Research Article
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The management of cervical spine lateral mass fracture injuries treated surgically in kalafong tertiary provincial hospital: A 12-year review

Abstract

Introduction: This study was undertaken to review the management of the lateral mass fractures of the cervical spine in our institution.

Methods: Forty-six cervical spine lateral mass fracture patients presenting to a tertiary provincial hospital in South Africa between December 2006 and July 2018 were analyzed as a retrospective cohort. The average follow up of the patients was 18 months (range 12 – 24).

Results: For the 46 patients the male to female ratio was 2:1 and the average age was 36 years. Neurological deficit occurred in 35% of the patients. Nine patients (19.5%) had associated injuries which had an impact on decision making. All patients with lateral mass fractures were managed surgically. Most patients needed single level surgery and about 22% needed more than one level surgical intervention.

Conclusions: The majority of lateral cervical spine fractures can be managed via the anterior approach. Associated cranio-cervical injuries and/or other vertebral column fractures do influence the surgical approach. Radiologically one should expect a high degree of successful fusion. Neurological improvement after surgical intervention is highly variable.

Keywords: cervical spine, lateral mass fracture, classification, surgical management

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Abbreviations: CT, computer tomography; CSISS, cervical spine injury severity score; TLICS, thoracolumbar injury classification and severity score

Introduction

Although cervical spine lateral mass fractures are uncommon, they can have devastating consequences if not adequately treated. The reported incidence of unilateral lateral mass fractures is 7% to 16% of subaxial cervical spine fractures.[1,2] The rate of spinal cord injury in one study was found to be 3.6%.[1]

Motor vehicle related trauma is the most common cause of injury (65%) in cervical spine lateral mass fractures. Other mechanisms are assault, falls and hanging.[3–6] The highest incidence rate is reported among patients aged 15-45 years and between 65 – 80 years of age. Males are the most commonly affected individuals.[6]

A lateral mass fracture can be defined as a fracture of any part of the lateral mass complex, including the pedicle and/or articular processes.[7,8] The mechanism of injury for lateral mass fractures is hyperextension, lateral compression and/or rotation of the cervical spine. These fractures have a high degree of rotational instability.[1,3,4,9,10]

One of the commonly used classifications for lateral mass fractures for lateral mass fractures is that proposed in the study by Kotani et al. This is a computer tomography (CT) scan-based classification.[9]

The Kotani et al. study proposes a classification where there are four types of cervical lateral mass fractures: Type A is a separation fracture, has two lines involving the unilateral lamina and pedicle and separating the entire unilateral articular mass. Type B is a communition type of fracture, has multiple fracture lines in the lateral mass with significant fragmentations, frequently accompanied by lateral wedging deformity in the coronal plane. Type C is a split type fracture, has a vertical fracture line in a coronal plane in the unilateral lateral mass creating an anterior- posterior separation with invagination of the superior articular process of the caudal adjacent vertebra. Type D is a traumatic spondylolysis, has bilateral horizontal fracture lines at the pars interarticularis, leading to the separation between the anterior and posterior spinal elements.[9]

There appears to be a rational justification for managing lateral mass fractures of the cervical spine surgically, given the incidence of related neurologic injury, incidence of malalignment, failure rates with conservative therapy, and satisfactory results with surgical stabilisation and fusion.[11–14] The management of the lateral mass fractures is controversial. There are no clear guidelines about management of these fractures. The surgical approach can either be anterior or posterior. Single versus multi-level surgery is an additional consideration.[1,2,3,4,9,15,16] The objective of our study is to review the surgical management of patients in the Kalafong Tertiary Provincial Hospital who sustained lateral mass fractures of the cervical spine.

Methods

After receiving approval from the local institutional review board, a retrospective review study was conducted on spinal trauma patients who sustained cervical spine lateral mass fractures and were admitted into the spinal unit at Kalafong Tertiary Provincial Hospital from December 2006 to July 2018.

All patients were evaluated pre-operatively with normal x-rays and CT scans. Magnetic resonance imaging (MRI) scans were requested in all patients who had concomitant cranio-cervical junction injuries and/or fractures.

Inclusion criteria were all adult patients with cervical spine lateral mass fractures resulting from spinal trauma. Exclusion criteria were patients who were managed conservatively and/or patients who had incomplete radiologic and clinical data.

The recorded demographic data is detailed in Table 1. Associated significant vertebral column injuries refer to those injuries that are classified either according to the cervical spine injury severity score (CSISS) for the cervical spine or the thoracolumbar injury classification and severity score (TLICS) system for the thoracolumbar spine.

Table 1 Patient demographic data

No	Age	Sex	Injury mechanism	Kotani study cassification	Associated vertebral spine fractures	Frankel grade
1	19	M	MVA	C		E
2	23	M	MVA	A	T2	E
3	25	F	MVA	C		E
4	25	M	MVA	D	T2/T3	C
5	25	F	MVA	B	C1	E
6	25	M	MVA	C	C3	C
7	25	M	MVA	C		E
8	27	M	MVA	A	C1	E
9	28	M	Crush injury	D		A
10	30	M	MVA	C	C4	E
11	30	M	MVA	A		E
12	30	M	MVA	A		E
13	30	M	MVA	C		E
14	30	F	PVA	D		A
15	31	F	MVA	D		E
16	31	F	MVA	B		E
17	32	M	MVA	A		E
18	32	F	MVA	C		E
19	33	M	MVA	C		E
20	34	M	MVA	C	C3	E
21	34	F	Assault	A		E
22	34	M	MVA	D		E
23	34	M	MVA	C		E
24	34	M	MVA	A		E
25	34	M	MVA	A		E
26	35	M	Fall	D		E
27	36	F	MVA	A	SACRAL	D
28	37	F	MVA	B		E
29	37	F	PVA	D		B
30	38	F	MVA	D		E
31	38	M	MVA	A		E
32	38	M	MVA	A		E
33	39	M	MVA	C		C
34	40	M	MVA	C		E
35	40	M	MVA	D		A
36	42	M	MVA	C	C7	C

Table Continued...

