Cervical Facet Dislocations. Outcome of Reduction & Anterior Plating in a Series of 21 Patients

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Abstract

Background Data: treatment of cervical facet dislocations has varied from closed reduction and external immobilization to combined anterior and posterior instrumentation and fusion.

Purpose: to evaluate single level anterior fixation for the management of cervical facet dislocations following closed or open reduction.

Study Design: retrospective analysis of a case series.

Patients and Methods: twenty-one patients (12 unilateral and 9 bilateral) with cervical facet dislocation were treated by reduction and anterior plate fixation.

Results: the male to female ratio was 3.2:1. The mean age was 44 years. The commonest affected level was C5-6 (48.2%). Closed reduction by traction and open reduction were successful in 81.2% and 88.8% of attempted trials respectively. Radicular and incomplete spinal cord injuries showed better outcome than complete lesions. Solid fusion in good alignment was achieved in 20 patients while solid fusion with partial re-dislocation occurred in one patient with no further treatment required.

Conclusion: anterior plate fixation alone is effective in treatment of cervical facet dislocations which can be successfully reduced either by traction or open anterior reduction. (2012ESJ029)

Keywords: cervical facet, dislocation, fracture dislocation, anterior plating, reduction.

Introduction

Cervical facet fracture-dislocations accounts for about 10 % of all cervical subaxial spine injuries and are secondary to a force of flexion and distraction as commonly seen with motor accidents and falling from heights.[3,17,21]

These injuries are characterized by anterolisthesis of one cervical vertebra over the other. A force of flexion and rotation causes unilateral dislocation while more severe force without rotation results in bilateral dislocation. If the inferior facet of the superior vertebra slides anteriorly to a place in front the superior facet of the inferior vertebra, the facet becomes locked.[3,21,33]

Varying opinions still exist on the surgical approach for management of these injuries.[4,28] Traditionally, unilateral and bilateral cervical facet dislocations have been treated with closed reduction techniques followed by either external immobilization or posterior fusion using wires or plates and screws.[2,5,9,10] External

immobilization, however, was associated with a high incidence of redislocation approaching 45 %.[9,21] In one study reporting upon 90 cases of unilateral facet injuries, those treated non-operatively had worse pain and functional outcome compared to those treated operatively.[12]

Numerous studies has shown an incidence of anterior disc herniation associating cervical dislocation injuries[6,7,35] which has made surgeons elect anterior discectomy prior to reduction in such cases for fear of development of neurological deterioration following reduction by traction.[29,36] In addition, with the introduction of improved anterior cervical plate designs, successive reports of successful treatment of cervical dislocations by anterior discectomy and cervical plate fixation following either open or closed reduction has been described.[1,14,25,29,33,34]

This study demonstrates our experience in Cairo University in the management of cervical facet dislocation injuries with anterior plate fixation following closed or open reduction.

Patients and Methods

Twenty-one patients in whom anterior single level cervical fixation operation for cervical facet dislocation at the departments of Neurosurgery and Orthopaedics in Cairo University were reviewed.

The inclusion criteria for patients were traumatic single level facet dislocations (unilateral or bilateral), treated by single level anterior cervical discectomy, fusion and plating. All patients had minimum criteria of instability at least 3 mm anterior subluxation.[41]

All patients had a complete history and neurological examination. Radiographic work-up included plain X-rays of the cervical spine, CT scan cervical spine and MRI. Associated traumatic injuries were treated simultaneously. Neurological assessment of functional cervical cord injury below the level of lesion was done according to Frankel grading system.[13]

High dose steroid (methyleprednisolone) as per spinal cord injury protocol was administered intravenously over a 24-hour period to patients with spinal cord deficit arriving within 8 hours of injury.

Initially all patients were stabilized in a hard cervical collar after radiographic work up. Reduction by craniocervical traction was then instituted unless there was evidence of anterior disc compression on MRI (N=6) in which cases open anterior reduction after discectomy was undertaken. No trial of closed reduction under a general anaesthetic was attempted. When reduction by traction was unsuccessful, open anterior reduction was done at the time of fixation.

