Manipulation for cervical spinal dislocation under general anaesthesia: serial review for 4 years

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Manipulation under anaesthesia is an important method to reduce cervical spinal dislocations in the acute stage. Causes of failure have not been clearly identified and neurological complications can be the major concern. All cervical dislocations have been traditionally treated by manipulation under anaesthesia in the Christchurch Spinal Injuries Unit as the primary treatment. We reviewed all 31 patients treated from 1991 – 1995, with detailed documentation of neurological progression and final outcome. Three patterns were identified: bilateral dislocation, unifacet dislocation and fracture dislocation. Most of the dislocations (74%) were successfully reduced by manipulation alone with minimum complications. The remaining 26% patients required open reduction. The predominant causes of failure of reduction by manipulation were co-existing fractures. The success rate of reduction by manipulation was 90% for pure bifacet and unifacet dislocations, but was only 22% for the fracture dislocations. The study concluded that manipulation under anaesthesia is a safe and effective procedure for pure cervical spinal dislocations. Fractures related to the dislocation should be identified early and open reduction be considered.

Keywords: dislocation; reduction; cervical spine; manipulation under general anaesthesia

Introduction

Cervical spinal dislocations require urgent management with great experience and skill. Yet no unified recommendations have been accepted universally among the three approaches: closed manipulation (MUA), increasing skull traction and open reduction.[1,2,5] There have been increasing concerns over the safety of closed reduction which may cause neurological deterioration particularly secondary to herniated discs.[1–4] Recent studies however indicated that MRI might be over sensitive as there was much less reported neurological involvement related to disc lesions even though the latter were found in up to 80% of dislocations.[1,5,10]

Manipulation under anaesthesia is an effective way of reducing the dislocations. However, the failure rate can be high (26% in our series and 27% in Lee's series 1994). Our study is aimed at explaining why some dislocations could not be reduced by manipulation. This study also presents the detailed outcomes of all patients who showed favorable recovery and reflect the quality of current spinal rehabilitation. The safety and success of the manipulative reduction of cervical dislocation will be discussed.

Patients and methods

Thirty-one patients with traumatic cervical dislocations have been included in the study. There were three patterns of dislocation: (1) bifacet dislocation without fractures; (2) unifacet dislocation without fractures; (3) fracture dislocation involving either one or both facets. The causes of injury included Motor Vehicle Accidents (MVA) in 15 cases and Rugby injuries in 11 cases. The patients were young adults (20 – 40 years) in 66% of cases (14 were between 20 – 30 years and seven between 31 – 40 years), but age ranged from 16 to 79 years old. Twenty-four of the patients were male and seven female.

Pre-reduction investigations included A-P and lateral plain X-ray for all the patients and tomography, oblique views of CT scans for selective cases, particularly when fracture(s) were suggested by plain films.

The manipulation is a carefully controlled procedure involving total relaxation with general anaesthesia and muscle relaxants, gentle traction by the operator holding the chin and occiput and counter traction by the assistant holding the wrists from the foot of the bed. A 'click' will be felt, especially by the operator on reduction. An X-ray image intensifier is required to confirm the reduction. Patients with non-reducible dislocations remain in traction with somewhat improved alignment to be further investigated by CT and/or MRI. Alternatively, open reduction will be performed.

Results

All unifacet dislocations and bifacet dislocations except one, were successfully reduced by manipulation alone

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(Table 1). Of the patients with fracture dislocation however, seven out of nine attempts were unsuccessful and required open reduction and internal fixation (Table 1).

All patients were internally fixed by 'H' plate fixation via an anterior approach once reduction was achieved. Patients with un-reduced dislocations were treated by open reduction and wiring fixation posteriorly (Table 2).

Non-reducible dislocations were related to co-existing fractures in seven out of eight patients. The most common fractures were lateral mass fractures with facet involvement (in seven of the 11 patients). Other patterns identified included fractures of the vertebral body (in three cases) and transverse process (in one case). The timing of reduction or attempt of reduction under general anaesthesia were 4–27 h post accident with an average of 13.6 h in this series. The neurological impairments were classified into four groups: complete; incomplete; minimal (with root involvement, segmental or temporary impairment) and none (Table 3).

Neurological outcomes were assessed according to Frankel scale. All patients with complete lesions remained complete, while patients with incomplete lesions showed significant recovery (Table 4). Of the 19 incomplete patients, 17 recovered to near normal function (including three cases with initial sacral sparing only). Only two cases stayed at level D.

There was only one case showing significant neurological deterioration following manipulation and reduction. The patient was a 31 year old male who was attacked by a cow causing C5/6 bifacet dislocation. The reduction was achieved at 19 h post the injury. However, the deterioration was not immediately post manipulation but peaked at 3 days. The patient regained full function above the level of his complete cord lesion (Table 5). American Spinal Injury Association (ASIA) Scoring System was used to describe his sensory and motor function changes.

Other complications included respiratory compromise (three cases), requiring ICU care with or without artificial ventilation, DVT and pulmonary emboli which occurred in four cases. Among the three patients with respiratory compromise, one was due to ascending levels involving the diaphragm (same case shown in Table 5).

