

Neglected traumatic dislocation of the subaxial cervical spine

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The optimal method for the management of neglected traumatic bifacetal dislocation of the subaxial cervical spine has not been established. We treated four patients in whom the mean delay between injury and presentation was four months (1 to 5). There were two dislocations at the C5-6 level and one each at C4-5 and C3-4. The mean age of the patients was 48.2 years (27 to 60). Each patient presented with neck pain and restricted movement of the cervical spine. Three of the four had a myelopathy.

We carried out a two-stage procedure under the same anaesthetic. First, a posterior soft-tissue release and partial facetectomy were undertaken. This allowed partial reduction of the dislocation which was then supplemented by interspinous wiring and corticocancellous graft. Next, through an anterior approach, discectomy, tricortical bone grafting and anterior cervical plating were carried out.

All the patients achieved a nearly anatomical reduction and sagittal alignment. The mean follow-up was 2.6 years (1 to 4). The myelopathy settled completely in the three patients who had a pre-operative neurological deficit. There was no graft dislodgement or graft-related problems. Bony fusion occurred in all patients and a satisfactory reduction was maintained.

The posteroanterior procedure for neglected traumatic bifacetal dislocation of the subaxial cervical spine is a good method of achieving sagittal alignment with less risk of iatrogenic neurological injury, a reduced operating time, decreased blood loss, and a shorter hospital stay compared with other procedures.

Flexion-distractive forces on the neck may disrupt the subaxial spine, causing injuries which can range in severity from facet subluxation to frank dislocation.¹ A bilateral fracture-dislocation of a facet joint is a distractive flexion injury of stage 3 or stage 4 according to the classification of Allen et al² and is an unstable three-column injury. Bifacetal dislocation adds to the risk of the development of quadriplegia and respiratory embarrassment and even death. An acute bifacetal dislocation is initially treated by closed reduction on skull traction under close observation. If this fails, treatment is by open reduction using either an anterior or posterior approach, followed by instrumented or halo-vest stabilisation. The management of a patient who presents late, more than three weeks after the initial injury is challenging, and differs from that of the patient who is seen early.³ There have been few studies on the management of late bifacetal dislocation.³⁻⁷ Consequently, we report our experience of four patients whom we treated in two stages by posterior and anterior stabilisation under the same anaesthetic.

Patients and Methods

Between May 2005 and June 2008, four patients (three men, one woman) were treated at our hospital with a mean age of 48.2 years (27 to 60) for an old bifacetal dislocation of the subaxial cervical spine. Two had fallen from a height, one had dived from a height and one had been hit by a bull. The mean interval between injury and operative intervention was 11.75 weeks (27 days to 24 weeks). The diagnosis had been missed in two patients, who subsequently developed a neurological deficit over the ensuing three weeks. The other two patients initially failed to seek medical help. There were no other associated injuries. They all had persistent neck pain and limited movement of the cervical spine. On admission, three patients had a partial injury to the spinal cord with upper motor-neurone signs in the lower limbs. One had no abnormal neurological signs. There was one dislocation, one at C4-5 and two at C5-6. Anteroposterior (AP) and lateral radiographs and an MR scan of the cervical spine were obtained in all the patients and

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Table I. Clinical details of the patients

Case	Age (yrs)	Gender	Mode of injury	Duration of injury	Level of dislocation	Pre-operative neural status	Treatment before reporting to hospital	Follow-up (yrs)	Neural status
1	27	M	Diving	27 days	C4-5	Weak hand grip, UMN* signs	Massage	4.0	Complete recovery
2	50	F	Fall from height	12 weeks	C5-6	Weak hand grip, UMN signs	Conservative	1.0	Complete recovery
3	56	M	Hit by a bull	24 weeks	C3-4	No neurological signs	Cervical collar	2.2	Neurologically intact
4	60	M	Fall from height	5 weeks	C5-6	Weak hand grip, UMN signs	Conservative	3.2	Complete recovery

