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Audit of Spinal Deformity Surgery Cases to Improve Future Surgical Outcome – A Retrospective Institution-Based Study

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Abstract

Background: Audit is an essential component of healthcare quality improvement. When conducted systematically with predefined standards, it allows institutions to evaluate performance and identify areas for refinement. This audit aimed to evaluate epidemiological characteristics, perioperative parameters, and early complications of spinal deformity surgery at our tertiary spine institute against predefined institutional benchmarks.

Methods: A retrospective audit was performed of patients who underwent deformity correction between 1 January 2019 and 31 December 2020. Institutional standards were predefined through departmental consensus based on contemporary spine literature and institutional performance data. Parameters assessed included operative time, blood loss, hospital stay, and early complications (within 90 days). Descriptive statistics were used.

Results: Seventy-two patients were included. The mean age was 34.92 ± 25.88 years (range 5–80; median 22.5), with 40 males and 32 females. Mean hospital stay was 7.67 ± 4.50 days (range 1–23). Mean blood loss was 911.67 ± 383.34 mL. Mean operative time was 379.03 ± 134.77 minutes. There were 52 scoliosis surgeries (72.2%), 10 kyphosis (13.9%), and 10 kyphoscoliosis (13.9%). Three patients (4.2%) developed early complications: two transient neurological deficits and one pseudomeningocele.

Conclusion: This audit establishes baseline institutional performance data. Perioperative parameters and complication rates were within predefined internal targets. The findings provide a framework for structured quality monitoring and future re-audit.

Keywords: audit; deformity; kyphosis; kyphoscoliosis; spinal curvatures

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Introduction

Audit is a structured process in healthcare aimed at evaluating clinical performance against predefined standards and implementing improvement strategies.[1] It forms a critical component of quality assurance in surgical disciplines.

Spinal deformity encompasses complex three-dimensional abnormalities, including scoliosis, kyphosis, and kyphoscoliosis.[2] These deformities may arise from congenital, idiopathic, neuromuscular, degenerative, traumatic, or infective causes.[3] Scoliosis is defined as a lateral spinal curvature >10° with vertebral rotation[4], and may be idiopathic or secondary.[5] Kyphosis refers to excessive sagittal curvature, commonly exceeding 40°.[6]

Severe deformities may lead to neurologic compromise, cardiopulmonary impairment, cosmetic concerns, and functional limitation.[7] Surgical intervention aims at deformity correction, neural decompression, and restoration of alignment.[8]

Although spinal deformity surgery is well studied, there is limited reporting of structured institutional audits in this domain. This study was therefore conducted to describe epidemiological and perioperative characteristics, evaluate outcomes against predefined institutional benchmarks, and to identify areas for quality improvement.

Methods

Study Design:

Retrospective institutional audit. Institutional tertiary spine center. Cases from 1 January 2019 to 31 December 2020. Approved by Institutional Review Board. Consent waived due to retrospective design. Patients undergoing surgical correction for scoliosis, kyphosis, or kyphoscoliosis were included. Non-spinal deformity cases, isolated trauma without deformity correction, incomplete records, duplicates were excluded.

Sample Size and Sampling:

113 records screened → 83 spinal deformity cases identified → 11 duplicates removed → 72 unique patients included. (Figure 1)

Radiological Review:

Preoperative X-rays, CT, MRI, and postoperative radiographs were reviewed using institutional PACS.

Definition of Complications:

Early complications were defined as events within 90 days postoperatively, including:

- New neurological deficit
- Dural tear with symptomatic pseudomeningocele
- Surgical site infection
- Implant failure
- Reoperation

Neurological deficits were considered transient if motor power improved during follow-up.

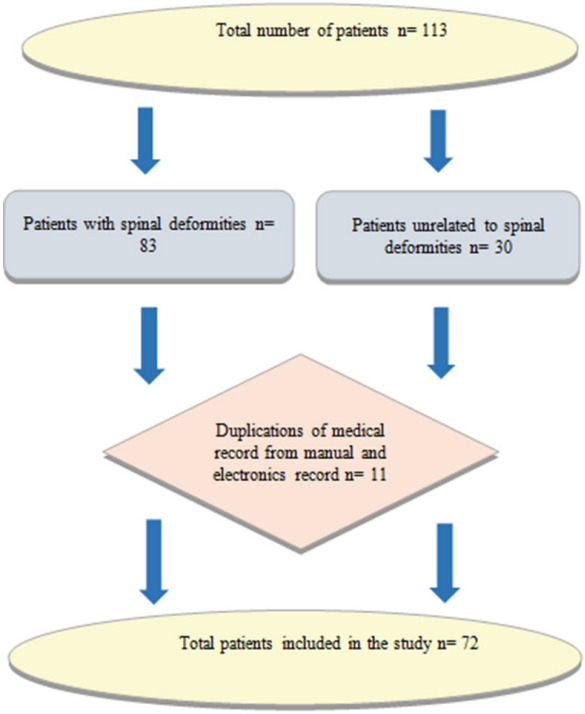

Figure 1 Flowchart showing patient selection: 113 records reviewed, 30 excluded for unrelated diagnoses, and 11 duplicates removed. Final audit cohort included 72 patients with spinal deformities.

