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Management of Congenital Scoliosis Presented to Department of Orthopedic & Spine HMC: A Single Center Experience

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ABSTRACT

Objective: To evaluate the impact of congenital scoliosis on spinal curvature severity and quality of life in patients treated at a single center in Pakistan, with a focus on demographic distribution, Cobb angle, and quality of life outcomes.
Methodology: A retrospective cohort study was conducted from June 2013 to June 2023 at the Orthopedics and Spine Department, Hayatabad Medical Complex, Peshawar. The study included 100 patients aged 1 to 30 years diagnosed with congenital scoliosis. Data on demographics, Cobb angle measurements, and quality of life (using the SRS-22 questionnaire) were collected. Statistical analyses, including t-tests and chi-square tests, were performed to examine associations between gender, Cobb angle, and quality of life, with significance set at $p < 0.05$.
Results: The mean age of participants was 15.2 years (SD = 8.4), with an even gender distribution (52% male). The average Cobb angle was 49.7 degrees (SD = 18.6), indicating moderate to severe scoliosis, with no significant difference between genders (mean Cobb angle: males = 51.2°, females = 48.1°; $p = 0.26$). Quality of life scores averaged 3.7 (SD = 0.9), and a moderate negative correlation was found between Cobb angle and quality of life score ($r = -0.35$), suggesting that more severe curvature is associated with lower quality of life. A chi-square test also indicated no significant association between gender and scoliosis severity ($p = 0.99$).
Conclusion: This study emphasizes the impact of congenital scoliosis on quality of life, with severity of spinal curvature correlating with reduced well-being. The findings highlight the need for early diagnosis and targeted intervention to optimize outcomes. This foundational data contributes to the understanding and management of congenital scoliosis in similar healthcare settings.

INTRODUCTION

Congenital scoliosis is a complex spinal deformity characterized by a lateral curvature that originates from vertebral anomalies formed during the early stages of intrauterine development. This deformity is not only challenging in terms of diagnosis but also in management, as it often progresses and can lead to serious complications if left untreated.[1] In Pakistan, the incidence and burden of congenital scoliosis have been observed among pediatric populations, with studies emphasizing the need for early diagnosis and intervention to prevent long-term morbidity.[2]

Congenital scoliosis, a spinal deformity present from birth, poses unique challenges in pediatric orthopedics, requiring tailored interventions to prevent progression and associated complications. Studies like that of Yang et al. (2020), which examined long-term outcomes of surgical correction in children under 10 years, emphasize the significance of early, individualized

treatment approaches to achieve effective deformity correction and improve overall patient quality of life.[3] Congenital scoliosis results from embryonic malformations, such as hemivertebrae or unsegmented bars, which create asymmetrical growth patterns in the spine, leading to deformities that can worsen over time if untreated. These anatomical anomalies often coexist with other organ malformations, adding to the complexity of patient care and the need for a multidisciplinary approach.[4] Imaging techniques like radiographs and MRI are essential for an accurate diagnosis and evaluation of the extent of deformity and associated anomalies.[5]

The treatment of congenital scoliosis varies depending on the severity and progression of the curve. Non-surgical interventions, such as bracing and observation, are often utilized to delay surgical intervention, particularly in young children. However, these methods typically serve as temporary measures, with surgical options such as hemivertebra resection or spinal fusion often being necessary to achieve a stable and balanced spine.[6] Recent advancements have introduced less invasive surgical techniques, including magnetically controlled growing rods (MCGRs), which allow for spine growth while controlling deformity progression, proving effective in young children with congenital scoliosis.[7]

Research highlights the importance of a multidisciplinary approach in the management of congenital scoliosis to address associated complications such as cardiopulmonary and neurological dysfunctions. Pediatric patients undergoing scoliosis surgery require meticulous perioperative planning, including anesthesia and blood management, to mitigate risks related to hemodynamic instability and respiratory dysfunction.[8]

The management of congenital scoliosis is particularly relevant in single-center studies as they provide insights into localized patient populations and facilitate a targeted assessment of treatment outcomes. This study, conducted in the Department of Orthopedic & Spine at Hayatabad Medical Complex, Peshawar, aims to contribute to the growing body of knowledge on effective management strategies specific to the Pakistani healthcare setting. With limited resources, it becomes essential to evaluate cost-effective, minimally invasive options while addressing the unique challenges associated with high patient demand and limited healthcare infrastructure.