* upper motor-neurone



Fig. 1a

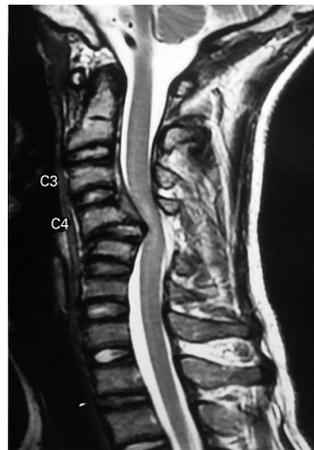


Fig. 1b



Fig. 1c

a) Lateral radiograph of a patient presenting one month after injury with bifacetal dislocation at C4-5. b) Midsagittal T2-weighted MR scan showing bifacetal dislocation with compression of the cord. c) Lateral radiograph of the cervical spine showing good alignment of vertebrae with posterior and anterior fusion at follow-up at one year.

showed a bifacetal dislocation with translation of 50% or more of the upper over the lower vertebral body, MRI showed abnormal disc tissue lying behind the upper vertebral body in all the patients. In three, there was a prolapse of the intervertebral disc at the affected level. Details of the patients are given in Table I.

Operative technique. Each patient was operated on in the prone position under general anaesthesia by the senior author (AKJ). In the first patient (case 1) closed reduction of a four-week-old dislocation of C5-6 was attempted awake in theatre under image-intensifier control. Despite applying 30 lbs of traction while paying close attention to the neurological status of the patient, the reduction failed and was not attempted again thereafter in the remaining patients. The spine was explored through a posterior mid-line approach and the relevant segments completely displayed. The locked facets were found to be enveloped by fibrous tissue and were irreducible. Under image-intensifier control a release of the soft tissues and partial facetectomy were carried out and the facet joint reduced by levering the proximal over the distal facet with a blunt dissector. The spinous processes

were wired together using Roger's technique⁸ and the posterior elements fused with corticocancellous autogenous graft from the iliac crest. The posterior wound was closed.

The patient was then carefully placed in the supine position. The relevant spinal segments were exposed through an anterior cervical approach. There was fibrosis around the vertebral bodies to the level of the uncovertebral joints. A discectomy was carried out at the appropriate level. A tricortical graft was taken from the anterior iliac crest. As soon as this had been done the vertebral body aligned spontaneously.

A caspar intervertebral body distractor was used to distract the disc space and any fibrous tissue in the uncovertebral joints was cleared before reduction. The tricortical graft was sited after applying axial traction with Crutchfield calipers and the motion segment was stabilised by a locking plate (Vectra AO, Synthes, Solothurn, Switzerland). The position was checked on the image intensifier (Fig. 1). The wound was closed over a corrugated drain. Post-operatively, the patients were mobilised in a Philadelphia collar (MGRM, Hyderabad, India).

Table II. Details of studies of neglected bifacetal dislocations of the cervical spine

Author/s	Number of cases	Delay	Treatment	Outcome
Hassan ⁶	10	3.5 mths	Traction, posterior laminectomy/facetectomy, traction, followed by anterior plate and fusion	Fusion and neurological recovery in all cases
Bartels and Donk ⁵	3	10 wks, 8 wks, 8 mths	Antero-postero-anterior	Good outcome in all cases
Payer and Tessitore ⁷	1	10 wks	Antero-postero-anterior	Fusion and complete neurological recovery
Liu et al ³	4	2.8 mths	Postero-anterior	Fusion and complete neurological recovery in all cases
Madhavan et al ¹⁴	3	4 to 6 wks	Antero-posterior, posterior only	Fusion and complete neurological recovery in all cases
Present series	4	4 mths	Postero-anterior	Fusion and complete neurological recovery in all cases

Results

The mean operating time was 180 minutes (150 to 220) and the mean intra-operative blood loss 200 ml (180 to 320). The mean hospital stay was 14 days (11 to 20) and the mean follow-up was 2.6 years (1 to 4). The neurological condition did not deteriorate in any patient. Nearly anatomical reduction and sagittal alignment were achieved in each case. The earliest sign of improvement in motor power was seen on the second post-operative day. At the final follow-up, the three patients who had neurological signs post-operatively had recovered completely, the fourth had no neurological involvement before surgery and no deficit post-operatively. There were no graft-related problems. Reduction was maintained and bony fusion occurred uneventfully in each case. The patients reported a considerable reduction in their neck pain and sufficient movement for normal activities.

