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Correlation between Radiological Outcome and Health Related Quality of Life after Posterior Spinal Fusion for Adolescent Idiopathic Scoliosis

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ABSTRACT

Background: Posterior spinal surgery for adolescent idiopathic scoliosis is aimed at correcting deformity and stopping deformity progression to improve the health related quality of life. The correlation between radiological outcome and health related quality of life is yet unclear. This study aimed to assess the correlation between radiological outcome and health related quality of life.

Methods: A descriptive cross-sectional study of 31 cases of adolescent idiopathic scoliosis who underwent posterior spinal surgery at our center from July 2013 to August 2019, was done. Radiological outcomes were measured by the Cobb's angle before and after surgery in standing whole spine X-ray and compared by paired t-test. Health related quality of life was measured by Scoliosis Research Society-30 questionnaire. Correlation between radiological outcomes and Scoliosis Research Society-30 and its domains were assessed by Pearson's correlation coefficient, and Spearman's rank correlation coefficient.

Results: There were 18 females (58.06%) and 13 males (41.93%) with a mean age of 14.81 years (range 12-18 years). Average post-operative follow-up was 37 months (range 6-82 months). The mean amount of deformity correction post-operatively was 46^0 (range 30^0-74^0). The mean of total SRS-30 score was 137.64 ± 7.84. The post-operative Cobb angle correlated significantly with the mean total Scoliosis Research Society-30 score ($p=0.046$). Self-image/appearance and satisfaction with management correlated significantly with residual deformity and amount of deformity correction. Self-image/appearance and pain correlated significantly with satisfaction with management. Self-image/appearance had a significant positive correlation with mental health ($p=0.004$).

Conclusions: Posterior spinal surgery for adolescent idiopathic scoliosis provided better radiological outcomes, and a positive correlation with health related quality of life. There was significant improvement of self-image/appearance and satisfaction after surgery, which in turn, improved mental health.

Keywords: Adolescent idiopathic scoliosis; health related quality of life; posterior spinal surgery; radiological outcome

INTRODUCTION

Adolescent idiopathic scoliosis (AIS) is a complex three-dimensional deformity of spine that occurs in children from10 to 18 years of age. Clinically, it presents as coronal plane deformity of spine with shoulder imbalance, rib hump, ilio-costal impingement, lumbar hump and pelvic obliquity. Cosmesis is a common complaint of a patient with AIS.[1]

Treatment options for AIS include observation, brace, and surgery, and posterior spinal surgery is the mainstay of treatment in majority of the cases.[2] Surgery is aimed at correcting the deformity and stopping deformity progression by arthrodesis to improve health related quality of life (HRQoL) of the patient.[3] There are limited and sometimes contradicting reports on the correlation between radiological outcome and HRQoL.[3] Hence, this study was done to assess the radiological outcome after posterior spinal surgery in AIS and its correlation with HRQoL of the patient.

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METHODS

A descriptive cross-sectional study of all the cases of AIS who underwent posterior spinal surgery at the Hospital and Rehabilitation Center for Disabled Children (HRDC), from July 2013 to August 2019, was conducted after IRB approval and patient consent. Above patients with minimum follow up of 6 months were included in the study. We excluded all cases of spinal deformity from causes other than AIS.

Of 36 cases, 31 cases met the inclusion criteria. The deformity was classified according to Lenke classification. Preoperative imaging included whole spine antero-posterior and lateral views with supine side bending antero-posterior views. Severity of deformity was determined by measuring Cobb's angle subtended by line drawn parallel to superior endplates of upper end vertebra and another line parallel to inferior endplate of lower end vertebra. Post-operative x-rays of the whole spine antero-posterior and lateral views at the latest follow up were used to measure residual deformity after surgery. The same preoperative upper and lower end vertebrae were taken to measure postoperative Cobb's angle. The degree of deformity correction was measured by calculating the difference between preoperative and post-operative Cobb's angle. Health related quality of lfe (HRQoL) was measured by Scoliosis Research Society (SRS)-30 questionnaire. Telephone or face to face interview was conducted by the same interviewer with each patient during latest follow up.

