

# Non Surgical management of Cervical Spine Trauma

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## Disclosure information

I have no financial relationships with commercial entities that produce health-care related products.

# Non surgical management

Goals of management of cervical fracture:

- Preservation or improvement of neurological function.
- Avoidance of collateral damage.
- Restoration of spinal alignment
- Restoration of spinal stability
- Restoration of spinal function
- Resolution of pain

# Medical treatment of cervical fracture.

- Painkillers.
- Antiinflammatory drugs.
- Antithrombotic
- Ulcus prevention.
- Antibiotics
- Immobilization

# Medical treatment of spinal cord injury.

- Maintain blood pressure > 90 mmHg
- 100 % oxygen saturation
- Early diagnosis of injury (RMN).
- Bolus of 30 mg/Kg Methylprednisolone followed by an infusion of 5,4 mg/Kg per hour for 23 hours. (Start within 8 hours after injury).
- Reduction / traction
- Surgery in case of progressive incomplete lesion.

Tabla V. Tratamiento inicial lesionado medular

1.	Mantener T sistólica > 90 mmHG
2.	Saturación O <sub>2</sub> del 100%
3.	Diagnóstico precoz de la lesión
4.	Metilprednisolona (inicial 30 mgrs / Kg) seguido infusión 5,4 mg / Kg / H 23- 48 horas.
5.	Reducción - tracción inmediata
6.	Imagen medular (RNM o TAC)
7.	Cirugía en caso de lesión incompleta y progresiva.

# Medical treatment of spinal cord injury.

- The role of steroids in acute spinal cord injury is very **controversial**.
- Potential side effects of high dose methylprednisolone: such as infections, diabetic descompensations , pancreatitis , myopathies, psychosis, and lactate acidosis in combination with intravenous adrenaline
- NASCIS (National Acute Spinal Cord Injury Study) II study
- Treatment with methylprednisolone for either 24 or 48 hours is recommended as an option... that should be undertaken only with the knowledge that the evidence suggesting harmful side effects is more consistent than any suggestion of clinical benefit.
- However, many researchers revisited this concern within the evidence-based framework of a critical appraisal of the accumulation of clinical studies and concluded that high-dose methylprednisolone cannot be justified as a standard treatment in acute spinal cord injury within current medical practice.
- We only consider high-dose methylprednisolone treatment for young patients with a monotrauma of the spine.

Bracken MB, Shepard MJ, Collins WF, Holford TR, Young W, Baskin DS, Eisenberg HM, Flamm E, Leo-Summers L, Maroon J, et al. (1990) A randomized, controlled trial of methylprednisolone or naloxone in the treatment of acute spinal-cord injury. Results of the Second National Acute Spinal Cord Injury Study. N Engl J Med 322:1405–11  
Short D (2001) Is the role of steroids in acute spinal cord injury now resolved? Curr Opin Neurol 14:759–63

# Non surgical management: immobilization

- In the initial stage, as a temporally treatment.
- Later on as an adjunct to surgery.
- As the definitive treatment.
- **Cervical brace** (four categories)
  - **Soft collars**: provides minimal motion restriction.
  - **Rigid collars**: Philadelphia, Aspen, Miami, etc
  - **Poster braces** (connection to the torso by two or four metal struts) and **cervicothoracic orthoses**: SOMI
  - **Minerva cervical brace**.
- **Cast**: uncomfortable for the patient.
- **Traction**.
- **Halo immobilization** (cast, jacket or pelvic).

Johnson RM, Hart DL, Simmons EF, Ramsby GR, Southwick WO (1977) Cervical orthoses. J Bone Joint Surg (Am) 59-A:3

## Rigid collar: Philadelphia collar

- The Philadelphia collar is a two-piece semirigid orthosis made of Plazote, reinforced with anterior and posterior plastic struts.
- The **Philadelphia collar** has been shown to control neck motion, especially in the flexion/extension.
- Restriction in flexion/extension is 71%, lateral bending 34%, and axial rotation 56% (1).
- Disadvantages of the Philadelphia collar are the lack of control for flexion/extension control in the upper cervical region and lateral bending and axial rotation.
- Further, the Philadelphia collar was shown to elicit increased occipital pressure, which may result in scalp ulcers, particularly in elderly or comatose patients.
- **Indications:** can be used to treat stable cervical fractures, or in the postoperative period. In the absence of both neurological abnormality and compression to neural structures observed in CT/MRI, treatment with the Philadelphia collar alone is safe, cost-effective and easily applicable for many cases of upper **cervical** injury (2).



