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On purpose: posterior subaxial fixation due a cervical dislocation without neurologic deficit

A propósito de un caso: fijación posterior subaxial debido a una luxación cervical sin déficit neurológico

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ABSTRACT

Introduction: subaxial cervical dislocation it's a terrible injury, usually due high energy trauma. Management is still arguable, even more with an adequate neurological status. Appropriate radiological images are needed to assess the best reduction method (open versus close), and the optimal approach (anterior, posterior or 360°). **Case presentation:** male patient of 19 years old, history of motorcycle accident, assisted in Regional Peten Hospital, Guatemala. Neurological evaluation without abnormal signs, radiological evaluation (X-rays and tomography computed) with C5-C6 fracture-dislocation. Underwent cervical immobilization and transferred to our medical center. Upon admission, skeletal traction with a total weight of 12 kg, obtaining a partial reduction. An open posterior cervical instrumentation (C3-C7), with an optimal post-operative neurological status. **Conclusions:** the management of subaxial dislocations remains controversial, particularly in patients with a stable neurological status. Clinical assessment plays a crucial role in hospital settings without access to magnetic resonance imaging, as closed reduction can be an effective option when accompanied by continuous neurological monitoring. Additionally, the posterior approach supports healing of the posterior elements and facilitates future evaluation for potential hardware removal, considering the preservation of the intervertebral discs.

RESUMEN

Introducción: la luxación cervical subaxial es una grave lesión, usualmente debido a un trauma de alta energía. El manejo es controvertido, más aún cuando el cuadro neurológico está intacto. Tener los estudios necesarios para evaluar el método de reducción (abierto o cerrado), así como la mejor opción de abordaje (anterior, posterior o 360°). **Presentación de caso:** paciente masculino de 19 años con historia de accidente de motocicleta, asistido en Hospital Regional de Petén, Guatemala. El examen neurológico evidencia función sensitiva y motora completa, radiológicamente (rayos X y tomografía) con fractura luxación C5-C6. Paciente fue inmovilizado y transferido a nuestro centro hospitalario. Al ingreso, se le realiza tracción esquelética con peso de 12 kg, con obtención de reducción parcial. Posteriormente, se realizó una instrumentación mediante abordaje posterior de C3-C7, el paciente evolucionó con adecuada función neurológica. **Conclusión:** el manejo de las luxaciones subaxiales sigue siendo controversial, especialmente en pacientes con un cuadro neurológico estable. La evaluación clínica adquiere un papel fundamental en centros hospitalarios sin acceso a resonancia magnética, ya que la reducción cerrada puede ser una opción efectiva siempre que se acompañe de una vigilancia neurológica continua. Asimismo, el abordaje posterior permite favorecer la cicatrización de los elementos posteriores y facilita la evaluación futura para un posible retiro del material, considerando la preservación de los discos intervertebrales.

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INTRODUCTION

Subaxial cervical dislocation is a rare presentation of cervical trauma characterized by greater than 100% listhesis.¹ Globally, the prevalence of spinal injury secondary to cervical dislocation is 250 to 900 per million; of these patients, at least half of them suffer complete spinal cord injuries and at least a third of this population has tetraplegia consequently.² Other studies describe subaxial cervical dislocation as the injury that presents the most severe neurological damage, again describing the incidence of neurological injury between 85 and 90% of cases³ and tetraplegia in more than 87% of cases.⁴ The most affected group are males between 20 and 50 years old.⁵

The etiology of cervical dislocation is usually the result of high-energy trauma, mainly due to a traffic accident;⁶ other etiologies are falls from a height and sports injuries.^{2,4} The morphology of subaxial vertebral dislocations of the cervical spine can be divided into two groups: unifacet dislocations in 51.2% and bilateral dislocations in 48.8% of the cases, with the most frequent vertebral level being between C6 and C7. Greater vertebral translocation together with apposition of the inferior facets were described as the radiological criteria to distinguish a dislocation from a subluxation. Glasgow coma scale alteration, spinal canal occlusion and spinal cord compression are also described as characteristics of the lesion that warn of a long-term neurological deficit.⁴ Other studies confirm that bilateral traumatic cervical dislocation is more prevalent in the lower cervical spine, and in most cases the dislocation is caused by a failure in posterior ligamentous structures, which is associated with the worst clinical presentations with an 11% mortality, preservation of motor strength in 30% of patients at the initial evaluation of which only 14% remain without neurological change after hospital admission.¹

