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Research Article

Therapeutic Outcome of Posterior Surgical Correction and Fusion in Patients with Idiopathic Scoliosis Lenke Type 1

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Abstract

Background: Idiopathic scoliosis is a lateral curvature of the spine with rotation, occurring without congenital or musculoskeletal abnormalities. This study evaluated outcomes of patients with idiopathic scoliosis (Lenke type 1 curves) who underwent posterior spinal corrective surgery between 2018 and 2021.
Methods: In this cross-sectional study, patients with Lenke type 1 curves treated at Imam Khomeini Hospital Complex, Tehran, Iran, were included based on defined criteria. Following subperiosteal dissection of paravertebral muscles, pedicle screws were inserted by the free-hand technique. Spinous processes were resected, and osteotomies were performed in rigid curves using an osteotome from the lamina's inferior border to the pars interarticularis bilaterally. Patient data were extracted from the hospital information system (HIS), and radiographs were assessed pre- and postoperatively. Cobb angles were measured on standing anteroposterior (AP) and lateral spine radiographs, and thoracic kyphosis (T5-T12) was similarly evaluated.
Results: Twenty-one patients were studied. Mean Scoliosis Research Society-22 (SRS-22) scores and curve magnitudes exhibited significant postoperative improvements ($P = 0.001$). In right-sided curves, both SRS-22 scores and curve magnitudes improved significantly ($P = 0.001$), while in left-sided curves, only the curve magnitude improved ($P = 0.001$). Curve correction was significant in men ($P = 0.038$), whereas women demonstrated significant improvements in both SRS-22 and curve magnitude ($P = 0.001$).
Conclusion: Surgical outcomes were comparable between genders; however, differences in SRS-22 results may reflect higher cosmetic expectations among female patients.

Keywords: Scoliosis; Treatment Outcome; Spinal Fusion

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Background

Scoliosis affects an estimated 3% of the global population, with reported prevalence being 2-3 percent in the United States (US), 6% among Iranian adolescents, 11.1% among white individuals, 6.5% among African Americans, and 7% among the total Northern European population (1). Although it occurs in both sexes during adolescence, the prevalence of this condition is higher in Chinese adolescent girls than in their Indian and Malaysian counterparts (2). The lateral curvature of the spine, along with rotation of the vertebrae, causes a 3-dimensional (3D) spine deformity in the sagittal, coronal, and frontal planes. Nonsurgical treatment for idiopathic scoliosis includes observation, bracing, or physical therapy. Most people with adolescent idiopathic scoliosis (AIS) do not require surgery and should be managed with bracing or observation. Small curves (under 25°) do not require surgery or bracing. If the curve angle progresses, bracing is recommended. Bracing is the mainstay of treatment for curves between 25°-40°. Patients should be seen every 3 to 6 months until skeletal maturity. Surgical treatment depends on several factors, including the type and size of the curve, the angle of curve progression, skeletal maturity, and postoperative pain. The most common indication for surgery is the progression of the Cobb angle. Surgical treatment should be performed in patients with cosmetic deformity, significant trunk shift, coronal decompensation, and those with Cobb angle greater than 40°-50°. Curves reaching these magnitudes (specifically exceeding 50°) are associated with a heightened risk of progression into adulthood (3).

Studies have reported a curve progression of 1° per year (4). Lenke type 1 curve in AIS is characterized by structural major thoracic and nonstructural minor thoracolumbar curves. It is the most common type of AIS curve, accounting for 51% of cases (5). Thoracic fusion is a common strategy used for surgical treatment of Lenke 1 curves to achieve surgical correction of thoracic curves while preserving as many lumbar motion segments as possible. Proper selection of the lower instrumented vertebra (LIV) remains challenging for spine surgeons. However, several studies have demonstrated that ending fusions too proximally often results in suboptimal deformity correction and the distal adding-on (AO) phenomenon. Various methods have been proposed for determining the LIV during AIS correction to minimize the risk of AO.

