Clinical Research

Surgical approach in treatment of translation/rotation injuries of the lower cervical spine in 21 patients

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Abstract

Background: The management of lower cervical spine injuries with a dislocation of one or both facet joints and a displacement of a vertebra over the adjacent stills generates considerable controversy. We describe our experience in surgical approach of these injuries.

Methods: We present 21 cases treated between 2003-2010. Neurological status was evaluated with Frankel scale. Diagnosis was done by radiograph (XR), computed tomography (CT) and/or magnetic resonance image (MRI). Cervical traction was placed in 10 cases before surgery. Posterior and/or anterior approach was used for reduction and stabilization.

Results: The 21 cases presented were treated by surgery. Posterior approach was initially used in 17 cases and complete reduction was achieved in 13 of them. The 4 cases where we only got a partial reduction, surgery had to be delayed for different reasons. Anterior approach was initially used in 4 of the 21 cases. In 3 of them, reduction was previously obtained by traction and the fourth case anterior approach was used initially due to an important spinal cord compression. Permanent stabilization was achieved in 19 of the 21 cases. In 1 of the other 2 cases an important deformity was detected after the anterior approach. The other case had a minimal progression after a posterior approach with no increase in successive check-ups. In the first 10 cases, we used traction before surgery but reduction was achieved only in 3 of them. As the number of cases increased we rather used posterior approach in the first place, without even trying a preoperative traction. There was no case of neurological deterioration after surgery.

Conclusion: Translation/rotation injuries of the lower cervical spine are unstable and surgical treatment must be indicated. It is our impression that posterior approach allows a better reduction and stabilization of this injuries and should be used initially without even trying a preoperative traction.

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Abordaje quirúrgico en el tratamiento de las lesiones por traslación/rotación de la columna cervical inferior en 21 pacientes

R E S U M E N

Antecedentes: El tratamiento de las lesiones del raquis cervical inferior con luxación de una o ambas facetas articulares y desplazamiento de una vértebra sobre la adyacente todavía genera una controversia considerable. Describimos nuestra experiencia en el tratamiento quirúrgico de este tipo de lesiones.

Métodos: Presentamos 21 casos tratados entre 2003-2010. La situación neurológica fue valorada con la escala de Frankel. El diagnóstico se hizo mediante radiografía (XR), tomografía computarizada (CT) y/o resonancia magnética (MRI). La tracción cervical fue utilizada en 10 casos antes de la cirugía. En su estabilización se utilizó un abordaje posterior y/o anterior.

Resultados: Los 21 casos presentados fueron tratados mediante cirugía. Se realizó inicialmente un abordaje posterior en 17 casos y se consiguió la reducción completa en 13 de ellos. Los 4 casos donde obtuvimos solo una reducción parcial, la cirugía tuvo que retractarse por diferentes motivos. El abordaje anterior se utilizó inicialmente en 4 de los 21 casos. En 3 de ellos, la reducción se consiguió previamente mediante tracción y en el cuarto caso se utilizó el abordaje anterior inicialmente por la importante compresión medular. Se logró una estabilización permanente en 19 de los 21 casos. En uno de los dos casos restantes, se detectó una importante deformidad después del abordaje anterior. El otro caso presentó una mínima progresión después del abordaje posterior que no se incrementó en los controles sucesivos. En los 10 primeros casos, utilizamos la tracción antes de la cirugía, aunque la reducción se logró únicamente en 3 de ellos. A medida que se incrementaba el número de casos, preferimos emplear el abordaje posterior en primer lugar, incluso sin utilizar la tracción preoperatoria. No se produjo ningún caso de deterioro neurológico tras la cirugía.

Conclusión: Las lesiones por traslación/rotación del raquis cervical inferior son inestables y se debe indicar su tratamiento quirúrgico. Nuestra impresión es que el abordaje posterior permite una mejor reducción y estabilización de estas lesiones y se debería utilizar inicialmente incluso sin intentar una tracción preoperatoria.

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Introduction

There is controversy in the treatment of lower cervical injuries with a dislocation of one or both facet joints and a displacement of a vertebra over the adjacent (use or not of preoperative traction, operative or non-operative management, initial type of surgical approach, simple or double approach). Although there is not a consensus in the classification of these injuries, they are included as translation/rotation injuries in the Subaxial Injury Classification (SLIC) and are considered unstable. In this paper, we describe our experience in surgical approach of these injuries.