1. Podolsky S, Baraff LJ, Simon RR, Hoffman JR, Larmon B, Ablon W (1983) Efficacy of cervical spine immobilization methods. J Trauma 23:461–5.

2. Cosan, T.E.; Tel, E.; Arslantas, A.; Vural, M.; Gunter. Indications of Philadelphia collar in the treatment of upper cervical injuries., A.I. European Journal of Emergency Medicine. 8(1):33-37, March 2001.



# Cervicothoracic orthoses: Sternal-Occipital-Mandibular-Immobilizer (SOMI)

- By incorporating the upper torso into the construct, these braces limit the amount of pivoting compared with a conventional collar
- Adjustability to immobilizes head in prescribed position
- Dorsal section allows patient to lie flat
- Chin support is easily removed as needed (for eating, i.e.)
- Ease of fitting in supine position ensures minimal disturbance.
- Cervical flexion is limited by 93%, Lateral bending is limited by 66% and Rotation is limited by 66%
- Extension is limited only 42%: The SOMI controls extension less effectively than do other orthoses.
- Compared with cervical collars, a cervicothoracic orthosis provides better restriction of motion of the mid and low-cervical spine (C5-C7).
- **Indications:** can be indicated in relatively stable injuries to the lower cervical spine or in the treatment of cervicothoracic injuries, or postoperatively in patients with a questionable fixation.



Rev Spine. 2018;15(1):1-10. Epub 2018.01.01.  
DOI: 10.1051/revspine/2018150101

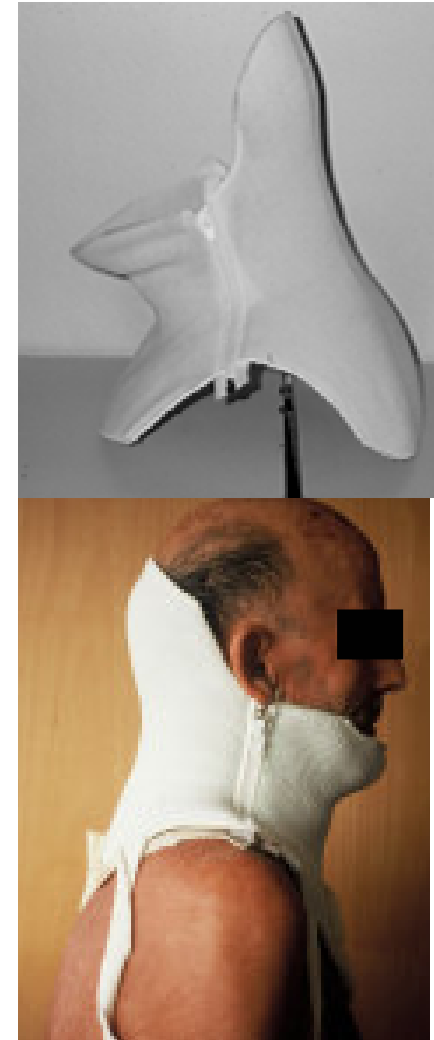
REVIEW ARTICLE

Role of conservative treatment of cervical spine injuries

Philippe Lemaire

# Minerva cervical brace

- A Minerva cervical brace is a cervicothoracic orthosis with mandibular, occipital, and forehead contact points.
- Modern adaptations of the Minerva exist, incorporating a plastic vest with liner to a mandibular support and an extension to the posterior aspect of the head.
- Radiological evaluation showed the Minerva cervical brace to limit flexion/extension in 79%, lateral bending in 51%, and axial rotation in 88% of cases.
- This brace provides adequate immobilization between C1 and C7, with less rigid immobilization of the occipital-C1 junction.
- The addition of the forehead strap and occipital flare assists in immobilizing C1–C2 .
- It restricts up to 75% of flexion–extension at C1–C2.



