

A stati dress de fering et de Section et Spine Summit 2016 Constati de Section et al Proposition Constation C

Randall Hlubek MD; Michael Bohl MD; Clinton David Morgan MD; Tyler Scott Cole MD; Jay D. Turner MD, PhD; Udaya K.

Kakarla MD

[Institution]

Add Logo

Click To

## Introduction

C2 pedicle and pars screws require accurate placement to avoid injury to the nearby neurovascular structures. Freehand, fluoroscopically guided, and CT-based navigation techniques have been described in the literature. The purpose of this study is to compare the safety and accuracy of freehand versus navigated technique for c2 pedicle/pars screw placement.

#### Methods

Retrospective review of consecutive patients treated with posterior fixation constructs containing C2 pars or pedicle screws placed by spine surgeons from 2010 to 2016 at Barrow Neurological Institute. Basic demographic data, intraoperative and postoperative complications, screw diameter and length, method of screw placement (freehand vs. navigated), and incidence of stroke and all-cause mortality within 30 days of the operation were recorded. Accuracy of screw placement was assessed in those patients with intraoperative/postoperative CT imaging available. Screw accuracy was graded independently by two reviewers according to the following criteria: Grade A (no breach of the cortical surfaces), grade B-E (breach with transverse foramen obstruction of 1-25%, 26-50%, 51-75%, 76-100% respectively), Grade M

# Results

A total of 426 c2 pedicle or pars screws (312 freehand, 114 navigated) were placed in 220 patients. Three vertebral artery injuries (2 freehand, 1 navigated; p=1), 5 deaths (4 freehand, 1 navigated; p=1), and 1 stroke in the navigated group (p=.6) occurred. CT imaging was available for accuracy grading of 182 screws (131 freehand, 51 navigated). No breaches (Grade A) occurred in 86% of the freehand screws and 67% of the navigated screws (p=.023). More screws had acceptable placement in the freehand group (94%) than the navigated group (82%) (p=.023).

### Conclusions

Freehand is significantly more accurate than CT- based navigation for c2 pedicle/pars screw placement. There was no difference in complication rate between the two techniques.

### Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the technique for freehand and navigated placement of c2 pedicle and pars screws. 2)Understand the limitations of CTbased navigation in the cervical spine 3) Understand the importance of direct visualization of the pedicle during c2 screw placement.

#### References

1. Du JY, Aichmair A, Kueper J, Wright T, Lebl DR. Biomechanical analysis of screw constructs for antlantoaxial fixation in cadavers: a systematic review. J Neurosurg Spine 22:151-161, 2015

2. Paramore CG, Dickman CA, Sonntag VK. The anatomical suitability of the C1–2 complex for transarticular screw fixation. J Neurosurg 85: 221–224, 1996

3. Mueller CA, Roesseler L, Podlogar M, Kovacs A, Kristof RA. Accuracy and complications of transpedicular C2 screw placement without the use of spinal navigation. Eur Spine J. 19: 809-814, 2010

4. Ondra SL, Marzouk S, Ganju A, Morrison T, Koski T. Safety and efficacy of C2 pedicle screws placed with anatomic and lateral C-arm guidance. Spine (Phila Pa 1976) 31: E263-267, 2006

5. Mason A, Paulsen R, Babuska JM, Rajpal S, Burneikiene S, Nelson EL, Villavicencio AT. The accuracy of pedicle screw placement using intraoperative image guidance systems. J Neurosurg Spine 20: 196-203, 2014

6. Ishikawa Y, Kanemura T, Yoshida G, Matsumoto A, Ito Z, Tauchi R, et al: Intraoperative, full-rotation, threedimensional image (O-arm)-based navigation system for cervical pedicle screw insertion. Clinical article, J Neurosurg Spine 15: 472–478, 2011

7. Ebraheim NA, Fow J, Xu R, et al. The location of the pedicle and pars interarticularis in the axis. Spine (Phila Pa 1976) 26: E34–37, 2001

8. Hoh DJ, Maya M, Jung A, et al. Anatomical