This study aims to investigate the outcome of patients with idiopathic scoliosis Lenke 1 curves who underwent surgery using the posterior fusion technique. The literature recently used a questionnaire called Scoliosis Research Society-22 (SRS-22), the best-standardized questionnaire focusing on clinical outcomes. This questionnaire considers the results by emphasizing the function and pain level, the person's perception of their appearance, other psychological assessments, and the patient's satisfaction with the treatment.

Methods

Based on inclusion and exclusion criteria, this cross-sectional study evaluated patients with Lenke type 1 idiopathic scoliosis curves who underwent spinal correction surgery at Imam Khomeini Hospital Complex, Tehran, Iran. The study population was identified through a 2-year census of patients with AIS who underwent posterior approach surgery at the abovementioned center. Patients with other forms of scoliosis, such as congenital, neuromuscular, or syndromic scoliosis, those younger than 10 years, and those managed nonoperatively were excluded. The type of scoliosis is based on the Lenke classification, which is a 3-tier classification system that includes curve type (types 1-6), the lumbar spine modifier (A, B, or C), and the sagittal thoracic modifier (-, N, or +). The six curve types are defined as follows: type 1, main thoracic; type 2, double thoracic; type 3, double major; type 4, triple major; type 5, thoracolumbar/lumbar; and type 6 thoracolumbar/lumbar-main thoracic. Another criterion that was investigated was the Risser sign, which is an indirect measure of bone maturity, based on the ossification of the iliac apophysis. This scale is graded from 0 to 5 based on the radiographs of the patients under investigation. Cronbach's alpha in this study was 0.72 for pain, 0.87 for self-concept, 0.83 for mental health, 0.63 for satisfaction with treatment, and 0.81 for function. After determining the Lenke curve type, the levels of fixation were selected and categorized. The spinal fusion levels achieved in our patients are presented in figure 1.

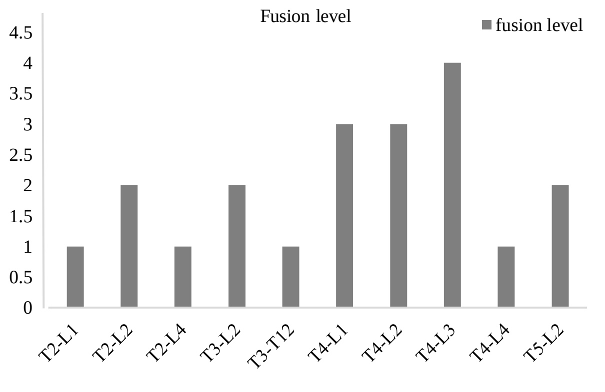

Figure 1. Fusion level of vertebrae

Preoperative Proceedings

Full-length spinal, flexion-extension, side bending, traction, and bolster radiographs demonstrate the spinopelvic alignment and curve characteristics, such as the severity and flexibility of the deformity. The following radiographical parameters were assessed: Risser grade, Cobb angle, sagittal and lumbar modifiers, sagittal vertical axis, curve flexibility (via bending radiographs), clavicle angle, T1 tilt angle, LIV-central sacral vertical line (CSVL) distance, LIV + 1-CSVL distance, thoracic apical vertebra (AV)-CSVL distance, LIV + 1 tilt angle, LIV tilt angle, T l-CSVL distance, number of vertebrae within Cobb, pelvic tilt, pelvic incidence, sacral slope, and Nash-Moe grade for vertebral rotation. Based on preoperative evaluations, spinal deformities can be categorized into one of the three following groups: 1) fully flexible, 2) partially flexible, and 3) rigid/fixed. Depending on the type of deformity, curve flexibility, and magnitude, soft tissue releases and/or osteotomies can be performed to restore spinal alignment. Magnetic resonance imaging (MRI) was performed to assess curve progression, atypical features, pain, or neurological symptoms.

Surgical Technique

After general anesthesia, patients were placed in prone position on a radiolucent table. During the surgery, the patients were monitored with motor evoked potentials (MEPs), somatosensory evoked potentials (SSEPs), and continuous electromyography (EMG). After surgical preparation and draping, posterior elements of the spine were exposed by subperiosteal dissection of paravertebral muscles, and then pedicle screws were inserted using a free-hand technique at the desired levels. The spinous processes were resected. For rigid scoliotic or kyphotic curves, osteotomy was performed by initiating an incision at the midline of the inferior laminar border and extending it superolaterally to pass the lateral border of the pars interarticularis. This procedure was performed in the same way on the opposite side of the posterior vertebral arch. According to the preoperative evaluations, a multi-level v-shaped osteotomy can be performed on the desired vertebra to achieve favorable correction.

