

Management of atlantoaxial instability with C1-2 fusion with Harms technique and intra-operative Iso-C3D imaging

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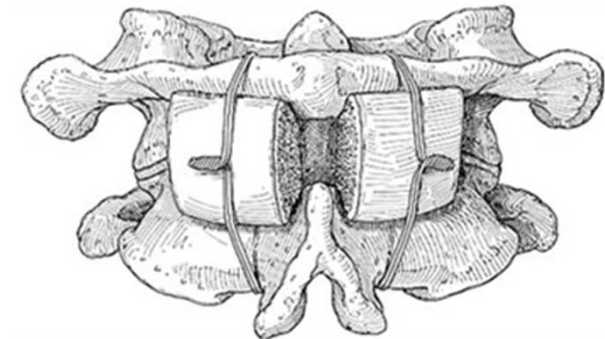
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Introduction I

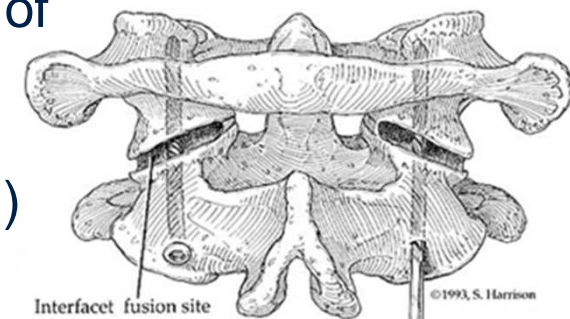


- atlantoaxial region due to unique anatomy and biomechanical properties surgically challenging
- posterior stabilization techniques with wires
 - ➔ neurological risk
 - ➔ nonunion rates of 50 %



Ronald Schulz, MD,* Nicolás Macchiavello, MD,* Elias Fernández,† Xabier Carredano, MD,‡ Osvaldo Garrido, MD,‡ Jorge Diaz, MD, § and Robert P. Melcher, MD,¶ Harms C1–C2 Instrumentation Technique. SPINE Volume 36, Number 12, pp 945–950

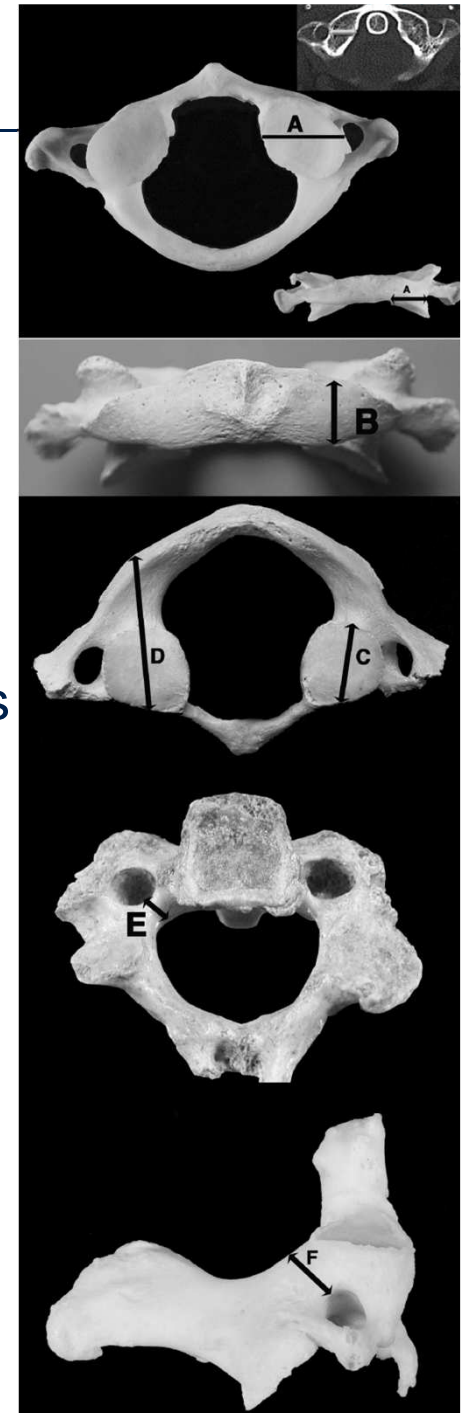
- addition of Magerl's technique improved stability of the construct and fusion rates
 - ➔ high risk of vertebral artery injury (18 %)
 - ➔ indirect reduction of C1-C2



Magerl F, Seemann P. Stable Posterior Fusion of the Atlas and Axis by Transarticular Screw Fixation. ed. In: Kehr P, Weidner A (ed). Cervical Spine I. New York, Wien: Springer, 1990:222-7

Introduction I

- technique published by Harms has addressed many of the problems
 - ➔ intraoperative reduction possible
 - ➔ preservation of atlantoaxial joints
 - ➔ screw positioning in anatomical difficult situations possible
- F. Kandziara¹ · K. Schnake¹ · R. Hoffmann Surgical procedures to stabilize the upper cervical spine . Unfallchirurg 2010 · 113:845–859
- ➔ due to proximity to the spinal cord, thin C2 pedicles and variable vertebral artery surgically demanding
 - ➔ navigation infrequently possible





