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Flowchart for management of Cervical Spine Trauma and non surgical management

AOSpine Advanced Symposium—

Managing the complex cervical spine

Barcelona
3-4 April 2017

Guillem Saló Bru, MD, PhD

Orthopedic Department. Spine Unit. Hospital del Mar. Barcelona.
Associated Professor UAB

Goals of management of cervical fracture.

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

Methodological approach to the cervical spine injuries

Evaluation

Polytraumatic evaluation (ATLS).

The main principles of cervical evaluation are:

- Assessing and classifying the skeletal injury
- Assessing and classifying the neurological injury
- Assessing associated spinal injuries
- Identifying associated non-spinal injuries
- Establishing treatment priorities during the assessment phase.

Curr Rev Musculoskelet Med (2016) 9:496–504
DOI 10.1007/s12178-016-9377-0

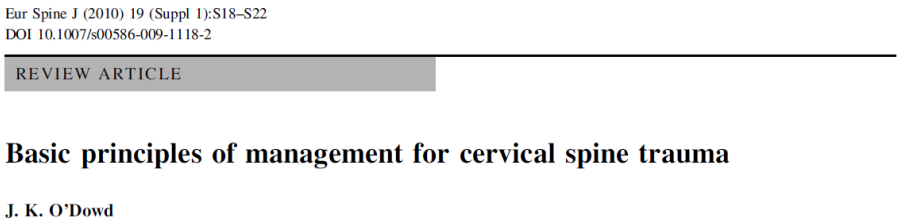
CERVICAL INJURIES AND TREATMENT (HJ KIM, SECTION EDITOR)

Subaxial cervical spine trauma

Eric Feuchtbaum[1] · Jacob Buchowski[1] · Lukas Zebala[1]

Methodological approach to the cervical spine injuries

- Spinal trauma ranges from trivial injuries requiring no interventive treatment, through to major complex, spinal cord and life threatening spinal column injuries.
- Cervical spine injury patients are divided based on the neurological involvement: patients with spinal cord injury and patients neurologically intact.
- On the other hand, patients should be also classified in stable and unstable.
- Patients with SCI will be considered as unstable in any case, and require surgical management.


Eur Spine J (2010) 19 (Suppl 1):S18–S22
DOI 10.1007/s00586-009-1118-2

REVIEW ARTICLE

Basic principles of management for cervical spine trauma

J. K. O'Dowd

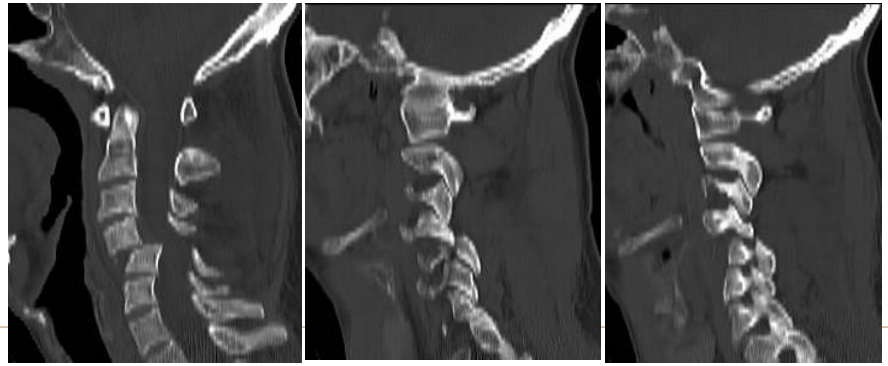
Methodological approach to the cervical spine injuries

Actions:

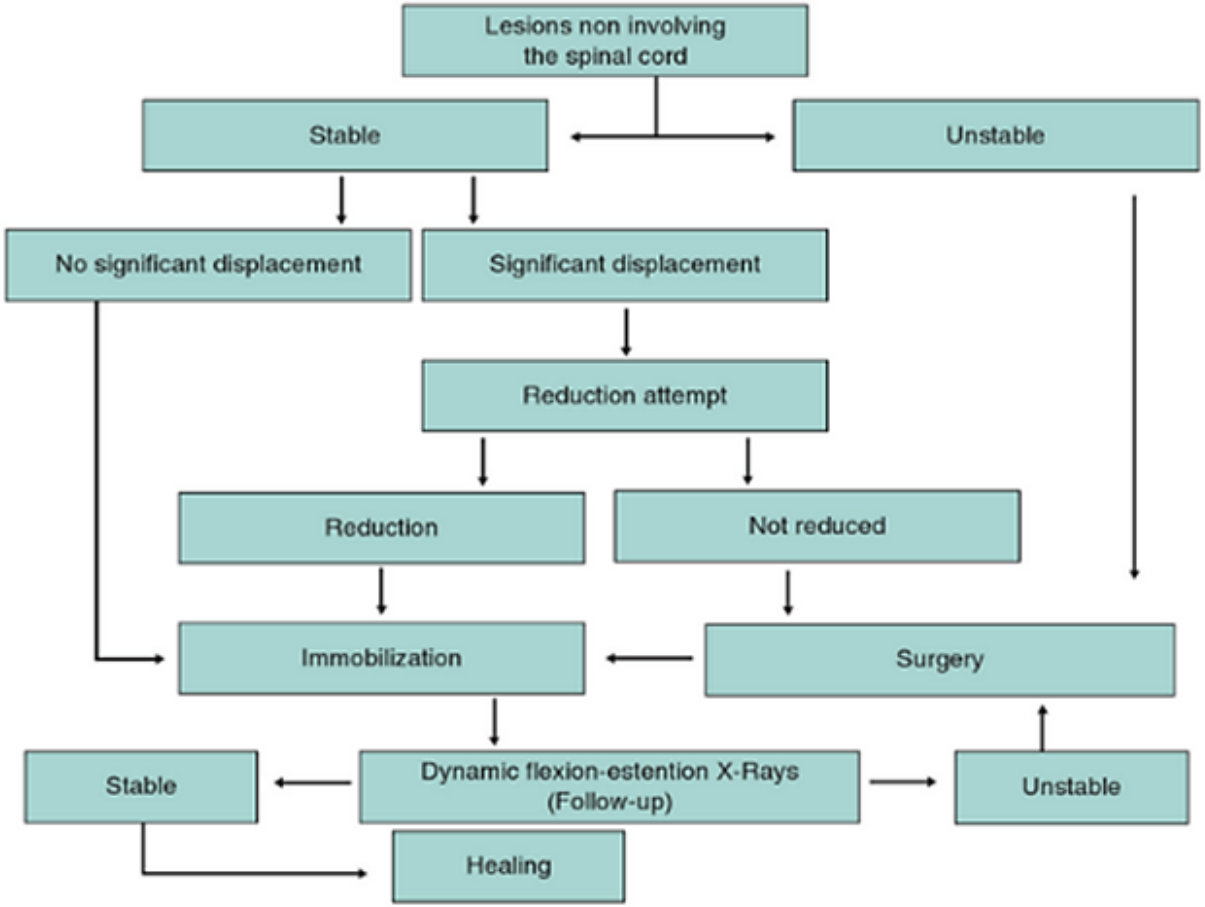
- Proper classification of the injury type
- Assessment of stability of the affected segment.
- Displacement of the cervical fracture.
- Likelihood of reduction.
- Compression of spinal cord.
- Lesion of spinal cord.

Tools.

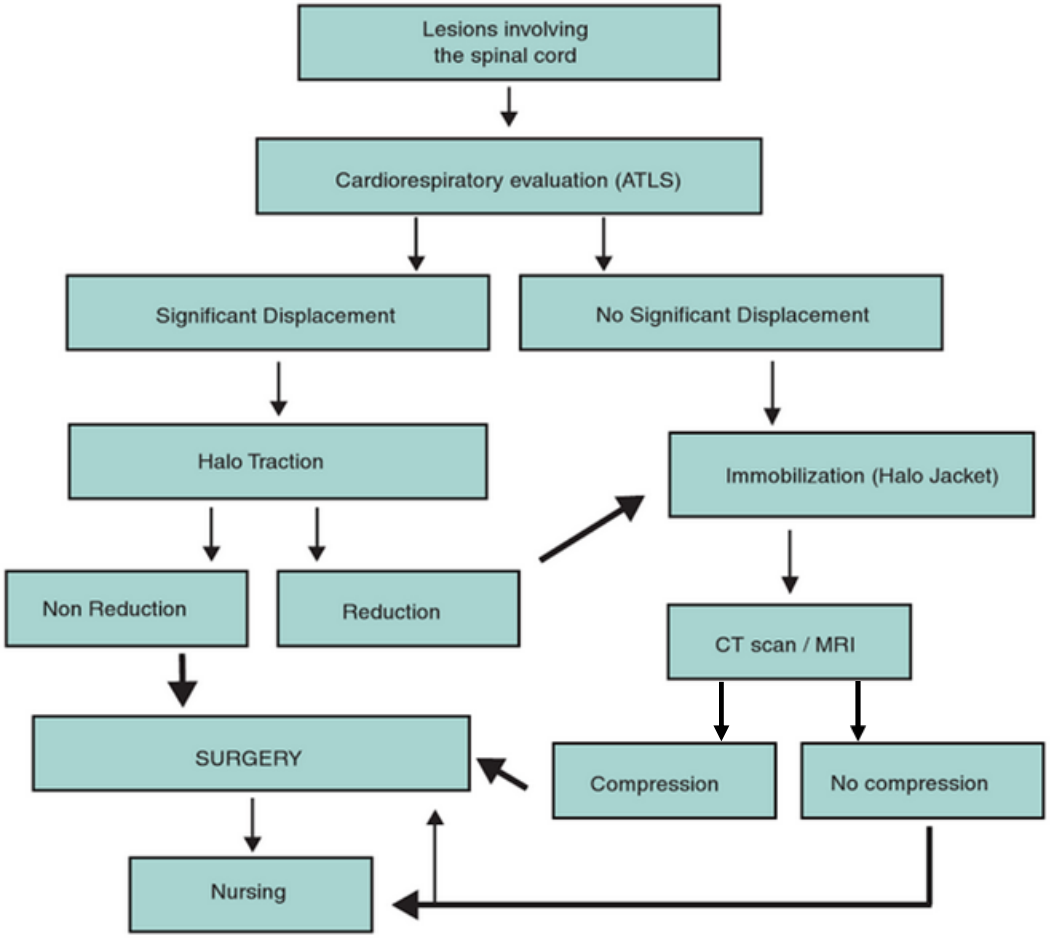
- Complete neurological evaluation.
- Standard / dynamic X-ray
- CT-Scan.
- MRI



