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Influence of Preoperative Disease Course on the Quality of Life of Adolescent Idiopathic Scoliosis Patients

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Abstract: To study the influence of preoperative disease course on the operation and postoperative quality of life of adolescent idiopathic scoliosis (AIS) patients. Patients who were treated with simple posterior correction and pedicle-screw internal fixation were divided into two groups according to their preoperative disease courses: a short course group with preoperative course < 2 years (S group), and a long course group with preoperative course ≥ 2 years (L group). The gender, Lenke type, and major curve cob angle were matchable between the two groups, and 112 cases were included in each group. Various radiographic measurements and indices like fusion level, intraoperative blood loss and blood transfusion scores of SRS-22 were compared between the two groups during preoperative, postoperative and follow-up periods. The preoperative side scoliosis angle Cobb in S group was less than that in L group (P=0.040). The coronal plane and sagittal plane radiographic parameters were similar after operation, and there were no statistical differences between the volume of intraoperative blood loss and blood transfusion. The preoperative major scoliosis Cobb angles were similar between the two groups, but the flexibility of the major scoliosis in S group was larger than that in L group (P=0.039). The number of fused vertebrae in L group was higher than that in S group (P=0.024). The function/activity, pain, self-image/appearance, and mental health in the SRS-22 scales of the two groups had no statistical differences during follow-up, and L group had a lower satisfaction rate of treatment compared with S group (P = 0.037). The scoliosis flexibility decreased with increasing disease course. Disease course might be a risk factor for side scoliosis progression and it affected the quality of life of AIS patients after operation.

Keywords: Adolescent Idiopathic Scoliosis, Orthopedic Surgery, Quality of Life

1. Introduction

Adolescent idiopathic scoliosis has insidious onset. Many patients arrived at the hospital for diagnosis and treatment for the first time due to physical abnormalities (such as razor back deformity, uneven shoulders and waist asymmetry) [1]. This situation is more common in developing countries because their imperfect investigation systems. Treatments for the patients with AIS mainly include surgery, brace treatment and follow-up observation [2]. There were about 20%-24% of AIS patients undergoing brace treatment who eventually required surgery, while 13% of AIS patients with follow-up observation required so [3]. Cobb angle size, Risser sign, scoliosis type are the risk factors of AIS, and AIS progresses at significantly different speeds [4] that result in obvious differences between the preoperative courses of patients. Therefore, this study analyzed the clinical data of AIS patients who were admitted to our hospital from June 2011 to June 2012, and evaluated the influence of preoperative disease course on the operation and postoperative quality of life of AIS patients.

2. Materials and Methods

2.1. Inclusion Criteria and Baseline Data

AIS patients treated with simple posterior correction, pedicle internal fixation who were admitted to our hospital during from June 2011 to June 2012 were included in this study. Inclusion criteria: (1) Follow-up time was more than 2 years; (2)

follow-up data were complete; (3) all patients arrived at hospital for the first time due to physical deformities. The patients received physical examination caused by other reasons or incidental findings (such as chest X-ray film) were excluded.

Patients were divided into two groups according to their preoperative disease courses: a short course group with preoperative course < 2 years (S group), long course group with preoperative course ≥ 2 years (L group). In order to control the interference of confounding factors, the gender, Lenke type, and major curve Cobb angle (difference < 5°) was performed by matching design between two groups. Each group had 112 cases in conformity with the above standards. There were 96 female cases and 16 male cases in two groups. Lenke type 1: 66 cases, 58.9%; Lenke type 2: 3 cases, 2.7%; Lenke type 3: 9 cases, 8.0%; Lenke type 4: 3 cases, 2.7%; Lenke type 5: 25 cases, 22.3%; Lenke type 6: 6 cases, 5.4%. The average operation age was 14.5 ± 1.79 (11.2-18.2 years old) in S group, the average follow-up time was 3.3 ± 1.23 years (2 ~ 5.5 years), the average duration was 7.9 ± 6.89 months (0 21 ~ 20.3 months), the average Risser sign was (3.2 ± 1.56)° (0° ~ 5°) during operation, and 21 patients (18.75%) were subjected to brace treatment before operation. The average operation age was 15.4±1.73 (11.1 ~ 18.0 years old) in L group, the average follow-up time was 3.3 ± 1.3 years (1 ~ 18.0 years), the average duration was 46.4 ± 28. 87 (23.9 ~ 175.8 months), the average Risser sign was (3.7 ± 1.119)° (0° ~ 5°) during operation, and 53 patients (47.3%) were subjected to brace treatment before operation. The differences between two groups in preoperative disease course and the case number of preoperative brace treatment were statistically significant (P<0.0001).