Sharpe KP, Rao S, Ziogas A (1995) Evaluation of the effectiveness of the Minerva cervicothoracic orthosis. Spine 20:1475–9

# Minerva cervical brace

- We prefer a customized Minerva castmade of a **Scotch** cast, which can be individually molded and provides a reliable fixation which the patient cannot simply take off
- the use of thermoplastic materials and custom-made braces further enhances comfort, compliance and will thus better meet the ultimate goal of brace treatment.
- **Indications:** orthosis of choice when rigid immobilization is required of an unstable cervical spine injury. Stable fractures in C1-C2 segment.

Rev Spine J 1995; 5: 1475-9

REVIEW ARTICLE

Role of conservative treatment of cervical spine injuries

Philippe Lemaire

Sharpe KP, Rao S, Ziogas A (1995) Evaluation of the effectiveness of the Minerva cervicothoracic orthosis. Spine 20:1475–9



# Cervical braces

SPINE Volume 32, Number 1, pp E1-E6  
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## Reduction in Head and Intervertebral Motion Provided by 7 Contemporary Cervical Orthoses in 45 Individuals

Adam M. Schneider, MD, John A. Hipp, PhD, Lyndon Nguyen, MS, and Charles A. Paitman, MD

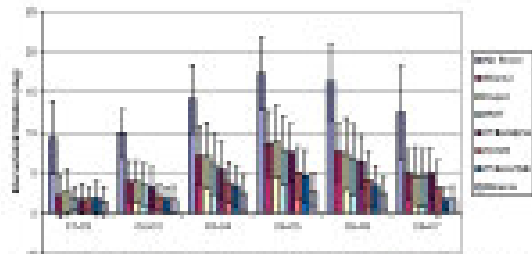


Figure 4. Sagittal plane intervertebral rotation by level and brace. The error bars show one standard deviation, deg indicates degrees.

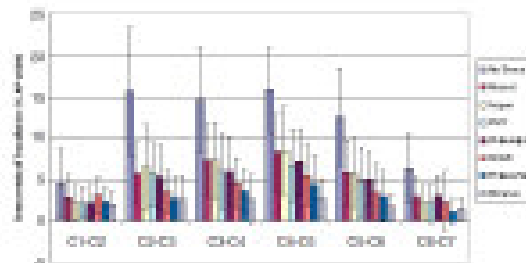


Figure 5. Sagittal plane intervertebral translation by level and brace. The error bars show one standard deviation. AP indicates anteroposterior.

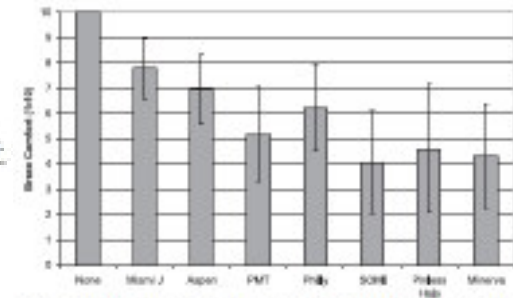


Figure 2. Mean brace comfort score for the different braces. The error bars show one standard deviation. The significance of any differences between any 2 types of braces is provided in Table 2. Philly indicates Philadelphia.

- cervical collars were more comfortable than the cervicothoracic orthoses.
- all cervical braces significantly reduced overall sagittal plane flexion/extension motion of the head, as well as axial rotation and coronal plane side-to-side bending ( $P < 0.0001$ ).
- In general, CT orthosis reduces motion more than C orthoses



Philadelphia collar



Aspen cervical collar



PMT cervical collar



Miami J cervical collar



Lerman noninvasive halo



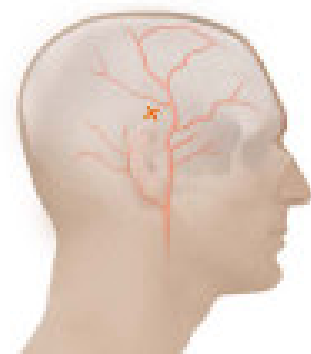
Sternal-Occipital-Mandibular-Immobilizer (SOMI)