Institutional Audit Standards:

Benchmarks were defined through departmental consensus informed by contemporary literature[9-19] and institutional historical performance:

- Mean operative time ≤ 450 minutes
- Mean blood loss ≤ 1500 mL
- Mean hospital stay ≤ 10 days
- Early complication rate ≤ 10%

Statistical Analysis:

Descriptive statistics (mean, SD, frequency, percentage) were calculated using SPSS Version 29. No inferential comparison with literature was performed.

Results

The mean age of the patients was 34.92 +/- 25.88 years (Range: 5-80, Median age: 22.50) with 40 males and 32 females. The mean hospital stay was 7.67 ± 4.50 days (Range: 1-23). Mean blood loss was 911.67+/-383.34 ml. Mean operative time= 379.028+/-134.77 min. There were 52 scoliosis surgeries, 10 surgeries each for kyphosis and kyphoscoliosis. (Table 1)

Reason for surgery ranged from cosmesis to neurological deficits. (Table 2)

Six surgeries were performed in staged manner, which were for congenital kyphoscoliosis, post-

Table 1. Types of Spinal Deformity Surgeries Performed

Type of Deformity	Number of Patients (%)
Kyphoscoliosis	10 (13.9)
Congenital	6
Neuromuscular	4
Scoliosis	52 (72.2)
Congenital	16
Juvenile idiopathic scoliosis	4
Adolescent Idiopathic scoliosis	6
Degenerative scoliosis	26
Kyphosis	10 (13.9)
Congenital	2
Tubercular	8

Table 2. Indications for Surgery in Various Types of Spinal Deformities

Reason for surgery	Type of deformity			Total
	Kyphoscoliosis	Scoliosis	Kyphosis	
Cosmesis	6	18	2	26
Pain	0	34	6	40
Neurological Deficit	0	0	2	2
Sitting Imbalance	4	0	0	4
Total	10	52	10	72

Table 3. Distribution of Spinal Cord Anomalies Across Different Types of Deformities

Type of cord anomaly	Type of deformity			Total
	Kyphoscoliosis	Scoliosis	Kyphosis	
Absent	6	40	10	56
Syrinx	2	6	0	8
Diastematomyelia	2	0	0	2
Spina Bifida	0	6	0	6

tubercular kyphosis, and neuromuscular kyphoscoliosis. Sixty six surgeries were non-staged. Variable numbers of cord anomalies were seen on MRI, and surgery was planned accordingly. (Table 3)

Perioperative Parameters:

Mean operative time: 379.03 ± 134.77 minutes

Mean blood loss: 911.67 ± 383.34 mL

Mean hospital stay: 7.67 ± 4.50 days

All values were within predefined institutional targets.

Complications:

Three patients (4.2%) developed early complications:

1. Post-tubercular lumbosacral kyphosis – transient neurological deficit (Figure 2).
2. Congenital lumbar scoliosis – tractional neuropraxia (Figure 3).
3. Congenital scoliosis – pseudomeningocele (Figure 4).

Both neurological deficits improved during follow-up. The pseudomeningocele resolved with conservative management by 3 months.

No mortality, deep infection, or implant failure occurred within 90 days.

Discussion

This audit evaluated institutional outcomes against internally defined benchmarks. Hospital stay in our series (7.67 days) is comparable to reports in congenital deformity surgery[11] and shorter than some adult deformity series.[9,10] Mean blood loss (911 mL) lies within ranges reported across congenital and adult deformity populations.[10-13] Variability in literature reflects heterogeneity in age groups and surgical techniques. Operative time (379 minutes) is consistent with previously reported ranges for complex deformity correction.[10-13]

Published complication rates vary widely depending on population and deformity type[9,14-19], ranging from approximately 5% in adolescent idiopathic scoliosis[18] to over 40% in certain adult or neuromuscular cohorts.[14] The 4.2% early complication rate in our series compares favorably within this context. Importantly, no permanent neurological deficit occurred. Literature reports neurological deficit rates between 0.8% and 2% depending on etiology.[19]

This study has several limitations that should be acknowledged. First, it's a retrospective design that may introduce selection and information bias, as the data were collected from previously recorded clinical information rather than through a prospectively controlled protocol. Second, the findings are based on data from a single center, which may limit the generalizability of the results to other institutions or

