Central Asian Journal of Medicine

METHOD AND IMPLEMENTATION OF SURGICAL CORRECTION FOR SPINE DEFORMATIONS

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ABSTRACT

That article provides the results of the design and implementation of reconstructive correction surgery method in cases of progressive forms of scoliosis. Within the period from 2001 to 2022 104 patients whose average age was 16.6±5.8 (13-18) years old with average Cobb scoliosis angle equal to 125.4±2.6 (95-180^{o}) were operated in compliance with three-stage surgical correction method.

Key words: scoliotic disease, scoliosis surgery, instrumental correction, children and adolescents.

INTRODUCTION

Relevance. Despite the successes of modern orthopedics, surgical treatment of severe and rigid scoliotic deformities remains imperfect [10-20]. The incidence of scoliosis in different age groups of children and adolescents ranges from 3 to 17.3%. Currently, scoliosis is one of the most common diseases of the musculoskeletal system [21-29]. According to the turnover data, it was 0.01 per 1000 among men and 0.06 per 1000 among women (an average of 0.04 per 1000 population). According to medical examinations, the number increases to 14.5 in men and 21.1 in women, with an average of 18.2 per 1000 population for both sexes [26, 27].

The purpose of the study is to develop and implement a method of reconstructive-corrective surgery for progressive forms of scoliotic disease.

Materials and methods of research: The studies were carried out in the department of adolescent orthopedics of the Republican Center for Children's Orthopedics (2001-2004) and in the department of Plastic Surgery of the clinic of the Tashkent Pediatric Medical Institute (2004-2022).

In the period from 2001 to 2022, 104 patients were operated on using a three-stage surgical correction method, whose average age was 16.6±5.8 years (13-18). The average angle of scoliosis in the group was 125.4±2.6 (from 95 to 180°) according to Cobb, the Risser sign was 3-4. Mainly thoracolumbar 57.2% (n=52) and thoracic 42.8% (n=39) localizations, imbalance of the trunk over the sacrum was detected in 74.7% (68), the average angle of Th1-Th12 kyphosis was 45± 2.6 (5-108o), lordosis L1-L5-49.9±1.2 (108±36º). By etiology, idiopathic 61.1% (n=61) and dysplastic 26.6% (n=26) scoliosis prevailed. Congenital anomalies and systemic pathology (neurofibromatosis, Ehlers-Danlos syndrome) amounted to 10.3% (n=10), 63.7% (n=74) of patients had a burdened anamnesis, concomitant pathology and complications in most cases in the form pyelonephritis, cholecystitis, osteoporosis, syringomyelia, hypothyroidism, hyposmia, myelopathy, congenital heart disease, etc. The following research methods were used in the work: clinical, x-ray, anthropometric, photogrammetric, statistical, functional: electromyographic, EFR, clinical laboratory, ECG, CT, MRI.

Results of the study: At the first stage of the three-stage correction course, spinal deformity was corrected to the value of the functional component of deformity mobility, achieved in the process of conservative preparation in traction. In this case, a single rod telescopic distractor with 4-5 hooks for sublaminar fixation to the spine was installed along the concave side of the deformity.

The second stage included transpleural mobilizing discectomy (average 5.2 discs (range 3 to 7)) with segmental reconstruction of the vertebral bodies and interbody fusion using autografts. The correction was completed through additional correction of the deformity with subperiosteal resection of 3-6 ribs, segmental resection of the posterior parts of the spine along the arch and posterior spinal fusion with bone autografts. To correct the deformity, original one-rod and two-rod endo correctors were used (patent No. IAP 03203 dated September 22, 2006).

Surgical correction was carried out in three stages (247 operations in total), on average 3.2 stage operations per patient, 15.6 days (14-25 days) per stage, on average 49.2 days for the entire treatment period. The average rate of scoliosis correction after the first stage was 46.7% (31.2-58.6%) and 64.1% (43.7-79.2%) upon completion of correction, the average residual scoliosis arc angle after correction was 44.1° (23°-92°).

An average increase in height of 12.5 cm (from 4 to 29) was recorded due to an increase in body length.

Complications developed in 10.8% of children: incoming pyramidal disorders - 3, soft tissue fistulas (St.Aureus. Ps.aerugenosae) - 5, liquorrhea - 1, exacerbation

of chronic diseases - 3. All complications were stopped, which required an increase hospitalization for an average of 4.3 days.

The average amount of correction loss after 2 years is 6.5±1.450, or 7.5% of the amount of correction achieved. In terms of 3 to 5 years - 3.8±1.220, or 4.4%, respectively. The average volume of correction of pathological kyphosis was 62.3±2.73°. Correction of pathological kyphosis to the physiological level for deformities of the thoracic and thoracolumbar localization was achieved in all patients, while in eight patients hypercorrections and a state of hypokyphosis were noted. The loss of the achieved correction of pathological kyphosis after two years was 4.6±0.5, or 7.4%, and in the period from 3 to 5 years - another 3.8±0.310, or 6.1%. In one of the two patients with pathological kyphosis localized in the lumbar spine, it was possible to form physiological lordosis, in the other - hypolordosis.

The balance of the frontal plane was restored on average by 87.4±3.8%. Loss of balance over 2-5 years of observation did not exceed 1.5%. Hyperlordosis changed by 44.2%, to physiological sizes, on average for the group to 35.8±1.540. During the correction process, an increase in height was achieved on average by 10.3±1.24 cm (6 - 27 cm) due to an increase in the length of the body. After 2 years, an average of 2.9±1.26 cm of body length was lost, and in the period from 3 to 5 years another 0.8±0.01 cm was lost.