Postoperative Proceedings

For all patients, posteroanterior (PA)/lateral full-length radiography was performed after the operation (Figures 2-4).

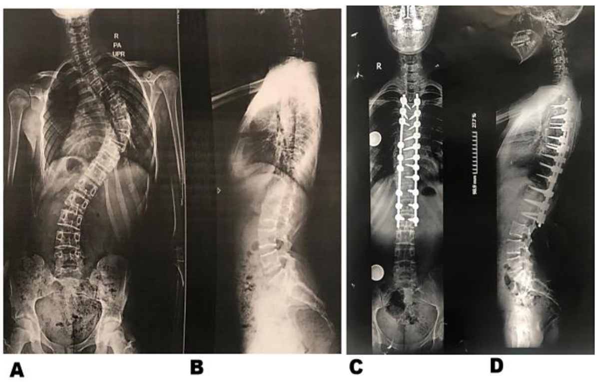

Figure 2. A 12-year-old girl with Lenke type 1 curve undergoing T4-L2 posterior spinal fusion; A, B preoperative standing full length posteroanterior and lateral radiographs; C, D after deformity correction and instrumentation

Data related to any postoperative complications, including rod or pedicle and screws loosening, rod fracture, pseudo-arthrosis, adjacent segment disease (ASD), failure to correct the patient's curvatures, failure to correct the pelvic axis, and surgical site infection, were collected.

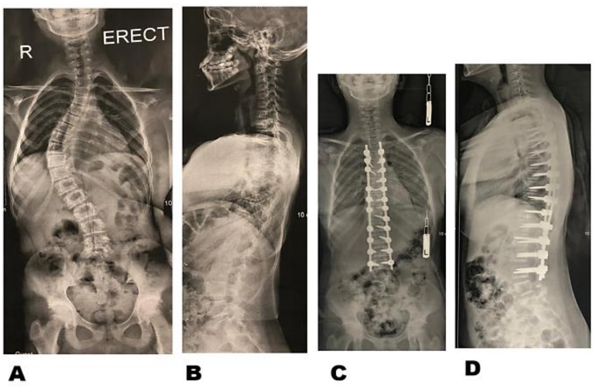

Figure 3. A 13-year-old girl with Lenke type 1 curve undergoing T4-L5 posterior spinal fusion; A, B preoperative standing full length posteroanterior and lateral radiographs; C, D after deformity correction and instrumentation

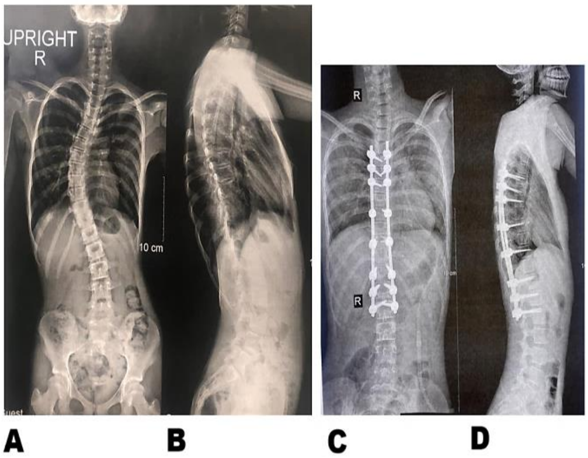

Figure 4. An 11-year-old girl undergoing T4-L5 posterior spinal fusion; A, B preoperative standing full length posteroanterior and lateral radiographs; C. D after deformity correction and instrumentation

Patient information was obtained form the items recorded for each patient in the hospital information system (HIS) and from radiographs obtained before and after surgery. The scoliotic angle was measured based on the Cobb method on standing, full-length anteroposterior (AP), and lateral spinal radiographs. Thoracic kyphosis angle (from T5 to T12) was also measured similarly. The SRS-22 questionnaire was filled out for all patients. This study included a consecutive cohort of patients with AIS who underwent posterior spinal fusion between 2018 and 2021.

