EVALUATION OF THE EFFICIENCY OF PREOPERATIVE PREPARATION OF SCOLIOTIUS DISEASE IN ADOLESCENTS

[1]S.S.Gulyamov, [2]U. B. Sangilov
[1]Tashkent Pediatric Medical Institute. Tashkent, Uzbekistan
[2]Department: Traumatology, Orthopedics and Neurosurgery
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Abstract. *Indications for the use of an optimized preoperative diagnostic and treatment complex for the preparation of paravertebral tissues and the contents of the spinal column for radical correction in children with stage IV scoliosis were determined. The proposed method expands the possibilities of a practical orthopedic-vertebrologist in rendering assistance to sick children with this disease.*
Keywords: *adolescents, scoliosis, preoperative preparation.*

Relevance. The treatment of scoliotic spinal disease is one of the most challenging problems in modern vertebrology. Significant progress has been made in the surgical treatment of this pathology; however, the outcomes of the performed surgical interventions do not always satisfy both vertebrologists and patients [2].

The problems encountered in the surgery of scoliotic deformities, such as the use of imperfect means, functional diagnostics, and preoperative preparation, indicate the need for the search and development of new, more effective comprehensive methodologies. These methodologies should not only incorporate precise standardized methods and functional diagnostics but also include effective and safe preoperative preparation methods and the prediction of surgical treatment outcomes [4].

The most widely used method of surgical instrumental correction of scoliotic deformities in Europe, known as CDI [3], is not always effective and safe. The degree of correction achieved after the use of this technology in patients with a moderate angle of scoliotic curvature is only 54.5% out of 550 deformity corrections. Furthermore, in the long term, only 41.9% of the correction is maintained [1]. The number of complications remains high at 26% [2], including acute neurological disorders that can reach 17%.

The preoperative therapeutic and diagnostic complex, which has been elevated to a mandatory level, includes simultaneous physiotherapeutic interventions. These include physical therapy exercises and discrete traction effects on a gravity frame. This not only helps achieve the necessary mobility along the curve, but also prepares the paravertebral tissues and the spinal tissues with their contents for the extreme conditions of radical correction. Additionally, it enables more precise preoperative planning, determines surgical tactics, and predicts the occurrence of neurological disorders.

Aim of the research: Assessment of the Effectiveness of Preoperative Preparation in Adolescent Scoliotic Disease.

Materials and Methods: The study is based on data from the examination of 54 patients with scoliotic disease of various origins. The examined children were divided into two groups based on the performance of preoperative preparation. The main group consisted of 34 children who received modified preoperative preparation, while the comparison group comprised 20 children who received standard preoperative preparation. In most cases (52.9%), patients between

the ages of 15-18 predominated in both groups. The average age was 14.3 ± 0.79 years. The distribution of patients by gender favored girls (1.7 times more). The study included patients with IV degree scoliosis. The average deformity angle in our observations was 75.3 ± 3.32°, with a slight predominance of patients with scoliosis angles ranging from 43 to 98°.

The objective of the developed preoperative preparation complex is to enhance the effectiveness of preoperative planning and prognosis of treatment outcomes, increase surgical correction of scoliosis, and prevent loss of correction, respiratory disorders, neurological, and surgical complications. This objective is achieved by applying systematically repeated suspensions of patients by the head with gradual increase in duration and load. The suspensions are performed in a deep head holder, cyclically and variably, increasing the traction load in terms of magnitude, frequency, and duration. The achievement of maximum functional mobility and flexibility of spinal deformity and the thoracic cage in standard physical values are determined through systematic chronological, anthropometric, and spirometric monitoring. The maximum traction indicators are recorded through X-ray spondylography, anthropophotometry, and somatosensory evoked potentials.