Data was recorded in SPSS version 20. The pre-operative and post-operative Cobb's angle were compared using paired t-test. Pearson's correlation coefficient, and Spearman's rank correlation coefficient were used to assess the correlation of postoperative Cobb's angle and the amount of deformity correction with mean of SRS-30 scores. Each domains of SRS-30 were correlated with the amount of deformity correction and postoperative Cobb's angle. A p-value of <0.05 was considered significant. Correlations between each domains of SRS-30 were also assessed by Pearson's correlation and Spearman's rank correlation coefficient, and p-value of <0.01 was considered significant for this.

RESULTS

There were 18 females (58.06%) and 13 males (41.93%) with a mean age of 14.81 years (range 12-18 years) at the time of surgery. The deformity was classified as Lenke Type 1 in 20 cases, Type 3 and Type 5 in four cases each, and Type 6 in three cases. Average follow up after surgery was 37 months (range 6-82 months).

The mean pre-operative Cobb's angle was 66^0 (range 45^0-100^0) and post-operative Cobb's angle was 19^0 (range 0^0-50^0). There was highly significant correction of deformity after posterior spinal surgery (p=0.00) when pre and post-operative Cobb's angle were compared. The mean amount of deformity correction was 46^0 (range 30^0-74^0) which was statistically significant (p=0.031) (Table 1).

Table 1. Radiological Outcome after Posterior Spinal Surgery for AIS.

Status	Mean Cobb's angle in degree	Range in degree	P value
Pre-operative	66	45-100	
Post-operative	19	0-50	0.00** (paired t-test)
Amount of correction	46	30-75	0.031* (correlation)

*Note: Paired t-test was applied between preoperative and postoperative Cobb's angle , Bivariate (2 tailed) Pearson correlation was used to see correlation between preoperative Cobb's angle and Amount of correction) **Correlation is significant at 0.01 level, *Correlation is significant at 0.05 level*

The mean of total SRS-30 score was 137.64+/- 7.84. The score for functional activity, pain, self-image/ appearance, mental health, and satisfaction with management, were 29.16+/-2.91, 38.26+/-1.95, 41.68+/-3.00, 24.55+/-1.15, 14.00+/-1.32 respectively.

Table 2. Descriptive analysis of SRS 30 and its Domain and their correlation with Post-operative Cobb's angle and Amount of correction.

SRS 30 and its domains	Mean Score	Correlation with mean Post-Op Cobb's angle (P value)	Correlation with amount of curve correction (P value)
Total SRS-30	137.64+/-7.85	0.046 *	0.148
Functional Activity	29.16+/-2.91	0.969	0.688
Pain	28.26+/-1.95	0.664	0.453
Self-image/ Appearance	41.68+/-3.00	0.001**	0.027*
Mental health	24.55+/-1.15	0.078	0.913
Satisfaction with Management	14.00+/-1.32	0.013*	0.015*

***Correlation is significant at 0.01 level (2 tailed), *Correlation is significant at 0.05 level (2 tailed)*

Table 3. Correlation between each domain of SRS 30 following Posterior Spinal Surgery for AIS.

Domains	Functional activity	Pain	Self-image/ appearance	Mental health	Satisfaction with management
Functional activity	-	0.001**	0.100	0.111	0.017
Pain	0.001**	-	0.011	0.018	0.000**
Self-image /appearance	0.100	0.011	-	0.004**	0.000**
Mental health	0.111	0.018	0.004**	-	0.011
Satisfaction with management	0.017	0.000**	0.000**	0.011	-

**Correlation is significant at 0.01 level (2 tailed)

The post-operative Cobb angle was correlated significantly with the mean total SRS-30 score (p=0.046). Among the five domains of SRS-30, self-image/appearance (p=0.001), and satisfaction with management (p=0.013), were correlated significantly with residual deformity after posterior spinal surgery. There was no significant correlation between amount of deformity correction after posterior spinal surgery and mean total SRS-30 score (p=0.148), but again, self-image/appearance (p=0.027) and satisfaction with management (p=0.015) were correlated significantly with the amount of deformity correction (Table 2).

The correlations between each domain of SRS-30 were analyzed. Satisfaction with management was correlated highly with self-mage/appearance (p=0.000) and pain (p=0.000). Mental health had a significant positive correlation with self-image/appearance (p=0.004) (Table 3).

