UNILATERAL FACET DISLOCATIONS AND FRACTURE-DISLOCATIONS OF THE CERVICAL SPINE

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We treated 36 patients with unilateral facet dislocations or fracture-dislocations of the cervical spine at the Mayo Clinic between 1975 and 1986. Adequate records were available for 34; ten patients were treated by open reduction and posterior fusion, and 24 by nonoperative management. Of these, 19 had halo traction followed by halo-thoracic immobilisation, four had a simple cervicothoracic orthosis, and one received no active treatment.

Anatomical reduction was achieved more frequently in the operative group (60% compared with 25%). Nonoperative treatment was more likely to result in cervical translation on flexion/extension lateral radiographs, and in significant symptoms. Only 36% of the patients treated by halo traction achieved anatomical alignment; in 25%, halo traction failed to achieve or maintain any degree of reduction. During halo-thoracic immobilisation, half of the patients lost some degree of reduction and patient satisfaction with the appliance was low.

Open reduction and internal fixation of unilateral facet injuries gave better results.

Unilateral facet dislocations and fracture-dislocations of the cervical spine represent 12% to 16% of all cervical spine injuries (Berquist and Cabanela 1986). The goal of treatment is to return the patient to full function as quickly as possible. How best to achieve these goals for unilateral facet injuries is not clear from the literature. The questions to be answered include:

1) Is reduction necessary?
2) If it is, can it be achieved effectively with weighted axial traction in a closed fashion?
3) Is closed reduction followed by halo immobilisation better or worse than open reduction and fusion as a treatment?

In Beatson’s series (1963), 13 of 14 unilateral facet dislocations left in an unreduced position caused minimal or no symptoms, but others have found late pain and persistence of neurological symptoms when these dislocations were left unreduced (Braakman and Vinken 1967; Rorabeck et al 1987). Crutchfield (1936) and Cotler et al (1987) found axial traction with increasing weights to be an effective means of obtaining reduction. However, both O’Brien, Schweigel and Thompson (1982) and Rorabeck et al (1987) reported that closed reduction by weighted traction was ineffective. Excellent results have been reported after operative as well as nonoperative treatment (Bohlman 1979; Cotler et al 1987). Some contend that operative intervention is necessary because of instability after external immobilisation (O’Brien et al 1982). Others have found that operation decreases the time in hospital and absence from work and prevents late deformity and pain (Forsyth et al 1959; Osti et al 1987).

To try to answer the above questions we reviewed the Mayo Clinic experience with unilateral facet dislocations and fracture-dislocations of the cervical spine.

MATERIALS AND METHODS

The records of all patients with cervical spine injuries treated at our institution between 1975 and 1986 were reviewed; 36 cases of unilateral facet dislocation or fracture-dislocation were found, of whom adequate follow-up information was available on 34. Follow-up data was gathered through record review, telephone interview, or clinic visit. Every patient had routine anteroposterior radiographs and flexion/extension lateral views at their latest clinic visit.

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All radiographs were reviewed by one radiologist (THB) looking particularly for presence or absence of fusion, residual subluxation, angular deformity, degenerative changes, and abnormal translation at any level of the cervical spine. Anatomical reduction was defined as restoration of normal cervical alignment with no subluxation or angulation on the lateral radiograph.

The patients were questioned with respect to function, neurological symptoms, pain or stiffness, and general satisfaction with the treatment. Pain and stiffness were graded as 'mild', if minimal and occasional; 'moderate', if of moderate intensity or frequency without interfering with activity; and 'severe' if the intensity or frequency interrupted daily activities. Additionally, patients treated with halo immobilisation were asked about their tolerance of the device. Statistical analysis of the data was computed by both the Fisher exact test and \( \chi^2 \) methods.

**RESULTS**

The mean age of the initial 36 patients was 33 years (range 15 to 87) and 28 were men. Motor-vehicle accidents were the most common cause of the unilateral facet injury. The diagnosis was delayed for at least one day after the injury in 12 (mean eight days). Levels C5 to C6 and C6 to C7 were most frequently involved. Two patients had unilateral facet displacement at more than one level. Over half of the patients had an associated facet fracture apparent on the radiographs. Eight patients had no neurological signs or symptoms at presentation. An isolated radiculopathy corresponding to the side and level of the unilateral facet injury was seen in 23 cases at presentation. No patient had a complete cord lesion, but three had partial lesions.

Of the 34 patients on whom follow-up information was obtained, 24 had been treated throughout by nonoperative means and ten by operation; mean ages were 30 years (range 16 to 74) and 33 years (range 15 to 71) respectively. The mean follow-up was nearly nine years in the nonoperative group and 6.5 years in the operative group.

Of the 24 patients in the nonoperative group, 18 were treated by attempted closed reduction with halo traction and one by halo traction alone. All 19 then had

![Fig. 1](image)

Lateral and oblique radiographs showing unilateral facet subluxation, C6 on C7. Closed reduction failed and the patient underwent open reduction and interspinous wiring.

![Fig. 2](image)

Extension and flexion lateral radiographs after three years, showing anatomical alignment and no translation.

**Table 1. Summary of results of treatment**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Non-operative</th>
<th>Operative*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>Number achieving bony ankylosis</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Class of reduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anatomical</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Imperfect</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Still dislocated</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Translation seen at follow-up</td>
<td>9</td>
<td>2</td>
</tr>
</tbody>
</table>

*all treated initially in halo traction
external support with different orthoses. Simple immobilisation with a cervical brace was used in four patients; one received no treatment.

In the operative group, all ten had been treated initially in halo traction. The indications for operative intervention included: persistence or progression of a neural deficit in four, failed reduction in three, and loss of reduction in three (two while in halo traction and one in a halo jacket). Surgical treatment usually involved open reduction through a posterior approach, decompressive foraminotomy if necessary, and posterior fusion correlation was found between failure to achieve anatomical reduction and the presence of an associated facet fracture. Ten of the 28 patients who were treated initially by halo traction went on to have open reduction and interspinous wiring.