Data from the questionnaire were coded and subsequently entered into SPSS software (version 29.0, IBM Corporation, Armonk, NY, USA). Quantitative data were reported as mean ± standard deviation (SD), whereas qualitative data were summarized using frequencies and percentages.

A P-value of less than 0.05 was considered statistically significant. Parametric tests were used for normally-distributed variables, whereas non-parametric tests were used to analyze non-normally-distributed variables. The data were entered into SPSS software and analyzed using relevant statistical tests. Patient information remained confidential and was not provided to unrelated persons. A special code was considered for each patient, but the analyst was not informed of the patients' names. Before entering the patients into the study, sufficient explanations were given to them, and their consent was obtained. It was explained to the patients that participation or non-participation in this study would not affect the continuation of their treatment process. Patients were informed that they could withdraw from the study at any time.

The main limitations of the study were difficulties in contacting some patients because of incomplete or inaccurately recorded telephone numbers and addresses, missing or incorrectly recorded patient data, and withdrawal from participation. To reduce these limitations, the importance of ongoing cooperation was explained to patients before enrollment.

Results

In this study, we examined 21 patients. The mean age of the participants was 13.80 ± 1.69 years, with a range of 12 to 17 years. Three patients (14.3%) were men and 18 (85.7%) were women (Figure 5).

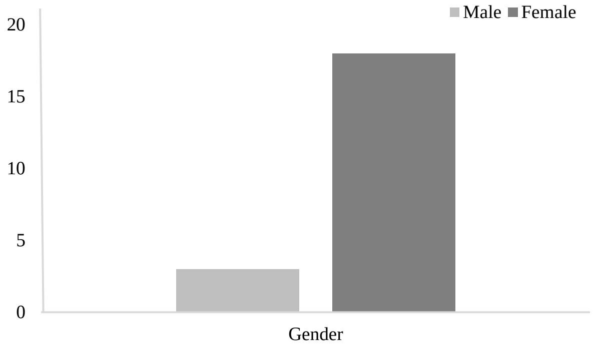

Figure 5. Gender frequency

Regarding the Lenke classification, all patients were identified as type 1.

Table 1. Comparison of preoperative and postoperative right-sided and left-sided curves

		Side		P-value
		Left (mean ± SD)	Right (mean ± SD)	
SRS	Preoperative	7.67 ± 86.62	4.98 ± 85.15	0.598
	Postoperative	8.39 ± 92.87	8.13 ± 94.38	0.688
Cobb angle (o)	Preoperative	8.99 ± 57.00	11.82 ± 65.61	0.094
	Postoperative	5.33 ± 30.00	8.33 ± 32.84	0.353

SRS: Scoliosis Research Society; SD: Standard deviation

Nineteen patients (90.6%) were type A, one patient (4.7%) was type B, and one patient (4.7%) was type C.

Table 2. Preoperative and postoperative mean Scoliosis Research Society (SRS) scores and Cobb angles

		Mean ± SD	Min-Max	P-value
SRS	Preoperative	6.00 ± 85.71	74-99	0.001
	Postoperative	8.05 ± 93.80	82-114	
Cobb angle (o)	Preoperative	11.42 ± 62.33	48-90	0.001
	Postoperative	2.38 ± 1.09	0-8	

SRS: Scoliosis Research Society; SD: Standard deviation

Regarding the direction of the scoliotic curve, 13 patients (61.9%) presented with a right-sided curve (R group), and eight patients (38.1%) presented with a left-sided curve (L group) (Tables 1-3).

Table 3. Preoperative and postoperative Scoliosis Research Society (SRS) scores and Cobb angles in patients with right-sided curves

		Mean ± SD	Min-Max	P-value
SRS	Preoperative	4.98 ± 85.15	79-97	< 0.001
	Postoperative	8.13 ± 94.38	86-114	
Cobb angle (o)	Preoperative	11.82 ± 65.61	50-90	< 0.001
	Postoperative	0.00 ± 0.00		

SRS: Scoliosis Research Society; SD: Standard deviation

In terms of the Risser sign, 10 patients (47.6%) were grade 0, 3 patients (14.3%) were grade 2, 6 patients (28.6%) were grade 4, and 2 patients (9.5%) were grade 5 (Figure 6).