DISCUSSION

Adolescent Idiopathic Scoliosis (AIS) is the most common cause of late onset scoliosis and accounts for 80% of all Idiopathic scoliosis. It is a complex three-dimensional deformity of the spine which affects children between ages of 10 to 18 years. The etiology is unknown and diagnosis is by exclusion.[4] It presents as lateral bending deformity of the spine, shoulder asymmetry, rib hump, trunk shift, ilio-costal impingement, pelvic obliquity, and sometimes a leg length discrepancy. Progression of the deformity leads to damaged self-image and mental health, loss of self-confidence and decreased participation among peer groups, family and society. Unless the deformity is very severe, functional disability is minimal, especially in adolescents.[5, 6] The aim of treatment is to correct the deformity and to stop progression. Posterior spinal surgery is effective in correction of almost all types of deformity in AIS.[2] In addition to objective radiological correction, the goal is also to improve the subjective HRQoL of the patient.[7] However, consensus is lacking on the correlation between radiological outcomes and HRQoL.

In Elnady's series, the mean Cobb's angle of major curve was 61.3^0 preoperatively which was corrected to 12.8^0 postoperatively with percentage of correction of 79.1%.[8] Similarly, Basu et al showed mean percentage of correction by 59.57% (range 26.92% to 76.17%).[9] In the present study, the mean pre-operative Cobb's angle was 66^0 (range 45^0-100^0) and post-operative Cobb's angle was 19^0 (range 0^0-50^0) and mean amount of deformity correction was 46^0 (range 30^0-74^0). This shows that a significant amount of deformity correction can be achieved by posterior spinal procedure only. Severe rigid deformities may require additional anterior spinal surgeries that add significant morbidity.

Ghandehari et al reported significant improvements in total SRS-30 scores as well as individual domains of SRS-30 after surgery. In their study, the mean total SRS-30 score was 127+/-13 and mean score for functional activity, pain, self-image/appearance, mental health and satisfaction were 27+/-4.3, 26+/-2.5, 33+/-5.2, 23+/-3.5 and 13+/-1.8 respectively.[4] In our study, the mean total SRS-30 score was 137.64+/- 7.84 which shows significant improvement in overall quality of life. There was significant improvement in each domain of SRS-30. The mean score of functional activity, pain, self-image/appearance, mental health and satisfaction with management were 29.16+/-2.91, 38.26+/-1.95, 41.68+/-3.00, 24.55+/-1.15, 14.00+/-1.32 respectively. In contrast to Ghandehari's study where best outcome was on self-image/appearance, the present study reported best outcomes for mental health followed by pain.

There are literature showing positive correlation between the radiological outcome and HRQoL,[4,10] and those that show no correlation.[1, 11] Linda et al found little correlation between radiological assessment and the SRS questionnaire scores in adolescents.[3] In the present study, the post-operative Cobb's angle was significantly correlated with mean Total SRS-30 score which shows significant overall improvement in quality of life despite residual deformity after posterior spinal surgery. Also, self-image/appearance and satisfaction

with management were significantly correlated with post-operative Cobb's angle as well as the amount of deformity correction. The degree of curve correction after surgery was found to be a significant predictor in self-image/appearance and satisfaction with management in male patient and function/activity in female patient.[10] These findings suggest that better radiological outcomes after posterior spinal surgery provide better self-image/appearance and satisfaction to the patient.

Correlation of each of the domains revealed that satisfaction with management was mainly attributed to improved self-image/appearance and absence of pain. Mental health had significant positive correlation with self-image/appearance. This is similar to Ghandehari et al who showed that self-image/cosmesis was positively correlated with satisfaction.[4] Thus self-image/appearance was found to be the most important factor for better satisfaction and improved mental health after posterior spinal surgery for AIS.

The main limitation of this study is that only the post-operative SRS-30 has been administered to the patient, and it has not been compared with preoperative SRS-30. Another limitation is that, the surgeries were performed by three different spine surgeons and the outcomes of different patients operated by different spine surgeons were not compared.

CONCLUSIONS

Posterior spinal surgery for AIS provided better radiological outcomes, which had a positive correlation with overall HRQoL. There was significant improvement of self-image/appearance and satisfaction after surgery, which in turn, improved mental health.

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