ORIGINAL ARTICLE

Early outcome of surgical intervention in subaxial cervical spine injuries

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Abstract

Objective: To determine the surgical outcome of patients with axial cervical spine fractures.

Methods: The study was conducted at the Spine Unit of Hayatabad Medical Complex, Peshawar, and Aman Hospital, Peshawar, from January 2012 to March 2013. Patients with sub-axial cervical spine fractures were treated surgically. The outcome was measured using Visual Analogue Score, Neck Disability Index, by neurology and on the basis of complications. SPSS 16 was used for statistical analysis.

Results: Of the 50 patients in the study, 7(14%) were females, while 43(86%) were male. Overall mean age was 30.3±7.9 years (range: 18-60 years). Major cause of injury was road traffic accidents in 29(58%). A total of 29(58%) patients had dislocation of the spine which was successfully reduced in 22(75.9%). Mean postoperative visual analogue score was 2.9±1.5 (range: 1-7) at last follow-up. Mean neck disability index score was 10.9±5.2 (range: 4-26). Dysphagia was the most common complication in 12(24%).

Conclusion: Majority of the sub-axial fractures can be treated effectively with good outcome through anterior approach. Gradual axial skull traction is an easy and safe method for reduction of cervical fracture dislocations.

Keywords: Sub-axial cervical spine fractures, Cervicaldiscectomy, Anterior cervical corpectomy, Fusion. (JPMA 64: S-83 (Suppl. 2); 2014)

Introduction

Cervical spine is very commonly injured due to blunt trauma. As reported, 2% to 6 % of all blunt trauma patients suffer cervical spine injury, of whom10% to 25 % may deteriorate later on.[1] In one large population-based study, the yearly reported incidence of cervical spine injury was up to 64/100,000 population.[2] Cervical spine injuries are very often associated with spinal cord injury in almost 55 % of the cases.[3] At times, it may cause significant morbidity and mortality. The most common causes of injury are road traffic accidents (RTAs) and falls. The risk of cervical injury increases with age and male gender,and acute mortality may reach 20% in older patients.[4]

With recent advances in cervical spine instrumentation and surgical techniques, surgical treatment is now most commonly advised to patients with cervical spine fractures. Conservative treatment can lead to post-traumatic instability and chronic pain, which can be a constant source of disability.[5] The goals of surgical treatment are to achieve maximum function, minimal pain, neurological improvement and future disability prevention. Surgery can offer best restoration of anatomy, direct decompression of neural elements, early mobilisation and less nursing care problems.[6] The controversies are now mostly about the approach used: anterior, posterior or combined approaches.

In recent years anterior approach is gaining popularity. Most of the cervical spine fractures are treated with anterior approach. It is less traumatic and can directly decompress the cord, achieves better fusion rates and there is no need for adjacent segment fusion like in the posterior approach. The rate of infection in posterior approach is high, can lead to late deformity and it cannot address disrupted disk.[7] However, posterior approach is used in locked facets in cases of cervical fracture dislocations and severe instability where anterior procedure alone may not be sufficient.[8] We also believe that majority of the sub-axial cervical spine fractures can be treated satisfactorily with anterior approach alone.

Anterior approach for sub-axial cervical spine surgery was introduced in 1952. Later on, iliac crest bone graft was added for intervertebral fusion. Initially, standard AO plates ("Arbeitsgemeinschaft für Osteosynthesefragen" [German for "Association for the Study of Internal Fixation]) were used for fixation and then H-type locking plates were introduced. In cervical spine trauma, the cord compression is due to instability, fragments or dislocation which all can be addressed from the anterior.[9] Posterior approach is now rarely used for locked facets that cannot be reduced preoperatively with traction usually in old fracture dislocations. However, there are now advocates of open reduction from anterior approach.[10]

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Surgical treatment of cervical fractures is slowly increasing in our country although at the moment surgery for cervical spine fractures is performed at very few centres due to lack of facilities and technical expertise. Local literature on this topic, as such, is very limited. In this study we are presenting our surgical experience of various sub-axial fractures in terms of pain improvement, functional improvement, union and neurological outcome.