Materials and methods

We present 21 cases of traumatic subaxial cervical spine instability by translation and/or rotation injury treated between 2003-2010 (Table 1). Sex distribution was thirteen men and eight women, with ages ranging from 17 to 80 years. The assessment of neurological status at the moment of admission was done with the Frankel scale. Initial diagnostic imaging was usually done by conventional radiography (XR), followed by computed tomography (CT) and/or magnetic resonance imaging (MRI). The follow up period ranged from 9 to 57 months.

In 18 cases deformity was detected immediately. In 2 cases dislocation was detected later and 1 case was not initially a translation/rotation injury but deformity appeared afterwards and it was included in the study. In 7 of the 21 cases, there was also a vertebral body fracture. In 10 of the 21 cases, cervical traction was placed before surgery.

In 17 of the 21 cases a posterior approach was initially performed and it was completed in 5 of them with an anterior approach. In 4 of the 21 cases the initial approach was anterior being 2 of them completed with a posterior one. Lateral mass screws and/or laminar hooks and bars were used in the reconstruction of the posterior column. In the anterior approach the autologous bone graft alone or encompassed in a mesh with a cervical plate fixation was used.

Results

The posterior approach was initially used in 17 cases (81%). Stabilization was obtained in all of them.

Complete reduction was achieved in 13 of the 17 cases of posterior approach. The 4 cases where we only got a partial reduction, surgery had to be delayed for different reasons: a late detection of the lesion (cases 10 and 11), a progressive deformity in the check-ups (case 9), and previous medical complications (case 12). In one of the 17 cases, we got a
complete reduction although posterior approach was done in a delayed way (case 8, Fig. 1). The patient was initially treated conservatively because she refused surgery. When progression was detected, she accepted surgery and a complete reduction was achieved with a posterior approach. 5 of the 17 cases posterior approach was completed with an anterior approach for several reasons: 3 of them had also a vertebral body fracture (cases 14, 15 (Fig. 2) and 16). Another one had a pedicle fracture at its junction with the vertebral body (case 17), and 1 had a bilateral dislocation (case 13).

Figure 1 – a) Sagital CT image showing a translation of C4 on C5; b) Sagital CT image showing the reduction after posterior approach; c) Postoperative lateral XR showing the complete reduction of the lesion and the posterior fixation.
The anterior approach was initially used in 4 of the 21 cases (19%). In 3 of them reduction was previously obtained by traction. In the fourth one anterior approach was used without previous traction because there was an important anterior spinal cord compression. In this case, it was also necessary a posterior approach after the anterior one (case 21) (Fig. 3). This resulted in a good decompression and stabilization of the cervical spine.

In the follow up period of the 21 cases permanent stabilization was achieved in 19 of the 21 cases. In 1 of the other 2 cases (case 20) (Fig. 4) an important deferred deformity was detected after the anterior approach. It was necessary to remove the initial plate and mesh, reduce and stabilize by posterior approach and supplement with iliac crest graft and plate with a new anterior approach. The other case (case 1) had a minimal progression of the translation after a posterior approach with no increase in successive check-ups. The 21 cases had a satisfactory outcome. At the beginning, when we started collecting cases we used traction before surgery in 10 cases but only in 3 of them reduction was achieved. In those cases an anterior approach was used to stabilize the lesion. As the number of cases increased, the good results of reduction and stabilization made us rather use an initial posterior approach without even trying a preoperative traction.

There was no case of neurological deterioration after surgery. Regarding the neurological level, 3 patients were admitted with Frankel grade A, 2 with grade C (that after treatment improved to grade D), 3 with grade D and 13 with grade E. 1 patient with grade E revealed a pure C5 root deficit which improved after reduction. A patient with a Frankel grade A died due to sepsis two and a half months after surgery. We have a very small number of surgery complications: 1 case of transient C7 radiculopathy after a posterior approach and 2 cases of transient vocal cord paresy after anterior approach, with
a total and complete recovery in both cases. There were no complications such as spinal cord injury, infection or fixation break.

Discussion

There is no universally accepted classification for lower cervical spine injury. This limits the possibility to compare results from different clinical studies.\(^1,2,5,4\) We really think that classification of Vaccaro\(^6\) is a good and useful one. In this classification the group of translation-rotation injuries includes the most unstable of lower cervical spine injuries. They exhibit the horizontal displacement of one vertebra relative to an adjacent vertebra and surgical treatment is indicated in all of them.

