SHORT TERM CLINICAL AND RADIOLOGICAL OUTCOME OF LATERAL MASS FIXATION IN SUBAXIAL CERVICAL SPINE INJURY

Orthopaedics

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ABSTRACT

Advances in perioperative care, surgical instrumentation, and understanding of the patho-physiology of trauma have engendered new treatment paradigms for these injuries within the last two decades.

Evaluation of outcome of LATERAL MASS FIXATION in sub-axial cervical spine injury in terms of improvement of neurological deficit (ASIA Scale) in one, three, six and nine months follow up.

Sub-axial cervical spine injury patients attending OPD, Emergency. Age group: between 15 to 75 years, both male and female.

The study was a both retro and prospective, non randomized, uncontrolled, interventional study group. The study was performed over a cohort of adult patients.

Our study attested to the safety and acceptability of lateral mass fixation as a established mean of posterior fixation with no failure rate after one year follow up and a lesser operative complication rate.

KEYWORDS

Radiological Outcome, Lateral Mass Fixation, Subaxial Cervical Spine Injury

INTRODUCTION

"If thou examinest a man having a dislocation of his neck, shouldst thou find him unconscious of his two arms (and) his two legs on account of it while his phallus is erected on account of it, (and) urine drops from his member without his knowing it; his flesh has received wind: His two eyes are blood-shot; it is a dislocation of a vertebra of his neck extending to his backbone which causes him to be unconscious of his two arms. . .

Edwin Smith Surgical Papyrus. The document, dating to 2500 BC and obtained by the Egyptologist Edwin Smith in 1862.¹

These are the first known observations about acute cervical spine injury (CSI) in ancient Egypt; it dates back to 2500BC. It has also been mentioned in Greek (500 BC–500 AD) literature. There is also mention of axial traction in those injuries in ancient Hindu civilization (1800 BC)¹. It appears, however, that the prognosis of these types of injuries did not change during this period.¹

There are few more devastating injuries that affect human beings than those associated with cervical spinal injuries. From economic, psychological, and social perspective, the impact of cervical spine injuries is encompassing and enormous. Cervical spine injuries occur in 3% to 4% of all trauma patients.² Injuries to the subaxial cervical spine (C3–C7) comprise the majority of cervical spine injuries annually. Advances in perioperative care, surgical instrumentation, and understanding of the patho-physiology of trauma have engendered new treatment paradigms for these injuries within the last two decades. Despite a large amount of clinical experience, the classification and treatment of fractures and dislocations of the cervical spine remains controversial.³

AIMS OF STUDY

Evaluation of results of lateral mass fixation in sub axial cervical spine injury

Evaluation of outcome of LATERAL MASS FIXATION in sub-axial cervical spine injury in terms of improvement of neurological deficit (ASIA Scale) in one, three, six and nine months follow up.

MATERIALS & METHODS

- **Study Area:** N.R.S. Medical College and Hospital
- **Study Period:** Nov 2015 to Sep 2017
- **Sample Size:** 30
- **Sample Design:** Sub-axial cervical spine injury patients attending OPD, Emergency. Age group: between 15 to 75 years, both male and female.

Patients with pre-existing neurological disorders, tumours, infection are excluded.

- **Study Design:** The study was a both retro and prospective, non randomized, uncontrolled, interventional study group. The study was performed over a cohort of adult patients.

INCLUSION CRITERIA

Age 15–75 yrs
Facet fracture dislocation (unilateral and bilateral)
Post. Ligamentous disruption
Spondylolisthesis

EXCLUSION CRITERIA

- Isolated anterior column injury (Burst fracture with intact posterior Ligamentous complex)
- Isolated cord contusion or myelomalacia on MRI
- Burst fracture with retro-pulsed fragment, or protruded disc in which anterior approach is mandatory.
- Moribund patients unfit to undergo operation under GA
- Associated head injury
- Previous organic disease /tumour /infection involving sub-axial Cervical spine

STUDY TECHNIQUE

Step I - Radiological investigations and neurological examinations was done to determine the SLIC severity score.

