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Research Article

# CLINICAL UPDATE OF ADOLESCENT IDIOPATHIC SCOLIOSIS IN A TERTIARY CARE HOSPITAL

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**ABSTRACT**

The human spine performs numerous structural and physiological functions. Integrating the brain and nervous system with the axial skeleton and safe guarding the spinal cord are two crucial roles that the spinal column plays in all animals. Herein, we aimed to provide a clinical update on idiopathic scoliosis in adolescents. Adolescents with idiopathic scoliosis who were formerly at our hospital were invited to participate in this study.In total, 269 individuals with idiopathic scoliosis with a mean age (standard deviation) of 16.5 ±2.1 years met the inclusion criteria. Of the individuals with idiopathic scoliosis, 129 remained untreated, 59 were being treated with bracing, 35 had previously been prescribes braces, and 46 had undergone surgery. The scoliosis group had significantly lower SRS-22r subscore ($p < 0.001$) as well as the function ($p = 0.009$), pain ($p < 0.001$) and self-image ($p < 0.001$) scores than the healthy control group had. The EQ-5 index was also significantly lower ($p = 0.034$) in individuals with scoliosis than in the healthy controls. Adolescents with idiopathic scoliosis are more likely to be satisfied with surgical management.

**Keywords :-** Adolescent idiopathic scoliosis, lumbar spondylosis, health-related quality of life, patient-reported outcome measures, function, pain, self-image.

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## INTRODUCTION

The human spine performs numerous structural and physiological functions. Integrating the brain and nervous system with the axial skeleton and safe-guarding the spinal cord are two crucial roles of the spinal column in all animals. In addition to tumours and fractures, lumbar spondylosis, stenosis, and segmental instability or deformity are prevalent diseases of the adult spine. The prevalence of scoliosis, a lateral spinal deformity, rises with advancing age and disc degeneration. A three-dimensional torsional distortion of the spine that affects otherwise healthy people and is frequently found during periods of rapid growth is known as idiopathic scoliosis. 1 Understanding health and disability has undergone a paradigm shift over the past few decades, with an increased focus on the health-related quality of life (HRQoL) and comprehending disability with regard to functioning after health changes.

The most prevalent paediatric musculoskeletal condition in children under the age of 18 years is adolescent idiopathic scoliosis (AIS), which affects more than 29 million children globally. Progressive untreated AIS is linked to deformity, discomfort, and restrictive lung disease later in life. Right-sided thoracic abnormalities are common; however, the curve patterns can vary.[2] The danger of significant deformity is greatest in children whose scoliosis worsens before the peak of growth velocity. However, after skeletal maturity, the risk of "curve progression" dramatically declines.3 Orthotics, such as a back brace,can be

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prescribed to prevent the development of the curve until skeletal maturity rather than repairing an abnormality that develops.4

Bracing is said to have "failed" if the curvature progresses to around 50° before the closure of growth plates, as determined using iliac crest or hand X-rays. Surgery is the treatment of choice in this situation to reduce the deformity, prevent advancement of the deformity by fusing the affected vertebral bodies, and balance the head, shoulders, and trunk over the pelvis. Typically, during surgery, metal instruments are implanted to generate forces necessary to correct the deformity. The current study's objective is to provide a clinical update regarding the genetics associated with AIS.

## MATERIAL AND METHODS

Individuals with idiopathic scoliosis who were treated at Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry, were invited to participate in this study. Individuals were included if they had been diagnosed with AIS on standing radiographs with a curve of at least 10° in the frontal plane (as measured according to the method described by Cobb[6]), were 12–18 years of age, and were able to understand the language.

Individuals were excluded if they had signs or symptoms associated with scoliosis of non-idiopathic origin. In total, 269 individuals with AIS with a mean age (standard deviation) of 16.5 ± 2.1 years met the inclusion criteria.

Of the 269 individuals, 129 remained untreated, 59 were being treated conservatively with a brace, 35 had previously used a brace, and 46 underwent surgery. The untreated group comprised of individuals did not have a minimum Cobb's angle of 25°, which is required for initiating brace treatment, individuals who had reached skeletal maturity, those who had declined brace treatment, and those who were being planned for surgery.

