Freehand C2 Pedicle Screw Placement by Neurosurgical Trainees

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Introduction

Freehand C2 instrumentation is technically challenging with a learning curve due to its unique anatomy. This study evaluated the accuracy of C2 pedicle screws placed freehand by neurosurgical residents.

Methods

We retrospectively reviewed all patients at LAC+USC Medical Center undergoing C2 pedicle screw placement using the freehand technique from June 2016 to March 2017 by neurosurgical residents. Measurements of C2 were obtained from preoperative CT scans, and breach rates were determined from coronal reconstructions on postoperative CT scans. Severity of breaches reflected percentage of screw diameter beyond the cortical edge (I = < 25%; II = 26–50%; III = 51–75%; IV = 76–100%).

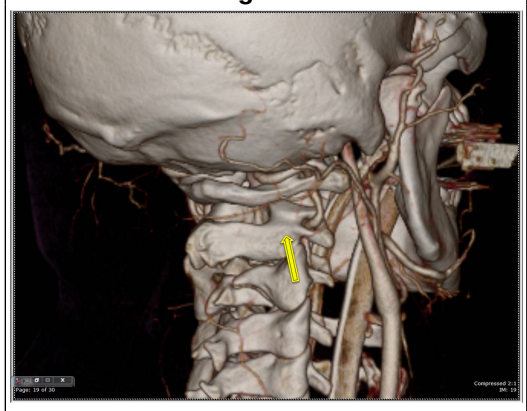
Results

There were 29 C2 pedicle screws inserted in 18 consecutive patients by neurosurgical residents. All screws were placed by or under the guidance of M.H.P. who is a PGY-7 with attending staff privileges, with a PGY-2 to PGY-4 resident assistant. We found an average axial pedicle diameter of 5.7 mm, axial angle of 43.2 degrees, sagittal angle of 24.4 degrees, and spinal canal diameter of 25.0 mm. Average screw length was 26.6 mm with a screw diameter of 3.5 mm or 4.0 mm. There were 6 total breaches (20.7%), of which 4 were superior (13.8%) and 2 were lateral (6.9%). There were no medial breaches. The breaches were classified as I in 2 cases (33.3%), II in 3 cases (50.0%), III in 1 case (16.7%), and IV in no cases. There were no clinical sequelae due to these breaches.

Conclusions

Freehand placement of C2 pedicle screws can be done safely by neurosurgical residents in early training. When breaches occurred, they tended to be superior in location related to screw length choice, and were not clinically significant. Controlled exposure to this unique anatomy is especially pertinent in the era of work hour restrictions.

Figure 1



Starting point showing the lateral to medial trajectory of the freehand pedicle screw.

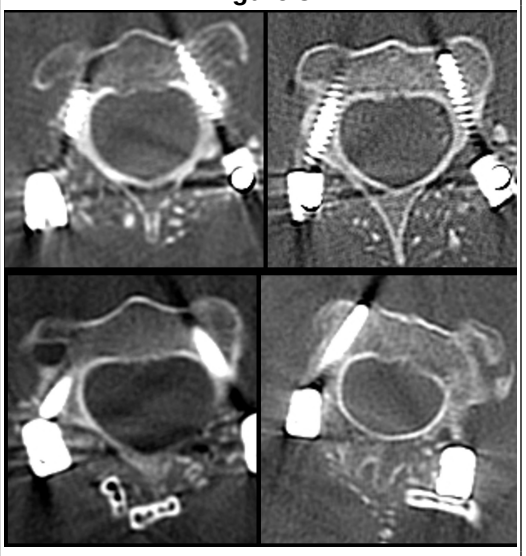
Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the importance of C2 pedicle screw placement, 2) Discuss the accuracy of C2 pedicle screw placement by neurosurgical residents 3) Identify the most common location of screw breaches in this study.

Figure 2

Axial and sagittal CT scan demonstrating freehand C2 pedicle screw placement.

Figure 3



Postoperative CT scans demonstrating freehand C2 pedicle screw placement