

## ORIGINAL PAPER

# The Posterior Corrective Spondylodesis – Method of Choice of Surgical Scoliosis Treatment

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**T**he adolescent idiopathic scoliosis – AIS over 40° measured by Cobb, are treated by surgery. Most frequently are used corrective spondylodesis by Harrington (with hooks), by Luque (with wires), anterior spondylodesis (with transcorporeal screws). In last two decades, the posterior corrective spondylodesis by transpedicular screws is popularized. **Aim** of this work is to present advantages and disadvantages of posterior corrective spondylodesis of scoliosis. **Methodology:** Twenty-three patients have been included in this study, average age of 15 y. (10-32), and mostly female gender. The dynamic and quality of postoperative flow after posterior corrective spondylodesis have been analyzed at the AIS patients on the Dept. of orthopedics and traumatology, Clinical centre University of Sarajevo during last three years. **Results:** The length of postoperative hospitalization in the analyzed group was 7 days, compared with results achieved by other methods. Faster recovery, returning to life activities, final esthetic and functional result were superior, and there was no need for revision surgery. **Conclusion** of this work is that posterior corrective spondylodesis by transpedicular screws at the AIS patients is method of choice, if all requirements of correct performing of that method are met. **KEY WORDS:** SCOLIOSIS, POSTERIOR SPONDYLODESIS, RECOVERY, TRANSPEDICULAR SCREW, SPINE.

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## 1. INTRODUCTION

Progression at 75% of patients, and use for treatment of idiopathic scoliosis with Cobb angle 25°-40°, and proven progression (more than 5° in comparison to the previous exam) (1, 2). Indications for orthoses are: at least one year of remain growth period (3, 4), Cobb angle 25°-35°, flexible deformity, acceptance of orthotic, 50% of correction in orthotic, and contraindication are bone maturity, thoracic lordosis, curve higher than 45°, nonacceptance

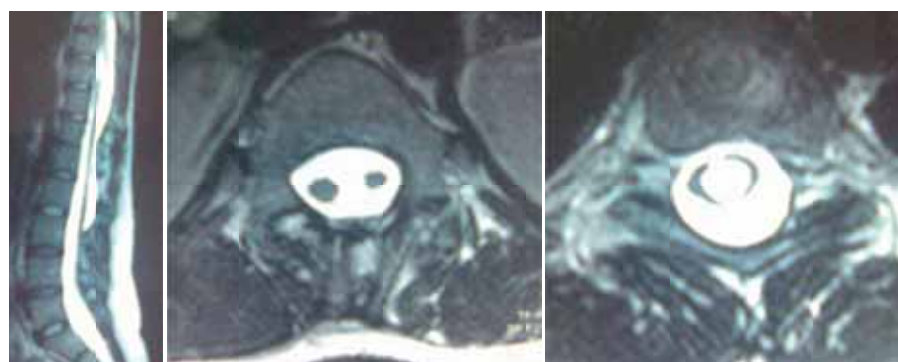
of orthotics, obesity, congenital anomalies. Patients report in 38-100% on difficulties with orthoses, and orthosis is physical burden, as well. Orthoses should be wear 24 h/day, and take of only two times 20 minutes for exercises or bathing, till end of growth period (5th degree off Risser, or two years after menarche or appearance of axillar haring). At the end of growth period it can be wear 12-16h/day. Most often is used Boston TLS orthosis, if curve apex is below Th8, seldom night

orthosis in hypercorrection (Charleston), and very seldom CTLS orthosis (Milwaukie), only if apex is above Th8 (5, 6). The surgery is indicated at skeletally immature patients with Cobb angle  $\geq 40-45^\circ$ , skeletally mature patients with thoracic curve higher than 50°, and lumbar curve higher than 40°. Double curves are better tolerated, boys tolerate this deformity easier than girl. AIS over 40° by Cobb, is treated operatively – corrective spondylodesis. It has used to be posterior spondylodesis by Harrington (with hooks), by Luque (with sublaminar wires), and anterior spondylodesis (thoracotomy with transcorporeal screws) (7).

