

METHODS OF SURGICAL CORRECTION FOR SEVERE SCOLIOSIS

Umarkhojaev F.R.

Doctor of Medical Science, Department of Traumatology, Orthopedics and Neurosurgery,
Tashkent Pediatric Medical Institute

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Abstract. *The treatment of scoliosis is one of the most challenging problems in modern orthopedics. Currently, scoliosis ranks among the top conditions in terms of prevalence within the musculoskeletal system. Despite the high effectiveness of modern instrumental surgical techniques for scoliosis correction, they often limit the spinal mobility and carry a high risk of complications, reaching 32-50%. This highlights the need for further development of pathogenetically justified surgical methods, which is an important medical and social issue.*

Keywords: *scoliosis, instrumental surgical techniques, medical, severe and rigid forms.*

Research conducted worldwide has proposed various solutions aimed at improving the outcomes of surgical treatment for scoliotic deformities, including restoration of sagittal and frontal balance and achieving reliable spinal fusion while preserving maximum functionality. In the surgical treatment of scoliosis of varying severity, modern constructs such as two-rod systems (Hari I, 2015), hook systems (Suh SW, 2009), hybrid systems (Lukissas MG, 2013), and transpedicular screw-rod constructs (Luo M, 2017) are utilized. These techniques provide highly effective correction (70% or more) of spinal deformities without the need for additional anterior mobilization (Lehman et al., 2014; Kim et al., 2006; Lenke et al., 2009; Lykissas MG et al., 2013; Lonner BS et al., 2018).

Objective: The aim of this study was to develop and implement a corrective method for severe and rigid forms of scoliosis.

Materials and Methods: We operated on 92 patients at the TashPMI clinic between 2001 and 2023 using a three-stage surgical correction technique. The average age of the patients was 16.6 ± 5.8 years (ranging from 13 to 33 years). The average scoliosis angle in the group was -120.4 ± 2.60 degrees (ranging from 95° to 1860°) according to Cobb's angle, with a Risser sign of 3.4.

The scoliosis was predominantly located in the thoracolumbar region in 57.7% (62) of cases and in the thoracic region in 42.3% (30) of cases. Pathological kyphosis was detected in 71.8% (61) of patients, with a mean central angle of hyperkyphosis of 91.6 ± 1.4 degrees (ranging from 420° to 1810°). Imbalance of the trunk above the sacrum was observed in 71.8% (62) of patients. The average kyphosis angle from T1 to T12 was 45 ± 2.6 degrees (ranging from 50° to 108°), and the lordosis angle from L1 to L5 was -49.4 ± 12 degrees (ranging from -108° to -340°). Idiopathic scoliosis accounted for 49.3% (55) of cases, while dysplastic scoliosis accounted for 23.9% (17). Congenital anomalies and systemic pathologies such as neurofibromatosis and Ehlers-Danlos syndrome accounted for 14.1% (10) and 12.7% (9) respectively. In 74.6% (73) of patients, there was a significant medical history, accompanying pathologies, and complications, including pyelonephritis, cholecystitis, osteoporosis, syringomyelia, hypothyroidism, hypopnea, myelopathy, myocarditis, VZV infection, sepsis, etc.

The first stage of the three-stage correction course involved correcting the spinal deformity by the amount of functional component of the deformity's mobility achieved during conservative preparation with traction. For this purpose, a single-rod telescopic distractor with 4-5 hooks for sublaminar fixation to the spine was installed on the concave side of the deformity.

The second stage included transpedicular mobilizing discectomy, with an average of 5.2 discs (ranging from 3 to 7) undergoing segmental reconstruction of the vertebral bodies and interbody spinal fusion using autotransplants. The correction was completed by additional correction of the deformity through subperiosteal resection of 3-6 ribs, segmental resection of certain spinal regions along the curve, and a single spinal fusion using autologous bone grafts. Original single-rod and double-rod endocorrectors were used for deformity correction (patent № IAP 03203, issued on September 22, 2006). The surgical correction was performed in three stages, totaling 241 operations, with an average of 3.2 staged operations per patient over 19.6 days (ranging from 14 to 25 days) per stage, and an average of 49.2 days for the entire treatment period.

The average scoliosis correction rate after the first stage was 46.7% (ranging from 31.2% to 58.6%), and 64.1% (ranging from 43.7% to 74.2%) at the completion of correction. The average residual angle of the scoliosis curve after correction was 44.1° (ranging from 2° to 92°). An increase in height was recorded, with an average gain of 12.5 cm (ranging from 4 to 29 cm) attributed to increased trunk length. Complications occurred in 10.8% of children and included pyramidal disorders in 3 cases, soft tissue infections (*Staphylococcus aureus* and *Pseudomonas aeruginosa*) in 5 cases, cerebrospinal fluid leakage in 1 case, and exacerbation of chronic diseases in 3 cases. All complications were successfully managed, but required an average increase in hospitalization by 4.3 days.

Discussion: In the comprehensive treatment of severe scoliosis, additional mobility is increased through segmental resection of the anterior regions of the spine based on discectomy or vertebral column resection (PSO, VCR) (Mehhnan ST, 2004; Qian BP, 2006; Xia L, 2015). The number of components in implanted constructs has increased, as well as the volumes of instrumental, hardware, and medication support, blood loss, risk of complications, and the frequency of revisions, which significantly elevated hospital expenses and made the procedure less accessible (Chan et al., 2003; Mueller et al., 2012; Ydnuiz et al., 2012; Samdant et al., 2013; Lomner et al., 2017; Kwan et al., 2017). The positional strategy of translational scoliosis correction by installing a single-body segmental hook construct on the convex side of the main scoliotic curve may hypothetically be equally effective and potentially capable of addressing most of the problems associated with widely used traditional methods. However, the effectiveness and safety of this technique have not been previously investigated in clinical practice, and there is a lack of research publications dedicated to studying the results of scoliotic deformity correction using such a less invasive positional strategy.

Conclusion. Thus, staged segmental reconstruction and instrumental correction surpass contemporary global analogs, serving as the method of choice in the comprehensive treatment of severe (Cobb angle 95-116°) forms of scoliosis in children and adolescents.

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