Traction procedure:

Cervical traction was applied in 16 cases. Six cases where excluded because of the presence of an associated disk herniation on MRI. Cervical traction Tongs were applied under local infiltration anaesthesia. Initial weight application was calculated as follows: 3kgs for the head and an additional 1kg for every cervical level. Therefore, for C4/5 dislocation, the initial weight of traction would be 7kgs. Patients were monitored for their neurological status and radiologically in hourly intervals. Weights were increased in 2kg increments until facet disengagement was seen on radiographs; then a gradual extension of the neck was performed monitoring translational reduction. Once this was achieved, traction was gradually decreased to allow sliding of the facets back to their normal position. In case of presence of facet fractures, the reduction was unstable and was maintained by the traction. Traction was aborted when patients complained of neurological symptoms, the presence of deteriorating neurological function or when segmental over distraction was seen on radiographs.

Operative procedure:

Surgery was done through a classic anterior approach where the disc was excised. In case reduction was performed intraoperatively, a small Cobb elevator was used between the endplates to act as a fulcrum facilitating reduction of the dislocated facet joints. Manual manipulation of the superior vertebra did help achieve reduction. The use of the Casper distractor was also helpful in the reduction. Drilling of the caudal portion of the vertebra above was occasionally required to allow initial exposure of the disc space. Finally, an anterior fusion was performed with either an autologous iliac crest bone graft in 10 cases (48%) or a cervical cage in 11 cases (52%) followed by stabilization with an anterior cervical plate. After surgery, a Philadelphia cervical collar was prescribed for six weeks. Patients were followed by plain radiographs at 3,6,12 weeks and at 6 months postoperatively.

Results

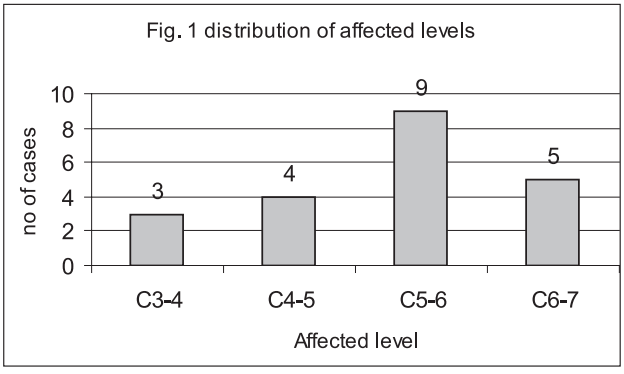
This study demonstrates 21 out of total 22 cases with cervical facet dislocation successfully reduced either by traction or open anterior reduction followed by anterior interbody fusion and anterior plate fixation. One patients was attempted for treatment but excluded from outcome assessment because closed reduction by traction and open anterior reduction failed and the case was treated by posterior facet drilling, lateral mass fixation, followed by anterior grafting and plating (anterior/ posterior/ anterior surgery). This case was referred from another hospital 7 weeks following trauma.

Patients ages ranged from 17 to 62 years (mean 44 years). 16 patients were males and 5 were females with a male to female ratio 3.2:1. Patients' follow up period ranged from 4 to 24 months (mean 14 months). The cause of injury was road traffic accidents in 71.4 % and falling from height in 28.6 %.

Upon admission 9 patients had incomplete spinal cord injury (3 patients Frankel B, 4 Frankel C and 2 Frankel D), 7 patients had complete spinal cord injury (Frankel A on admission), and 5 patients had no cervical cord injury (2 were completely intact and 3 cases had only radiculopathy). Radicular weakness and pain in total was found in 10 cases (3 isolated and 7 in association with cord injury).

Out of 21 patients, 12 had unilateral facet dislocation and 9 had bilateral facet dislocation.The affected levels on admission radiographs were as follows in order of frequency. C5–6 (9 cases, 48.2%), C6–7 (5 cases, 23.8%), C4–5 (4 cases, 19%), C3–4 (3 cases ,14.3%). (Figure 1)

Figure 1. Showing the distribution of affected cervical levels.



CT scan of the cervical spine demonstrated associated vertebral fractures as follows: 6 cases with laminar fractures, 3 cases with facet fractures, 5 spinous process fractures and 2 foramen transversarium fractures (Table 1).

Table 1. Shows the Associated Vertebral Fractures

Type of fracture	No of cases
Laminar fracture	6
Facet fracture	3
Spinous process fracture	5
Foramen transversarium fracture	2

Magnetic resonance imaging documented associated disc herniation in 6 cases. Based on MR imaging findings, closed reduction was not attempted in those 6 cases because it was believed to be contraindicated due to presence of anterior disc herniation (Figure 2).

