to PE is required when the sternocostal complex is elastic. PE with worsening SCC elasticity required the thoracoplasty in modification.

KEYWORDS: Children, chest, pectus excavatum elasticity, D. Nuss procedure.

BACKGROUND

The chest deformities have various forms, the overwhelming majority of them is the pectus excavatum (PE) (90 %).[1,2] The treatment of children with PE remains not to be resolved completely problem of the children orthopedics. This is confirmed by a high percent of unsatisfactory results after PE surgeries, which are found in more than 30 %.[1,3] While having diversity of various correction methods of PE.

Though the majority of the authors use D. Nuss technique for the purpose of PE elimination, the orthopedic features of treatment remain without appropriate attention. It is quite logical, that the performance of the same method of thoracoplasty in patients with different types and severity of PE and various ages leads to the predispositions for occurrence of various postoperative complications and unsatisfactory results at long-term postoperative periods.[4]

The purpose of work was to improve the results of PE repair in children.

MATERIALS AND METHODS

In the Children Injuries Surgery Department of Bukhara branch of the Republican Scientific Center of Emergence Medical Care 15 patients with PE at the age from 5 to 18 y. were operated during the period from 2016 to 2019. All patients were known about their cosmetic impairment and so, they had moral degradation. Because, patients and their parents were given their consent to perform the operative intervention, notably, they completed out the act about occurrence of any complaints during the operation.

These children were divided into three groups in relation to the degree of sternocostal complex elasticity (SCC). All patient was performed treatment with use of the SCC elasticity criteria (patent № DGU 02466) including the following parameters: the test of autocorrection, difference of chest excursion at a deep inspiration and expiration, "torsion" of the breast bone and the angle of steepness of the deformed ribs. On the basis of SCC elasticity degree there were formed groups of the patients, according to which the choice of a method of operative correction was made. For operative correction of the SCC we used our developed (2010) and made by firm ChM (Poland) metal plate (patent № FAP 00825).

The results of the study are devoted to research of all parameters data of SCC elasticity degree, which are shown in table 1.

Table 1: Distribution of the children with PE by the SCC criteria elasticity degree (n = 15).

Criteria	SCC elasticity degree			Totally
	High elastic SCC	Moderate degree SCC elasticity	Hypoelastic SCC	
Test autocorretion (TA)	7 (46,7%)	5 (33,3%)	3 (20%)	15
Chest excursion degree (CE)	8 (53,3%)	4 (26,7%)	3 (20%)	15
Breastbone torsion (BBT)	7 (46,7%)	3 (20%)	5 (33,3%)	15
Angle of the steepness of the deformed ribs	6 (40%)	5 (33,3%)	4 (26,7%)	15

The table 1 shows, that summarizing all parameters of criteria of deformed SCC area in 7 (46,6%) children we establish the high elastic SCC, in 4 (26,7%) moderate elasticity was determined and in 4 (26,7%) the hypoelastic SCC area is established.

Depending on a degree of SCC elasticity the method of operative correction was chosen. In 7 (46,6%) patients with normal elasticity of SCC (as a rule they are children in the age under 10 years), there was carried out the D. Nuss procedure with application of a metal plate. At the moderate degree of elasticity in 4 (26,7%) children PE repair was performed using chondrotomy of the deformed ribs with stabilization using plate. In the third group of 4 (26,7%) patients the PE was corrected by «T»-shaped or transversal sternotomy and cartilages resection and stabilization with plate too.

The duration of immobilization period was 3.2 ± 0.9 y. in relation to character and rate of growth of the patient. The long-term results of the operated patients were investigated in 37 (68.5%) out of common number of operated children during the period of follow-up from 2 till 4 years. In the other 17 (31.5%) patients there were studied nearest postoperative results.

The results of operative correction we have estimated as good, satisfactory and unsatisfactory:
– The good result is considered when the patient does not show the complaints and the good cosmetic effect, complete restoration of the functions of pulmonary-cardiovascular system;
– The satisfactory result is considered when there is a periodic pain sensation in the field of operative intervention, intercostal pain, and light inflammatory reaction in the area postoperative wound on the basis of good cosmetic result.
– The unsatisfactory result is when there is noted the deeping of SCC looking-like PE 1 degree, that is, the relapse of deformation is of mild degree.

In 7 (46,6%) children with sufficient SCC elasticity there was performed D. Nuss procedure. The good result was obtained in 6 (86%) children, thus PE was eliminated with a good relief without relapsing and complaints of the patient. In one (14%) patient the satisfactory result was achieved.

In 4 (26,7%) patients with moderate degree of SCC elasticity with the purpose of reduction of resistant SCC the D. Nuss operation was performed with modification. The good result was obtained in 3 (75%) children, they have good relief in the SCC area and recurrences were absent. In 1 (25%) case there was received satisfactory result that associated with periodic pain sensations in the area of surgery and the forming of rough keloid scars. The unsatisfactory result was not found. The hypoelastic chest was established in 4 (26,7%) patients, them were performed thoracoplasty in modification with "T"-shaped or transversal sternotomy and cartilages resection, then the plate of D. Nuss was inserted under sternum. The good result was obtained in 2 (50 %) children. The satisfactory result was noted in 1 (25%) case. The unsatisfactory results were received in 2 (16.7 %) cases with occurring of the mild relapse of deformation. These patients underwent repeated operative intervention. Intra- and postoperative results of the operative correction of the patients with pectus excavatum are presented in table 2.

Table 2: Results of operative intervention depend on SCC elasticity degree.

Results	SCC elasticity degree			Totally
	High elastic SCC	Moderate degree SCC elasticity	Hypoelastic SCC	
Good	6 (86%)	1 (14%)	0 (0%)	7
Satisfactory	3 (75%)	1 (25%)	0 (0%)	4
Unsatisfactory	2 (50%)	1 (25%)	1 (25%)	4

The rate of restoration and improvement of the patient state was directly proportional to volume of operative intervention. The duration of D. Nuss procedure (group 1 of the patients) was 25 ± 2,5 minutes, at modified method of D. Nuss, (groups 2–3) was more than an hour - 72 ± 9,4 minutes ($p < 0,001$).

Because of strong pain syndrome in the postoperative period in the patients from groups 2–3 the ventilation function of the lungs was limited and worsened, the need of the body in oxygen was not supplied, this was expressed by slowing of physical activation of the patient, and as a result the patients received treatment in the department of resuscitation and intensive therapy for

a longer period, 3,4 ± 0,8 days. At an easy degree of elasticity the pectus excavatum deformity is easily corrected without negative effect on the internal organs of the thorax. And at the moderate and hypoelastic thorax the elimination of deformation is carried out with the certain difficulties and with additional interventions. In these cases the possibility of the occurrence of intraoperative complications is increased. We believe that presence of breast bone torsion and marked steepness of the deformed ribs are the contributing factors to occurrence of the secondary deformations.

CONCLUSION

As our results shown, that with the growth of patients their SCC is became as a rigid. So, in such moment the correction of the PE deformity without sternotomy or cartilages resection is impossible.

The results of the performed operative interventions and their comparative analysis show that thoracoplasty by D. Nuss due to PE is required when the sternocostal complex is still elastic. The worse elasticity of the sternocostal complex there are more and more often complications and relapses of the deformation after the thoracoplasty.

The results obtained of the comparative characteristic in three groups of the patients indicate that "with age" the SCC elasticity in PE loses, that is difficult for correction and with some complications. Thus, the operative intervention at PE should be performed with taking into account SCC elasticity that contributes to the easy performance of the correction and provides good cosmetic and functional results.

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