Discussion

An accurate, detailed history and physical examination are essential if a diagnosis of cervical spinal injury is not to be missed.^{6,7} Bohlman⁹ found that delays in diagnosis were common and that one third of severe cervical spinal injuries were not recognised initially. The reported frequency of missed injuries ranges from 4% to 30% and the most common cited reason for this is inadequate radiological examination.⁹⁻¹¹ Commonly missed injury patterns include odontoid, teardrop, facet and hangman's fractures.¹² Even in the absence of fracture, clinically significant instability may be present. Injury to the spinal cord without any radiological abnormality has been reported in 0.08% of adults after blunt cervical spinal trauma.¹³ When an injury is missed initially, the delay in diagnosis puts the patient at risk of progressive instability and neurological deterioration. In developing countries this is more likely to occur because of late presentation. In our series, all the patients initially thought that they had a simple soft-tissue injury and approached a bone-setter for treatment. When their pain persisted or they developed neurological symptoms and signs they attended our hospital.

Traumatic bifacetal dislocations are unstable injuries and may be associated with severe neurological damage. The

aim of treatment is to achieve anterior alignment and a stable movement segment. Non-operative treatment leads to a high incidence of redisplacement. Late presentation is not uncommon. The chance of successfully reducing a dislocation which has been present for more than 72 hours by closed means is approximately 20% compared with 64% in a fresh dislocation.²

A cervical spinal injury is considered to be neglected when the interval between the injury and the correct diagnosis is more than three weeks.⁶ Delay makes the treatment more difficult because persistent dislocation results in fibrosis around the locked posterior facet joints, vertebral bodies and uncovertebral joints which resists reduction.

Skull traction or an isolated anterior or posterior procedure alone is insufficient to achieve an anatomical reduction. A combined procedure is required which releases the soft tissues from the front and back and unlocks the facet joints thereby allowing anatomical reduction to occur.⁵ The ultimate aim is to obtain good anatomical alignment, decompression of the neuraxis and solid fusion.

There are only a few reports in the English literature which highlight the treatment of delayed bifacetal dislocation of the cervical spine.³⁻⁷ Hassan⁶ described 12 patients with old (mean delay 3.5 months) dislocations of the lower cervical spine which were treated by skull traction for one week. Myelography was undertaken in the first eight patients and MRI in the other four. Reduction was achieved in only two patients and was followed by anterior fusion with plating. In the ten other patients in whom traction failed to achieve reduction, one was treated by a posterior release and lateral mass fusion with plating while reduction was obtained in the other nine after a posterior release. These were stabilised by anterior discectomy, iliac-bone grafting and plate fixation.⁶ In no other study has closed reduction on traction been achieved in such injuries.

Other authors have reported success with a combination of three procedures, either antero-postero-anterior or postero-antero-posterior (Table II).^{3,5,7,14}

In our series we dealt with the posterior aspect first, carrying out a soft-tissue release and partial facetectomy to gain a partial reduction. This was achieved in all cases. The

interspinous wiring allowed the reduction to be completed at the time of anterior fusion with instrumentation. We did not need to carry out a partial laminectomy as Hassan⁶ had done in 30% of his cases. Removal of the fibrocartilaginous tissue around the facet joints through a posterior approach followed by its removal around the deformed uncovertebral joints in an anterior approach gives a circumferential release, after which reduction can be achieved. Even so, anterolisthesis of the upper vertebra of 1 mm to 2 mm remains after reduction.

When compared with the five-stage treatment of Hassan⁶ and the three-stage procedure reported by Bartels and Donk,⁵ the posteroanterior procedure which we describe for neglected bifacet dislocation of the subaxial cervical spine has several advantages including a decreased risk of iatrogenic neurological injury, a reduced operating time, less blood loss and a shorter hospital stay.

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