# Traction (Gardner-Wells tongs or halo)

## TECHNIQUE.

- The Gardner-Wells tongs can be applied using local anesthesia.
- Trendelenburg position with shoulder straps attached to the footend of the table.
- The device should be tightened until 1 mm of the spring-loaded stylet protrudes, which corresponds to an average of 13.5 kg of compressive force.
- The average force necessary to penetrate the inner table with cadaveric specimens with the tong pin was 73 kg, indicating a large safety margin.
- Contraindicated in atlanto-occipital dislocation or complete discoligamentous injuries because of the inherent risk of rapid neurological deterioration, which can be irreversible
- The initial weight should not exceed 5–7 kg (depending on body weight) and increases incrementally (30–60 min) only after control imaging.
- After tongs application, new radiographs are mandatory
- If reduction cannot be obtained, or in cases of increasing neurologic deficit, urgent surgical intervention is necessary.



Lerman JA, Dickman CA, Haynes RJ (2001) Penetration of cranial inner table with Gardner-Wells tongs. J Spinal Disord 14:211–3

# Traction (Gardner-Wells tongs or halo)

## Indications

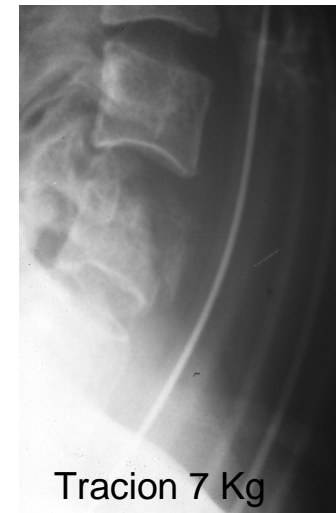
- As a temporally treatment is mainly indicated in cases of facet subluxation or dislocation, and in burst-type fractures, to stabilize and realign the cervical spine.
- Early application and attempt at reduction is advocated in patients with a spinal cord injury.
- Controversy mainly exists in those cases of a neurologically intact or cognitively impaired patient, recent literature supporting the safety of early reduction before magnetic resonance imaging (MRI) investigation
- When the patient is awake, closed reduction with skull tongs is a safe procedure, and MRI is not mandatory in this situation.
- However, if the patient has to undergo general anesthesia for a closed or open reduction, then MRI scan is absolutely indicated.
- long-term skull traction has a poor tolerance for the patient and is associated with morbidity, it can be part of a treatment plan to avoid fusion in complex fractures, considering conversion to a halo vest after a 6-week to 3-month period.

Rev Spine J (2016) 19 (Suppl 1):S23–S28  
DOI 10.1007/s00586-016-4116-4

### REVIEW ARTICLE

## Role of conservative treatment of cervical spine injuries

Philippe Laverdyne



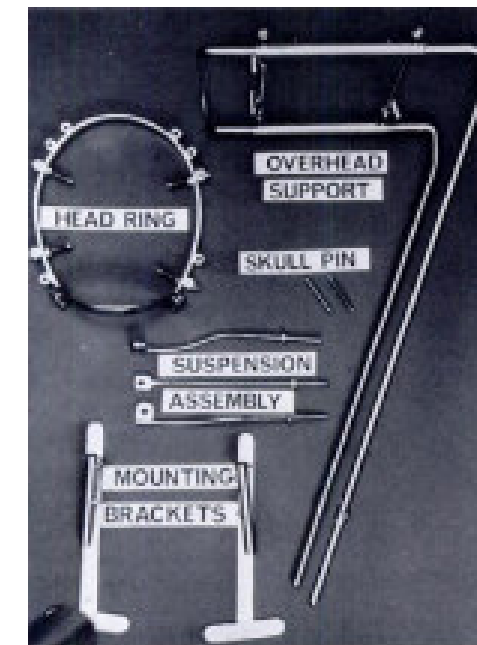
# Halo

- Frank Bloom (1943)
  - Apparatus for stabilization of facial fractures
  - “Maxillofacial surgeon”
  - World War II: treated pilots with inwardly displaced facial fractures
- Nickel (1968)
  - Similar design
  - Incomplete ring with 3 pin tiara
  - originally developed to immobilize the unstable cervical spine for surgical arthrodesis in patients with poliomyelitis.