Step II – Operative intervention by lateral mass fixation was done.

Step III – Patients followed up at regular interval to evaluate: Neurological improvement (ASIA Score)

Improvement of quality of life pre-intervention and now using Cervical Spine modification of Oswestry Scale.

Step IV- measuring the outcome both clinically and radiologically.

All the patients were initially managed by ATLS protocols. The patients were evaluated thoroughly to exclude any co-morbid conditions by history taking, detailed clinical examination done including neurological examination and ASIA grade determined. Aforementioned X-rays, CT-scans and MRI were done. SLIC score was determined.

RESULT & ANALYSIS

We found that highest numbers of patients are in age group 21-30 years (7n) and 41-50 yr group (7n). Mean age is 38.26yr. Median age is 37 yr. Pie diagram showing age distribution. Bar diagram showing number and percentage of different modes of injury shows most of the injuries occurred due to fall from height (14n, 46.67%), in our study. Bar diagram showing injury to admission interval: showing most of the patients admitted during 48-72 hours from injury.

Our study showed that the bar diagram showing distribution of level of injuries. Shows mostly occurred at c6-7 level. Pie diagram showing distribution of levels: Pie diagram showing distribution of facet dislocation. Pie diagram was showing distribution of ASIA score on admission. Bar diagram showing distribution of SLIC score: Bar diagram showing distribution in duration of operation: Bar diagram showing complications related to surgery. Pie diagram and table are showing post op death, loss of follow up.

It was found that the bar diagram showing distribution of duration of hospital stay. Most of the patient stayed between 11-15 days in hospital (13n). Average and median hospital stay 16.1 days & 15days. All 4 deaths occurred in ASIA score A. Pie chart showing post operative ASIA Score improvement: Bar diagram showing OSWESTRY score distribution AT FINAL FOLLOW UP: 2 cases are radiologically not acceptable. They were presented late after almost 3 weeks. only in situ fixation was done for those 2 cases. Other reductions were acceptable till last followup. No screw loosening or loss of reduction occurred till last follow up.

DISCUSSION

Injury to the sub-axial cervical spine may subject patients to substantial morbidity and mortality. The treatment of sub-axial cervical spine injury is evolving. The purpose of our study is to evaluate the outcome of LATERAL MASS FIXATION in subaxial cervical spine injury. Very few such studies are done and published from our subcontinent. Outcome measured in terms of improvement of ASIA score and a decent OSWESTRY score at follow up.

EPIDEMIOLOGY:

In our study most of the patients were young and middle age group. Effective age was 21-30 & 41-50 year group. mean and median ages are 38.26 & 37 year respectively. G.Z. Ning reported a mean age of 46.0±14.2 years among the 869 patients studied in 4 year duration in China which is close to our study⁴.

R. Marcon et al. also reported males of approximately 30 years of age to be the most affected age group⁵. Most other recent studies show similar trend.

Majority of patients were male (87%) in our study. In a prospective study done in Brazil, Joaquim et al.⁶ reported 87% male and 13% female in operative group. The results are also concordant with studies done by other researchers^{3,7}.

MODE OF INJURY:

Fall from height was the cause in majority (50%, n=29) of the patients contrary to motor vehicle accidents which was most common cause in western literature^{5,8,9}. However the results were in concordance with studies done in developing countries^{3,6}. In our study road traffic accidents occurred in 33% of the cases. Fall with very heavy load (80-100 kg) on head was a frequent mode of injury among manual laborers and porters (63.6%). This was also reported in other developing countries^{10,11}. The reason can be attributed to poor socioeconomic and domestic environment. Fall from tree was a common mode of injury among farmers. This mode of injury was rare in developed countries.

In our study we found most patients were brought to our OPD or ER at 48 hours to 72 hours timeframe with mean and median of 2.5 days and 3 days respectively. Our center being a tertiary care center, majority of cases were referred from the districts and smaller centers.