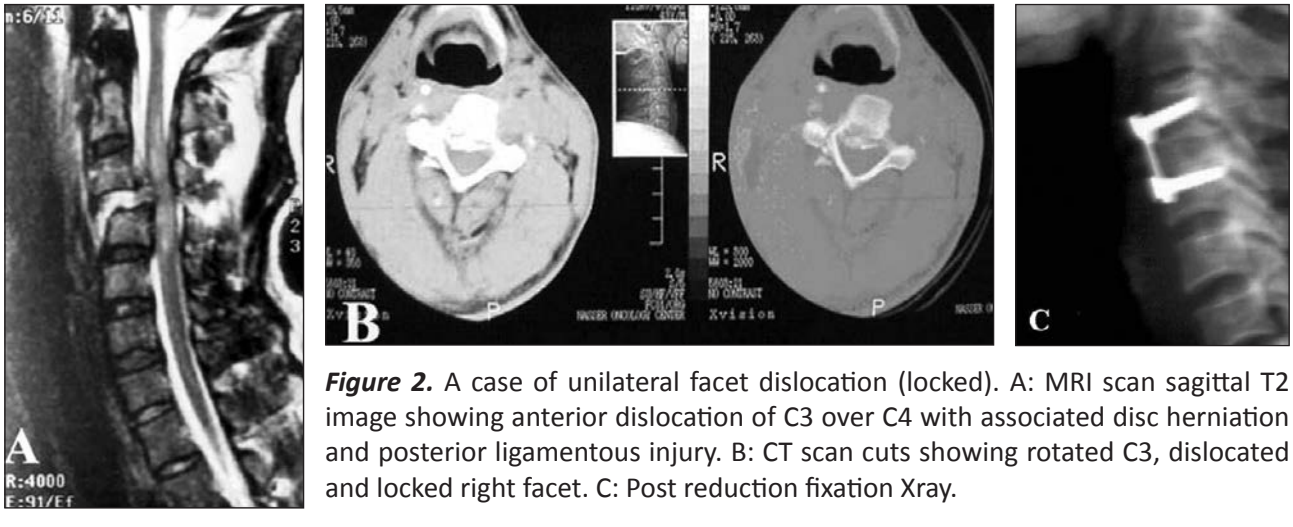


Figure 2. A case of unilateral facet dislocation (locked). A: MRI scan sagittal T2 image showing anterior dislocation of C3 over C4 with associated disc herniation and posterior ligamentous injury. B: CT scan cuts showing rotated C3, dislocated and locked right facet. C: Post reduction fixation Xray.

Closed reduction was attempted in a total of 16 out of 22 patients and was achieved in 13 patients (81.2%).Open reduction was attempted in a total of 9 patients (3 failed closed reduction and 6 initially considered for open reduction due to associated anterior disc herniation) and achieved in 8 (88.8%) of them surgically after anterior discectomy. One patient was finally excluded from the study because it failed closed and open anterior reduction and was treated by posterior facet drilling and posterior fixation. No cases of neurological worsening were recorded following traction reduction.

Follow up radiographs revealed solid fusion with good alignment in 20 cases. One patient with bilateral facet dislocation developed partial loss of alignment during the follow up period, however it was fused soundly with slight anterior displacement and no further treatment was required. This patient had an associated facet fracture on admission CT scan. This accounts for a total of 100% radiographic fusion rate and 95% normal radiographic alignment.

Clinically, five patients presented without cervical cord injury, all remained intact after operation. Two patients with Frankel grade D, one improved to normal and one remained unchanged. Two of four patients with Frankel grade C improved to grade D and 2 remained unchanged. Two of three patients with grade B improved to grade C and D respectively and one remained unchanged. Only two patients out of seven with complete (grade A) injury showed one grade improvement to grade B and five remained unchanged. Out of 10 patients with radicular muscle weakness, 6 patients regained full power in the affected muscle, 3 patients showed improvement but did not regain normal power and 1 patient remained unchanged. The Pre and postoperative Frankel grades of patients are shown in table 2.