Flowchart for management of Cervical Spine Trauma



Flowchart for management of Cervical Spine Trauma



AOSpine subaxial cervical spine injury classification

SPINE Volume 32, Number 21, pp 2365–2374

The Subaxial Cervical Spine Injury Classification System

A Novel Approach to Recognize the Importance of Morphology, Neurology, and Integrity of the Disco-Ligamentous Complex

Alexander R. Vaccaro, MD,* R. John Hulbert, MD,† Alpesh A. Patel, MD,‡ Charles Fisher, MD,§ Marcel Dvorak, MD,§ Ronald A. Lehman, Jr., MD,‖ Paul Anderson, MD,¶ James Harrop, MD,* F. C. Oner, MD, PhD,# Paul Arnold, MD,** Michael Fehlings, MD, PhD, MD,†† Rune Hedlund, MD,‡‡ Ignacio Madrazo, MD, DSc,§§ Glenn Rechtine, MD,‖‖ Bizhan Aarabi, MD,¶¶ Mike Shainline, MS,## and the Spine Trauma Study Group

Table 1. SLIC Scale

	Points
Morphology	
No abnormality	0
Compression	1
Burst	+1 = 2
Distraction (*e.g.*, facet perch, hyperextension)	3
Rotation/translation (*e.g.*, facet dislocation, unstable teardrop or advanced staged flexion compression injury)	4
Disco-ligamentous complex (DLC)	
Intact	0
Indeterminate (*e.g.*, isolated interspinous widening, MRI signal change only)	1
Disrupted (*e.g.*, widening of disc space, facet perch or dislocation)	2
Neurological status	
Intact	0
Root injury	1
Complete cord injury	2
Incomplete cord injury	3
Continuous cord compression in setting of neuro deficit (Neuro Modifier)	+1

Eur Spine J
DOI 10.1007/s00586-015-3831-3

ORIGINAL ARTICLE

AOSpine subaxial cervical spine injury classification system

Alexander R. Vaccaro · John D. Koerner · Kris E. Radcliff · F. Cumhur Oner · Maximilian Reinhold · Klaus J. Schnake · Frank Kandziora · Michael G. Fehlings · Marcel F. Dvorak · Bizhan Aarabi · Shanmuganathan Rajasekaran · Gregory D. Schroeder · Christopher K. Kepler · Luiz R. Vialle

The classification describes injury patterns based on the following four criteria: injury morphology, facet injury, neurological status, and the presence of specific modifiers.

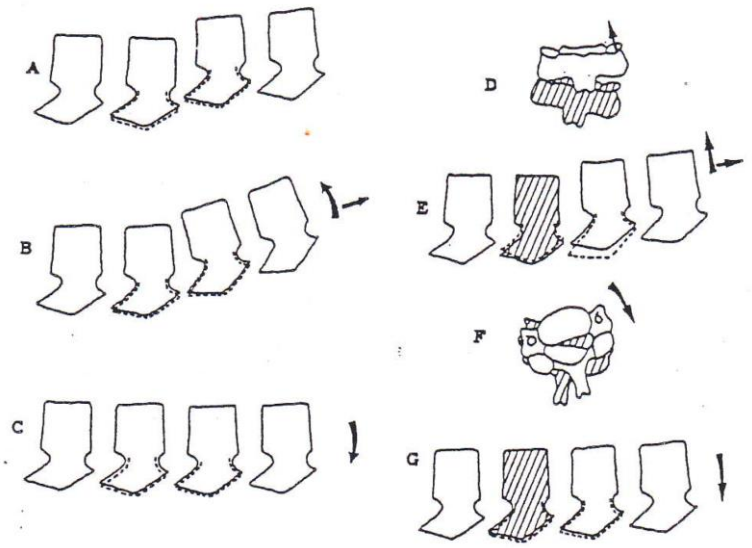
Non surgical treatment of cervical fractures.