2.2. Surgical Procedure and Postoperative Treatment

All patients were treated with posterior correction, pedicle internal fixation and screw placement freehand [6]. Internal fixation devices included Moss-Miami, CDH and XIA (Siemens, Germany). Bone graft fusion was performed through the mix of autogenous bone and (or) Osteoset artificial bone (Wright, USA) materials. SSEP (somato-sensory evoked potentials) [7] monitoring was performed during operation, and wake-up test was performed after operation. Patients were asked for ambulation after operation and wearing protective brace during postoperative 3 months. No patients underwent pseudoarticulation formation, broken rods or revision surgery after operation.

2.3. Measurement of Imaging Data

Imaging X-ray data included preoperative standing spine anteroposterior and lateral radiographs, left-right bending radiograph, postoperative and follow-up standing spine anteroposterior and lateral radiographs which were tested by a same orthopedist. The main and side scoliosis Cobb angles were measured on preoperative, postoperative 3 days and in postoperative follow-up for more than 2 years. The lateral bending flexibility was measured and calculated through preoperative left-right bending radiographs. Lateral radiographs were measured for thoracic kyphosis (T5 ~ T12) and lumbar lordosis (L1 ~ S1).

2.4. Number of Fusion Vertebrae, Intraoperative Blood Loss, Blood Transfusion Volume and Completion of SRS-22 Scale

The differences among the numbers of fusion vertebrae, lower fusion vertebrae and end fusion vertebrae were compared. At the same time, the intraoperative blood loss and the total amount of blood transfusion were compared. In the last follow-up, the patients were asked to fill the SRS-22 scale [8]. The scores of SRS-22 scale were also compared.

2.5. Statistical Analysis

All data were analyzed by SPSS 18.0. The indices before and after operation were compared by t test. P<0.05 was considered statistically significant.

3. Results

3.1. Coronal Plane Imaging Data

Table 1 showed that preoperative main scoliosis Cobb angles of two groups had no significant difference. In the last follow-up, main scoliosis Cobb angle had no significant difference in two groups. Preoperative side scoliosis Cobb angle of L group is larger than that of S group (P = 0.040); the immediate postoperative side scoliosis Cobb angles of the two groups had no significant difference, neither in the last follow-up. In addition, the main scoliosis flexibility [(54.9 ± 18.47%] of S group was greater than that of L Group [(48.5±18. 28)%, P = 0.039]. The immediate postoperative main scoliosis correction rates in the two groups were similar [(71.8 ± 9.81)% vs (70. 3 ± 10.11)%, P = 0.201].

Table 1. *Comparison of coronal plane changes between two groups (n = 100, x±s, α/°).*

Group	Main scoliosis Cobb angle			Side scoliosis Cobb angle		
	Preoperative	Postoperative (immediate)	Postoperative (last follow-up)	Preoperative	Postoperative (immediate)	Postoperative (last follow-up)
S	53.2±12.75	15.1±8.65	18.0±7.49	31.0±11.98	15.2±5.41	16.4±5.88
L	54.6±13.02	16.6±8.42	19.8±8.46	34.3±10.87	16.1±6.59	17.9±6.76
P value	0.796	0.341	0.239	0.040*	0.373	0.715

S: Preoperative disease course < 2 years; L: preoperative disease course ≥ 2 years. *P<0.05.

3.2. Sagittal Plane Imaging Data

Table 2 showed that the kyphosis angle of preoperative rear side radiograph thoracic T5 ~ T12 in the two groups were similar. The immediate postoperative and last follow-up thoracic kyphosis angle had no statistically significant differences. Moreover, the lumbar lordosis angles (L1 ~ S1) in the two groups were similar before and immediately after operation as well as in the last follow-up.

Table 2. *Comparison of sagittal plane change between two groups (n = 100, x±s, α/°).*

Group	T_5-T_{12} kyphosis angle			L_1-S_1 lordosis angle		
	Preoperative	Postoperative (immediate)	Postoperative (last follow-up)	Preoperative	Postoperative (immediate)	Postoperative (last follow-up)
S	26.5±9.66	24.9±7.22	27.0±5.59	58.3±8.67	53.5±7.11	55.1±6.91
L	26.4±9.20	22.7±6.19	25.9±5.46	56.9±10.21	51.7±7.01	54.3±6.09
P value	0.416	0.173	0.508	0.358	0.238	0.399

S: Preoperative disease course < 2 years; L: preoperative disease course ≥ 2 years.