The ongoing bracing group were being treated with braces for a mean of 1.6 ± 1.9 years, while those who had been previously prescribed braces had ceased wearing the brace 1.8 ± 1.6 years previously. Bracing was recommended to adolescents with curves ranging from 25° to 40°, where further skeletal growth was expected, as suggested by the Scoliosis Research Society.[7]

A full-time rigid thoracosacral orthosis (TLSO) was utilised by 39 (30.2%) individuals in the ongoing brace group and 56 (43.4%) individuals in the previously braced group. Night-time hyperextension brace was utilised by 29 (22.4%) individuals in the ongoing brace group and 5 individuals in the previously braced group (12.8%). Individuals wearing a full-time brace were encouraged to wear the brace for 20 h a day and those with night-time brace for 8–10 h. Surgical treatment was recommended in individuals with larger curves (usually ≥ 45°), if progression was expected. The mean interval since surgery for this group of 46 individuals was 1.4 ± 1.4 years.

### Radiography

The curve was measured using Cobb's approach and radiographs obtained during the last appointment prior to questionnaire completion from the medical records. Cobb's angles (min–max) as were obtained for the subgroups as follows: untreated, 30° (11–78°); ongoing bracing, 34° (21–57°); formerly braced 35° (25–50°); and surgical 24° (5–44°).

### Statistical analysis

Data are presented as the mean and standard deviation and range or number and percentage. Chi-squared test was used to analyse categorical data. Mann–Whitney *U* test and analysis of covariance (ANCOVA) were used to analyse continuous data, with adjustments for age, sex, and exercise participation. Descriptive and demographic statistics between the four different scoliosis treatment groups were described using analysis of variance (ANOVA). Post-hoc analysis using Tamhane's test for body mass index (BMI) and curve size as equal variances could not be assumed according to Levene's test. Statistical analysis between these four groups was completed with ANCOVA with adjustments for age, sex, and BMI.

For comparisons of curve severity, individuals with ongoing or previous brace treatment and untreated individuals were stratified according to threshold Cobb's angle (≤ 30°or > 30°) as well as larger angles (< 45° or ≥ 45°). Surgically treated individuals were stratified according to lowest fusion level (L2 as most caudal vertebra). All analyses were performed using the Statistical Package for the Social Sciences (SPSS) statistical software for Windows (version 26,; IBM Corporation, New York, NY, USA).

## RESULTS

Patients with AIS were significantly older ($p$ <0.001), predominantly females ($p$ = 0.024), and were less likely to be currently participating in exercise or sports ($p$ = 0.016) compared to the healthy control group (Table 1).

The scoliosis group had significantly lower scores in the Scoliosis Research Society (SRS)-22r subscore ($p$ < 0.001) as well as in the separate domains of function ($p$ = 0.009), pain ($p$ < 0.001) and self-image ($p$ < 0.001) than the control group had. The EuroQol 5D (EQ-5D) index was also significantly lower ($p$ = 0.034) in the scoliosis group than in the healthy controls group (Table 2).

Significant differences were detected between the treatment groups in terms of proportion of females, age, BMI and curve size ($p = 0.005$, $p < 0.001$, $p = 0.012$ and $p < 0.001$, respectively) (Table 3).

**Table 1: Descriptive statistics of patients with scoliosis and the healthy controls**

| | Patients with AI (N=269) | Healthy controls (N = 20) | P-value |
|---|---|---|---|
| Age | 16.5 ±2.1years | 15.0±2.2 | <0.001 |
| Male | 256 | 56 | 0.024 |
| BMI | 17.8±3.2 | 17.9±3.2 | 0.59 |
| Participating in exercise/sports | 159 | 15 | 0.016 |
| Curve size | 32±11.3(11-78) | NA | |

AIS, adolescent idiopathic scoliosis; BMI, body mass index; NA, not applicable.

**Table 2. HRQoL score comparison between patients with scoliosis and the healthy controls**

| | Patients with AIS (269) | Healthy controls (N = 20) | P-value |
|---|---|---|---|
| SRS-22r function | 4.65 ±0.49 | 4.56 ±0.32 | 0.009 |
| SRS-22r pain | 4.15±0.78 | 4.51±0.30 | <0.001 |
| SRS-22r self-image | 3.70±0.81 | 4.92±0.40 | <0.001 |
| SRS-22r mental health | 3.77±0.74 | 4.23±0.65 | 0.053 |
| SRS-subscore | 4.15±0.56 | 4.67±0.22 | <0.001 |
| EQ-5D | 0.96±0.08 | 0.97±0.05 | 0.034 |

HRQoL, health-related quality of life; AIS, adolescent idiopathic scoliosis; SRS, Scoliosis Research Society; EQ-5D, EuroQol 5D (health related quality of life developed by the EuroQol group).