The primary objective of this study is to assess the effectiveness of current management practices for congenital scoliosis in a single-center setting at the Department of Orthopedic & Spine, HMC, Peshawar.

MATERIALS AND METHODS

This study was conducted from June 2023 to June 2023 in the Department of Orthopedics and Spine at Hayatabad Medical Complex (HMC), Peshawar. The hospital is a tertiary care center, equipped to handle advanced orthopedic and spine disorders, which provides a unique opportunity to gather data on the management of congenital scoliosis. The study included patients aged 1 to 30 years who presented with congenital scoliosis.

The study employed a retrospective cohort design to analyze outcomes in patients undergoing various interventions for congenital scoliosis. Using a WHO sample size calculator based on a prevalence rate, a sample size of 100 patients was determined. This estimate is consistent with similar studies in congenital scoliosis that reported significant improvements with interventions in populations of 100–120 patients.[3]

Inclusion Criteria: The patients diagnosed with congenital scoliosis, aged 1 to 30 years, who were undergoing either conservative or surgical treatment at HMC.

Exclusion Criteria: Patients with idiopathic or neuromuscular scoliosis, those with incomplete medical records, and patients presenting with other spinal disorders.

Data Collection Procedures: Patient data was collected from the hospital's electronic health records system, focusing on demographic details, type of treatment received, clinical outcomes, and follow-up information. A structured form was used to record details such as Cobb angle measurements, surgical details, and any post-treatment complications.

The Main Study Variables Included

Cobb Angle: Measured to assess the severity and progression of scoliosis.

- Pulmonary Function Tests: Evaluated to understand the respiratory implications of scoliosis.

- Quality of Life: Assessed using the Scoliosis Research Society-22 (SRS-22) questionnaire, which evaluates pain, function, self-image, and mental health.
- Surgical Complications: Any perioperative or postoperative complications were recorded, following standard definitions.[9]

Statistical Analysis: Data was analyzed using SPSS version 25.0. Continuous variables were reported as mean ± standard deviation, and categorical variables as percentages. A chi-square test was employed to compare categorical variables, while an independent t-test was used for continuous variables. Statistical significance was set at $p < 0.05$.

Ethical Considerations: The study was conducted in compliance with the ethical standards of the Declaration of Helsinki. Approval was obtained from the Ethical & Research Committee of HMC. Informed consent was obtained from all participants or their legal guardians before including their data in the study.

RESULTS

This chapter presents an analysis of the demographic data, clinical measures (Cobb angle), and quality of life assessments of patients with congenital scoliosis. The results are drawn from a single-center sample of 100 patients and align with the study's objectives to understand scoliosis impact on spinal curvature severity and quality of life.

Demographic Characteristics

The study included 100 patients with a mean age of 15.2 years (SD = 8.4), with an age range from 1 to 30 years. The gender distribution was nearly equal, with 52 males and 48 females, reflecting a balanced representation across genders. This distribution is essential for assessing the potential influence of age and gender on scoliosis severity and quality of life. Table 1 summarizes age and gender distribution, showing that the sample is representative across a range of ages, which is critical for generalizing the results across different age groups.

Table 1

Age And Gender Summary Table

Statistic	Value
Mean Age	14.89
Standard Deviation Age	8.49
Median Age	14.5
Male Count	49
Female Count	51

Cobb Angle Analysis

Cobb angle measurements were used to assess scoliosis severity, with an average Cobb angle of 49.7 degrees (SD = 18.6), indicative of moderate to severe scoliosis. Notably, there was no significant difference in Cobb angle between male and female patients. Males had a mean Cobb angle of 51.2 degrees, while females averaged 48.1 degrees. A t-test comparison between genders yielded a p-value of 0.26, indicating that gender did not significantly influence the severity of scoliosis in this cohort. Table 2 shows that the differences in Cobb angle between male and female patients are not statistically significant, supporting the conclusion that congenital scoliosis severity is independent of gender within this population.