- Pharmacological treatment: Painkillers, NSAID's, Antithrombotic, Ulcus prevention, Antibiotics
- Closed Reduction in case of displaced fractures / dislocations.
- Immobilization.
- Rehabilitation.


SPINE Volume 23, Number 8, pp 949–955
©1998, Lippincott–Raven Publishers

Reduction Technique for Uni- and Biarticular Dislocations of the Lower Cervical Spine

Jean–Marc Vital, MD, Olivier Gille, MD, Jacques Sénégas, MD, and Vincent Pointillart, MD



Bilateral Unilateral

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 cevical brace.
  - Cast: uncomfortable for the patient.
  - Traction.
  - Halo inmobilization (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 Platazote, 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, AblonW(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
- Adjustabitily 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 limitted 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.

Eur Spine J (2010) 19 (Suppl 1):S23–S26
DOI 10.1007/s00586-009-1116-4

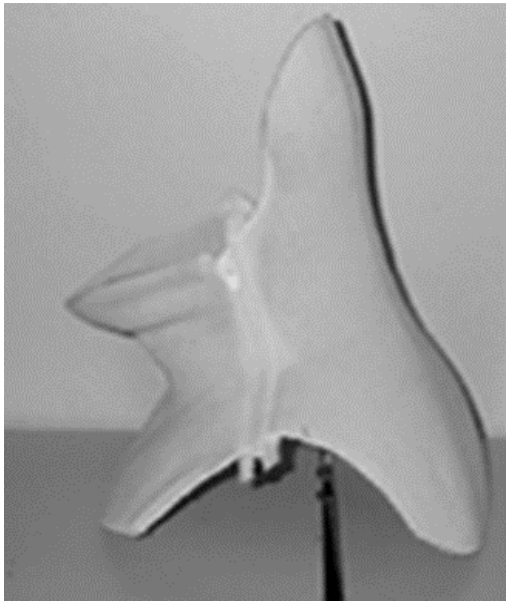
REVIEW ARTICLE

Role of conservative treatment of cervical spine injuries

Philippe Lauweryns

Minerva cervical brace

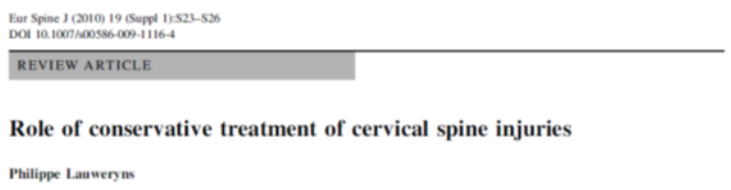
- A Minerva cervical brace is a cervicothoracal orthosis with mandibular, occipital, and forehead contact points.
- Modern adaptations of the Minerva exist, incorporating a plastic vest with liner to a mandibular support and an extension to the posterior aspect of the head.
- Radiological evaluation 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: Is the orthosis of choice when rigid immobilization is required of an unstable cervical spine injury. Stable fractures in C1-C2 segment.


Eur Spine J (2010) 19 (Suppl 1):S23–S26
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REVIEW ARTICLE

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

Cervical braces

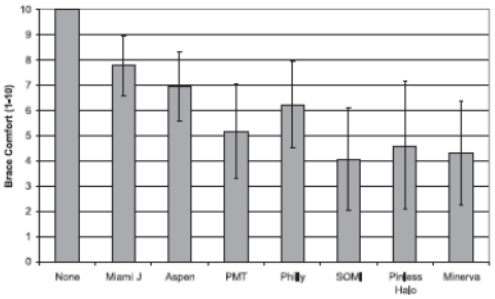

Figure 2. Mean brace comfort score for the different braces. The error bars show one standard deviation. The significance of any differences between any 2 types of braces is provided in Table 2. Philly indicates Philadelphia.

SPINE Volume 32, Number 1, pp E1–E6

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. Reitman, MD

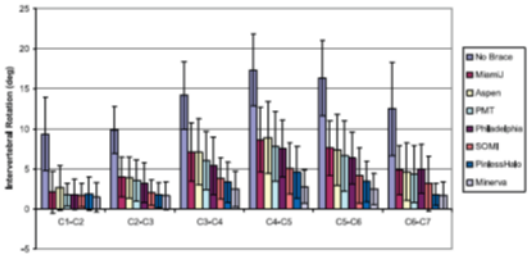

Figure 4. Sagittal plane intervertebral rotation by level and brace. The error bars show one standard deviation. deg indicates degrees.