The literature differs regarding the percentage of translocation in relation to the anteroposterior diameter of the vertebral body to differentiate a bilateral dislocation from a unilateral one, ranging from 36 to 50% of translocation that defines a bilateral dislocation and from 20 to 25% of translocation of a unilateral dislocation.^{4,7,8} As previously mentioned, this type of injury is characterized by severe neurological deficit; however, it is described that the fracture of posterior elements can reduce the risk of spinal cord injury by increasing the space available for the spinal cord.^{4,9} AO Spine classification system is worldwide used to classify trauma injuries, based

on morphology of the injury, facet involvement, neurologic status and modifiers.¹⁰

Cervical subaxial dislocation is described as highly unstable and surgical treatment is mandatory; however, there is still controversy regarding the appropriate fixation technique, as well as the role and effectiveness of closed reduction.⁴ AO Spine recommends starting the treatment of bilateral cervical dislocations with attempts at closed reduction with traction.⁸ Cervical traction can be implemented to restore anatomical alignment prior to stabilization, however its role in cases of partial neurological deficits or in the absence thereof is controversial since some suggest that a retropulsion of the disc into the spinal canal during traction can lead to spinal cord compression and cause further neurological impairment while others report that fracture of posterior elements functionally decompresses the spinal canal and allows cervical traction to be safely implemented.^{9,11,12}

CASE PRESENTATION

19-year-old male patient, with no medical history, who suffered a motorcycle accident. He received primary care at the San Benito's Hospital, Petén[ao1], Guatemala, where they evaluated and diagnosed a cervical dislocation and decided to transfer him to the national reference center, approximately 14 hours away.

Upon admission, the patient was hemodynamically stable, heart rate of 78 bpm, respiratory rate of 16 rpm, temperature of 36.9 °C, blood pressure of 115/70 mmHg, conscious, oriented, no evidence of skull fractures, photoreactive isochoric pupils with excoriations in the supraciliary region and left upper jaw. Cervical region immobilized with rigid neck, no soft tissue injuries in upper limbs and cervical region, mobile extremities, paresthesia in the left thumb and index finger, preserved sensitivity, muscle strength 5/5. No soft tissue injuries in lower limbs, mobile extremities, preserved sensitivity, muscle strength 5/5, distal capillary filling of the four extremities less than two seconds: Glasgow coma scale of 15 pts. Complementary studies (X-rays and CT) were performed in emergency and a complete clinical and radiologic classified by AO Spine as C5-C6: C (F4 BL; N2) (*Figures 1 and 2*).

In the emergency area, skeletal traction is placed with an initial weight of 7 kg, increasing 2.5 kg every hour until reaching a maximum weight of 12 kg with which radiological change corresponding to partial

reduction of dislocation was achieved (*Figure 3*), without neurologic change.

Patient was taken to the operating room five days after the accident for a posterior open reduction and cervical instrumentation of cervical vertebrae C3 to C7, placing eight polyaxially transpedicular screws and two bars, obtaining an adequate reduction of the dislocation (*Figure 4*).

Patient was discharged from the hospital 15 days later with no signs of local infection in the surgical wound, musculoskeletal function preserved, complete muscle strength in all extremities, normal deep tendon reflexes, with an appropriate sphincter control, capillary refill in four extremities less than two seconds. In follow-up one month post-operatively in the outpatient clinic, evidence of adequate healing of the surgical wound, no

motor or sensory-neurological deterioration. The use of a rigid neck was indicated for three months, which was removed and continued with adequate radiological evolution and was sent to rehabilitation for muscle strengthening, and recovery of cervical mobility arches.

DISCUSSION

The patient presented in this case adheres to the statistics where subaxial cervical dislocation occurs more frequently in males, with the lower cervical area being the most affected. In this case, our patient presents to the emergency room without a spinal cord injury, which presents a challenge in treatment. In this case, for multiple reasons, it was decided that the option of open reduction and internal fixation as an emergency treatment is not viable, due to the lack of experience of the staff on duty.