3.3. Number of Fusion Vertebrae, Intraoperative Blood Loss, Blood Transfusion Volume and Score of SRS-22 Scale

Table 3 showed that the differences of the number of fusion vertebrae in two groups were statistically significant (P = 0.024). The differences of lower fusion vertebrae and end fusion vertebrae in two groups were not statistically significant (P = 0.099). The bleeding amount and blood transfusion amount during operation in two groups had no statistically significant differences.

Table 4 showed that the differences of the function/activity, pain, self-image/appearance and mental health dimensions score were not statistically significant between two groups. L group scored significantly lower than S group did in satisfaction dimension (P = 0.037).

Table 3. *Comparison of fusion vertebrae number and intra-operative blood loss between two groups (n = 100, x±s).*

Group	Number of fusion vertebrae	<LEV	Blood loss V/ml	Blood transfusion V/ml
S	9.8±1.90	0.57±1.28	979±410	680±323
L	10.5±1.53	0.98±1.21	1059±383	759±295
P value	0.024*	0.099	0.377	0.161

S: Preoperative disease course <2 years; L: preoperative disease course ≥2 years. LEV: lower fusion vertebrae and end fusion vertebrae. *P<0.05.

Table 4. *Comparison of SRS-22 scale scores between 2 groups (n = 100, x±s).*

Group	Function/activity	Pain	Self-image/appearance	Mental health	Satisfaction dimension
S	4.1±0.57	4.4±0.55	4.0±0.39	4.3±0.49	4.1±0.74
L	3.9±0.50	4.5±0.60	4.0±0.51	4.1±0.51	3.9±0.76
P value	0.102	0.279	0.201	0.238	0.037*

S: Preoperative disease course < 2 years; L: preoperative disease course ≥ 2 years. *P<0.05.

4. Discussion

AIS occurs via a unravel mechanism. At present, scoliosis screening and examination system in China is not perfect [9]. Most patients arrive at hospital for the first treatment due to physical deformities, and only a few patients were diagnosed in physical examination or incidentally found in other treatment. In this study, to reflect the natural disease course of scoliosis, the patients who received the first treatment owing to physical deformities were selected. Luk et al. [10] found that idiopathic scoliosis bending flexibility was associated with patients' age (r = -0.6, P < 0. 01). Hwang et al. [11, 12] had reached a similar conclusion. In this study, although patients had similar age and Risser syndrome during operation, there remained difference in bending flexibility between two groups. Therefore, preoperative disease course may also affect the scoliosis bending flexibility. Although flexibility in two groups had certain difference, the main bending correction rates were similar in two groups, which may be attributed to the application of the pedicle screw system that provided powerful correction force to compensate the flexibility difference between two groups.

The main bending Cobb angle was similar in two groups, but the side bending Cobb angle in L group was larger than that in S group, indicating that the disease course had a great influence on side bending Cobb angle size, which might had a certain influence on the selection of fusion segment in scoliosis correction operation. For Lenke type 1, type 5 patients, the unstructured side scoliosis didn't need fusion and only needed selective fusion to main bending. But it needed to meet certain conditions in the selective fusion. For patients with thoracic bending, Larson et al. [13] believed that when thoracic bending and waist bending Cobb ratio was ≥ 1.2, thoracic bending could be selectively fused. Weiss et al. [14] considered that we can selectively fused thoracolumbar bending/ lumbar bending when thoracolumbar bending/ lumbar bending Cobb ratio were ≥ 1.25 for the main thoracolumbar bending/lumbar bending AIS patients. For patients with preoperative disease course more than 2 years, the main bending and side bending Cobb angle ratio were close to 1 since side bending Cobb angle increased, thus some Lenke type 1, type 5 patients cannot be treated with selective main bending fusion, thereby increasing the fusion segment. This may be one reason that the number of fusion vertebrae in L group was higher than that in S group. The poor main bending flexibility in L group may be another reason for the higher number. Disease course had no influence on patients' thoracic kyphosis or lumbar lordosis angles before and after operation, and it also had no influence on distal fusion level, intraoperative bleeding and blood transfusion.