According the experiences of authors and literary data in last 15 years posterior corrective spondylodesis with transpedicular screws achieves the best clinical and radiological result (8, 9). Aim of this work is to present postoperative flow at the patients whose scoliosis is corrected by transpedicular posterior spondylodesis, and to compare with postoperative flow after other types of spondylodeses.

## 2. MATERIAL AND METHODS

Twenty-three patients with scoliosis surgery by transpedicular posterior spondylodesis were 15 y. age in average (10-32 y.), mostly female gender (18:5). Including criteria were: posterior corrective spondylodesis by transpedicular screws due to AIS at the Department



**FIGURE 2.** MRI of tether cord, dyplomielia, hydromielia, syringomielia

for orthopedics and traumatology, Clinical center Sarajevo in period March 2008–March 2011, absence of factors which could influence on the measured parameters (other serious conditions and systematic diseases), completeness of image and written documentation. Preoperatively it was necessary to perform PA X-rays of whole spine in right and left bending position and in traction, to asses curve flexibility (10). The magnetic resonance imaging is performed to exclude intramedullary pathology (Arnold-Chiari malformation, tether cord, hydromielia, dyplomielia, etc. (Figure 2) (11).

Surgeries are performed in general anesthesia, in abdominal decubitus, with posterior subperiosteal exposure of thoracic or lumbal spine. At the patients with pronounced rib hump (Cobb angle  $\geq 70^\circ$ ), there was performed rib resection at the apex of deformity – thoracoplasty. In the cases of more stiff curves, the halo femoral traction was used (12), and at the curves higher than 100 degrees or presence of intramedullary pathology, the MEP neuromonitorisation



**FIGURE 3.** The normal intraoperative transduction of spinal cord neural motorways –MEP.

was (Figure 3) (13).

The screws were inserted by free hand technique, and in the most delicate pedicles, the mobile X ray device was used. The classical maneuver of correction were performed: manual pressure, reduction screws, rod derotation, compressions and distractions, segmental derotations (14). Most often were used polyaxial titanium screws of the Neurofrance company (Figure 4).

Two subfacial drains are inserted into wound, Vicryl sutures were running at each level (myolema, fascia, subcutis, cutis). The drained were activated 15 minutes each 6 hours, and removed after secretion was become lower then 100 ml/12h, usually third postoperative day, the sutures were removed af-



**FIGURE 4.** Transpedicular screws are connected by rod, and corrective forces are applied over that rod.

ter two weeks.

### 3. RESULTS

Average ages of the analyzed patients were 15,5 years (10-32), and curving – Cobb angle  $73^\circ$  ( $40^\circ$ - $111^\circ$ ). Intra and postoperative blood loss was 1,6 l (0,2-3,7l), duration of surgery 4,5 hours (2,5-8 hours), number of instrumented segments 11,7 (10-18), and postoperative hospitalization 7 days (4-14 days). Average corrections of Cobb angle was 77% (59%-100%), or postoperative Cobb angle was  $18^\circ$  ( $0^\circ$ - $36^\circ$ ), depending of age and preoperative Cobb angle. First day after surgery all patients were able to walk and sit, and two to three weeks have been able to perform all daily living activities, except of the hardest activities and sports. Full activities were noted after 6,5 months. There was no patient with decreased cardiopulmonary function after surgery (Figure 5, Table 1), there were no revisional surgeries.

There was found no significant correlation between all measured parameters, except negative correlations between correction of Cobb angle and age ( $r=-0,31$ ), and preoperative Cobb angle and percentage of Cobb angle correction ( $r=-0,19$ ; Person's correlations test).