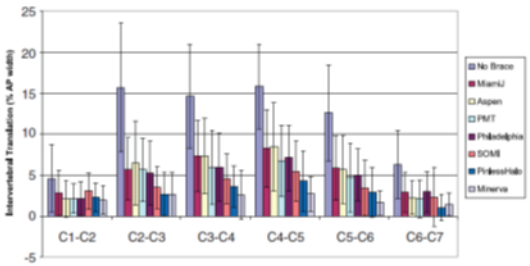

Figure 5. Sagittal plane intervertebral translation by level and brace. The error bars show one standard deviation. AP indicates anteroposterior.

- 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 ortesis 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)

Cervical braces

Journal of Craniovertebral Junction & Spine

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J Craniovertebr Junction Spine. 2016 Jan-Mar; 7(1): 13–19.
doi: 10.4103/0974-8237.176611

PMCID: PMC4790142

Evaluation of the efficiency of cervical orthoses on cervical fracture: A review of literature

Mohammad Taghi Karimi, Mostafa Kamali, and Francis Fatoye[1]

Department of Orthotics and Prosthetics, Rehabilitation Faculty, Isfahan University of Medical Sciences, Isfahan, Iran
[1]Department of Health Professions, Manchester Metropolitan University, United Kingdom

The comparison of efficiency of various cervical orthoses

Reference	Method	Results
[8]	Five cadavers were utilized for this study. Motion analysis system was used to capture motion relative to the C5-C6 vertebral bodies. The range of motion of flexion/extension, lateral bending, and rotation were evaluated following three conditions: (1) One-piece extraction collar (2) Two-piece collar (3) No collar	Although using a cervical collar is better than no immobilization, collars do not effectively reduce motion in an unstable cervical spine cadaver model
[14]	The halo vest orthosis was compared with soft collar, Minerva brace, and Miami J collar. The control effect for the segments of C1-2, C2-4 was tested for all devices for fracture of type II odontoid process	All four devices produced motion control at both C1-2 and C2-3. The soft collar did not provide stabilization to the unstable spine. Miami J and Minerva produced moderate control on the sagittal plane. Halo restricted motion significantly. Thus it would be the first choice for conservative treatment of unstable injury of the upper cervical spine
[15]	Twenty normal subjects participated in this study. The efficiency of some cervical collars (Philadelphia, Aspen, stiff-neck, Miami J, and NecLoc) in controlling the motion of flexion/extension, lateral bending, and rotation was evaluated	NecLoc cervical orthosis produced superior restriction of cervical motion in flexion, extension, rotation, and lateral tilt. The Miami J was the next best and was superior to Philadelphia and Aspen orthoses
[16]	The effectiveness of Newport/Aspen collar in restricting the motion of cervical was evaluated on 15 normal volunteers	The orthosis allowed flexion/extension by 31%, lateral bending by 51.1%, and rotation by 41% of the normal. The orthosis had no ability to control snaking
[17]	Two orthoses (Aspen, Miami J collar) and 2 CTOs (Aspen 2 post, Aspen 4 post) were tested on 20 normal subjects. An optoelectronic motion measuring system was used	No statistically significant difference was found between Miami J and Aspen collars in controlling gross motion. CTO produced more motion control (gross and intervertebral motion) compared to the two others. Aspen 2 post CTO and Aspen 4 post produced the same restriction of flexion but Aspen 4 produced more motion restriction of extension motion

The results of the reviews done on efficiency of cervical orthoses in treatment of cervical fractures

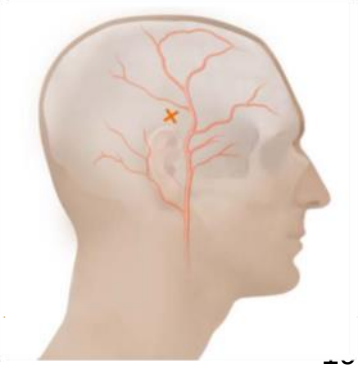
Reference	Method	Results
[4]	A search was done on various databases. Some key words such as axis fracture and axis and atlas fractures were used with halo fixation	A total of 47 papers were found that cover the results of treatment of 1078 patients with C1-C2 fracture treated with halo fixation. Halo fixation has a defined place in the management of fractures of the cervical spine. Management of cervical spine with halo is safe and effective
[29]	The outcomes of treatment of cervical fracture with halo vest orthosis were evaluated based on 35 studies	In 35 studies, 682 patients were treated with 709 different injuries. The results of treatment with halo were unsatisfactory with regard to combined injury of odontoid type 2 fracture. The healing rate was 86%. This treatment is a good alternative to operations on injuries of the upper cervical spine
[30]	This is a critical review	Halo vest may be more effective in controlling and effective in mobilization injuries above C2, but Minerva is safer, more comfortable, freer of compliance from patients, and more reliable for injuries below C2. The skills to maintain both devices are also important

- Based on the studies mentioned above, it can be concluded that the use of the cervical orthosis is a good and effective alternative to surgery to stabilize the injured spine. The Minerva orthosis was as effective as the halo in controlling the cervical motions, especially in the lower part of the cervical spine.