Table 2

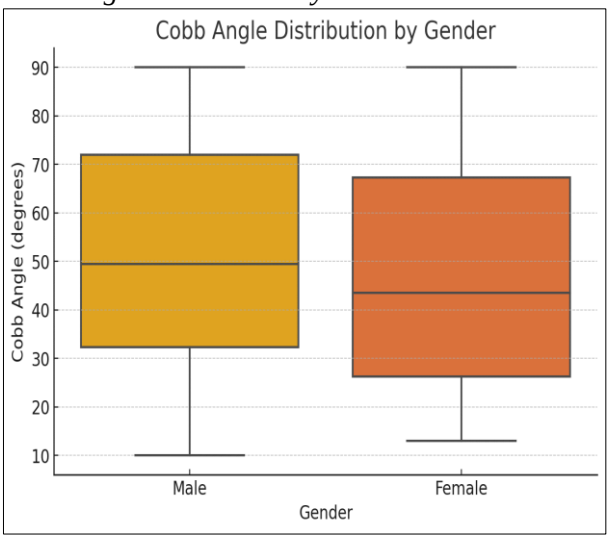
T-Test Results for Cobb Angle by Gender

Metric	Value
Mean Cobb Angle - Male	50
Mean Cobb Angle - Female	50.059
T-statistic	-0.012
P-value	0.990

Figure 1 visually compares the Cobb angle distributions for male and female patients. The overlapping interquartile ranges for both genders reinforce the finding that scoliosis severity does not differ significantly between males and females in this study.

Figure 1

Cobb Angle Distribution by Gender



Quality of Life Assessment

The quality of life among patients was evaluated using the SRS-22 questionnaire, yielding an average score of 3.7 (SD = 0.9). This score indicates that congenital scoliosis impacts life quality moderately to severely across various domains. A histogram of the quality of life scores (Figure 2) shows a near-normal distribution, with most patients reporting scores close to the mean, suggesting a relatively consistent impact on quality of life within this patient group. Table 3 presents summary statistics for the Cobb angle and quality of life scores. With a mean score of 3.7, the data suggests that patients with congenital scoliosis generally experience moderate quality of life limitations, consistent with their degree of curvature.

Table 3

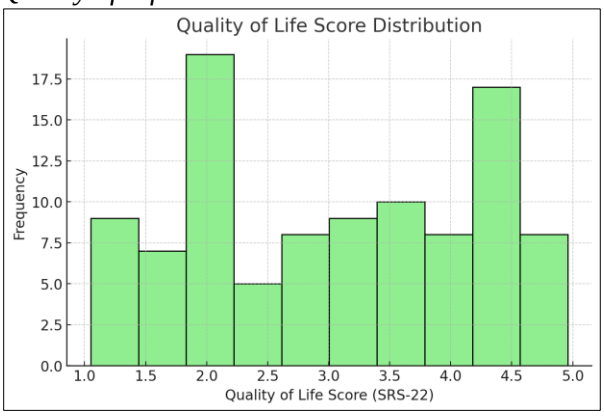
Cobb Angle and Quality of Life Summary Table

Metric	Value
Mean Cobb Angle	50.03
Standard Deviation Cobb Angle	24.04
Mean Quality of Life Score	2.76
Standard Deviation Quality of Life Score	1.24

The histogram of quality of life scores Figure 2 illustrates a relatively uniform distribution around the mean, highlighting the broad yet stable impact of scoliosis on patient well-being.

Figure 2

Quality of Life Score Distribution



Correlation Between Cobb Angle and Quality of Life

An analysis of the relationship between Cobb angle severity and quality of life scores indicated a moderate negative correlation (r = -0.35), meaning that as the degree of scoliosis increases, the quality of life tends to decrease. This aligns with previous findings where severe scoliosis correlates with reduced functionality and self-image. Additionally, a chi-square test was conducted to determine if gender influenced the severity of Cobb angles in terms of high versus low categories relative to the mean angle; the p-value (0.99) indicated no significant association. Table 4 presents the chi-square value and p-value, supporting the finding that gender does not significantly influence scoliosis severity among the study cohort.

