

A Retrospective Analysis of Pedicle Screw Placement in the Surgical Treatment of Adolescent Idiopathic Scoliosis – An Analysis of 10 Years of Cases

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Objectives

- Review intra and post-operative imaging for adolescent idiopathic scoliosis (AIS) patients
- Comparison of rate of screw malplacement between various surgical techniques
- Analysis of revision rates following instrumented fusion

Introduction

AIS is the most common form of scoliosis, presenting in children between the ages of 10 and 18. It is a diagnosis of exclusion that is more prevalent in girls, and approximately 30% of children have a family history of the disease¹.

Posterior fusion with instrumentation is the most common surgical intervention for severe AIS, involving placement of metal screws into the pedicles, attachment of rods and application of correctional force to rectify the abnormal curvature². Malpositioning of pedicle screws can result in serious complications, such as permanent neurological deficit and vascular injury³.

Various surgical techniques were used over the 10-year period. Between 2013 and 2016, a freehand technique, reliant on the use of anatomical landmarks to determine the entry point for the screws, was used without any additional intraoperative imaging. Intraoperative image intensification (II) was introduced in 2017, used alongside the freehand technique. In 2023, the use of MySpine® guides, created with pre-operative CT imaging, became routine, replacing the freehand technique⁴.

Methods

- Obtained complete list of operations carried out between January 2013 and December 2023 from the Bluespier database
- Patients undergoing primary instrumented fusion to treat AIS between the ages of 10 and 18 were included in the study
- Radiological imaging stored on the Synapse database was interpreted by a consultant spinal surgeon to assess screw placement
- Data analysis carried out through the use of IBM SPSS Software Version 27

Results

226 girls and 39 boys (N=265) were included in this study, with a mean age at operation of 14.6 years. A total of 5070 screws were placed over the 10-year period, with a mean of 19.13 screws per patient (SD±3.98, range 11-29). Of total screws placed, 516 (10%) were malpositioned, with an overall average of 1.95 malpositioned screws per patient (SD±1.85, range 0-8). 71% of patients had at least one malplaced screw.

Between 2013 and 2016, where a freehand technique was used without any intraoperative imaging, 14% (260/1866) of screws placed were malpositioned. Between 2017 and 2022, where intraoperative II was used alongside a freehand technique, 9% (238/2627) of screws were malpositioned. In 2023, with the use of MySpine® guides, malplacement was reduced to 3% (18/577). This is represented in Figure 1.

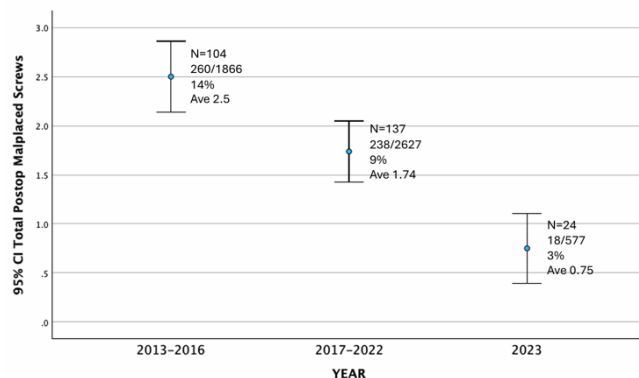


Figure 1: Depicts the decrease in average number of malplaced screws per patient between 2013 and 2016, 2017 and 2022, and in 2023.

23 patients (9%) underwent revisional surgery following their primary surgery. The mean number of months from the date of surgery to revisional operation was 27.2 months (SD±27.2). Revisional operations performed are summarised in Figure 2.

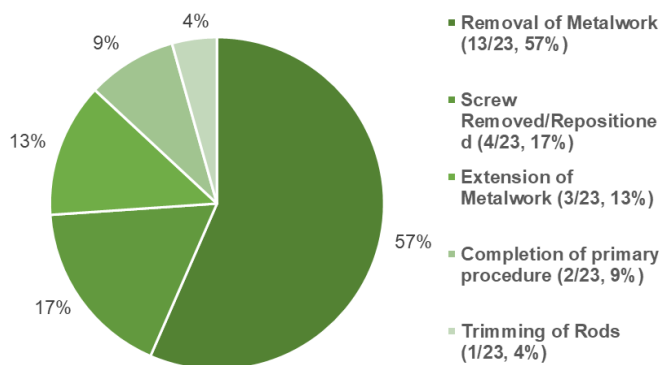


Figure 2: Pie chart representing the proportion of different revisional procedures carried out

Conclusion

Overall, this study demonstrates that intraoperative image intensification alone reduces the average number of malpositioned screws per patient from 2.5 to 1.7. The addition of MySpine® guides further reduces this average to 0.75. These findings hold significance for guiding surgical techniques in order to reduce screw malplacement as it demonstrates that the use of surgical guides combined with intraoperative II is an effective method. Special thanks to Mr McCarthy, Mr James for supporting the creation of this project.