Discussion

The most important finding in our study is the correlation between co-existing fractures with dislocations and their inability to be reduced manually. The most common pattern of fracture is lateral mass fracture and/or facet joint fracture. Lateral mass fractures have been recognized as important due to their difficulty of detection and their major influence on stability.[11] Even under these circumstances, manipulation under general anaesthesia will improve alignment of the displacement and offers considerable decom-

Table 1 Diagnostic classification

	Bifacet dislocation	Unifacet dislocation	Dislocation with fractures
Number of cases	10	10	11
MUGA			
Reduced	9	8	2
Not reduced	1	0	7
		One by traction alone One delayed admission	2 cases need primary ORIF

Table 2 Internal fixations

	Bifacet dislocation	Unifacet dislocation	Fracture dislocations
'H' Plate	9	8	4
Posterior wiring	1	2	7
		One due to delayed admission and one re-dislocation	

Table 3 Neurological impairment

	Bifacet dislocation	Unifacet dislocation	Fracture dislocations
Complete	5		5
Incomplete	3	3	4
Minimal	1	6	2
None	1	1	

Table 4 Frankel scale outcome

		A	B	C	D	E
Bifacet Group	Admission	5	2 — — — — — —		2 — —	1
	Discharge	5				5
Unifacet	Admission	0			9 — —	1
	Discharge					10
Fracture dislocation	Admission	5	1 — — — — —		5 —	
	Discharge	5			2 —	4

Table 5 Neurological deterioration

	Motor	*Sensory*	*Level*
Original scores	5	14	C_5
24 h post MUGA	4	12	C_4
3 days post MUGA	0	12	C_4
3 months	10	16	C_5
6 months	13	16	C_5

MRI: Mild cord compression; Extensive cord edema

pression effect. Our recommendation is to attempt to identify associated fractures prior to attempted reduction by careful study of the plain films supplemented by CT Scan if there is any doubt. Fracture of the vertebral body, on the other hand, would generally be obvious in plain films.

It is our philosophy not to force any reduction. If a dislocation cannot be reduced, more investigations are indicated or alternatively, an open reduction should be performed once the pattern of injury has been identified. By following these principles, we have observed very few neurological complications which if occurred, could be extremely serious. Our series also did not show the high mortality rate noted by Lee *et al*[5] in the manipulation group. We feel this is due to skilled but gentle reduction, good ancillary care and attention to preventing anoxia with respiratory support if required.

The only case with clear post reduction deterioration was described in the section discussing results. The post reduction MRI scan in this patient identified no significant external contributing factors such as bony impingement, disc compression or haematoma. Spinal cord edema was regarded as the cause of his temporary ascending neurological picture. He eventually regained all functions generally expected for the same level of complete lesion (Table 5). Cord edema, or other intrinsic factors have been recognized as the most common mechanism of post reduction neurological deterioration.[2,6] Post reduction CT or MRI of other patients without deterioration have show disc injuries but none were significant. In one patient who had a failed reduction, MRI imaging demonstrated bony and disc material behind the dislocated vertebral body, indicating potential risk if reduction had been attempted more vigorously. This particular patient was successfully reduced via a posterior approach followed by decompression anteriorly and 'H' plate fixation. He returned to full time university in a year with near normal mobility and hand function, though he presented initially as a near complete tetraplegic with Frankel Scale B.

The rationale behind this approach (reduction first rather than decompression first) was due to the fact that the dislocated facet belongs also to the free lateral mass segment (with ipsilateral fractures of the lamina and pedicle) that was clearly irreducible by closed methods. Open reduction of the facet itself did not endanger the spinal cord as minimal movement would have occurred at the disc level. However, without such reduction, the relevant subluxed vertebral body would not be reduced even after disc decompression.

In our experience, the necessity of decompressing the disc prior to reduction recommended by some authors[1,4] was not observed. Such an approach would also present technical difficulty as the destabilized spine would need a much stronger posterior fixation or three operations (Front–Back–Front) to finally stabilise the spine by anterior plating.

In our experience, manipulation under general anaesthesia is a safe and quick method to reduce cervical dislocations. Previous studies showed that prompt reduction of dislocation is of paramount importance for patients with significant neurological involvement.[1,5,9] Others, on the other hand, have suggested that patients with incomplete neurological damage can still make significant neurological recovery even when dislocations have been left unreduced.[13] The timing of reduction in patients with minimal neurological deficits is less critical, though there have been reports of progressive paralysis after bilateral facet dislocation; most occurred outside spinal injury units. Up to now, little evidence is available to prove that delayed reduction will cause significant deterioration of the neurological impairment. Therefore, the absolute value of urgent reduction is still not clear despite the fact that it is practised almost routinely all over the world. Further controlled studies are needed to clarify the necessity of reduction and the timing of reduction.

The choice of reduction procedure is among manipulation under anaesthesia (MUA), traction with increasing weight and analgesia and open reduction.[1,5,7] The MUA has the advantages of being the most rapid method of reduction, avoiding repeat radiation exposure and frequent monitoring required in rapid traction. This may be particularly true in experienced hands. However, one disadvantage of manipulation under general anaesthesia is the inability of the clinician to monitor the patient neurologically during the procedure. Therefore, such a procedure is not recommended for clinicians not experienced in spinal and spinal cord injuries and the manipulation procedure. With the recognition that anterior 'H' plate fixation has become one of the best ways of achieving cervical stability,[12] MUA also provides best pre-operative conditions and timing for this procedure. This will avoid posterior open reduction and wiring fixation which is mechanically less desirable and carries more post operative complications including prolonged rehabilitation and undesirable neck postures secondary to surgical damage to the posterior musculature.

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