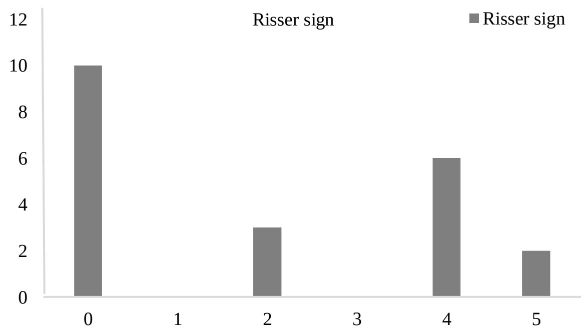

Figure 6. Risser index

The mean preoperative SRS-22 score was 85.71 ± 6.00, which improved to a postoperative mean of 93.80 ± 8.05 (P = 0.001). Preoperatively, the mean Cobb angle was 62.33^{o} ± 11.42^{o}, reducing to a postoperative mean of 2.38^{o} ± 1.09^{o} (P = 0.001). Significant differences were observed in both SRS-22 scores and Cobb angle measurements following surgical intervention (Table 4).

Table 4. Preoperative and postoperative Scoliosis Research Society (SRS) scores and Cobb angles in patients with left-sided curves

		Mean ± SD	Min-Max	P-value
SRS	Preoperative	7.67 ± 86.62	74-99	0.206
	Postoperative	8.39 ± 92.87	82-105	
Cobb angle (o)	Preoperative	8.99 ± 57.00	48-70	< 0.001
	Postoperative	3.22 ± 2.87	0-8	

SRS: Scoliosis Research Society; SD: Standard deviation

The results of Pearson correlation analysis revealed no significant associations between the age of patients and postoperative SRS score, Cobb angle, or the magnitude of changes in these variables (P > 0.05). In patients with right-sided scoliotic curve (R group), both SRS scores and Cobb angles demonstrated significant postoperative improvement compared to preoperative values. Conversely, in the left-sided scoliotic curve group (L group), significant differences were observed only in the Cobb angle, with no significant change in SRS scores. Comparative analysis indicated no statistically significant difference between the outcomes of the right-sided and left-sided groups. Regarding gender-based outcomes, men demonstrated a significant reduction in Cobb angle magnitude (P = 0.038), whereas women showed significant improvements in both SRS scores (P = 0.001) and Cobb angle magnitude (P = 0.001). Comparison of surgical outcomes by gender revealed no significant differences in most parameters; however, SRS scores differed significantly between men and women. The results of Spearman correlation analysis revealed no significant relationships between the Risser sign and SRS score and Cobb angle after surgery as well as the magnitude of changes in these variables (P > 0.05) (Tables 5-7).

Table 5. Preoperative and postoperative Scoliosis Research Society (SRS) scores and Cobb angles in men

		Mean ± SD	Min-Max	P-value
SRS	Preoperative	9.07 ± 88.66	82-99	0.710
	Postoperative	3.51 ± 85.66	82-89	
Cobb angle (o)	Preoperative	19.08 ± 62.33	48-84	0.038
	Postoperative	2.88 ± 1.66	0–	

SRS: Scoliosis Research Society; SD: Standard deviation

Short-term complications such as infection, device failures, and neurological complications during and after the operation were not observed in the follow-up.

Table 6. Preoperative and postoperative Scoliosis Research Society (SRS) scores and Cobb angles in women

		Mean ± SD	Min-Max	P-value
SRS	Preoperative	5.55 ± 85.22	74-97	0.001
	Postoperative	7.83 ± 95.16	84-114	
Cobb angle (o)	Preoperative	10.52 ± 62.33	84-90	0.001
	Postoperative	2.37 ± 1.00	0-8	

SRS: Scoliosis Research Society; SD: Standard deviation

Moreover, at the 1-year postoperative follow-up, none of the patients developed AO or junctional kyphosis, defined as Cobb angle greater than 10^{o} or an increase of at least 10^{o} from the preoperative value.