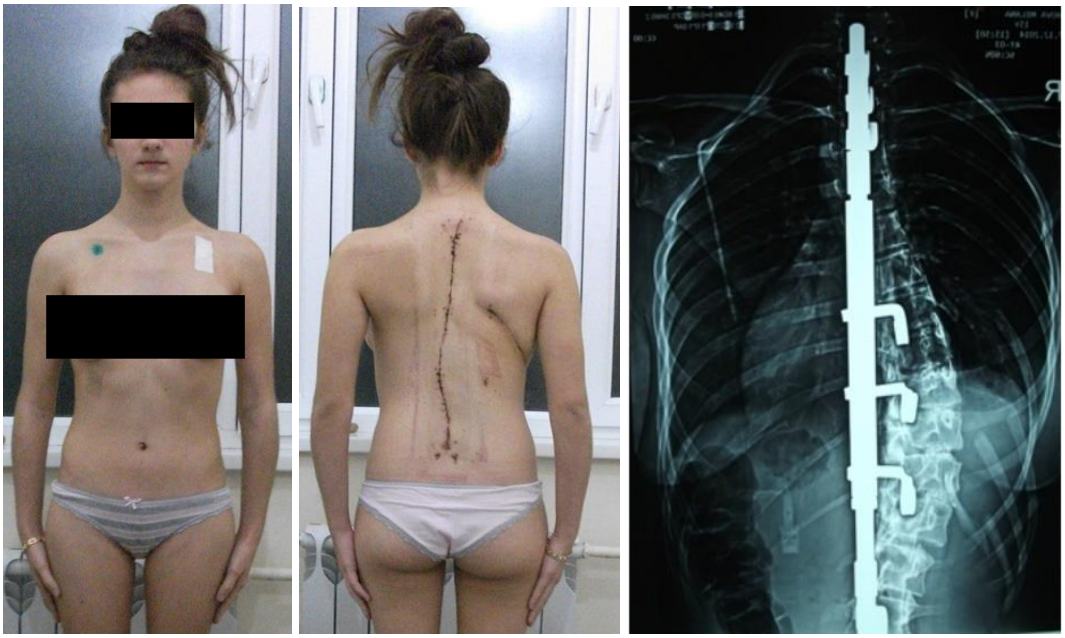
All patients rose to a vertical position on days 3–5 after the correction, and were discharged home on days 8–14 after the final stage without external immobilization. After a month, patients could return to study and work with restrictions, and after 6 months - without restrictions.

Clinical example: we present an extract from the medical history, No. 325/327. Patient G., 15 years old, was admitted to the orthopedic department of the TashPMI clinic with complaints of curvature of the spine, the presence of a rib hump, fatigue, and back pain. The deformity was discovered when the patient was 12 years old; despite a course of conservative therapy, the disease progressed. Upon admission, a clinical and x-ray examination and a full course of preoperative preparation were carried out. During the stay in the clinic, the achieved mobility was: posterior distance ± 7 cm (C7 – S1); anterior Makarov distance ± 5cm; free hanging in an unsupported position on a gravity frame – 12 minutes; the angle of the main scoliotic curve is 115º (R standing), kyphosis – 60º (see figure).

Clinical diagnosis: Scoliotic disease. Idiopathic, right-sided, progressive, thoracolumbar, subcompensated, mobile, IV degree kyphoscoliosis. Posterior, right-sided, gentle, subtotal, costal hump. Functional failure of the spine. Associated: reflex-radicular syndrome.

Taking into account the severe fixed deformity of the spine, the presence of a rib hump, imbalance of the torso, and a sharp decrease in the parameters of the respiratory and cardiovascular systems, staged surgical correction was undertaken.

A.



B.

Pic. Appearance and radiographs of patient G., 15 years old, (A) before surgical correction (B) after surgical correction.

Discussions: in the complex treatment of severe scoliosis, complex reconstructive-corrective methods are used aimed at mobilizing deformity, including staged preliminary correction (Jesiewice, 2009; Buchowski, 2006;2007; Tan, 2012) or halo-traction (Rinella, 2005; Park, 2013; Kulkarni, 2013), multi-

segmental reconstruction of the anterior and/or posterior supporting structures of the spine (Jasiewiez, 2009; Lenke, 2009; 2013). Some surgeons neglect anterior mobilization of the deformity, considering its posterior variants sufficient, combining them with instrumental correction (Newton P.O., 2007; Demura S., 2013); others are confident in the effectiveness of vertebrotomy and spinal reconstruction. (Suk S.L., 2002; 2005). Implanted systems, due to their design features, are not always able to provide an adequate direct corrective effect on the main scoliotic arch (Hamzaoglu, 2008; Crostelli, 2013) therefore, the effectiveness of correction remains unworthy and in most cases reaches 30-40% (Potashek, 2009; Jasiewiez, 2009;), complications (pseudoarthrosis, infection, loss of achieved correction with imbalance of the body, pain, and others) vary in the range from 20 to 59% (Suh, 2009; Li, 2009), and depending on the severity of the curvature severe neurological disorders, in 0.68%-7.7% of cases (Hamilton D.K., 2011). Complications and insufficient correction, loss of ability to work, cosmetic defects and anatomical disproportions limit professional choice, reduce the chances of employment, starting a family and having children in the younger generation, being the main cause of medical and social disadaptation and a decrease in the quality of life of such patients (Luhmann S.J., 2009).

Conclusion: The reconstructive-corrective strategy for the staged correction of progressive forms of scoliosis with single-body implantable systems of the conductor type is not inferior in its effectiveness and safety to modern methods of surgical treatment and is a less labor-intensive, resource-saving and socially justified surgical technology.

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