Increase in Harmful Radiation in Patients Undergoing CT-based Navigation for Pedicle Screw Insertion

Vishal Sarwahi¹, Katherine Eigo¹, Effat Rahman¹, Sayyida Hasan, Keshin Visahan, Junho Song², Yungtai Lo³, Terry David Amaral¹

¹Cohen Children's Medical Center, ²Mount Sinai Hospital, ³Albert Einstein College of Medicine

INTRODUCTION: In the past, pedicle screw insertion has been done using a freehand technique or fluoroscopy guidance. Recently, intraoperative CT-based navigation has been implemented to enhance the visualization of pedicle screw insertion, ensuring greater accuracy and safety in spine surgery. Despite the safety benefits of this new technology, it poses a risk of increased radiation exposure to the vulnerable pediatric population. METHODS:

A retrospective chart review of 564 AIS patients between 2015-2023 from a single institution was done. 61 patients were operated on with just CT-based technology (CT-nav group), 297 patients were operated on using FOFA (freehand with occasional fluoroscopic assistance), and 206 patients were operated on utilizing a hybrid, TNT (technique n' technology), approach. Patients were categorized based on the technique used during their surgery. Surgical and clinical outcomes were compared. Kruskal-Wallis tests were used for continuous variables and Chi-Squared tests were used for categorical variables.

RESULTS: There were no significant differences in demographic or radiographic variables. CT-nav and TNT had a significantly higher radiation dose when compared to FOFA (p<0.001), CT-nav having the highest radiation dose at 24.2 mGy, while FOFA was at a dose of 2.3 mGy. CT-nav and FOFA groups had similar time under radiation, TNT having significantly less time under radiation at 18.4s. Operative time in the CT-nav group was significantly higher than the other two groups, taking 291.0 minutes to complete surgery (p<0.001).

DISCUSSION AND CONCLUSION: New medical technology brings both advantages and disadvantages. In this instance, CT-based technology can boost surgeons' confidence in screw placement, leading to safer and more accurate procedures. However, the increased radiation exposure and extended operative time can be harmful to adolescents. Adopting a hybrid approach can help mitigate these effects and provide benefits to the patient.