The technical result obtained by implementing the method is the rapid development of maximum functional mobility of scoliotic deformity of the spine, thoracic cage, and surrounding tissues. This reduces the loss of surgical correction of scoliosis, enhances compensatory reserves and adaptive mechanisms of the respiratory, cardiovascular, nervous systems, and paravertebral tissues. The determination of maximum flexibility and mobility of deformations is standardized, and the patient's anthropometric and physiological condition is evaluated through objective methods of hardware and other clinical diagnostics, recording standard physical values under standard conditions simulating maximum functional correction of scoliosis. The preventive effect of preventing the development of surgical complications, loss of correction of scoliosis, respiratory, and neurological disorders is directly related to the accelerated development of mobility and increased extensibility of soft tissues, which fix vertebral segments and surround the spine and thoracic cage to the maximum possible extent. This increases the functional reserves of patients and reduces tissue resistance and tension during surgical correction. The system of objective and hardware control includes non-invasive methods for monitoring traction on a daily basis, such as timing, anthropometry, and spirometry.

Results of the study: The following level of spinal deformity mobility was achieved: the average hanging time on the gravitational frame without support for the main group was 423±1.27 seconds; the distance increased by 5.8±0.23 cm; the scoliotic curve angle decreased on average by 48.3±0.63%; the kyphotic curve decreased by 78.1±1.21. During the preoperative preparation process, regression of muscular paresis was achieved in one patient (Table 1).

It is also worth noting that when using the modified complex of preoperative preparation for children with scoliotic disease, the children's height increased on average by 6.2±0.2 cm more compared to children who underwent preoperative preparation using standard methods.

According to the obtained results, out of 54 examined patients with scoliotic (n=16) and kyphoscoliotic (n=-38) spinal deformities with idiopathic scoliosis, there were 28 cases, dysplastic - 17 cases, neurofibromatosis Recklinghausen - 2 cases, kyphoscoliosis due to congenital anomalies - 4 cases, neurogenic (syringomyelia) - 2 cases, and Ehlers-Danlos syndrome - 1 case. The magnitude of the scoliotic component ranged from 43° to 98°, with an average of 78.7±12.43°.

During the physical examination, the presence of pronounced spinal deformity was noted in all patients. Additionally, most patients had minor developmental anomalies such as "flat" (5.9%) or "funnel-shaped" (2.9%) chest, flat feet (23.5%), and joint hypermobility (5.9%). These findings undoubtedly indicate the presence of congenital connective tissue dysplasia.

Table 1.

Comparative characteristics of spinal mobility after preoperative preparation

Mobility indicators	Main group	Group comparison (n=2(>1
Average hover time on gravity frame (sec)	423±1,27	-
Increase in distance (cm)	5,8±0,23	-
Reducing the angle of the scoliotic curve (%)	48,3±0,63	34,1±0,52*
Reducing the angle of kyphotic shower	78,1±1,21	45,6±1,3*
Height gain (cm)	6,2±0,2	2,4±0,1*

Note: * - statistically significant difference in indicators between groups (P≤0.01)

Clinical examination of the children revealed varying shoulder heights, asymmetry of scapular positioning, deviation of spinous processes from the midline, presence of rib and muscle humps. The progression of scoliosis in children is determined by the nature of risk factors for its development and their combination. According to the obtained results, significant risk factors include a combination of cervical instability, joint hypermobility, congenital vertebral anomalies, gastrointestinal and thyroid disorders, and the child's age at the onset of spinal deformity.

Radiographic studies showed that in most cases of children with grade IV scoliosis, the deformity angle ranged from 41° to 90°. Based on MRI diagnostics, it was determined that 29.4% of children had an S-shaped type of scoliosis. Initial manifestations of osteochondrosis were registered in 44.1% of adolescents. Disc protrusions were found in 5.9% of cases. Two cases of syringomyelia were detected.

Conclusion: In terms of preoperative examination, it is necessary to supplement standard radiography with magnetic resonance imaging for comprehensive assessment of skeletal deformity and detection of subclinical forms of organic nervous system damage.

Upon analysis of traditional preoperative preparation methods, it was found that the use of these methods did not achieve the necessary mobilization of the rigid curves of scoliotic distortion and preparation of paravertebral tissue and spinal tissue with its contents for extreme conditions of radical correction. Consequently, preoperative planning, determination of surgical tactics, and prediction of the occurrence of neurological disorders were insufficiently effective.

The obtained results have proven that the modified method of preoperative preparation allows for individual assessment of the adaptive and reserve capacities of each patient based on the gradual re-adaptation of the spinal cord and its vascular system to the future new conditions of the corrected spine, thus reducing the risk of neurological complications and decreasing their severity.

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