- description of fixation technique and treatment results of the C1 / 2 fusions with HARMS technique
- assess intraoperative Iso-C3D imaging

Methods I



retrospective study:

- 01/2003 – 12/2010, n = 25 patients (♀ : ♂ = 4 : 21, age: 57 years +/- 23)

etiology:

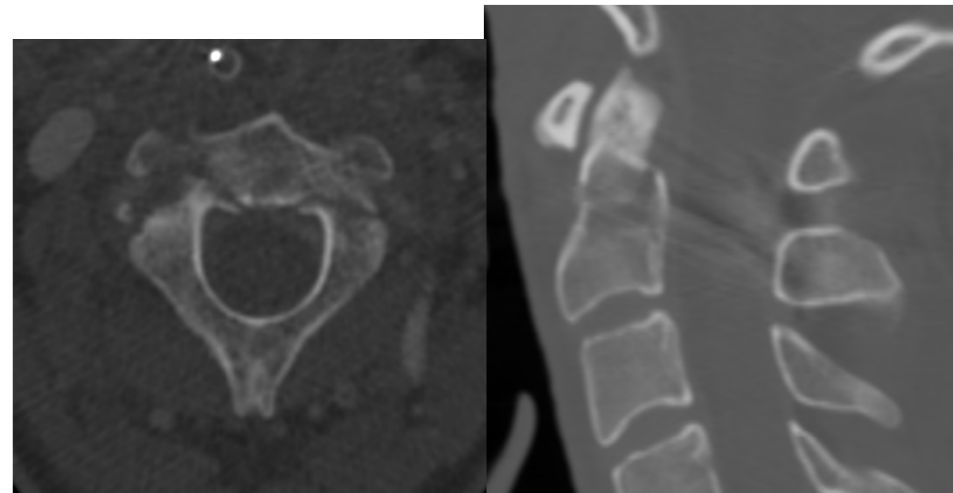
- fractures (n = 18)

fracture type	n
C1 (dislocated Jefferson fracture)	2
C2 (Anderson 2/ 3, Benzel 2)	12
combined C1/2 combined C2/3	4

- tumor destruction C1/ 2 (n = 2)

- Os odontoideum (n = 3)

- ligament instabilities (n = 2)



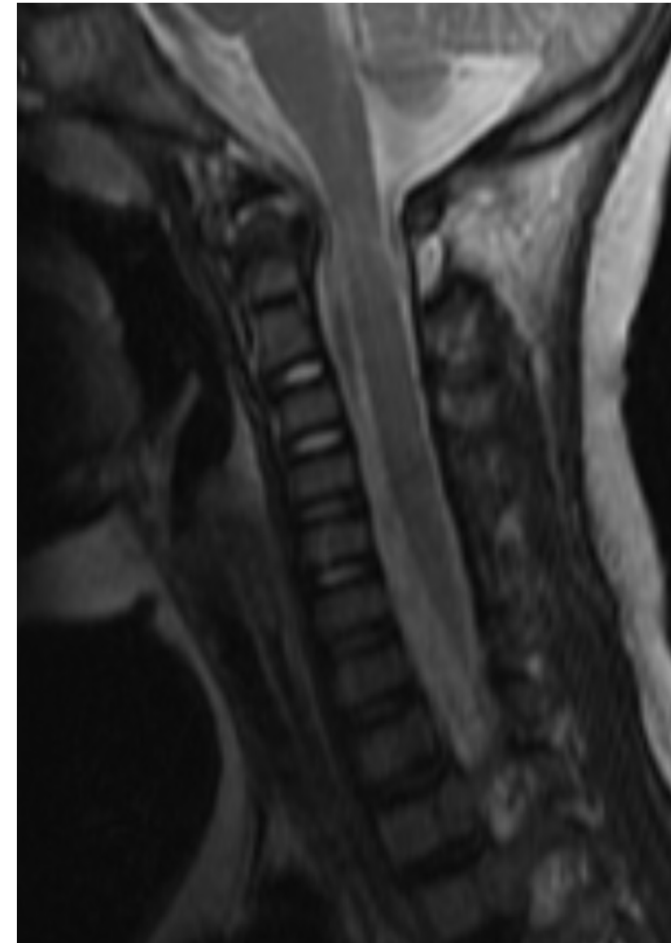


preoperative neurological status:

- 7 patients with cervical myelopathy
- 2 patients with complete spinal cord injury

investigations:

- X ray, CT scan, MRI, PET-CT





stabilisation:

- all patients received fusion in a Harms technique
- on both sides
- C1 Massa lateralis screws : - bicortical 3,5 mm polyaxial screws
- without navigation
- C2 transpedicular screws
- overall: 50 screws C1/2
- extended to C0/ C3 or C4 in 7 patients
- laminectomy of C1 in 2 cases
- intraoperative Iso-C 3 D image control





postoperative evaluation with CT scan:

- accuracy of Massa lat./ transpedicular screws in C1/C2 recorded after Gertzbein & Robbins

GRGr 1	perfectly within the pedicle
GRGr 2	perforating the pedicle wall by less than 2 mm
GRGr 3	perforating the pedicle wall by more than 2 mm, but less than 4 mm
GRGr 4	perforating the pedicle wall by more than 4 mm, but less than 6 mm
GRGr 5	perforating the pedicle wall by more than 6 mm

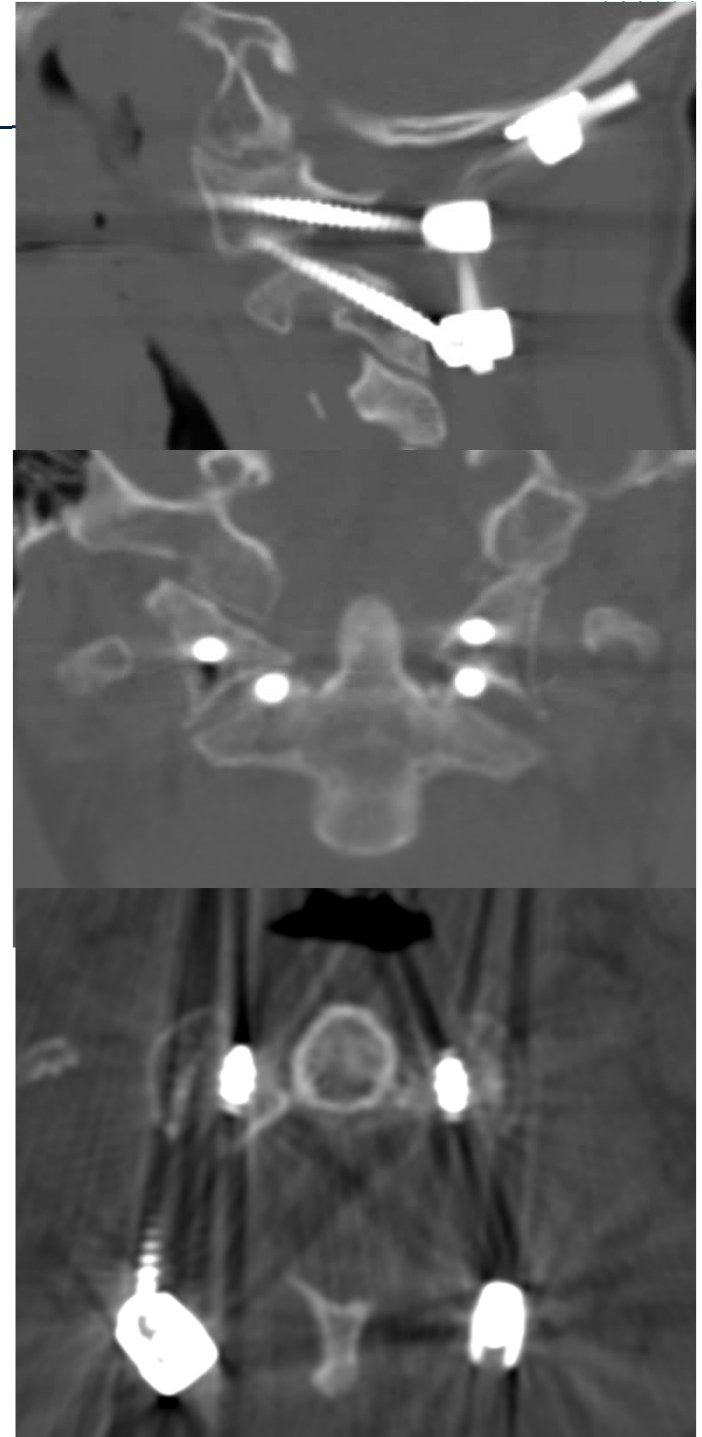
Results I



- operation time: 212 +/- 81min
- neurological outcome: all patient improved on 1 Frankel scale
- complication:
 - unilateral visual loss, n = 1
 - slight injury of the vertebral artery n = 1
 - wound infection n = 1

Results I

- Iso-C 3 D scan:
 - new positioning of C1 screws (n = 2)
- postoperative CT-scan:
 - GRGr 1-2 n = 21
 - GRGr 3 n = 2
 - GRGr 4-5 n = 0





- The C1 / 2 fusion in HARMS technique allows a sufficient stabilization of the atlantoaxial complex at C1 / 2 fracture / instability.
- Due to low risk of vertebral artery injury, protection of the C1 / 2 facets, possibility of any re-release of the C1/2-segmentes, intraoperative resetting and enlargement of the instrumentation, it represents a valid alternative to the Magerl fusion.
- Iso-C3D imaging allows reliably intraoperative visualization and correction of incorrectly positioned screws

Disclosure declaration



none of the authors
has any potential conflict of interest