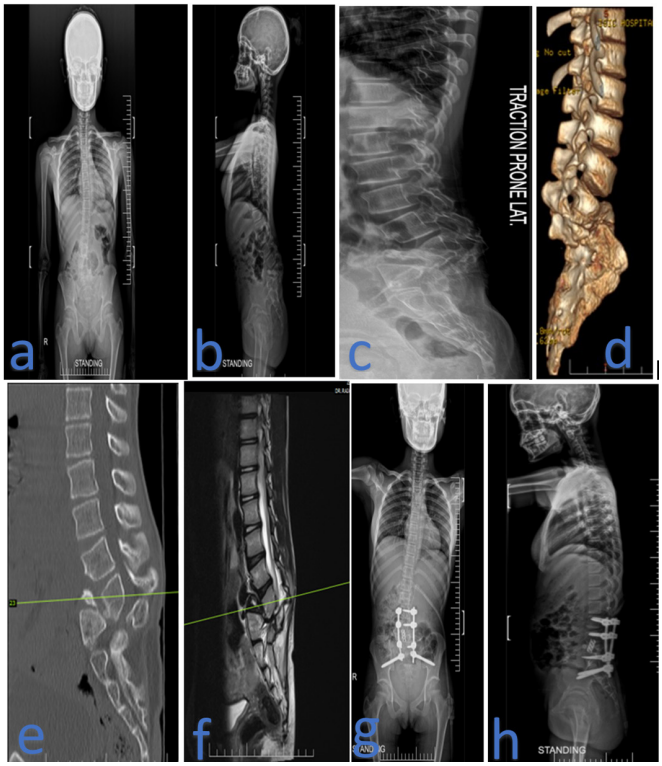

Figure 2 Imaging of a lumbosacral kyphosis patient with postoperative neurological deficit: preoperative radiographs (a–c), CT scans (d–e), MRI (f), and postoperative radiographs (g–h) showing spinal alignment and deformity correction.

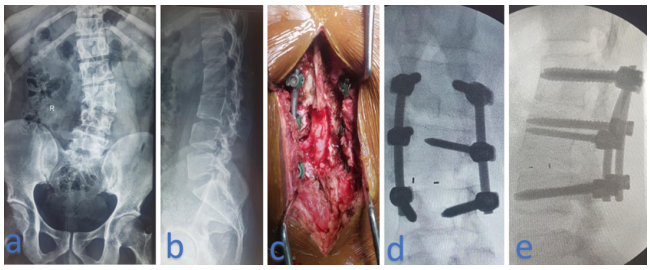

Figure 3 Imaging and intraoperative views of a lumbar scoliosis patient with tractional neuropraxia: preoperative radiographs (a–b), intraoperative photograph (c), and postoperative fluoroscopic AP (d) and lateral (e) views.

populations with different clinical practices and patient characteristics. In addition, a stratified risk analysis was not performed, which restricts the ability to evaluate outcomes across different patient risk categories. The follow-up period was limited to 90 days, preventing assessment of longer-term outcomes and complications.

Finally, functional outcome scores were not included in the analysis, which limits the ability to comprehensively evaluate the impact of the intervention on patient quality of life and functional recovery.

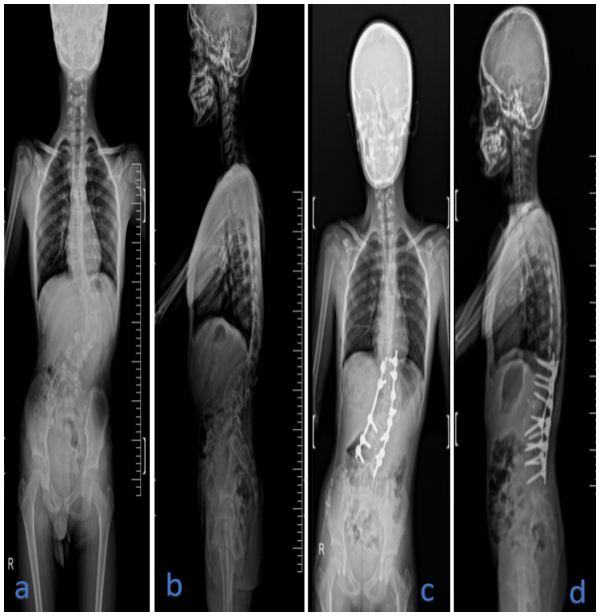

Figure 4 Imaging of a thoracolumbar kyphoscoliosis patient with postoperative pseudomeningocele: preoperative whole spine AP (a) and lateral (b) radiographs, and postoperative whole spine AP (c) and lateral (d) radiographs showing deformity correction.

Quality Improvement Measures:

Following audit discussion, the following strategies were emphasized:

- Routine intraoperative neuromonitoring
- Avoidance of excessive nerve root traction
- Careful dural handling and watertight closure
- Blood conservation protocols

A prospective re-audit is planned to complete the audit cycle.

Conclusion

This institutional audit establishes baseline performance data for spinal deformity surgery. Perioperative parameters and early complication rates were within predefined institutional benchmarks. The study provides a structured foundation for ongoing quality monitoring and future re-audit rather than definitive comparative conclusions.

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Acknowledgement: None

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