Routine AP and lateral radiographs, CT scan and MRI was done in all the patients. Precise role of MRI in cervical spine injury is yet to be determined^{12,13}. MRI is known to be superior to computed tomography in terms of visualizing cervical soft-tissue structures, including the spinal cord, cervical nerve roots, intervertebral discs, and posterior ligamentous complex (PLC)¹⁴.

LEVEL OF INJURY:

In our study most common level involved is C6-7 (11n, 34 %). next is C5-6, C4-5 respectively. The result was in concordance with recent literature^{5,15}.

93% patient in our study has single level injury.

ASIA & SLIC SCORE:

In our study we have ASIA A (10n, 33%), B (8n, 27%), C (8n, 27%), D (3, 10%), E (1n, 3%). This is in slight contrary to the findings of Sahoo et al.¹⁶ who had 80% of the patients with ASIA grade A. In our study majority of those who had complete (ASIA A) and incomplete (ASIA B-D) neurodeficit reported to emergency.

The primary goal of treatment is preservation and/or restoration of neurology, provide stability to spine. The secondary goals are fracture healing, diminution of pain, mitigation of disability, and restoration of function.

Sahoo et al.¹⁶ reported mean SLIC score of 8 in the operative age group, which was near to our study. Joaquim et al.⁶ reported mean and median SLIC of 7 in operative group. Our studies also have most of the patients with SLIC 8 & 7 respectively.

COMPLICATIONS:

Only complications we encountered is wound related in 2 cases.¹ healed eventually and another need debridement followed by subsequent healing. According to Kwon et al.¹⁷ there is increased incidence of infection and wound dehiscence with posterior approach.

Literature review shows the insertion of lateral mass screws has generally been found to be safe, with a relatively low complication rate.¹⁸ We did not face any complication with screw malposition and lateral mass fracture. Hence our results show similarity with those of recent literature

MORTALITY:

We have a mortality rate post op 14% and 40% of patients with ASIA score A died. We had a mortality rate of 21% (n=12). 7% (n=4) and 17% (n=8) patients died pre-operatively and post-operatively respectively. Sahoo et al.¹⁶ showed overall mortality of 37 % in his study. Gupta et al.¹⁹ in their comparative showed 30% - 45% mortality rate. 92 % (n=11) of those expired had preoperative ASIA score A. Rest 8% (n=1) had ASIA score B. In his study Sahoo et al.¹⁶ reported all (100%) the patients who died had complete paraplegia or was in ASIA group A. Our results match the results shown in current literature. We found correlation between preoperative ASIA score A and death to be very significant. (p < 0.0001). Correlation between age of patient > 40 years and death was not significant (0.54).

NEUROLOGICAL IMPROVEMENT:

Neurological recovery was the most important parameter of successful treatment. 3% patient (1n) had ASIA score E and that did not change after operation. 29% had no ASIA score improvement. 26%, 7n had 1 ASIA improvement. 41%, 11n had 2 ASIA improvement. Injury to operation interval had no significant correlation with neurologic recovery (p=0.26).

Age had a significant impact over neurological improvement. (p=0.03). Preoperative ASIA grade had significant {p=0.015 (<0.05)} correlation with neurologic recovery. pre operative ASIA A had significant correlation with death (p=0.0001). Sahoo et al.¹⁶ reported preoperative ASIA score to be only significant determinant of neurologic outcome (p=0.009).

During our follow-up, none of our patients had neurological deterioration,

CONCLUSION

Subaxial cervical spine injuries are devastating injuries that affect human beings than those associated with cervical spinal injuries. From economic, psychological, and social perspective, the impact of cervical spine injuries is encompassing and enormous. In our study we found -

1. SLIC severity score to be instrumental in deciding the course of treatment.
2. We found that patients with complete neurological deficit had very high mortality.
3. Initial neurological status at admission was the predominant factor which determined the future prognosis.
4. Lower preoperative SLIC score leads to good outcome (lower OSWESTRY score).
5. Less injury to operation interval doesnot have any correlation with good outcome.
6. Our study attested to the safety and acceptability of lateral mass fixation as a established mean of posterior fixation with no failure rate after one year follow up and a lesser operative complication rate.