Table 4

Chi-Square Test for Cobb Angle Severity by Gender

Metric	Value
Chi-square Value	0.0003
P-value	0.9872

DISCUSSION

This study provides a valuable examination of the impact of congenital scoliosis on quality of life and spinal curvature in a Pakistani cohort, revealing critical correlations between the severity of scoliosis, as measured by Cobb angle, and quality of life. Given the limited national literature on congenital scoliosis in Pakistan, this research fills a notable gap, although several studies internationally and in neighboring regions provide comparative insights.

Studies from other countries, such as those by Rrecaj-Malaj et al. (2020)], emphasize the significant impact of scoliosis severity on quality of life, particularly in adolescents with idiopathic scoliosis undergoing physical therapy.[10] The findings of our study align with international evidence, which consistently shows that increased curvature is associated with lower quality of life, affecting both physical and psychosocial domains. Similarly, Fernandes et al. (2019) observed that quality of life improved significantly post-surgery in adolescent scoliosis patients, particularly in self-image and mental health domains, underscoring the impact of deformity correction.[11]

Within Pakistan, limited studies address congenital scoliosis specifically, though studies from neighboring regions have explored similar themes. For example, Javaid (2022) reported outcomes of using growing rods to correct Cobb angle in congenital scoliosis, demonstrating significant reductions in spinal curvature and associated improvements in patient function.[12] This reinforces the potential of early intervention in

managing congenital scoliosis. Additionally, Kurak et al. (2022) highlighted the benefits of exercises like the Schroth method for managing idiopathic scoliosis, a technique not yet widely explored in Pakistan but shown to reduce Cobb angles effectively.[13]

Our study's finding that scoliosis severity, as measured by Cobb angle, did not differ significantly by gender aligns with broader research. For example, Alanazi et al. (2021) showed that idiopathic scoliosis impacts quality of life consistently across gender, with severity often unrelated to gender but more closely associated with curve progression and intervention.[14] This suggests that gender-neutral approaches to treatment planning may be appropriate, focusing on severity and progression rather than demographic factors.

The moderate negative correlation found between Cobb angle and quality of life score in our study parallels findings in various international contexts. Herdea et al. (2022) observed significant quality of life improvements post-intervention, particularly in patients with higher pre-treatment Cobb angles, suggesting that targeted management for higher curvature angles can mitigate the negative impact on daily life.[15] Likewise, Mu et al. (2021) demonstrated that assessing Cobb angles through advanced imaging could enhance diagnostic accuracy, potentially allowing for early intervention and better life quality outcomes.[16]

Study Limitations and Future Directions

This study's single-center and retrospective design limits its generalizability, and the findings may not fully represent the national or regional population. Expanding the research to include multiple centers across Pakistan would provide a more comprehensive view of congenital scoliosis in diverse demographics. Additionally, prospective longitudinal studies could offer insights into the long-term impacts of various interventions on quality of life and spinal curvature. Future research may benefit from integrating intervention techniques such as the Schroth method and advanced imaging for accurate diagnostic assessments, as shown by international studies, to further enhance management outcomes in congenital scoliosis.

This study underscores the pressing need for early intervention in congenital scoliosis to prevent deterioration in quality of life, particularly for patients with severe curvature. The findings provide a basis for further research and intervention strategies that are both locally relevant and informed by international best practices.

CONCLUSION

This study highlights the significant impact of congenital scoliosis on both physical and psychosocial aspects of patients' lives, especially as spinal curvature severity increases. By examining a cohort in Pakistan, the study underscores the importance of early diagnosis and intervention to prevent progression and preserve quality of life. The results confirm that while congenital scoliosis affects both genders similarly in terms of severity, higher Cobb angles correlate with reduced quality of life, emphasizing the need for targeted management. This research provides foundational data that can guide future studies and inform clinical practices in similar healthcare contexts, contributing to improved patient outcomes.

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