Table 2. Shows the Preoperative and Postoperative Frankel Grades

	Frankel grade after operation					
Frankel grade before operation	No of cases	A	B	C	D	E
A	7	(5)	2			
B	3		(1)	1	1	
C	4			(2)	2	
D	2				(1)	1
E	5					5
The numbers between brackets indicate the total number of patients with no improvement in each functional grade						

Procedure related complications were recorded as follows: One case of transient recurrent laryngeal nerve dysfunction causing dysphonia (improved over three months). 2 cases of pneumonia developed during the hospital stay and were treated medically. No cases of operative site infection or postoperative neurological deterioration were recorded (Figure 3).

Figure 3. A case of bilateral facet dislocation. A: CT scan with 2 dimensional sagittal reconstruction showing significant anterolisthesis of C5 over C6. B: Sagittal MRI T2 weighted image showing an associated disc herniation. C: post reduction and fixation plain X-ray showing the anterior plate and inter body fusion.

Discussion

Cervical facet fracture-dislocations accounts for about 10 % of all cervical subaxial spine injuries and are secondary to a force of flexion and distraction as commonly seen with motor vehicle accidents and falling from heights.[3,17,21] These lesions should be treated by realignment followed by stabilization either externally using halo brace or surgically, however, external immobilization following reduction has been associated by a high incidence of failure.[9,21,38]

Traditionally, cervical facet fracture dislocations have been treated by posterior fixation assuming posterior elements injury.[2,5,9,10] However, with the advent of improved cervical plates designs and due to several advantages of anterior approach over posterior one, anterior plating is becoming increasingly used for treatment of such injuries. The reported advantages of treating facet dislocations through an anterior approach includes the following: The patient is treated in supine position, thus avoiding turning to the prone position with risk of loss of reduction.[18,33] Further more, the anterior approach enables the surgeon to remove an associated anterior disc herniation and thus ensure that disc sequestration will not cause neurological deterioration after reduction and fusion.[14,29,36] The anterior approach enables stabilization of one motion segment, whereas posterior element fractures, particularly those that extend into the lateral mass or facet, often require the fusion to extend over two or more segments.[24,37] Short-level posterior fixation, on the other hand, may, in trauma patients, result in kyphosis of the affected segment due to subsequent disc degeneration with reported increase in complaints of neck pain.[19] The dissection in the natural anatomic planes versus the posterior muscle separation has a lower infection rate and less postoperative pain.[22] On the other hand, it may be argued that the pathology of cervical facet injuries is primarily posterior and therefore a posterior instrumentation would be biomechanically sounder. Paxinos et al[30] have provided biomechanical proof for the efficacy of anterior plating in cervical facet injuries.

In this study, MRI scans were ordered routinely before applying craniocervical traction. Grauer et al [15] have demonstrated the existing differences in opinion regarding the timing and the use of MRI in cervical facet injuries. Traction was the initial method used for realignment in patients without MRI evidence of anterior disc compression. Closed reduction was achieved successfully in 81.2% of attempted cases. The efficacy of closed reduction in this series is in accordance with most other reports.[11,23,39] No cases of neurological deterioration following reduction occurred in our series which we correlate to avoidance of traction under anaesthesia and in cases with associated disc herniation. It is to be noted, however, that although neurological deterioration following traction in cases associated by disc herniation is a feared complication[29,36] whether it is dangerous to apply traction gradually to the cervical spine in the presence of a cervical disc herniation is debatable, as cases with permanent neurological deficit following traction reported in the literature were either under sedation or anasthesia[21] thus obviating the advantage of monitoring the neurological status of the patient during reduction which if occurs during awake reduction, the reduction procedure should be stopped and the inciting additional weight reversed.

Open anterior reduction in our study as well as demonstrated by Vital et al[40] was found superior to traction where out of three patients that failed reduction by traction 2 were successfully reduced operatively. The overall success of open anterior reduction in this study was 88.8% compared to 90% and 91% as reported by Ordonez et al[29] and Vital et al[40] respectively. The single case in our study and all five cases in Vital et al[40] series which failed open reduction were long standing cases prior to surgery.