Radiographic evaluation at follow-up revealed a solid fusion in all ten patients treated operatively (Table 1). In the nonoperative group 13 of 24 cases went on to spontaneous fusion. Anatomical reduction was attained more frequently by operative intervention (60% versus 25%, \( p = 0.112 \) by Fisher's exact test; \( p = 0.052 \) by \( \chi^2 \) test). Patients without anatomical reduction showed residual subluxation or angular deformity or both. Cervical translation, at or adjacent to the injury level, as seen on flexion/extension lateral radiographs (Figs 3 to 5), was observed more frequently with nonoperative treatment than with operative treatment (38% versus 20%, difference not statistically significant).

Fig. 3
Lateral and oblique radiographs reveal unilateral facet injury at the C3 to C4 level.

Fig. 4
Extension and flexion lateral radiographs four months after injury reveal spontaneous fusion at C3 to C4 with residual subluxation of C3 on C4 but no translation.

Fig. 5
Extension and flexion lateral radiographs at five years after injury show apparent 3 mm retrolisthesis of C4 on C5 in extension and fusion at C3 to C4.
With respect to the relationship of cervical translation to reduction, ten of 22 patients with less than anatomical reduction (two from the operative group; eight from the nonoperative group) had evidence of cervical translation, whereas only one of 12 patients with an anatomical reduction had cervical translation (p = 0.0527 by Fisher's exact test; p < 0.03 by χ² test). This suggests that less than anatomical reduction is a risk factor for cervical translation, regardless of treatment modality. The translation typically occurred one level above or below the site of initial injury and was usually associated with fusion. Of the nine patients with translation above or below the level of injury, eight had either spontaneous or surgical fusion at the level of injury. In two patients without spontaneous fusion, cervical translation occurred at the site of initial injury. This may be related to failure of ligamentous healing at that level.

The patients treated operatively appeared to fare better clinically. Fewer patients treated surgically had serious complaints of pain or stiffness (10% versus 42%; not statistically significant). The one patient with serious symptoms in the operative group complained primarily of stiffness and had radiographic evidence of a multi-level ankylosis after a fusion was performed encompassing only two spinal levels. Of ten patients in the nonoperative group who had complaints that were graded moderate or severe, nine had nonanatomical reduction or cervical translation or both on lateral radiographs.

The patients in both groups generally showed complete resolution or improvement of the initial neurological deficit; this was true for all ten patients treated operatively. Three of the patients treated non-operatively showed no change or possibly some deterioration at follow-up.

DISCUSSION

The literature on unilateral facet dislocations and fracture-dislocations of the cervical spine contains a number of important contradictions. The majority of the published studies, including this one, are based on a relatively small number of patients, and different methods of management divide these groups into even smaller subgroups, making statistical analysis difficult.

Our series is similar to others with respect to patient population, type of accident, level of injury and frequency, and length of delay in diagnosis (Beatson 1963; Braakman and Vinken 1967; Bohlman 1979; Rorabeck et al 1987). We also found a high rate of associated facet fracture. In contrast to other reports of good results with weighted axial traction (Crutchfield 1936; Cotler et al 1987), we found halo traction and halo immobilisation to be inadequate for attaining and maintaining anatomical alignment and they were often disliked by patients. Our greatest chance for achieving and maintaining an anatomical reduction was through operative interven-

tion. It has been suggested that surgical treatment may not be necessary because of the tendency towards spontaneous fusion after trauma (Beatson 1963). We found that more than half of the patients with significant symptoms did have a spontaneous fusion at the level of the initial injury, but that did not seem to protect the patient from pain. However, anatomical reduction appears to be necessary to minimise the risk of dynamic cervical translation. Both cervical translation and failure of anatomical reduction, appeared to increase the risk of late pain or stiffness or both. Ten of 24 nonoperative patients had serious symptoms and in nine of these there was an association with less than anatomical reduction or cervical translation or both.

Others have documented subacute instability that becomes apparent weeks after an injury when the muscle spasm has subsided (Webb et al 1976; Mazur and Stauffer 1983; Herkowitz and Rothman 1984). However, to our knowledge, late cervical translation above or below a previous cervical spine injury has not been reported.

Although the amount of translation we saw could not be labelled as instability according to the criteria of White, Southwick and Panjabi (1976), the possibility exists that this translation (up to 3 mm of subluxation) which was not present immediately after treatment and was associated with pain at the time of follow-up, may progress, resulting in late instability or neurological damage. This is of particular concern because many of these patients were young at the time of the initial injury. The reason for this translation may lie in the altered biomechanics of the cervical spine as a result of the failure to achieve anatomical reduction.

Only one patient in the operative group had a significant complaint of stiffness. He had undergone a two-level surgical fusion (C5 to C7), but his ultimate fusion encompassed five vertebrae (C3 to C7). Because of the propensity of the cervical spine to fuse after surgical exposure, this might be prevented by limiting the exposure, with minimal soft-tissue dissection.

Conclusions.

1. It appears that a less than anatomical reduction may predispose to dynamic cervical translation. This translation occurred more frequently at a level contiguous with the level of injury and has not been reported before. It presents late, and may progress to frank instability.

2. Nonanatomical reduction and cervical translation are associated with late pain and stiffness.

3. Halo traction followed by halo immobilisation is an inadequate method for attaining and maintaining an anatomical reduction compared with surgical treatment.

4. When electing to treat unilateral facet injuries operatively, it is advisable to minimise the exposure to the desired level in order to avoid spontaneous extension of the fusion to other levels.

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REFERENCES