O'Donnell,P.W.; Anavian,J.; Switzer,J.A.; Morgan,R.A. The history of the halo skeletal fixator. *Spine*, 2009, 34, 16, 1736-1739

Nickel VL, Perry J, Garrett A, HeppenstallM(1968) The halo. A spinal skeletal traction fixation device. *J Bone Joint Surg Am* 50:1400–9

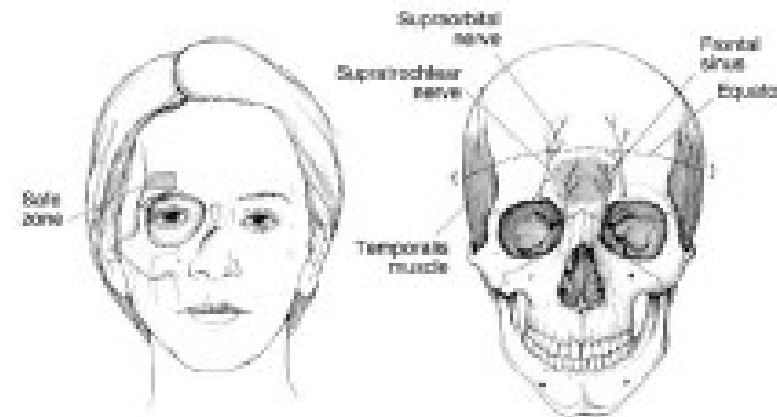
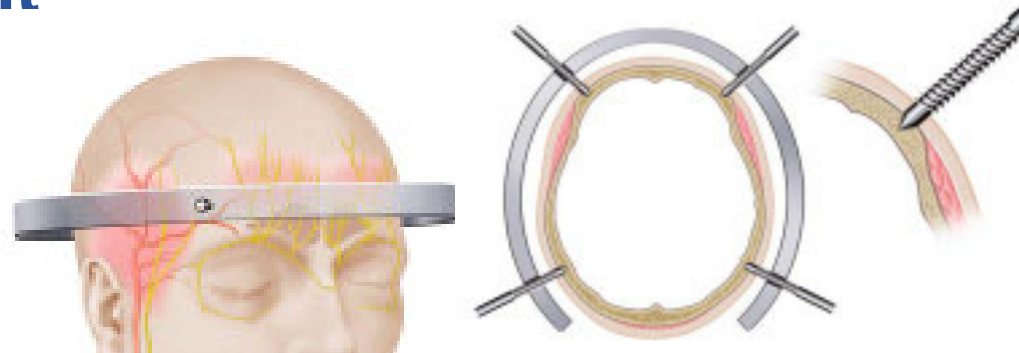
Nickel VL, Perry J, Garrett A, HeppenstallM(1989) The halo. A spinal skeletal traction fixation device. In: Nickel VL, Perry J, Garrett A, Heppenstall M, 1968. *Clin Orthop Relat Res*:4–11



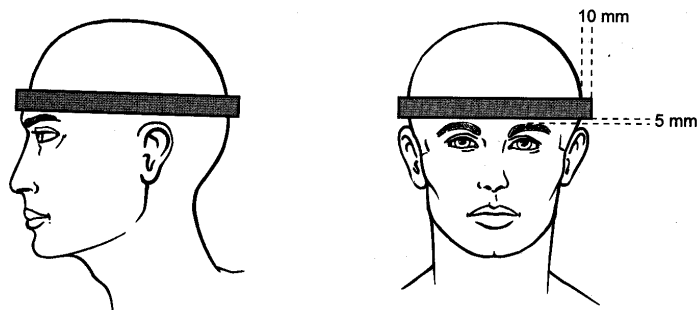


# Halo: Pin Placement

- The optimal position for anterior halo pin placement is 1 cm superior to the orbital rim(eyebrow), above the lateral two-thirds of the orbit, and below the greatest circumference of the skull. This area can be considered as a relatively “**safe zone**”
- Ring or crown size is determined by selection of a ring that provides 1–2 cm clearance around every aspect of the head perimeter