Successive clinical studies have reported satisfactory fusion outcomes following isolated anterior plating for cervical facet fracture and dislocation injuries.[1,14,25,29,32,33,34] Aebi et al[1] and Ripa et al[34], reported excellent results when treating cervical spine fracture dislocations with anterior plate alone. They individually concluded that their clinical findings strongly support the use of anterior plate fixation for cervical facet dislocation. Razack et al[33] reported final evidence of stability in all cases of bilateral facet dislocation on final follow up. In accordance with these reports, 95.2 % (20 patients) of our patients developed solid fusion in good alignment during their follow up period. In only one case with bilateral C5-6 facet dislocation, partial loss

of alignment occurred during follow up however, the patient finally had solid fusion by 3 month and no further treatment was required. In this case with partial redislocation, the patient had associated facet fracture together with the bilateral dislocation. Johnson et al[20] conducted a retrospective study on identifying the factors that predisposes to loss of alignment in cases with traumatic cervical flexion distraction injuries (cervical facet dislocation) treated by single segment anterior plating. Their conclusions correlated loss of alignment to the presence of end plate fracture of the lower vertebra or associated facet fractures that if intact offer additional resistance to anterior redislocation. They have found no correlation between construct failure and age of patient, sex, uni or bilateral facet injuries, plate type, level of injury, degree of anterior translation or sagittal alignment at the time of injury. Herniques et al[18] on the other hand correlated structural failure to the presence of severe neurological deficit, assuming poor muscular tone around the fixed segment and the repeated nursing movement for the quadriplegic patients which places the fixation construct under more stress.

In our study, neurological recovery of radicular and incomplete neurological injuries was better demonstrated than with complete lesions. Pollard et al [31] also pointed to the fact that completeness of the lesion at presentation was the most important factor for poor recovery and Hadely et al[17] correlated the association of spinal shock with the onset of injury as a very poor prognostic factor.

Procedure related complications in this study were low in the form of transient unilateral recurrent laryngeal palsy in one case and pneumonia which developed in two patients during their hospital stay and were successfully treated medically. Recurrent laryngeal nerve stretch causing malfunction is reported to occur temporary in up to 12% and permanently in 4 % of anterior cervical fixation. Other less frequently reported complications include oesophageal perforation, Horner syndrome, infection and vertebral artery injury.[8,16] The incidence of spinal cord injury by anterior screws have much been reduced since the development of constrained (locking) plates which obviates the need of passing the posterior body cortex.[27]

Conclusion

Anterior cervical plate fixation is adequate in stabilizing cervical facet dislocation injuries and is an excellent alternative for posterior instrumentation with a low complication rate.

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الملخص العربي

نتائج الرد والتثبيت الأمامي بواسطة الشرائح في علاج الخلع والخلع جانب الكسر للنتوء الخلفي للفقرات العنقية السفلية

البيانات الخلفية: تفاوتت وسائل علاج الخلع والخلع جانب الكسر للنتوء الخلفي للفقرات العنقية السفلية من الرد المغلق والتثبيت الخارجي إلى التثبيت الجراحي من الأمام والخلف.

الغرض: لتقييم نتائج الرد والتثبيت الأمامي بواسطة الشرائح في علاج الخلع والخلع جانب الكسر للنتوء الخلفي للفقرات العنقية السفلية.

تصميم الدراسة: تحليل بأثر رجعي لسلسلة من الحالات.

المواد والأساليب: تم علاج واحد وعشرون مريضا (١٢ أحادية الإصابة و٩ ثنائية الإصابة) وكان نسبة الذكور إلى الإناث ٣,٢:١. تم العلاج بواسطة الرد والتثبيت الأمامي بالشرائح.

النتائج: كان متوسط العمر ٤٤ عاما. وكان أشيع مستوى للإصابة الفقرة العنقية الخامسة والسادسة((٤٨,٢٪. بلغ نجاح الرد المغلق بواسطة الشد نسبة ٨١,٢٪ والرد المفتوح من الأمام نسبة ٨٨,٨٪. وأظهرت إصابات النخاع الشوكي غير الكاملة نتائج أفضل من الإصابات الكاملة. وقد تحقق الانصهار الصلب في محاذاة جيدة في ٢٠ مريضا.

الخلاصة: التثبيت الأمامي بواسطة الشرائح هو وسيلة فعالة في علاج الخلع والخلع جانب الكسر للنتوء الخلفي للفقرات العنقية السفلية.