### 4. DISCUSSION AND CONCLUSION

This paper has revealed that average patient with posterior corrective spondylodesis is a girl just after puberty, with average scoliotic curve  $73^\circ$  deg. More delayed surgery and higher preoperative Cobb angle have resulted in less percentage of postoperative correction. Surgical correction needs average hospitalization about 10 days, surgical intervention about 4 hours, blood loss 1,6 l, and fusion of 12 spine verte-

	average	SD	min.	max.
age (years)	15,5	4,1	10	32
preop. Cobb angle ( $^\circ$ )	73	13	40	111
blood loss (l)	1,6	0,7	0,2	3,7
number of fusioned levels	11,7	1,8	10	18
length of surgery (hours)	4,5	0,9	2,5	8
postop. hospitalization (days)	7	1,3	4	14
correction of Cobb angle (%)	77	11	59	100
postop. Cobb angle ( $^\circ$ )	18	2,0	0	36
no limitation in activities (mo.)	6,5	1,2	3	12
subjective estimation (0-5)	4,6	0,4	3	5

**TABLE 1.** The numerical parameters of scoliosis treatment



**FIGURE 5.** Clinical and X ray appearance before and just after surgery of scoliosis 111°

bras. Patients were very satisfied with their appearance, because Cobb angle was reduced four times, or curving was reduced under the level of clinical importance (18°). One day after surgery patients were able to walk, sit, and 2-3 weeks they have been returned to all life activities, except of the harder and sports. Activities with no limitations were able after half year, and there was no patient with decreased cardiopulmonary function or revisional surgeries. There was no intra or postoperative complications. Posterior corrective spondylodesis is method which achieve excellent clinical result at the patients

with AIS, and other types of scoliosis, if all circumstances of proper surgical techniques are met (9, 12).

If we compare this surgical method with other methods in AIS treatment we can state further. During anterior corrective spondylodesis the thoracotomy or lumbotomy is necessary, the Harington and Luque posterior spondylodesis need entrance into spinal channel. Consequences of those methods are adhesions, which makes reoperation extremely difficult and risky. On the other side, transpedicular instrumentation requires entrance in no body cavities, and screw passes through

three columns. The strength of screws is much higher than strength of sublaminar hooks or wires, or transcorporeal screws. Reintervention is much easier because it is necessary just to realize the nuts, perform manual correction of trunk and rod.

Instability of construct, thoracic hypokyphosis with consecutive hypolordosis „flat back“, insufficient level of correction and derotation are problems which appears during the usage of sublaminar and transversal hooks. Neurological deficiencies, bone hypergrowth and extremely hard reoperation were main disadvantages of Luque method. Anterior corrective spondylodesis has risky reoperation and there was noted breakage of implants in 30% of patients due to pseudoarthrosis, and ventilatory parameter are lower (15, 16). Posterior corrective spondylodesis by transpedicular screws has solved all mentioned problems.

The main advantage of this method is fast recovery, what was again proved by this study. After half year patients were come back to normal activities with no limitations. Negative point of this method is technically demanding, and has a long learning curve. But, adequate experience of surgeon, and high quality of C arm and neuromonitorisation, that problem can be solved. Even, the indications which were reserved for anterior approach now are treated by this method as well. For instance, non-flexible curves over 90 degrees, which require anterior release (disectomy and cut of anterior longitudinal ligament) posterior approach is possible without thoracotomy (17-21). It is possible due to different techniques of osteotomies (PSO, SPO), and posterior vertebral resection (PVR).

Thoracolumbal and lumbal scoliosis have been usually performed by anterior surgeries because of sparing of lumbal segments. Now, after invention of wide fasetomies and new spine systems, it is possible to achieve high segmental derotation it is possible to fuse same number of segments as anterior spondylodesis, with identical clinical and radiological result (22).

Level of clinical and radiological correction, fast recovery, no limitation in physical activities after one year, and

absence of complications are more than enough reason for usage of this method as a gold standard in treatment of all spine deformities.

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