Table 7. Comparison of preoperative and postoperative Scoliosis Research Society (SRS) scores and Cobb angles in men and women

		Gender		P-value
		Men (mean ± SD)	**Women (mean ± SD)**	
SRS	Preoperative	9.07 ± 88.66	5.55 ± 85.22	0.371
	Postoperative	3.51 ± 85.66	7.83 ± 95.16	0.056
Cobb angle (o)	Preoperative	19.08 ± 62.33	10.52 ± 62.33	> 0.999
	Postoperative	7.63 ± 36.66	7.16 ± 30.94	0.219

SRS: Scoliosis Research Society; SD: Standard deviation

Discussion

Our analysis revealed no significant differences in surgical outcomes between male and female patients, with the notable exception of SRS scores, which differed significantly by gender. In the study by Ghandehari et al., the relationship between radiographic findings, final SRS-30 score, and patient satisfaction was evaluated. Cobb angle and coronal balance were significantly improved, and the total SRS-30 score was reported to be 127.00 ± 13.00 (6). Our study's mean and SD of preoperative and postoperative SRS scores were 85.71 ± 6.00 and 93.80 ± 8.05, respectively. Previous studies have examined the relationship between patient age and scoliosis surgery outcomes. Lavelle et al. demonstrated that surgery in the youth group resulted in a greater number of fused vertebrae, higher bleeding rates, and lower rates of curve correction compared to adolescents (7). Shaw et al. reported that in older people, complications following scoliosis surgery increased in the short term (8). In the present study, no significant relationship was found between the age of the patients and postoperative SRS score, Cobb angle, or the rate of change in these variables. Studies have also been conducted to investigate the relationship between gender and the outcome of scoliosis surgery. Helenius et al. reported that the magnitude of curve correction was signficantly greater in women than men (9). Xu et al. demonstrated that scoliosis surgery significantly corrected curvature, but there was no significant difference in the degree of curvature correction between the two sexes (10).

In our study, it was observed that postoperative SRS scores and their respective changes were significantly higher in women than in men; however, no significant differences were observed between the two groups in postoperative Cobb angle or changes in Cobb angle. Several studies have been conducted on the effect of surgery on scoliosis angle and SRS score. Shapiro et al. found that surgery was indicated in adult patients with idiopathic scoliosis who simultaneously complained of pain and canal stenosis. Surgery for these patients can alleviate pain, restore function, and enhance patient satisfaction (11). Another study on adult scoliosis surgery by Ali et al. demonstrated that using third-generation techniques and devices significantly improved clinical symptoms, Cobb angle correction, and sagittal alignment, while also enhancing patient satisfaction with an acceptable rate of complications (12).

Chaib et al. examined scoliosis surgery outcomes in patients with AIS using the SRS-22 questionnaire; they observed a significant improvement in Cobb angle correction, self-image, and patient performance. Further, their results highlighted a significant relationship between preoperative Cobb angle and the level of postoperative patient satisfaction (13). Consistent with these findings, our study demonstrated that scoliosis surgery significantly reduced the Cobb angle, improved the deformity, and increased the SRS score.

Conclusion

Our study demonstrated that scoliotic surgery significantly reduced the Cobb angles and improved the SRS scores. We also found that postoperative SRS scores and their respective changes were significantly higher in women than in men, which may be attributed to the higher cosmetic expectations among female patients.

Conflict of Interest

The authors declare no conflict of interest in this study.