Hadley\(^5\) performs an extensive review in 2002. He concludes, but without accurate differentiation into specific injury types with altered alignment, that non-surgical reduction is successful in between 64% and 91% of cases.\(^7-10\) However orthoses fails to maintain this reduction in 7 to 56% of cases.\(^11-15\) Overall 30% of patients have recurrent displacement or misalignment during external immobilization.\(^16\) Although there is no a defined pattern, it seems clear, according to Mizuno,\(^17\) that the main objective of preoperative traction is a temporary external stabilization and early surgery should be done regardless of the result of traction. Hadley\(^5\) also reports that prolonged bedrest and cervical traction alone for 12 to 16 weeks duration is associated with the highest mortality of all treatment strategies reported (up to 27% in a group of 41 patients).\(^18\) However, the failure to maintain anatomical reduction after surgery ranged from 1 to 18%.\(^3,8,19-22\)

In our serie of 21 cases treated, only one case (5%), who was treated with an anterior approach, had a belated displacement requiring a second surgery. Another had a minimal displacement after surgery and did not require additional procedure. These satisfactory results, according to literature review, make us believe surgical treatment to be superior to conservative treatment, so it is initially worthwhile to consider it.

Type of approach for operative reduction and internal fixation remains controversial. Literature to provide guidance in the decision of initial surgical approach is limited and gives reasons for both approaches.

Ensure of anatomical reduction of the facet joints and biomechanical strength favours the posterior approach. Furthermore, if a facet dislocation, with or without fracture, is irreducible by traction, posterior approach would be choose initially.\(^1,5,7,17,23\) The only case where anterior approach is clearly chosen is when an anterior decompression is required (slipped disc, burst fractures).

Although the reduction may also be done by anterior approach,\(^24\) it is our impression that the reduction is more difficult since the technique used is basically the same for closed reduction, based on direct distraction. However, posterior approach allows direct action on facets, and if there are no fragments to be removed, the reduction is usually achieved by pushing back the facet to its original condition. After this maneuver, the stabilization with posterior fixation is not complicated at all. We would use the anterior approach initially only when there was a burst fracture o disc that requires anterior decompression.

In the first cases of our serie we initially considered to do traction and when we got a reduction of the dislocation we used anterior approach. Only if we could not reduce the facet dislocation we used a posterior approach. As the number of cases increased, posterior approach’s good results (in terms of reduction and stabilization of the injury), made us rather preferred to use it initially, without even trying a preoperative traction. In fact, posterior approach allows easy and direct

Figure 3 – a, b) Sagital CT and T2-weighted MRI images showing C5 fracture and lesion of posterior elements with kiphosis and medular compression; c) Sagital CTafter anterior and posterior approach showing canal descompresion and anterior column reconstruction supported by expandable cylinder filled with autologous bone and cervical plate.
unlocking of the facets when there is no fracture, withdrawal of the fragments when there is fracture, release of compressed structures and a better patient management. Anterior approach was used initially after reduction was achieved with traction. As the number of cases increased it was only left for cases which had an important anterior spinal cord compression or a burst fracture.

We had surgical complications in 14% of the cases, a similar percentage that it is describe by literature: 9 to 25% of the cases. Complications of anterior approach are dysphagia and dysphonia. Radiculopathy may occur up to 25% of cases of posterior approach. In our serie, we found two cases of transient vocal cord paresy (9.5%) after the anterior approach and one only transient case of C7 radiculopathy in posterior approach (4.7%). Up to 7% of mortality after anterior fusion and 3% mortality after posterior fusion is also reported. We had only 4.7%, one death occurred in a patient with a Frankel grade A, long time after surgical process, due to a non related surgical sepsis. All of the reported cases in literature except one have a complete spinal cord injury, and mortality is more due to spinal cord injury complications than from surgery. Systemic complications are likely to be lower nowadays. There is some concern regarding postoperative wound infection in posterior approach. In our experience, it could be avoided when the collar is not used once the spine is fixed, especially in obese people. As described, there were no complications such as spinal cord injury increase or infection of fixation break.

**Conclusion**

Translation-rotation injuries of the lower cervical spine are unstable and since surgical treatment offers better results than non surgical treatment, we believe it must be indicated initially. Although the type of initial approach is controversial,
and our series is only of 21 patients, we think that posterior approach should be used initially without even trying a preoperative traction. The exception is the case where an anterior decompression is required.

REFERENCES