Traction (Gardner-Wells tongs or halo)

TECNIQUE.

- 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 aplication, 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 prior a fusion or prior the instauration of halovest in complex fractures. Conversion to a halo vest after a 1-2-weeks period should be considered.

Tracion 7 Kg

Eur Spine J (2010) 19 (Suppl 1):S23–S26
DOI 10.1007/s00586-009-1116-4

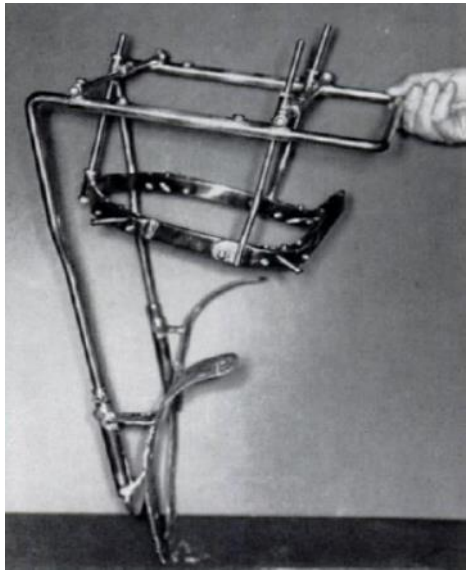
REVIEW ARTICLE

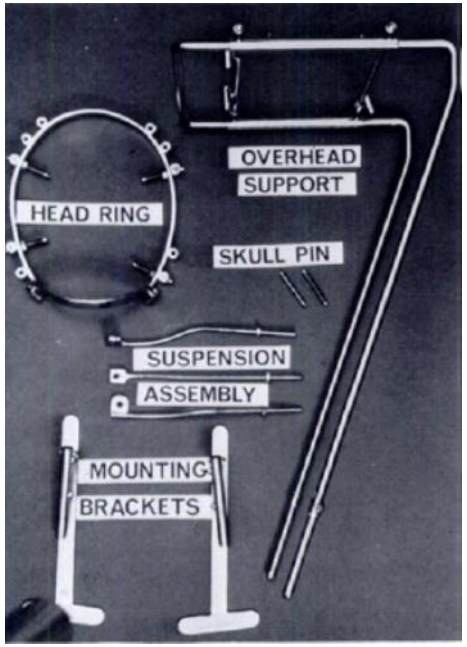
Role of conservative treatment of cervical spine injuries

Philippe Lauweryns

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.



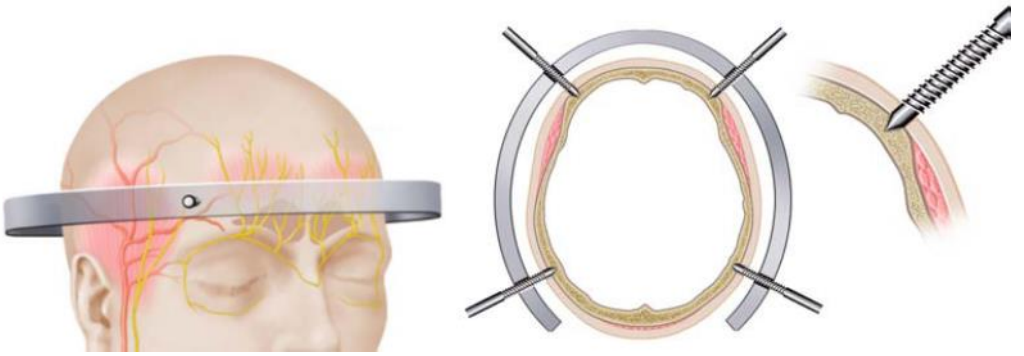


O'Donnell,P.W.; Anavian,J.; Switzer,J.A.; Morgan,R.A. The history of the halo skeletal fixator. *Spine*, 2009, 34, 16, 1736-1739