No	Age	Sex	Injury mechanism	Kotani study cassification	Associated vertebral spine fractures	Frankel grade
37	42	F	MVA	A		D
38	42	M	Fall	D		E
39	43	M	MVA	D		E
40	43	M	MVA	C		A
41	44	M	MVA	A		C
42	45	F	MVA	C		D
43	47	F	MVA	C		D
44	48	M	MVA	A		E
45	59	M	MVA	B		C
46	73	M	Fall	C		D

MVA, motor vehicle accident; PVA, pedestrian vehicle accident

Results

A total of 46 patients were admitted over a 12-year period. There were 32 male and 14 female patients with a mean age of 36 years (range 19 - 73). The majority of patients (65%) were neurologically intact. The distribution of neurology is illustrated in Table 2. Eleven out of the sixteen patients with neurology had serious neurological deficit: Frankel A, B, and C.

Table 2 Distribution of Neurology According to Kotani Classification of Cervical Lateral Mass Fractures

Kotani classification type	Number of Patients without neurology	Number of patients with neurology	Percentage of patients with neurology
A	11	3	21%
B	3	1	33%
C	10	7	41%
D	6	5	45%
Total	**30**	**16**	**35%**

The surgical approaches are illustrated in Table 3. The average follow up for these patients was at 18 months (range 12 - 24). The number of patients lost to follow up was 11 (23.9%).

One patient developed late subjacent subluxation, and the patient was revised with posterior revision surgery. All patients were assessed for fusion using normal x-rays and CT scans. The remaining 35 patients not lost to follow up all had a successful fusion.

Table 3 Surgical Intervention and Number of Levels Fused

Kotani fracture classification	Type of surgery	Number of patients	Number of levels fused
A	Anterior - 9	14	3-Jan
	Posterior - 4		
	Anterior plus posterior - 1		
B	Anterior - 3	4	1
	Posterior - 1		
C	Anterior – 14	17	2-Jan
	Posterior – 3		
D	Anterior – 9	11	1 – 3
	Posterior - 2		

Discussion

Our study shows that cervical spine lateral mass fractures are relatively uncommon injuries. Over a twelve-year period, we treated approximately 3 - 4 patients per year. Similarly, over an eight-year period the Kotani et al. study had 31 patients.[9] In the study by Manoso et al. 56% of cases developed neurology.[1] This is similar to our study where in 35% of our cases neurology was present. These results are not surprising given the rotational instability associated with lateral mass fractures. Eleven out of the 46 patients (23.9%) had significant associated vertebral column fractures.

According to our institutional protocol all patients with lateral mass fractures are operated. Lee et al. and Razzaq demonstrated anterior cervical decompression and fusion (ACDF) as having good outcomes.[3,17] However, there is good evidence which suggests similar outcomes when comparing anterior and posterior surgical approaches.[9,18,19] Our study agreed with the ACDF treatment of most lateral mass fractures as 75% of patients (n= 35) had the anterior procedure only.

The types of procedure were as follows: 36 were single level surgery, 10 were two levels or more fusion levels. Two patients had corpectomy due to associated vertebral body collapse. The patient who had both anterior and posterior procedures initially had an anterior procedure performed and 6 months later presented with subjacent subluxation for which the patient then underwent a successful posterior procedure and fusion. Similarly, in the study by Anissipour et al.[20] one of the 36 patients (2.8%) developed kyphosis postoperatively.[20]

In our study ten patients had posterior procedures only. The reasons for the decision to do a posterior procedure was based on the following:

1. Junctional injuries – cranio-cervical or cervicothoracic.
2. Double pathology – mid subaxial cervical as well as upper thoracic spine.
3. Multilevel contiguous fractures.
4. Fractures that presented more than 6 weeks after injury.

There was a variation in the level of improvement in the neurological status of patients after surgical intervention. Four patients who had Frankel A neurological deficits were lost to follow up, one patient who had Frankel B improved to a Frankel D, 6 patients with Frankel C and 5 patients with Frankel D showed improvement of their neurological status.

The management of lateral mass fractures is not standardized. There are no clear guidelines about which fractures must be treated surgically and what surgical approaches are recommended for each type of the lateral mass fractures.

The shortcoming of our study is the significant attrition rate.

Conclusions

Lateral mass fractures are a mixture of different fracture variations. About 75% of our patients were neurologically intact. The majority of the lateral cervical spine fractures can be managed via the anterior approach. Associated cranio-cervical injuries and/or other vertebral column fractures do influence the surgical approach. Radiologically one should expect a high degree of successful fusion. Neurological improvement after surgical intervention is highly variable.

Ethics statement

The authors declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010. Prior to the commencement of the study ethical approval was obtained from the Faculty of Health Sciences Research Ethics Committee of the University of Pretoria, South Africa under ethics reference number 301/2019.

All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. For this study formal consent was not required.

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None.

Conflicts of interest

The authors declare they have no conflicts of interest that are directly or indirectly related to the research.

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