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References

1. Negrini S, Aulisa AG, Aulisa L, Circo AB, de Mauroy JC, Durmala J, et al. 2011 SOSORT guidelines: Orthopaedic and Rehabilitation treatment of idiopathic scoliosis during growth. *Scoliosis*. 2012;7(1):3. doi: 10.1186/1748-7161-7-3. [PubMed: 22264320]. [PubMed Central: PMC3292965].
2. Du Q, Zhou X, Negrini S, Chen N, Yang X, Liang J, et al. Scoliosis epidemiology is not similar all over the world: a study from a scoliosis school screening on Chongming Island (China). *BMC Musculoskelet Disord*. 2016;17:303. doi: 10.1186/s12891-016-1140-6. [PubMed: 27444153]. [PubMed Central: PMC4957389].
3. Azar FM, Beaty JH, Canale ST. Campbell's Operative Orthopaedics, 4-Volume Set. 14th ed. Amsterdam, Netherlands: Elsevier; 2020.
4. Agabegi SS, Kazemi N, Sturm PF, Mehlman CT. Natural History of Adolescent Idiopathic Scoliosis in Skeletally Mature Patients: A Critical Review. *J Am Acad Orthop Surg*. 2015;23(12):714-23. doi: 10.5435/jaaos-d-14-00037. [PubMed: 26510624].
5. Lenke LG, Betz RR, Clements D, Merola A, Haher T, Lowe T, et al. Curve prevalence of a new classification of operative adolescent idiopathic scoliosis: does classification correlate with treatment? *Spine (Phila Pa 1976)*. 2002;27(6):604-11. doi: 10.1097/00007632-200203150-00008. [PubMed: 11884908].
6. Ghandehari H, Mahabadi MA, Mahdavi SM, Shahsavaripour A, Seyed Tari HV, Safdari F. Evaluation of Patient Outcome and Satisfaction after Surgical Treatment of Adolescent Idiopathic Scoliosis Using Scoliosis Research Society-30. *Arch Bone Jt Surg*. 2015;3(2):109-13. [PubMed: 26110177]. [PubMed Central: PMC4468625].
7. Lavelle W, Kurra S, Hu X, Lieberman I. Clinical Outcomes of Idiopathic Scoliosis Surgery: Is There a Difference Between Young Adult Patients and Adolescent Patients? *Cureus*. 2020;12(5):e8118. doi: 10.7759/cureus.8118. [PubMed: 32542171]. [PubMed Central: PMC7292702].
8. Shaw R, Skovrlj B, Cho SK. Association between Age and Complications in Adult Scoliosis Surgery: An Analysis of the Scoliosis Research Society Morbidity and Mortality Database. *Spine (Phila Pa 1976)*. 2016;41(6):508-14. doi: 10.1097/brs.0000000000001239. [PubMed: 26693670].
9. Helenius I, Remes V, Yrjönen T, Ylikoski M, Schlenzka D, Helenius M, et al. Does gender affect outcome of surgery in adolescent idiopathic scoliosis? *Spine (Phila Pa 1976)*. 2005;30(4):462-7. doi: 10.1097/01.brs.0000153347.11559.de. [PubMed: 15706345].
10. Xu X, Wang F, Zhou X, Cheng Y, Wei X, Bai Y, et al. Comparison of Radiographic Postoperative Outcomes Between Males and Females With AIS. *Medicine (Baltimore)*. 2015;94(41):e1616. doi: 10.1097/md.0000000000001616. [PubMed: 26469897]. [PubMed Central: PMC4616792].
11. Shapiro GS, Taira G, Boachie-Adjei O. Results of surgical treatment of adult idiopathic scoliosis with low back pain and spinal stenosis: a study of long-term clinical radiographic outcomes. *Spine (Phila Pa 1976)*. 2003;28(4):358-63. doi: 10.1097/01.Brs.0000048502.62793.0c. [PubMed: 12590210].
12. Ali RM, Boachie-Adjei O, Rawlins BA. Functional and radiographic outcomes after surgery for adult scoliosis using third-generation instrumentation techniques. *Spine (Phila Pa 1976)*. 2003;28(11):1163-9; discussion 9-70. doi: 10.1097/01.Brs.0000067267.04011.91. [PubMed: 12782986].
13. Chaib Y, Bachy M, Zakine S, Mary P, Khouri N, Vialle R. Postoperative perceived health status in adolescent following idiopathic scoliosis surgical treatment: results using the adapted French version of Scoliosis Research Society Outcomes questionnaire (SRS-22). *Orthop Traumatol Surg Res*. 2013;99(4):441-7. doi: 10.1016/j.otsr.2013.03.012. [PubMed: 23639761].