## HALO DE TRACCION

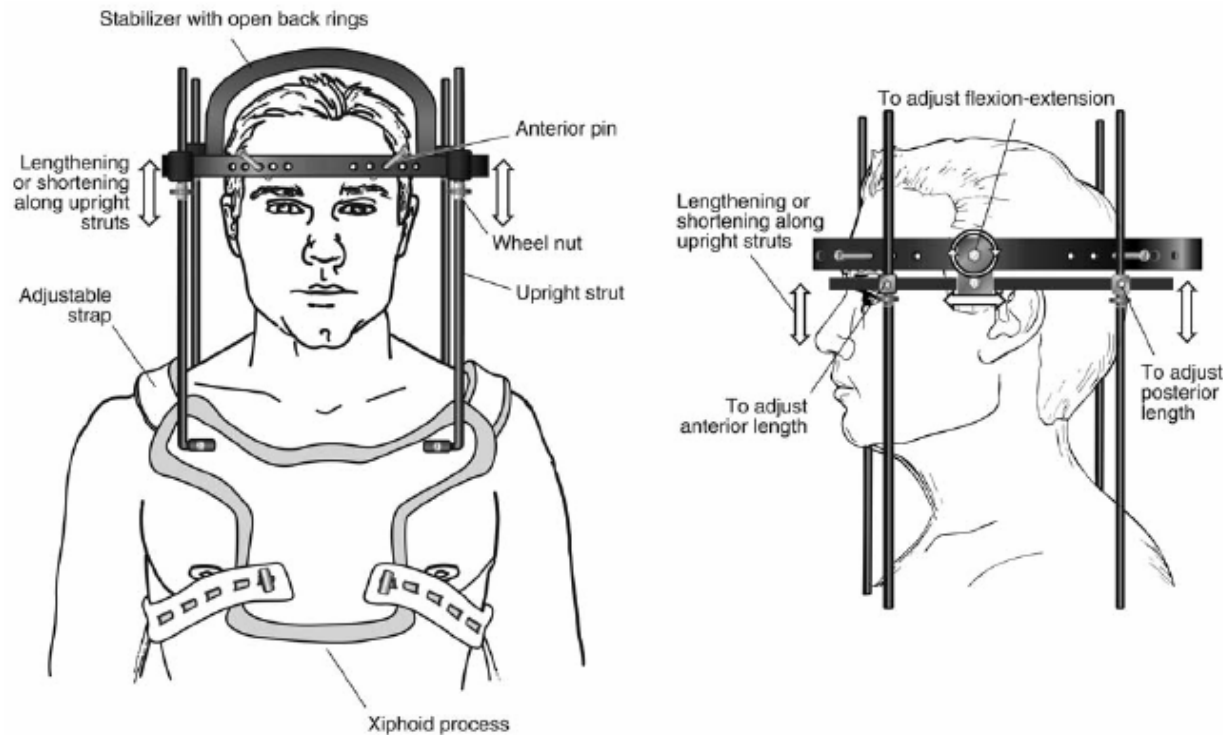


**A**, The safe zone for anterior pin insertion, an approximately 1-cm region just above the lateral one third of the orbit (eyebrow). **B**, Awareness of the safe zone avoids pin placement too far lateral within the thin temporal bone (deep to the temporalis muscle). In addition, it avoids injury to medial structures, including the supraorbital nerve, supratrochlear nerve, and frontal sinus. (Reproduced from Botte MJ, Byrne TP, Abrams RA, Garfin SR: Halo skeletal fixation: Techniques of application and prevention of complications. *J Am Acad Orthop Surg* 1996;4:44-53.)



# Halo

- The pins should be tightened sequentially in an opposite way, with increments of two in./lb, to a final torque of eight in./lb.
- The pins should be retightened once to eight in./lb 24–48 h later.
- Vest size is determined by measurement of chest circumference with a tape measure.