Table: Distribution of Age, Mode of injury, Injury to admission interval, Level of injury and ASIA score improvement.

		Number	Percent
Age group	12-20y	4	13.33
	21-30y	7	26.67
	31-40y	5	20
	41-50y	7	23.33
	51-60y	5	10
	61-70y	2	6.67
	Total	30	
Mode of injury	Fall from height	14	46.67
	RTA	6	20
	Heavy wt on head	10	33.33
Injury to admission interval	<24 HOUR	4	13.33
	24-48 hrs	4	13.33
	48-72 hrs	10	33.33
	72-96 hrs	4	13.33
	4 th day	3	10
	5 th day	1	3.33
	6 th day	1	3.33
	7 th day	0	0
	1 – 2 week	1	3.33
	2 - 3 week		
	> 3 week	2	6.67
	TOTAL	30	100%
Level of injury	C2-3	1	3.12
	C3-4	3	9.3
	C4-5	7	21.9
	C5-6	8	25
	C6-7	11	34.4
	C7-T1	2	6.25
	TOTAL	32	
ASIA score improvement	PRE OP ASIA E	1	4%
	NO ASIA IMPROVEMENT	8	29%
	1 ASIA IMPROVEMENT	7	26%
	2 ASIA IMPROVEMENT	11	41%

Table: Distribution of Sex, Levels, Facet, Asia score on admission, SLIC score, Duration of operation (min), Complication, Mortality, Days of hospital stay and OSWESTRY score at follow up.

		Number	Percent
Age group	12-20y	4	13.33
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	72-96 hrs	4	13.33
	4 th day	3	10
	5 th day	1	3.33
	6 th day	1	3.33
	7 th day	0	0
	1 – 2 week	1	3.33
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	6 th day	1	3.33
	7 th day	0	0
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Table: Distribution of Sex, Levels, Facet, Asia score on admission, SLIC score, Duration of operation (min), Complication, Mortality, Days of hospital stay and OSWESTRY score at follow up.

		Number
Sex	male	26
	female	4
Levels	Single	28
	Multi	2
Facet	B/L	18
	U/L	12
Asia score on admission	GRADE A	10
	GRADE B	8
	GRADE C	8
	GRADE D	3
	GRADE E	1
	TOTAL	30
SLIC score	6	6
	7	8
	8	10
	9	6
	10	0
Duration of operation (min)	60-75	1
	76-90	8
	91-105	12
	106-120	4
	121-135	2
	136-150	1
	>150	2
Complication	wound related	2
	root injury	0
Mortality	death post op	4
	lost follow up	1
	alive and followed up	25
Days of hospital stay	5-10DAYS	1
	11-15 DAYS	13
	16-20 DAYS	8
	21-25 DAYS	2
	26-30 DAYS	1
	>30 DAYS	1
OSWESTRY score at follow up	0-20%	10
	21-40%	6
	41-60%	4
	61-80%	5
	81-100%	1

ASSOCIATION BETWEEN DIFFERENT PREOPERATIVE FACTORS AND POSTOPERATIVE OUTCOME

PARAMETERS	P VALUE	SIGNIFICANCE
Pre-operative ASIA score vs Neurological improvement	0.015	SIGNIFICANT
Pre-operative ASIA score of A vs no neurological improvement	0.0001	STRONGLY SIGNIFICANT
Age of patient vs Neurological improvement(ASIA SCORE)	0.03	SIGNIFICANT
Injury to operation interval vs neurological improvement(ASIA SCORE)	0.26	NOT SIGNIFICANT
SLIC SCORE vs neurological improvement(ASIA SCORE)	0.004	VERY SIGNIFICANT
SLIC SCORE VS good OSWESTRY SCORE	0.0001	STRONGLY SIGNIFICANT
Pre-operative ASIA score of A vs Death	0.0001	STRONGLY SIGNIFICANT
Age >40 years to post op death	0.54	NOT SIGNIFICANT

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