Idiopathic scoliosis had obvious hazard to adolescent patients' mental health [15]. Sathira-Angkura et al. [16] studied the effects of age on idiopathic scoliosis patients' mental health. They found that patients below 15 years old used California Psychological Questionnaire to test after operation [17], all the parameters were in the normal range. In contrast, patients above 16 years old whose table scores of Minnesota Multiphasic Personality Inventory [18] were in the normal range, but those scores deviated more from normal after operation. Generally speaking, the older age was the longer scoliosis natural disease course. This seemed to remind us that the disease course may have an effect on patients' mental health [19]. The older operation age, the worse postoperative psychological outcome according to this study, which was questionable because of different ages in adolescent patients, there was a big difference in their cognitive maturity degree [20].

In this study, despite the similar age in two groups, the mental health dimension scores showed no significant difference. There are two possible reasons: (1) Disease course had no effect on patients' mental health; (2) there were just 5 evaluation of mental health project in the SRS-22 scale and the scale was too short, resulting in a low sensitivity. It failed to reflect the real situation. Preoperative disease course had no influence on the three dimension scores, i.e. function/activity, pain, and appearance.

Although the improvement of coronal and sagittal deformity was similar in two groups, there still existed significant difference in patients' treatment satisfaction dimension scores in two groups, and patients with more than 2 years disease course had low satisfaction for operation. Hence, with the increase of disease course, patients' expectations for operation increased, which led to low satisfaction [21]. Besides, AIS patients' preoperative psychosocial status can affect the satisfaction for operation treatment, and preoperative psychosocial dysfunction increased the possibility of dissatisfaction [22]. Although we did not evaluate patients' preoperative psychosocial status in two groups, it can be assumed that scoliosis had a longer impact on patients in L group and this group had bigger possibility of psychosocial dysfunction. Actually, the access to real situation still needs to evaluate the preoperative psychological status of patients with different disease courses.

The main purpose of this study was to research the influence of preoperative disease course on the operation and postoperative quality of life of AIS patients. However, the access to AIS patients' natural disease course was extremely difficult due to scoliosis insidious onset and only the period from scoliosis discovery to the operation can be used to reflect the natural disease course [23], being one limitation of this study. Patients' health-related quality of life assessment was influenced by many subjective and objective factors (e.g. patient's psychosocial status, family economic conditions and disease progression speed), which were interfering factors in this study. Another interfering factor in this study was the number difference of preoperative brace treatment cases in two groups. Mousavi et al. [24] suggested that whether patients were treated with brace treatment also influenced their postoperative mental status.

References

[1] Hwang SW, Dubaz OM, Ames R, Rothkrug A, Kimball JS, Samdani AF. The impact of direct vertebral body derotation on the lumbar prominence in Lenke Type 5C curves. *J Neurosurg Spine* 2012, 17: 308-313.

[2] Weiss HR. Adolescent idiopathic scoliosis (AIS) - an indication for surgery? A systematic review of the literature. *Disabil Rehabil* 2008, 30: 799-807.

[3] Manella KJ, Torres J, Field-Fote EC. Restoration of walking function in an individual with chronic complete (AIS A) spinal cord injury. *J Rehabil Med* 2010, 42: 795-798.

[4] Ding Q, Qiu Y, Sun X, Wang B, Zhu ZZ, Yu Y, *et al.* [Risk factors of thoracic curve decompensation after anterior selective fusion in adolescent idiopathic scoliosis with major thoracolumbar or lumbar curve]. *Zhonghua Wai Ke Za Zhi* 2012, 50: 518-523.

[5] Wang WW, Xia CW, Zhu F, Zhu ZZ, Wang B, Wang SF, *et al.* Correlation of Risser sign, radiographs of hand and wrist with the histological grade of iliac crest apophysis in girls with adolescent idiopathic scoliosis. *Spine (Phila Pa 1976)* 2009, 34: 1849-1854.

[6] Samdani AF, Ranade A, Sciubba DM, Cahill PJ, Antonacci MD, Clements DH, *et al.* Accuracy of free-hand placement of thoracic pedicle screws in adolescent idiopathic scoliosis: how much of a difference does surgeon experience make? *Eur Spine J* 2010, 19: 91-95.

[7] Kundnani VK, Zhu L, Tak H, Wong H. Multimodal intraoperative neuromonitoring in corrective surgery for adolescent idiopathic scoliosis: Evaluation of 354 consecutive cases. *Indian J Orthop* 2010, 44: 64-72.

[8] Beausejour M, Joncas J, Goulet L, Roy-Beaudry M, Parent S, Grimard G, *et al.* Reliability and validity of adapted French Canadian version of Scoliosis Research Society Outcomes Questionnaire (SRS-22) in Quebec. *Spine (Phila Pa 1976)* 2009, 34: 623-628.

