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## Treatment of old dislocations of the lower cervical spine

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**Abstract** We treated surgically 12 patients with an old dislocation of the lower cervical spine. The time from injury to presentation averaged 3.5 (range 1.5–12) months, and the majority of the dislocations were between C4–5. Treatment started with 1 week of skull traction. If this resulted in reduction the area was stabilised by anterior fusion with plate fixation. If reduction by traction did not succeed a posterior partial facetectomy was performed. If this allowed reduction it was followed by a posterior fusion with plate fixation. If reduction was not achieved the traction was continued for a further week and then followed by anterior discectomy and fusion with plate fixation. The average follow-up was 34 (range 12–54) months, and all patients developed bone fusion and showed neurological improvement.

**Résumé** Nous avons traité chirurgicalement 12 cas de subluxation ancienne du rachis cervical inférieur. Le délai depuis le traumatisme était en moyenne 3.5 (1.5–12) mois. La majorité des subluxations était localisée à C4/5. Nous avons utilisé le protocole de traitement suivant: Une traction du crâne a été instituée une semaine. Si la réduction était réalisée, une fusion antérieure avec fixation par plaque a été faite. Si la réduction n'était pas accomplie, une facetectomie partielle postérieure a été faite. Si la réduction pouvait alors se faire, une fixation par plaque postérieure et fusion a été faite. Si la réduction ne pouvait toujours pas se faire, la traction a été maintenue pour une autre semaine et une discectomie antérieure avec fusion et fixation par plaque a été faite. Le suivi moyen était 34 (12–54) mois. Tous les cas ont montré une amélioration neurologique et une fusion osseuse.

### Introduction

Studies from the United States report an annual rate of 3.2–3.5 new spinal cord injuries per 100,000 persons at risk. More than 50% of these involve the cervical spine. Early diagnosis and treatment improve chances of recovery and avoid the deleterious effects of missed injury [10]. An injury is considered as old when the interval between the accident and correct diagnosis is longer than 3 weeks [9]. There are few reports of the management of old dislocations of the sub-axial cervical spine in the English literature, but these injuries still occur and the aim of this prospective study was to assess the clinical and radiological results of the surgical treatment of these late-presenting problems.

### Material and methods

Twelve patients with an old dislocation of the lower cervical spine were treated at the Assuit University Hospital between May 1994 and June 1999 (Table 1). Ten of these patients were men and two were women. Their mean age was 50 (range 26–67) years. The average interval between injury and presentation was 3.5 (range 1.5–12) months, but full data from the time of the injury was not available. The cause of delay in treatment was misdiagnosis in three patients (one had an associated hangman fracture that was treated conservatively); six patients were treated conservatively after successful reduction by traction, as advised by the treating surgeons, and those six patients refused any surgical fixation; two patients sought no medical advice at all; and one patient was a woman 6 months pregnant who refused surgical treatment after failure of an attempted closed reduction. She was delivered by Caesarean section after 1.5 months but the baby died a few days later.

All patients had neck pain and a restricted range of neck motion. Neurological status on admission was that the cervical nerve roots were affected in two patients, Frankel C in six, and Frankel D in four. Dislocation levels were C4–5 in six patients, C5–6 in four, C3–4 in one, and C6–7 in one. Dislocation was bifacetal in ten cases and unifacetal in two. Radiographic studies (AP, lateral and stress flexion, and extension views) were done on admission to detect irreducibility of the dislocation. These radiographs revealed marked spondylotic changes in four patients. The associated hangman fracture healed in an acceptable stable position. Cervical myelography was performed for the first eight patients and MRI for the last four.

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**Table 1** Details of all patients