Patients and Methods

The prospective case series study was conducted at the Spine Unit of Hayatabad Medical Complex, Peshawar, and Aman Hospital, Peshawar, from January 2012 to March 2013. All patients presenting with cervical spine fractures, underwent surgery and were successfully followed for a year, were included. Informed written consent was taken from all patients.

The outcome was measured by Visual Analogue Score (VAS), Neck Disability Index (NDI), neurology and on the basis of complications.

All patients were initially stabilised according to Advanced Trauma Life Support (ATLS) protocol. Plane X-rays of the cervical spine were obtained in all cases. Computed tomography (CT) scan, magnetic resonance imaging (MRI) or 3D CT scan were obtained in selected cases. Initial stabilisation of the spine was achieved with hard cervical collar. After stabilisation of the patient, detailed history was obtained and complete examination was done. Patients' preoperative neurological statuses were graded according to the American Spinal Injury Association (ASIA) Impairment Scale. After careful preoperative preparation, patients underwent surgery on the next available list. In cases of fracture dislocations, patients were taken to the operation theatre (OT) and axial traction was applied. Initially, 10kg to 15kg weight was applied and then it was gradually increased by 2.5kg increments every 6 to 8 hours till reduction was achieved. We did not delay traction for MRI to assess disc rather we gradually applied traction and closely monitored neurology for any deterioration. Serial X-rays were obtained in traction and neurology was monitored carefully. If dislocation reduced, which was mostly the case, patients were operated on the next list. We routinely used anterior approach for surgery and posterior only for unsuccessful reduction or combined approach was used when there was severe instability. For fusion we used tricortical bone graft in anterior cervical discectomy and fusion (ACDF) or cage filled with autologus bone. We routinely used postoperative drain and intravenous (IV) antibiotics for 5 days. IV analgesia was given for initial 2 days.

Postoperative mobilisation of the patients was done as soon as the condition allowed, usually the same evening. Patients were then followed in outpatient department (OPD) at 2 weeks, then monthly for three months, and then every three months. On each follow-up, VAS, NDI and ASIA gradings were done. X-rays were done to assess implant fixation and fusion.

All data was collected on a proforma and analysed using SPSS 16.

Results

Of the 50 patients in the study, 7(14%) were female and 43(86%) were male. Overall mean age was 30.3±7.9 (range: 18-60 years). Only 5(10%) patients were above 40 years of age, while the remaining 45(90%) were below 40 years. The cause of injury was RTAs in 29(58%), followed by fall from height in 17(34%) cases, while in 4(8%) it was due to diving.

According to comprehensive classification of spine fractures, in 25(50%) patients fracture was type B, in 19(38%) type C and in 6(12%) patients it was type A. The most common level of injury was C5-6 in 21(42%) patients followed by C4-5 in 12(24%) and C 6-7 in 8(16%). In 29(58%) patients, dislocation of the spine was present and

Table-1: Pre- and post-operative neurology based on ASIA scale.

		Count	%
Pre-op Neurology	A	8	16.0%
	C	10	20.0%
	D	9	18.0%
	E	23	46.0%
Post-op Neurology	A	5	10.0%
	C	7	14.0%
	D	5	10.0%
	E	33	66.0%

ASIA: American Spinal Injury Association.

Table-2: Age wise distribution of VAS and NDI.

			Age (in years)		
			<= 30	31 - 45	46+
VAS	< 5.00	Count	25	14	2
		%	50.0%	28.0%	4.0%
	5.00+	Count	4	5	0
		%	8.0%	10.0%	.0%
Neck Disability Index	<= 14.00	Count	19	9	1
		%	47.5%	22.5%	2.5%
	15.00+	Count	6	4	1
		%	15.0%	10.0%	2.5%

VAS: Visual analogue score.

axial skull traction was used. Dislocation was successfully reduced in 22(75.9%) patients out of the 29 who had fracture dislocation.

Anterior approach — either ACDF or anterior cervical corpectomy and fusion (ACCF) — was performed in 43(86%) patients. Posterior spinal fusion (PSF) using lateral mass screw fixation and autogenous bone graft was done in 5(10%). Combined surgery was done on 2(4%) patients.

