Safety of reconstruction of complex cervical spine pathology using pedicle screws inserted with navigation

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Disclosures

- Theologis
  - OREF

- Burch
  - Medtronic

Cervical Spine Stabilization

Interspinous wiring
Facet wiring
Interlaminar clamps
Lateral mass screws

Adequate Fixation?

Chin-on-chest deformity
Facet fracture/dislocation
Spondyloarthropathy/Osteoporosis
Cervicle Pedicle Screws

- 3-column fixation

Cervical pedicle screws vs. lateral mass screws: uniplanar fatigue analysis and residual pullout strengths
Todd L. Johnston, MD, Eldin E. Karakovic, MD, PhD, Eugene P. Laursenklager, PhD, David Marcu, BS

Complications of Pedicle Screw Fixation in Reconstructive Surgery of the Cervical Spine
Kuniyoshi Abumi, MD, Yasuhiro Shono, MD, Manabu Ito, MD, Hiroshi Taneichi, MD, Yoshihisa Kotani, MD, and Kiyoshi Kaneda, MD

Challenging Anatomy?

Placement of Pedicle Screws in the Human Cadaveric Cervical Spine
Comparative Accuracy of Three Techniques
Steven C. Ludwig, MD, David L. Kramer, MD, Richard A. Balderston, MD, Alexander R. Vaccaro, MD, Kevin F. Foley, MD, and Todd J. Albert, MD
Purpose

- Determine the safety of cervical pedicle screw placement with navigation in patients with complex cervicothoracic deformities and revision cervical spine pathology.

Methods

- Retrospective analysis
- Single surgeon
- Cervical pedicle screws inserted using O-Arm imaging and Stealth Navigation
- Accuracy:
  (Number of intra-op screw revision) / (total number of screws)
- Data
  1) Operative data (indications for surgery, concomitant surgeries, length, EBL)
  2) # cervical pedicle screws
  3) Neurovascular complications
  4) Need for revision cervical surgery
Results

- 22 patients
  - Female: 10; Male: 22
  - Average: 63 years (32-83 yrs)
- Variable pathology
  - 10 primary operations for cervicothoracic kyphosis
  - 12 revision operations
- Radiographic follow-up
  - 15 months (1.4 - 46 mos).

<table>
<thead>
<tr>
<th>Cervical Level</th>
<th># Screws</th>
<th>Percentage of total screws</th>
<th># (%) of misplacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>C2</td>
<td>4</td>
<td>3.2</td>
<td>0</td>
</tr>
<tr>
<td>C3</td>
<td>20</td>
<td>16.1</td>
<td>0</td>
</tr>
<tr>
<td>C4</td>
<td>22</td>
<td>17.8</td>
<td>3 (2.4%)</td>
</tr>
<tr>
<td>C5</td>
<td>25</td>
<td>18.5</td>
<td>1 (0.8%)</td>
</tr>
<tr>
<td>C6</td>
<td>18</td>
<td>14.5</td>
<td>0</td>
</tr>
<tr>
<td>C7</td>
<td>37</td>
<td>29.8</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>124</td>
<td>100</td>
<td>4</td>
</tr>
</tbody>
</table>

- Accuracy: 96.8%
- No neurovascular complications
- 3 revisions:
  - C8 radiculopathy due to iatrogenic foraminal stenosis (reduction of kyphotic deformity), revision C1-3 PCF to improve chin-brow angle
  - No revisions for deformity progression or implant failure or malposition.

Conclusions

- In this study, placement of cervical pedicle screws using O-Arm imaging and Stealth Navigation is safe, accurate, and effective method for posterior stabilization in cervicothoracic deformity and revision operations of the cervical spine
References


Alamri K, Kandala M, Sklair M. One-stage posterior decompression and reconstruction of the cervical spine by using pedicle screw fixation systems. Birmingham, AL: Birmingham Spine Institute; 2999.


A Novel Patient-Specific Navigational Template for Cervical Pedicle Screw Placement

Song JH, MD, MD; Park J, MD, MS, MD; Baek K, MD, MS, MD; Yang J, MD, MS, MD; Kim H, MD, MS, MD; Jeon J, MD, MS, MD; Kwon E, MD, MS, MD; Oh Y, MD, MS, MD; and Park J, MD, MS, MD;