**Table 3. Descriptive statistics of the scoliosis treatment groups.**

| | Untreated (N=129) | Ongoing brace treatment (N=59) | Previous brace treatment (N=35) | Surgically treated (N=46) | P-value |
|---|---|---|---|---|---|
| Males | 75 (58.1%) | 50 (84.7%) | 32 | 46 | 0.005 |
| Age, yrs | 16.2±2.0 | 12.2±1.3 | 12.8±1.7 | 17.1±3.0 | <0.001 |
| Weight, kg | 66.4±9.7 | 41.9±9.0 | 48.2±12.6 | 57.6±13.6 | <0.001 |
| Height, cm | 168.7±9.8 | 165.5±9.3 | 160.0±6.1 | 180.0±8.6 | 0.10 |
| BMI, $kg/m^2$ | 20.1±3.6 | 15.5±3.8 | 20.2±3.2 | 19±3.0 | 0.012 |
| Curve size, degrees | 32.0±15.6° (11–78°) | 23.5±4.8° (21–57°) | 33.2±7.5° | 23.5±7.2° | <0.001 |
| Age at surgery, years | NA | NA | NA | 12.3±1.6 | |
| Time since surgery | NA | NA | NA | 1.7±1.7 | |
| Time since bracing was started | NA | 1.3±1.6 | NA | NA | |
| Time since bracing was stopped | NA | NA | 1.6±1.3 | NA | |
| Total duration of brace application | NA | NA | 2.0±1.1 | NA | |

**DISCUSSION**

As evaluated with the disease specific SRS-22r and the generic EQ-5D, the difference in the SRS-22r was mainly seen in the individual domains of function, pain and self-image. The mental health domain did not differ between the groups.

The SRS-22r scores in the self-image and pain domain in the present study were similar to those in the study by Mariconda et al., where a lower HRQoL was detected pre-operatively in a cohort of patients with AIS ($n = 87$) compared to in age- and sex-matched healthy controls. The score in the physical domains of the SF-36 questionnaire was also lower.

No differences were found between the scoliosis treatment subgroups in terms of HRQoL, as indicated by the EQ-5D score or SRS-22r subscores. Similar to previous studies, the surgically treated group exhibited lower function and pain scores in the SRS-22r categories compared to the continued bracing group, as well as lower function scores compared to the untreated group. However, these studies also determined that patients who underwent surgery had higher self-image scores than those who were treated conservatively. Furthermore, Bunge et al.[11] determined that better self-image scores were only seen in surgically treated persons without prior brace treatment. This may partially explain the

discrepancy in the current study where the surgical group included 24 individuals previously treated with bracing (28%).

In this study, individuals who underwent surgery had poor function ratings, a lower SRS-22r subscore, and lower self-image than their peers who were treated conservatively had. This would imply that the diminished function in those who have undergone surgery was not only transient but also persisted throughout adulthood. In Diarbakerli et al.'s study, individuals with a higher degree of caudal fusion also had lower EQ-5D scores, SRS-22r subscores, and pain and function subdomain scores.

Our findings demonstrate that, in contrast to patients in both bracing groups, those in the surgical group was more satisfied with their therapy despite a decrease in function and an increase in discomfort. Because of the immediate postoperative improvement in curve on anteroposterior radiographs and improvements in the aesthetic appearance, our study findings are consistent with those of the study by Colak et al.[12]

During a 4-year follow-up, Burstrom et al.[13] determined that patients with scoliosis who were surgically treated had a poorer functional outcome (as measured by the SRS-24) than healthy controls, which is similar to our study findings. However, the levels of discomfort and self-image and HRQoL scores were higher in the surgically treated group than in the untreated group, which were comparable to those in the healthy controls group.

In the current study, a lower SRS-22r subscore, indicating a poorer HRQoL, was found in the group with larger curves. This is consistent with the findings of the study by Berliner et al., which determined that teenagers (n = 286) with curves < 40° had higher overall SRS-22r scores and better pain and self-image subdomain scores that teenagers with curves > 40°.[14] In the current study, the differences in HRQoL scores were mostly caused by differences in the SRS-22r domains of function, pain, and self-image, which is in line with the results of a previous study. [15]

A big distinction was seen in the self-image domain, which is supported by evidence in previous studies that have demonstrated a correlation between self-image and medical and radiographic deformity. The present study confirmed differences in the SRS-22r subscore when individuals with scoliosis were stratified according to the curve size with cut-offs of 30° and 45°. However, differences within the EQ-5D were most effectively detected when patients were stratified according to the cut-off of 45°, indicating that the final degrees can be less sensitive in detecting HRQoL adjustments within this population.

## CONCLUSION

Adolescents with idiopathic scoliosis had a lower HRQoL than healthy controls as measured using scoliosis-specific and generic outcome measures. Adolescents with idiopathic scoliosis are more likely to be satisfied with surgical management.

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