The halo fixator Bono,C.M. *J.Am.Acad.Orthop.Surg.*, 2007, 15, 12, 728-737

# Halo

- A halo vest is the most effective way to immobilise the cervical spine externally and is superior to braces.
- Affords control and positioning in cervical flexion, extension, tilt, and rotation as well as longitudinal distraction forces.
- It is the stiffest immobilization, restricting up to 75% of flexion–extension in the upper cervical spine.
- It also provides the best control of rotation and lateral bending.
- The use of halo vest may allow in shortening the hospital stay, and is also a relatively cheap method of treatment.
- When a vest has been applied both the supine and upright X-rays must be performed to detect eventual loss of reduction in standing or sitting position.

[Injury](#). 2010 Nov;41(11):1127-35. doi: 10.1016/j.injury.2010.09.025.

**Upper cervical spine injuries: indications and limits of the conservative management in Halo vest. A systematic review of efficacy and safety.**

[Longo UG](#), [Denaro L](#), [Campi S](#), [Maffulli N](#), [Denaro V](#).

**Author information**



# Halo

- The halo vest seems to be the first choice for conservative treatment of unstable injuries of the upper cervical spine
- Management of upper cervical spine fracture with halo fixator is safe and effective
- Drawbacks:
  - pin track problems
  - accurate fitting of the vest
  - lack of patient compliance lead to clinical failures.
  - Difficultys of intubation.
  - The mean morbidity with therapy in a halo vest is 0%– to 3.7%

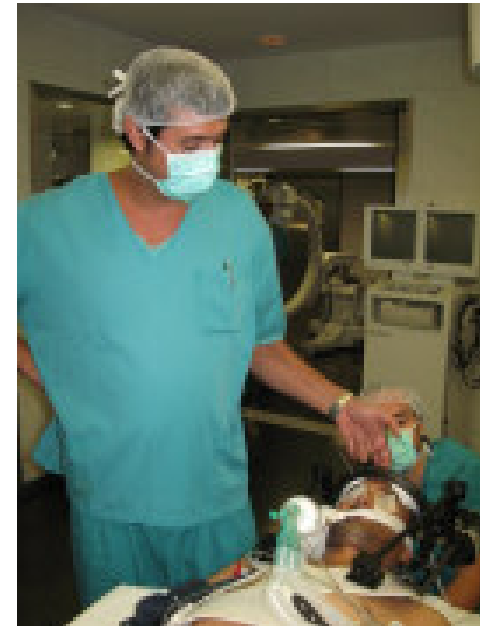
[Injury](#). 2010 Nov;41(11):1127-35. doi: 10.1016/j.injury.2010.09.025.

**Upper cervical spine injuries: indications and limits of the conservative management in Halo vest. A systematic review of efficacy and safety.**

[Longo UG](#), [Denaro L](#), [Campi S](#), [Maffulli N](#), [Denaro V](#).

**Author information**

Richter D, Latta LL, Milne EL, Varkarakis GM, Biedermann L, Ekkernkamp A, Ostermann PA (2001) The stabilizing effects of different orthoses in the intact and unstable upper cervical spine: a cadaver study. J Trauma 50:848–54



# Halo.

## Indications:

- A halo vest or jacket can be used as definitive treatment, as an adjunct to surgery, or as treatment for non-contiguous fractures.
- Upper cervical spine (C0-C2) isolated Jefferson fractures, hangman's fractures, odontoid type III and type I fractures, with a low dislocation rate
- Lower cervical Spine (C3-C7). is mainly indicated in cancellous bony injuries with limited displacement.
- The duration of treatment varies between 6 weeks and 4 months. Overall, its use is limited to the treatment of a minority of cervical fractures.

## Contraindications: is relatively contraindicated:

- In patients with severe cachexia
- in patients with severe deformity (ankylosing spondylitis or scoliosis).
- in morbid obese patients
- In the elderly
- In non-compliant or tetraplegic patients.



*Arch Orthop Trauma Surg* (2004) 128:104–111

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### ORIGINAL ARTICLE

O. Flöring · B. Schmitt

### A review of halo vest treatment of upper cervical spine injuries

ISSN 0939-6328 X Issue 11/2010  
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### Cervical Spine Trauma

Harold S. An, MD

*Injury*. 2010 Nov;41(11):1127–35. doi: 10.1016/j.injury.2010.09.025.