Khelifa et al. mentions that when using cervical traction to achieve a total reduction an average of 11.9 kg of weight is needed with an approximate traction time of six days while for a partial reduction at least 11.5 kg of weight is needed with an approximate time of 10 days.¹¹

Therefore, it was decided to manage the case with a closed reduction through traction with a Gardner Wells halo with an initial weight of 6.8 kg and an increase of 2.5 kg every hour with radiographic improvement after three hours. The patient remained under constant monitoring for risk of spinal shock, as well as for monitoring of neurological status. As the evidence supports it, despite the risk of worsening the neurological status and the controversy in the use or not of this initial treatment^{1,10} it is considered that the management of this patient was adequate, achieving a successful initial treatment and allowing open reduction

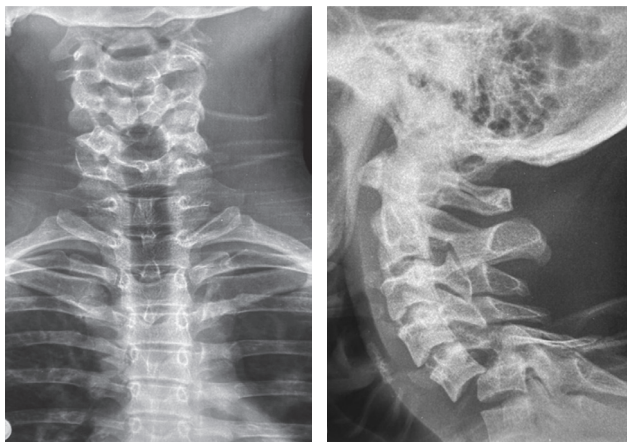


Figure 1: Anteroposterior and lateral radiographs of the cervical spine on the day of the traffic accident. AP and lateral radiograph of the cervical spine showing dislocation of an articular facet and anterior dislocation of the other between C5-C6.

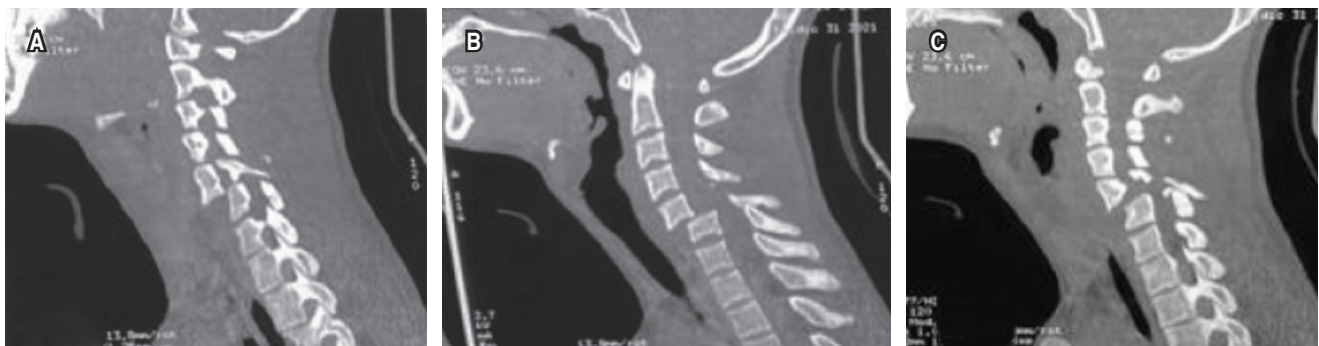


Figure 2: Tomography of the cervical spine (A: right facet; B: body; C: left facet) C5-C6 bilateral facet joint subluxation and displaced fracture of left facet.

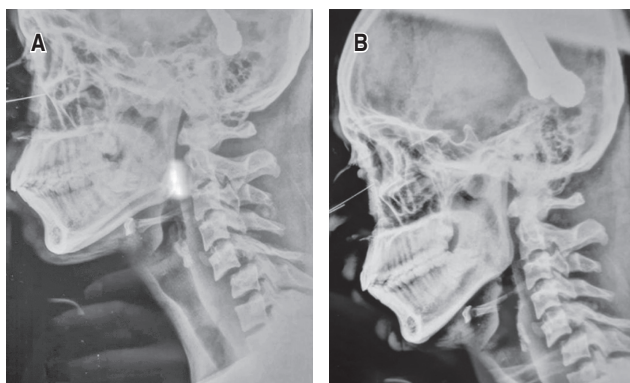


Figure 3: X-rays with cervical traction (A) at the first hour and (B) at three hours, showing partial reduction of dislocation.