[9] Lee CF, Fong DY, Cheung KM, Cheng JC, Ng BK, Lam TP, *et al.* Referral criteria for school scoliosis screening: assessment and recommendations based on a large longitudinally followed cohort. *Spine (Phila Pa 1976)* 2010, 35: E1492-1498.

[10] Luk KD, Cheung WY, Wong Y, Cheung KM, Wong YW, Samartzis D. The predictive value of the fulcrum bending radiograph in spontaneous apical vertebral derotation in adolescent idiopathic scoliosis. *Spine (Phila Pa 1976)* 2012, 37: E922-926.

[11] Hwang SW, Samdani AF, Lonner B, Miyanji F, Stanton P, Marks MC*, et al.* Impact of direct vertebral body derotation on rib prominence: are preoperative factors predictive of changes in rib prominence? *Spine (Phila Pa 1976)* 2012, 37: E86-89.

[12] Cheung WY, Lenke LG, Luk KD. Prediction of scoliosis correction with thoracic segmental pedicle screw constructs using fulcrum bending radiographs. *Spine (Phila Pa 1976)* 2010, 35: 557-561.

[13] Larson AN, Fletcher ND, Daniel C, Richards BS. Lumbar curve is stable after selective thoracic fusion for adolescent idiopathic scoliosis: a 20-year follow-up. *Spine (Phila Pa 1976)* 2012, 37: 833-839.

[14] Weiss HR, Werkmann M. Rate of surgery in a sample of patients fulfilling the SRS inclusion criteria treated with a Cheneau brace of actual standard. *Stud Health Technol Inform* 2012, 176: 407-410.

[15] Karakaya I, Sismanlar SG, Atmaca H, Gok U, Sarlak AY. Outcome in early adolescent idiopathic scoliosis after deformity correction: assessed by SRS-22, psychometric and generic health measures. *J Pediatr Orthop B* 2012, 21: 317-321.

[16] Sathira-Angkura V, Pithankuakul K, Sakulpipatana S, Piyaskulkaew C, Kunakornsawat S. Validity and reliability of an adapted Thai version of Scoliosis Research Society-22 questionnaire for adolescent idiopathic scoliosis. *Spine (Phila Pa 1976)* 2012, 37: 783-787.

[17] Carlson JA, Sarkin AJ, Levack AE, Sklar M, Tally SR, Gilmer TP*, et al.* Evaluating a measure of social health derived from two mental health recovery measures: the California Quality of Life (CA-QOL) and Mental Health Statistics Improvement Program Consumer Survey (MHSIP). *Community Ment Health J* 2011, 47: 454-462.

[18] Polimeni AM, Moore SM, Gruenert S. Mental health improvements of substance-dependent clients after 4 months in a Therapeutic Community. *Drug Alcohol Rev* 2010, 29: 546-550.

[19] Pike NA, Evangelista LS, Doering LV, Koniak-Griffin D, Lewis AB, Child JS. Clinical profile of the adolescent/adult Fontan survivor. *Congenit Heart Dis* 2011, 6: 9-17.

[20] Barriga AQ, Sullivan-Cosetti M, Gibbs JC. Moral cognitive correlates of empathy in juvenile delinquents. *Crim Behav Ment Health* 2009, 19: 253-264.

[21] Soroceanu A, Ching A, Abdu W, McGuire K. Relationship between preoperative expectations, satisfaction, and functional outcomes in patients undergoing lumbar and cervical spine surgery: a multicenter study. *Spine (Phila Pa 1976)* 2012, 37: E103-108.

[22] Forchheimer MB, Richards JS, Chiodo AE, Bryce TN, Dyson-Hudson TA. Cut point determination in the measurement of pain and its relationship to psychosocial and functional measures after traumatic spinal cord injury: a retrospective model spinal cord injury system analysis. *Arch Phys Med Rehabil* 2011, 92: 419-424.

[23] Peppa M, Koliaki C, Raptis SA. Adrenal incidentalomas and cardiometabolic morbidity: an emerging association with serious clinical implications. *J Intern Med* 2010, 268: 555-566.

[24] Mousavi SJ, Mobini B, Mehdian H, Akbarnia B, Bouzari B, Askary-Ashtiani A*, et al.* Reliability and validity of the persian version of the scoliosis research society-22r questionnaire. *Spine (Phila Pa 1976)* 2010, 35: 784-789.