Patient/sex/age Frankel's in years	Duration of injury in months	Level and type of dislocation	Pre-operative Frankel's grade	Operative procedures follow-up in months	Duration of grade	Final
1/M/51	3	C4–5 bifacetal	C	a) Traction, b) posterior laminectomy, c) Traction, d) anterior plate & fusion	54	E
2/F/45	1.5	C4–5 bifacetal	C	a) Traction, b) posterior facetectomy, c) Traction, d) anterior plate & fusion	51	E
3/M/66	4	C 5–6 bifacetal	D	a) Traction, b) posterior facetectomy, c) Traction, d) anterior plate & fusion	46	E
4/M/59	12	C4–5 unifacetal	D	a) Traction, b) posterior laminectomy, c) Traction, d) anterior plate & fusion	43	E
5/M/58	2	C4–5 bifacetal	Nerve root affection	a) Traction, b) posterior laminectomy, c) Traction, d) anterior plate & fusion	38	Complete recovery
6/M/52	3	C5–6 bifacetal	C	a) Traction, b) posterior laminectomy, c) Traction, d) anterior plate & fusion	37	E
7/M/67	2	C6–7 bifacetal	C	a) Traction, b) anterior plate & fusion	34	E
8/M/26	3	C3–4 bifacetal	D	a) Traction, b) anterior plate & fusion	27	E
9/M/38	3	C4–5 bifacetal	D	a) Traction, b) posterior facetectomy, d) Posterior lateral mass plate & fusion	26	E
10/F/40	2	C4–5 bifacetal	C	a) Traction, b) posterior facetectomy, c) Traction, d) anterior plate & fusion	20	E
11/M/49	5	C 5–6 bifacetal	C	a) Traction, b) posterior 16 facetectomy, c) Traction, d) anterior plate & fusion	E	
12/M/46	2	C5–6 unifacetal	Nerve root affection	a) Traction, b) posterior facetectomy, c) Traction, d) anterior plate & fusion	12	Complete recovery

Skull traction was applied and increased gradually. The weight used ranged between 6 kg and 12 kg and continued for 1 week. If perfect reduction was achieved an anterior fusion with plate fixation was performed. If closed reduction failed a posterior surgical reduction was attempted. In four patients a limited laminectomy of the two vertebrae at the level of the dislocation was done before partial facetectomy (Fig. 1) because there were marked spondylotic changes. In six patients a partial facetectomy without laminectomy was indicated (Fig. 2). If the reduction was complete a posterior lateral mass plate-screw stabilisation was done. If the reduction was not complete after posterior release, the traction was continued for another week and followed by anterior discectomy and fusion with an AO H-plate fixation. A cervical collar with chin support was advised for 6 weeks after operation.

## Results

Traction achieved reduction in two patients only and was followed by anterior fusion with plating. In the other ten patients traction did not achieve reduction. This necessitated a posterior release in one patient who then underwent posterior lateral mass fusion with plating. Traction after a posterior release achieved complete or nearly

complete reduction in the other nine patients, and anterior discectomy iliac bone grafting with plate fixation achieved complete and stable reduction.

The average follow-up was 34 (12–54) months. There were neither intra-operative nor post-operative complications, and no mortality. At the latest follow-up neck pain and movement had improved in all the patients. Neurological improvement, apart from the persistence of exaggerated reflexes or some weakness or clumsiness of the small muscles of the hands, occurred in all patients, and all could walk without support (Frankel E). Average time in hospital was 25 (15–29) days. Interbody bone fusion occurred in 11 patients. In the last patient, for whom a lateral mass plate fusion was used, bridging bone trabeculae could not be detected radiologically. However, the position of the plate and the screws was good at the last follow-up, so this was considered a successful fusion [11].

**Fig. 1** Case 1: A man aged 51 years with a C4–5 dislocation of 3 months duration. **a** Lateral radiograph at presentation, **b** after skull traction for one week, **c** after posterior laminectomy and partial facetectomy, **d** follow-up two years after anterior fusion and fixation with bone healing in a reduced position



## Discussion

Traumatic facet dislocations of the cervical spine are usually associated with severe neurological damage, but some patients sustain little or no injury to the spinal cord or nerve roots [8]. Some of these latter patients may present weeks or months after the injury, and Mahale and Silver [7] reported 13 patients with missed bilateral facet dislocation of the lower cervical spine who subsequently (6–48 h) developed severe spinal cord involvement. Korres et al. [4] reported 16 patients with old injuries of the lower cervical spine. Madhavan et al. [6] reported five patients with cervical instability due to an initially unrecognised fracture-dislocation at a different level

after an apparently isolated injury of the cervical spine. One of our patients had a misdiagnosis of a lower cervical dislocation because of the associated hangman fracture that was treated conservatively and healed in an acceptable position. Bilateral facet dislocations are unstable injuries, and non-operative treatment of these cases is associated with a high incidence of displacement (up to 48%) [1]. This occurred in six patients in our group.

Treatment of old injuries of the cervical spine presents a great challenge. Bohlman and Anderson [2] reported a series of 68 patients with incomplete quadriplegia due to a fracture or dislocation of the cervical spine treated by anterior decompression and fusion after more than 1 month from the trauma. They found func-

**Fig. 2** Case 10: A woman aged 40 years with a C4–5 dislocation of 2 months duration. **a** Lateral radiograph at presentation, **b** after traction and posterior partial facetectomy, **c** one year after anterior fusion and fixation with bone healing in a reduced position



tional neurological improvement in both the upper and lower limbs in 81% of these patients following treatment. The authors state that patients who sustain an incomplete spinal cord injury may have varying degrees of improvement but that mechanical compression of the anterior aspect of the cord is one factor that may prevent this improvement.