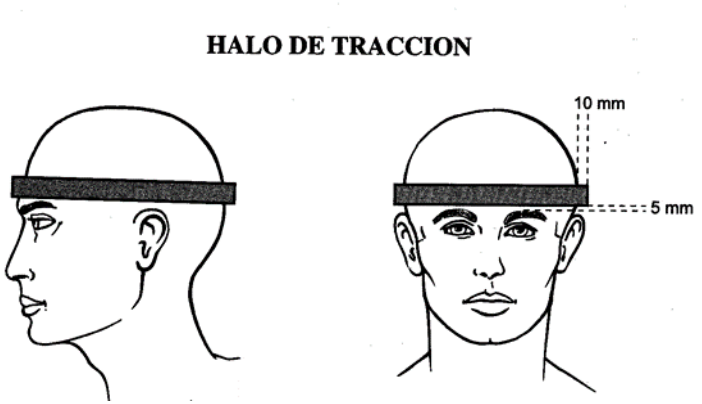
Nickel VL, Perry J, Garrett A, HeppenstallM(1968) The halo. A spinal skeletal traction fixation device. J Bone Joint Surg Am 50:1400–9

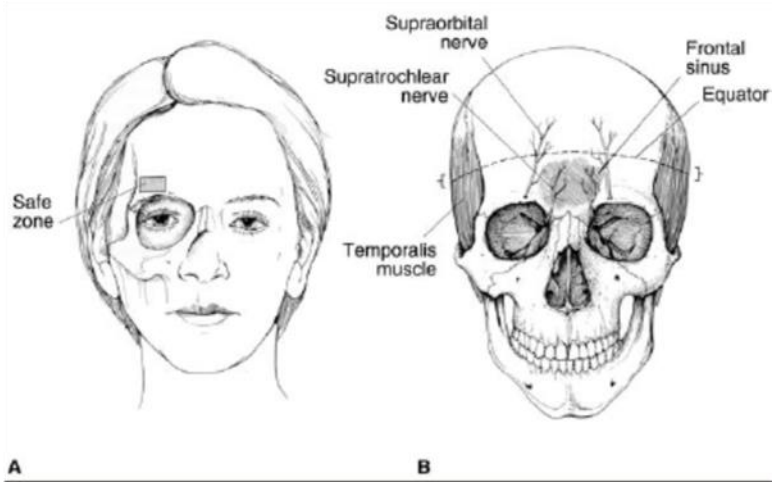
Nickel VL, Perry J, Garrett A, HeppenstallM(1989) The halo. A spinal skeletal traction fixation device. In: Nickel VL, Perry J, Garrett A, Heppenstall M, 1968. Clin Orthop Relat Res:4–11

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



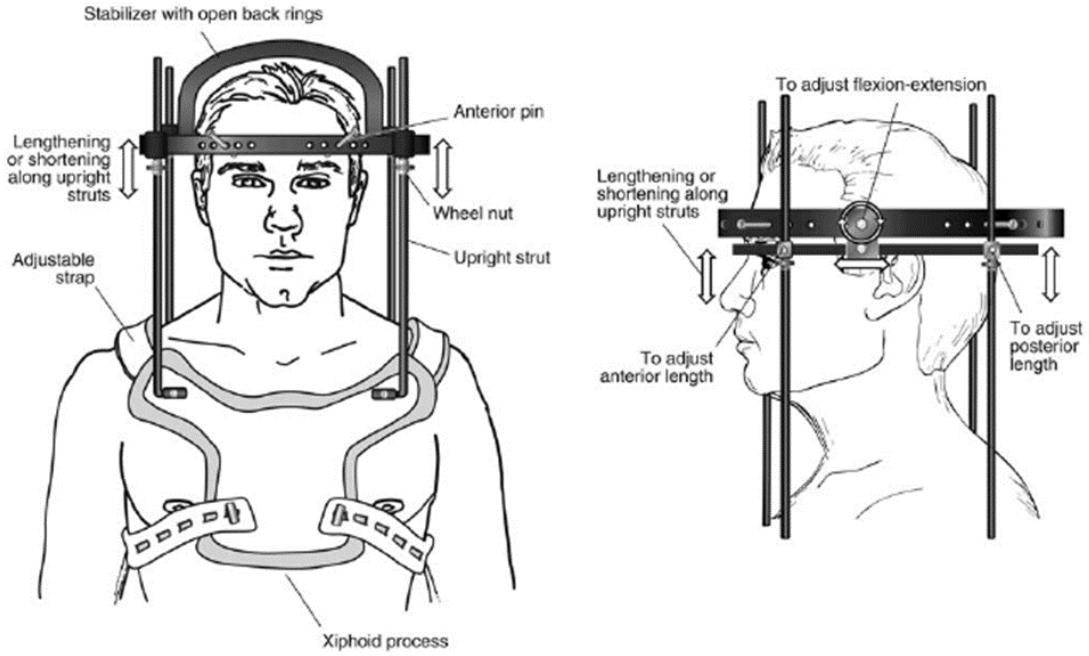


A, The safe zone for anterior pin insertion, an approximately 1-cm region just above the lateral one third of the orbit (eyebrow). **B,** Awareness of the safe zone avoids pin placement too far lateral within the thin temporal bone (deep to the temporalis muscle). In addition, it avoids injury to medial 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.)

