



A Prospective Multicenter Registry on Clinical Value of the O-arm® Imaging System and StealthStation®

Navigation for Improving the Rate of Correct Thoraco-lumbar Pedicle Screw Placement

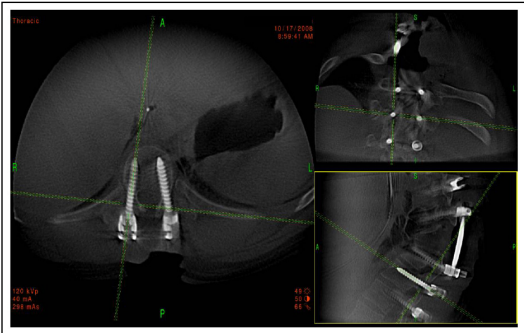
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Introduction

The reported accuracy of pedicle screw placement varies according to the used imaging technique. (1) Anteroposterior and lateral fluoroscopy results in up to 40% of misplaced screws. Intra-operative spinal navigation techniques, seems to reduce pedicle screw. The combination of intra-operative CT-scan (O-arm) and navigation technology may increase accurate pedicle screw placement.

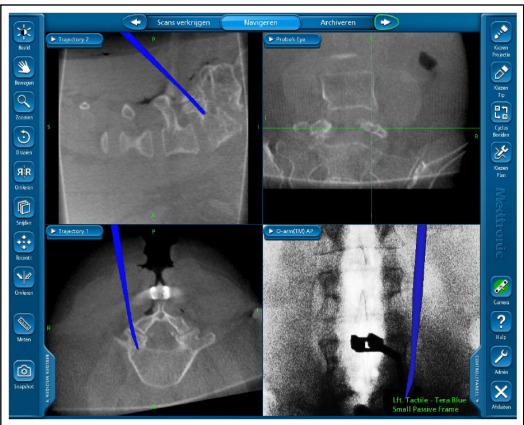
O-arm imaging system and StealthStation navigation



Second scan with O-arm to verify screw position

Methods

Patients planned for instrumented spinal surgery were operated using the combination of O arm® imaging device and Stealth station (Medtronic) as navigation tool. All pedicle screw insertions were evaluated by a validated method. (2) The accuracy of pedicle screw placement based on the intra-operative 3D scan, and the surgeon’s perception of correct screw placement by blunt probing were assessed, as well as the irradiation doses for the patient.



Navigation screen after first O-arm scan. 3-D imaging of the spine in sagittal, axial and coronal plane with pedicle finder in the right L5 pedicle

Results

During a 16 months period, a total of 1922 thoracic (n=180), lumbar (n=1510) and sacral (n= 230) pedicle screws in 353 patients were evaluated. In 97.5 %, the screws were correctly placed. Only 2.5% of the screws were considered as misplaced, and 1.8% of the screws were revised during the same procedure. When the surgeon perceived the screws to be correctly placed by blunt track probing, the CT scan found this to be true in 98.5% of the cases. On average the irradiation dose was 10.6 ± 14.0 mGy in two dimensional mode and 203.1 ± 279.3 mAs in three dimensional mode.

Conclusions

The use of the O-arm in combination with the Stealth navigation system increases the rate of correct pedicle screw placement in. The surgeon’s perception of correct pedicle screw placement was confirmed by the 3D scan. The radiation dose a patient receives during one 3D scan is about half the dose of a 64 multi-slice CT scan of the same body region. Therefore the value of the additional scan before closing should be carefully evaluated.(3)

Learning Objectives

By the end of this session participants should be able:

- 1) understand that different imaging and navigation techniques are usefull tools for accurate pedicle placement
- 2) The CT-scan of the inserted pedicle screw is the ultimate control
- 3) Intra operative CT-scan before wound closure allows adjustment of the screw in the same session
- 4) When the surgeon feels confident about the correct screw placement the additional patient exposure to irradiation is not justified.

References

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2)Abul-Kasim K, Ohlin A, Strombeck A, Maly P, Sundgren PC. Radiological and clinical outcome of screw placement in adolescent idiopathic scoliosis: evaluation with low-dose computed tomography. Eur Spine J. 2010;19:96-104

3)Zhang J, Weir V, Fajardo L, Lin J, Hsiung H, Ritenour ER. Dosimetric characterization of a cone-beam O-arm imaging system. J Xray Sci Technol. 2009;17:305-317.