Korres et al. [4] surgically treated 16 patients with old injuries of the lower cervical spine. Average age of their patients was 41 years, and the average interval after injury was about 3 months. The study included four patients with pure dislocation, two with unilateral and two with bilateral. Their treatment was posterior in three and anterior in one. They gave no details about the reduction

technique. They reported solid fusion in all patients except one. A post-operative deformity was present in seven patients (43%), and neurological improvement occurred in all but one who had a complete tetraplegia that remained.

Liu et al. [5] reported 12 patients with old facet dislocations of the cervical spine treated surgically. Average age was 37.8 years and average interval from injury to admission was 3.7 months. Neurological status was a spinal cord lesion in five, a nerve root lesion in five, and two were neurologically intact. Facetectomy with an iliac graft was performed in all cases. Four other adjuvant treatments were used, including internal fixation by wires (sublaminar or through the spinous processes) in four, a Luque rod in one,

anterior fibrolysis with posterior laminoplasty in one, and sustained skull traction without internal fixation in six. They stated that post-operative maintenance of reduction using skull traction was the most efficient treatment and that stainless steel wire fixation ranked the next best.

In our series average patient age was older (50 years) than in the series reported by Korres et al. [4], or Liu et al. [5], and was in fact older than the usual age of dislocation, which is less than 40 years [7]. This could explain the relatively mild neurological status of our patients (Frankel C or more) because, in this age group, the facet dislocation may be produced by less severe forces which are less likely to damage the cord [7]. As our patients were relatively old and had relatively good neurological function, we believed their treatment should be 'gradual'. During the anterior or posterior releases the spine was not manipulated, nor was there any trial of forcible reduction, so as to avoid the possible catastrophic complication of increasing any neurological deficit. Gradual traction can help to correct severe deformities from many causes, and Graziano et al. [3] reported five patients with severe cervical deformity due to rheumatoid arthritis who were treated by gradual skull traction and posterior instrumental fusion after the correction.

We conclude from our study that although the treatment of an old dislocation of the lower cervical spine is lengthy, it is safe, and is valuable for correcting the deformity and decompressing the neural structures.

## References

1. Bohlman HH (1979) Acute fractures and dislocations of the cervical spine. An analysis of three hundred hospitalised patients and review of literature. *J Bone Joint Surg [Am]* 61: 1119–1142
2. Bohlman HH, Anderson PA (1992) Anterior decompression and arthrodesis of the cervical spine: long-term improvement. Part I – Improvement in incomplete traumatic quadriplegia. *J Bone Joint Surg [Am]* 74: 671–682
3. Graziano GP, Hensinger R, Patel CK (2001) The use of traction methods to correct severe cervical deformity in rheumatoid arthritis patients: A report of five cases. *Spine* 26: 1076–1081
4. Korres DS, Nikiforidis GC, Vlachou BC et al (1995) Old injuries of the lower cervical spine treated surgically. *J Spinal Disorders* 8: 509–515
5. Lui H, Rao S, Wu J (1997) Reconstruction of cervical stability following old facet dislocation of cervical spine. *Chung Kuo Hsiu Fu Chung Chien Wai Ko Tsa Chih* 11: 40–42
6. Madhavan P, Monk J, Wilson-MacDonald J, Fairbank J (2001) Instability due to unrecognised fracture-subluxations after apparently isolated injuries of the cervical spine. *J Bone Joint Surg [Br]* 83: 486–490
7. Mahale YJ, Silver JR (1992) Progressive paralysis after bilateral facet dislocation of the cervical spine. *J Bone Joint Surg [Br]* 75: 219–223
8. Mahale YJ, Silver JR, Henderson NJ (1993) Neurological complications of the reduction of the cervical dislocations. *J Bone Joint Surg [Br]* 75: 403–409
9. Roy-Camille R, Edward B, Zeller R, Lapresle P (1988) Les lésions traumatiques anciennes du rachis cervical inférieure. In: *Rachis cervical inférieure, 6mes journées d'Orthopédie de la Pitié, Masson, Paris*, pp 139–146 (quoted by Korres et al 1995)
10. Slucky AV, Eismont FJ (1994) Treatment of acute injury of the cervical spine. *J Bone Joint Surg [Am]* 76: 1882–1896
11. Vale FL, Oliver M, Cahil DW (1999) Rigid occipito-cervical fusion. *J Neurosurgery (Spine 2)* 91: 144–150