**Upper cervical spine injuries: indications and limits of the conservative management in Halo vest. A systematic review of efficacy and safety.**

Lonzo UG, Denaro L, Campi S, Maffulli N, Denaro V.

# Halo in Elderly

- Tashjian J. Trauma 2006
  - 78 patients, age > 65yo
  - Type II or III odontoid fractures
  - Increased early morbidity and mortality
    - Compared with treatment using operative fixation or rigid collar
- Van Middendorp JBJS 2009
  - 239 patients
  - All ages in halo
  - No increased risk of pneumonia or death in patients >65 years old



Eur Spine J (2009) 17:465–469  
DOI 10.1007/s00586-008-0883-3

ORIGINAL ARTICLE

**Evaluation of morbidity, mortality and outcome following cervical spine injuries in elderly patients**

S. A. Malik · M. Murphy · P. Connolly ·  
J. O'Dwyer

Halo vest immobilization in the elderly: a death sentence? [Majercik,S.](#); [Tashjian,R.Z.](#); [Biffl,W.L.](#); [Harrington,D.T.](#); [Cioffi,W.G.](#) *J.Trauma*, 2005, 59, 2, 350-6; discussion 356-8

Incidence of and risk factors for complications associated with halo-vest immobilization: a prospective, descriptive cohort study of 239 patients van Middendorp,J.J.; Slooff,W.B.; Nellestein,W.R.; Oner,F.C. *J.Bone Joint Surg.Am.*, 2009, 91, 1, 71-79

# Halo Immobilization: complications

Eur Spine J (2012) 21 Suppl 2:S273–S275  
DOI 10.1007/s00381-012-1100-1

## CASE REPORT

### Brain abscess and generalized seizure caused by halo pin intracranial penetration: case report and review of the literature

Emrah D. Gökdemir · Gergely Csizmadia ·  
Eduardus Molis · Christina Jermolovskienė ·  
Theodor Kravitz

Neurochirurgie, 2012 Dec;58(6):386–90. doi: 10.1016/j.neuchi.2012.06.004. Epub 2012 Sep 16.

### Acute subdural hematoma following halo pin tightening in a patient with bilateral vertebral artery dissection.

Medhkour A, Massie L, Horn M.

Eur Spine J (2012) 21 Suppl 2:S269–S271  
DOI 10.1007/s00381-012-1104-7

## CASE REPORT

### Pneumocranium secondary to halo vest pin penetration through an enlarged frontal sinus

Min Lee Cheong · Chris Yin Wei Chan ·  
Lim Hong Sze · Man Kwong Kwun

Br J Neurosurg, 2012 Aug;26(4):566–7. doi: 10.3109/02688697.2012.683464. Epub 2012 May 15.

### Pin site allergic contact dermatitis: an unusual complication of halo fixation. Pressure ulcers in cervical spine immobilisation: a retrospective analysis.

Coulter J, Lee M, Zakaria R, Barrett C.

## Author information

Hugh C. Hemmings, Jr., M.D., Ph.D., Editor  
Alan Jay Schwartz, M.D., M.S. Ed., Associate Editor

### Excessive Occipital-C1 Flexion via Halo Vest Immobilization

### Oropharyngeal Space Reduction Leading to Difficult Airway Establishment

Kenneth N. Hiller, M.D.  
Department of Anesthesiology, The University of Texas Medical School at Houston, Houston, Texas.  
kenneth.n.hiller@uth.tmc.edu

J Wound Care, 2012 Jul;21(7):323–6.

Walker J.

## Author information

Applying a halo ring and vest requires the availability of a trained team

## Conclusions. Take at home message.

- The decision-making in choosing the most appropriate treatment modality for a cervical trauma involves many considerations, including injury type, neurologic status, risk of displacement, patient's body habitus and eventual deformity, location of the fracture, and compliance.
- The choice of one modality over the other should be made on an individual basis, taking the above-mentioned factors into consideration.
- Conservative treatment still has a role as a temporally treatment or as a definitive treatment in cervical fractures.

## Excellence in Spine



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