Preoperative neurology based on ASIA grading was E in 23(46%) patents. There was improvement in ASIA grading postoperatively (Table-1). Mean postoperative VAS was 2.9±1.5 (range: 1-7) at last follow-up. Only 9(18%) patients were with VAS 5 or above. Mean NDI was 10.9±5.2 (range:4-26). In 10(20%) patients, NDI scoring was not possible due to neurological status of the patients. Overall, 30(60%) patients were with minimal disability, with NDI between 5 and 14 (Table-2).

The most common complication was dysphagia In 12(24%) patients. There was no wound infection, no implant-related complication, and no postoperative deterioration in neurology.

Discussion

Proper and timely treatment of sub-axial spine fractures is of paramount importance. Cervical spine fractures are the most common fractures of the spine and most often associated with spinal cord injury. Regardless of the treatment modality, any delay in treatment can leave the patient with lifelong morbidity and some time may lead to acute mortality. Timely surgical treatment can decompress the cord and may lead to neurological improvement. This improvement in neurology, sometime by a single grade, can save patient from lifelong disability.[11] Each approach for cervical spine fracture treatment has its advantages and disadvantages. The job of the spine surgeon is to properly select optimal treatment for each patient with sub-axial cervical spine fractures so as to achieve good results.

Like other studies,86%of our patients were male. The most common cause of injury in our group was RTAs followed by fall. Similar results were reported in one study.[12] The most common level of injury in our study was C5-6(42%) followed by C4-5(24%) and C 6-7(16%). One study on sub-axial cervical fractures reported C6-7 as the most commonly fractured vertebrae, while C5-6 and C6-7 were the most common levels of dislocation.[13] In 27(54%) of our patients, there was neurological deficit to various degrees. A study reported neurological injury in 29(93.5%) out of 31 patients. This is a very high percentage compared to our results, but the other report studied only patients with fracture dislocations.[14]

It is now generally accepted that most of the sub-axial cervical spine fractures can be treated by anterior approach. The theoretical biomechanical properties of posterior lateral mass instrumentation are superior, but the clinical advantages and outcomes are excellent for anterior approach. The results about functional outcomes in cervical fracture treatment are rarely focused. Main focus is on neurology, fusion and complications. A recent study comparing ACDF with total disc replacement (TDR) confirmed the excellent outcome for ACDF in patients with mean follow-up of 4 years.[15] It reported consistent improvement in VAS and NDI in these patients. We focussed on the functional outcome and achieved good results in all patients. The mean VAS improved to 2.9 at last follow-up. In 37 out of 40 patients in whom NDI scoring was done showed minimal to moderate disability. One study also reported good results in 86% patients based on functional outcome and VAS with three-year follow-up. While comparing carbon fibre cage versus iliac crest graft, it concluded a better fusion rate for graft versus cage, 86% compared to 62%.[16] Its functional results directly correlated with fusion rate. One study reported good functional outcome with ACDF specifically in traumatic cervical instability.[17]

Today the most common indication for posterior surgery remains sub-axial fracture dislocation that fails to reduce on axial traction and severe instability. Majority of the cervical fracture dislocations can be reduced with axial skull traction. The reported success rate is about 80%.[18] In our study, we were able to reduce cervical fracture dislocation in 22(75.9%) out of 29 patients with axial skull traction. This is why majority of our patients (86%) had anterior surgery. The most important factor for reduction failure is late presentation.

One of the issues in patients with cervical fracture dislocation is the role of MRI prior to reduction for identification of herniated disc material. During reduction, the herniated disc can further deteriorate neurology. This is a rare phenomenon, but it may have a worse outcome.[19] But obtaining MRI may delay the reduction where time in spinal cord injury is a crucial factor. In our part of the world, obtaining MRI may take a whole day. As a routine practice, we do not delay reduction for MRI. We believe in gradual traction while the patient is awake and what can be a better monitor than the patient himself? In our series, though small, we had no deterioration of neurology with this approach.

The reported complication rate for ACDF is below 5%.

Complications like implant failure, graft dislodgement, hematoma, revision and deformity are rare.[20] We did not have any major complications. The most frequent complication we observed was mild dysphagia in 24% patients at 2 weeks. The reported incidence is about 71% in the first two weeks.[21]

Conclusion

Majority of sub-axial fractures can be treated effectively with good outcome through anterior approach. Gradual axial skull traction is an easy and safe method for reduction of cervical fracture dislocations.

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