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

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

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journal homepage: www.elsevier.com/locate/jocn

Review article

Indications and complications of crown halo vest placement: A review

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[b] Department of Neurological Surgery, Northwestern University Feinberg School of Medicine, 676 North St. Clair Street, NMH/Arkes Family Pavilion Suite 2210, Chicago, IL 60611, USA

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.
  - Intubation can be difficult.
  - 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

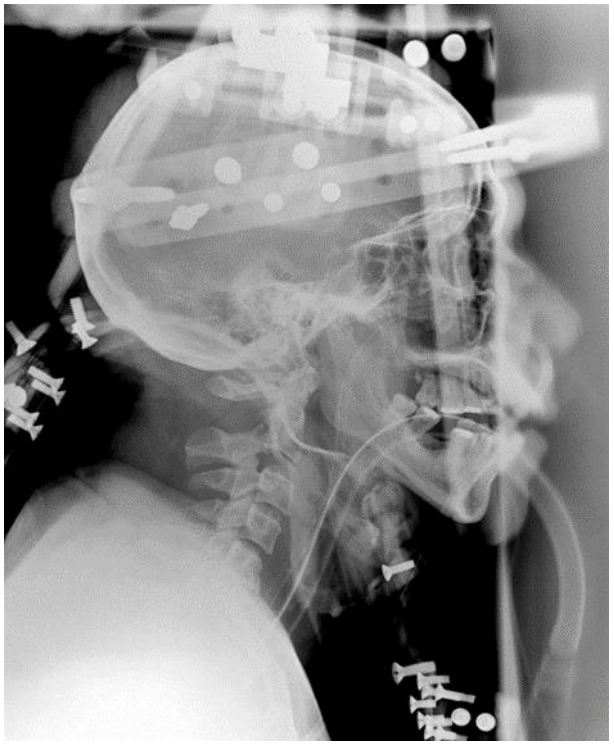
Halo.

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 (2001) 121 : 50–55 © Springer-Verlag 2001

ORIGINAL ARTICLE

U. Vieweg · R. Schultheiß

A review of halo vest treatment of upper cervical spine injuries

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ELSEVIER

Review article

Indications and complications of crown halo vest placement: A review

Dennis Lee [a], Adeola L. Adeoye [b], Nader S. Dahdaleh [b,*]

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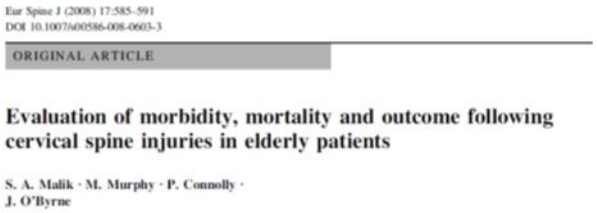
Injury. 2010 Nov;41(11):1127-35. doi: 10.1016/j.injury.2010.09.025.

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.

Halo in Elderly

- Tashijan 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 (2008) 17:585–591
DOI 10.1007/s00586-008-0603-3

ORIGINAL ARTICLE

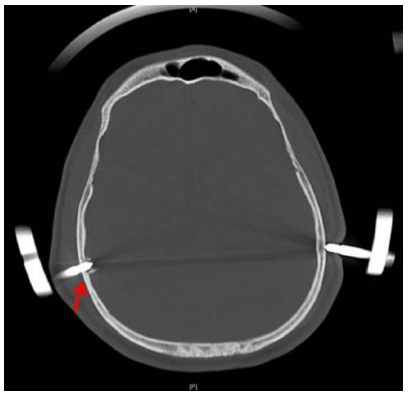
Evaluation of morbidity, mortality and outcome following cervical spine injuries in elderly patients

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

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



- Loosening (36%)
- Infection (20%)
- Discomfort (18%)
- Dural puncture (1%)
- Abducens nerve palsy
- Supraorbital nerve palsy
- Supratrochlear nerve palsy
- Medical complications

11-92% (30-50%)
- Disfagia 66%

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 (2009) 18 (Suppl 2):S172–S175
DOI 10.1007/s00586-008-0759-x

CASE REPORT

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

Ioannis D. Gelalis · Georgios Christoforou · Efstathios Motsis · Christina Arnaoutoglou · Theodore Xenakis

Eur Spine J (2009) 18 (Suppl 2):S269–S271
DOI 10.1007/s00586-009-1004-y

CASE REPORT

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

Min Lee Cheong · Chris Yin Wei Chan · Lim Beng Saw · Mun Keong Kwan

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.
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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.

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

Author information

J Wound Care. 2012 Jul;21(7):323-6.

Pressure ulcers in cervical spine immobilisation: a retrospective analysis.

Walker J.

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, unstability, 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.
- The halo fixator continues to be an important tool for cervical spine fracture management.

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