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# SURGICAL CORRECTION OF THE KEELED DEFORMITY OF THE CHEST IN CHILDREN

***Resume:*** The keeled thorax is a pathology in which the front part of the thorax protrudes, taking the form of a boat keel. It is a congenital anomaly, inherited, manifested as the patient grows. It is manifested by visible deformation of the anterior part of the chest (ribs and sternum). By itself, it does not have a negative effect on the work of internal organs, but it may be accompanied by a narrowing of the chest.

To clarify the diagnosis, determine the type and degree of deformation, radiography and computed tomography are performed. Conservative treatment is ineffective. Surgical operations are performed to eliminate the cosmetic defect.

This article fully describes the above fixes

***Keywords:*** keeled thorax, deformity, surgical tactics.

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# ХИРУРГИЧЕСКАЯ КОРРЕКЦИЯ КИЛЕВИДНОЙ ДЕФОРМАЦИИ ГРУДНОЙ КЛЕТКИ У ДЕТЕЙ

***Резюме:*** Килевидная грудная клетка – это патология, при которой передняя часть грудной клетки выступает, приобретая форму лодочного киля. Является врожденной аномалией, передается по наследству, проявляется по мере роста больного. Проявляется видимой деформацией передней части грудной клетки (ребер и грудины). Сама по себе не

оказывает негативного влияния на работу внутренних органов, однако может сопровождаться сужением грудной клетки.

Для уточнения диагноза, определения вида и степени деформации проводят рентгенографию и компьютерную томографию. Консервативное лечение неэффективно. Для устранения косметического дефекта проводятся хирургические операции.

В этой статье полностью описаны вышеуказанные исправления

***Ключевые слова:*** килевидная грудная клетка, деформация, хирургическая тактика.

**Relevance.** Congenital deformities of the chest represent a wide range of anomalies in the development of the sternocostal complex with a relatively high frequency of occurrence. Despite the small number of cases with functional respiratory disorders, most children and their parents have psychosocial problems caused by a cosmetic defect, which leads to apathy in behavior, isolation, unwillingness to play sports and requires the help of a psychologist.

In some cases, chest deformities are often misdiagnosed or their severity is underestimated by doctors, which leads to late diagnosis and improper treatment. Some chest malformations are isolated pathology, while others are symptoms of various syndromes

Congenital keeled deformities of the thorax (CDGC) have diverse forms of malformation — from barely noticeable to extremely pronounced and complex, while corporocostal deformities prevail — pyramidal, round, symmetrical or unilateral, which are often combined with areas of rib entanglement and their transposition. Keeled deformity is the second most common defect after funnel-shaped deformity of the chest (VDGK) and accounts for 6 to 22% of all types of deformities of the chest [1, 2, 6]. Keeled deformity of the chest is a malformation characterized by a protruding sternum and sunken sections of the rib cage of different shapes and sizes. This malformation, in addition to a depressing cosmetic defect, is often accompanied by significant functional

disorders on the part of the cardiovascular and pulmonary systems. CDGC is classified as systemic dyschondroplasia, it is often combined with other dysplastic defects: Marfan, Ehlers—Danlos syndromes, congenital scoliosis. Surgical treatment of CDGC in children is a long-standing urgent and complex problem of orthopedics. Currently, there are many methods of thoracoplasty that differ in the scope and radicality of the intervention. There are various techniques and means of postoperative fixation of the mobilized and corrected sternocostal segment - the most important factor in ensuring the functional stability of the chest.

Thoracoplasty methods using external fixing devices are complex: the structures are cumbersome, extremely inconvenient for patients, cause a lot of social and household problems, require constant monitoring by a specialist during treatment. Thus, the issues of optimizing the volume and simplifying the technique of surgical aid, as well as reliable stabilization achieved by correcting the deformed segment of the chest, remain relevant and unresolved.

**The purpose of the study.** Selection of the optimal surgical treatment technique, application and evaluation of the effectiveness of the use of titanium nickelide materials in the case of keeled chest deformity in children.

**Material and methods of research.** The studies are based on the analysis of the results of surgical treatment of CDGC on the basis of AOMPDB. 28 patients (26 boys and 2 girls) aged from 12 to 18 years were operated on in the period from 2021 to 2022. The clinical material is divided into two groups of observations. The first group was formed from 10 children and adolescents operated in 1977-1987, of which 5 had symmetrical keel—shaped deformation, 3 — asymmetric right-sided deformation, 2 - left-sided complex keel-shaped deformation.

**The results of the study.** In the first group of observations, 3 patients had bleeding from damaged thoracic and intercostal arteries during segmental rib section. In 4 patients, pneumothorax and hemothorax were detected

intraoperatively, which was eliminated by sealing and active aspiration of air and blood after the operation. In 3 patients in the postoperative period, marginal necrosis of the skin along the suture line was noted due to the wide mobilization of the skin-subcutaneous flap. The external locking device was quite cumbersome, limited the patient's activity; long-term observance of bed rest was required. In 2 children, limited inflammation was noted in the area of the exit holes of the threads. The external fixing device was removed at the end of the hospital stay, the duration of which was on average (44 ± 7) days.

When using spokes, the patient's stay mode was more relaxed, but the stability of the segment fixation was unreliable, a gradual displacement of the spokes was observed. In 1 patient there was an inflammatory reaction with purulent exudate at the exit of the ends of the spokes; it was removed 1 month after surgery; Later in patients, the ends of the spokes were left under soft tissues; in 3 other patients, the spokes were removed after 3-4 months. The duration of hospital stay in this subgroup was 36 days. During the follow-up period from 2 to 5 years, the residual asymmetric deformation remained in 6 children, 2 children had an incomplete recurrence of keel deformity. Analysis of the results of treatment of children of the first group showed that effective elimination of deformity is possible only by full mobilization of the deformed sternocostal segment: longitudinal and transverse, partial or extensive sternotomy, dissection or resection of ribs with transposition.

Reliable fixation of the sternal-rib complex after correction for a longer period remained an unsolved task. In the second group (18 patients), the following were intraoperatively noted: pneumothorax and hemothorax (in 3 patients), after surgery — superficial inflammation along the suture line (2 cases) with the formation of a ligature fistula (1 case), which passed after the removal of the suture node. There were no other complications. First cooled, and after implantation heated to body temperature, titanium nickelide plates created an additional corrective force due to the thermodynamic properties of the

material and at the same time provided stable fixation of the corrected section of the chest for the entire period of immobilization. The duration of inpatient treatment averaged 18 days. All patients were subjected to a control examination every 3 months for a year after discharge.

There were no complications in the long-term period after the operation. The plates were removed after 1-1.5 years through a small incision (1-2 cm) by removing the end seams fixing the plates and pulling them through the incision. In the long term — from 2 to 10 years — 12 patients showed good cosmetic results; 6 — satisfactory.

**Conclusion.** The use of titanium nickelide plates with shape memory for operative correction of keel deformity in children and adolescents is the method of choice.

Due to the bioinertness and dynamic properties of the material, the implanted plates do not provoke a rejection reaction, provide stable fixation of the newly formed chest frame for 1-1.5 years — until complete consolidation and restructuring of tissues. As a result of the improvement of surgical techniques, as well as the use of plates made of materials with shape memory, the duration of inpatient treatment of patients with CDGC decreased by 2-3 times, the number of postoperative complications decreased, and the clinical and cosmetic results of surgical treatment of keeled chest deformity in children and adolescents improved.

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