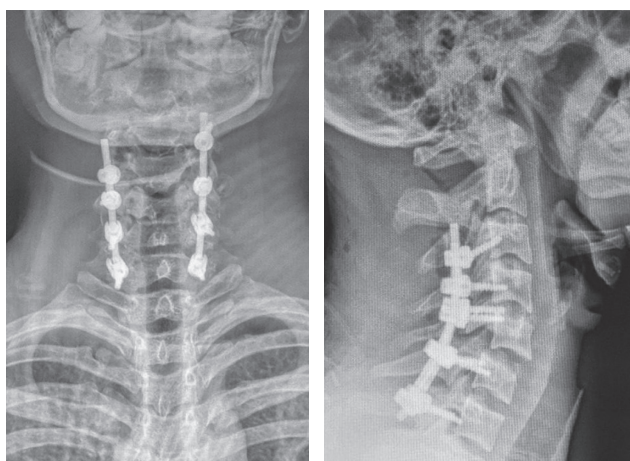


Figure 4: Postoperative radiographs. Anteroposterior and lateral radiograph of the cervical spine showing posterior cervical fixation of the affected segment.

and a posterior internal fixation of four vertebral levels with no deterioration of the patient.

Nakashima et al. proposed a diagram where shows how a cervical traction works when is complemented with flexion- extension maneuver during reduction, they have not found any neurologic deterioration after using posterior reduction.¹³

A common problem in all third world countries is the lack of magnetic resonance image (MRI) or intra-operative neurophysiology monitoring, in public health services,¹⁴ so surgical decisions must be based on clinical evaluation. Neurologic evaluation of the case was found normal and based on the subaxial injury classification (SLICS)¹⁵ and due the lack of MRI, was at least six points, surgical procedure was obvious.

But what would be the best approach? Khelifa et al. also mentions the trends in the fixation method of these injuries, 32% anterior fixation, 23% posterior fixation, and 45% anterior and posterior fixation.¹ This study shows a tendency to perform both approaches for cervical fixation for this type of injuries. For most cases, a single posterior approach that requires fixation of at least four vertebral levels can be used. However, a case of bilateral subaxial cervical dislocation treated with a posterior-only approach fixing a short segment was also documented. The case was reported as successful; however, no more updated evidence was found to support this treatment.¹¹ Dvorak et al. shows a surgical approach algorithm for bilateral facet fracture subluxation, establishing that if MRI has no disc in canal, an only posterior approach can be done.¹⁵ Hart et al. mention that the option of not doing a previous MRI depends on the neurologic status of the patient, however, it is a risk of deteriorate.¹⁶ Vaccaro et al. demonstrates an incidence of herniated disc pre-close reduction of 18% and 56% after it, nevertheless, non-impairment of neurologic status was demonstrated.¹⁶ Cabrera et al. made a cross sectional survey to spine surgeons in Latino America, about decision-making in subaxial cervical facet dislocation/subluxation (F4),¹⁰ reveal that 72.5% required an MRI, being younger spine surgeons (less than eight years) and neurosurgeons, who seek for more dynamic and vascular images (Figure 5).¹⁷



Figure 5: 3-month postoperative follow-up clinical photograph.

CONCLUSIONS

The management of high cervical dislocations remains controversial, mainly when the patient does not have a spinal cord injury or have partial injuries; however, closed reduction is an appropriate treatment in patients in whom, for multiple reasons, open reduction and fixation cannot be performed as initial treatment, which, performed progressively and monitored, can maintain the patient's neurological status. Lack of MRI in third world countries makes clinical evaluation crucial to decision-making, however, is too risky. Likewise, the advantage is the relatively simple technique and few complications have been reported after the placement of a Gardner Wells halo. Fixation by a single posterior approach may be sufficient after a complete cervical fracture-dislocation.

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