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A Prospective Study on Acute Thoracolumbar Junction (Tlj) Spine Injuries.

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Abstract
Background: *Thoracolumbar junction spine i.e. T11-L1 is a transition zone between the more stable T1-T10 spine which is connected by rib cage to the sternum & the more mobile L2-L5 spine. There are several factors that affect the outcome; but which are these factors are determining the outcomes are still unknown.*
Objective: *To study and evaluate the factors influencing the outcome following acute thoraco lumbar junction spine injury.*
Materials and Methods: *A prospective observational study at a single centre with all patients with thoracolumbar junction(TLJ) spine injury, attending our hospital within a week of injury during a period of November 2014 to August 2016 were included for analysis. Demographic factors like age, gender, aetiology of injury, pre op ASIA grade, thoraco lumbar injury classification and severity score(TLICS), imageological factors on MRI and timing of intervention were studied. Change in neurological status by one or more ASIA grade from the date of admission to 6months follow up was taken as improvement. Functional grading was assessed using functional independence measure (FIM) scale at 6months follow up.*
Findings: *A total of 25 patients with acute thoracolumbar junction (TLJ) spine injury, managed surgically were included in this study. Follow up was available for all patients at 6months. No improvement was noted in patients with ASIA grade A. Maximum improvement was noted in ASIA D group (83.3%). Patient with cord contusion showed mild improvement as opposed to those with just oedema wherein the improvement was seen in 75% patients. Maximum improvement in FIM score was noted in ASIA grade D and patients who had oedema in MRI TLJ spine.*
Conclusions: *Incomplete spinal cord injury, patients showing MRI oedema have good improvement in neurological status at 6months follow up.*
Keywords: *Thoracolumbar junction(TLJ), Magnetic resonance imaging, Outcome.*

I. Introduction

The incidences of injuries to spinal cord are on a rise and the impact on the health care system and economy is tremendous. Epidemiological research has demonstrated that SCI affects 10 to 40 persons per million population per annum in developed countries like USA. Among which >1/2 corresponds to cervical, >1/3 corresponds to thoraco lumbar injuries. Thoracolumbar junction comprised of D11, D12 & L1. Suspicion, early diagnosis of injury, preservation of spinal cord function and maintenance or restoration of spinal alignment and stability are the keys to successful management. Several factors influence the neurological outcome following thoracolumbar junction(TLJ) spine injury. This study main aim is to analyse the factors like demography, aetiology of injury, pre op ASIA grade, Thoracolumbar injury classification and severity score(TLICS), imageological factors on MRI and timing of intervention for their influence on outcome, and to formulate guidelines for the management of patients with spinal cord injury.

II. Materials & Methods

It is a single centre, prospective observational, non randomised study of all patients with TLJ Spine injury attending emergency department within a week of injury, who were surgically managed in Department of Neurosurgery, Guntur medical college, Guntur were included in the study. Patient enrolment began in November 2014 and ended in August 2016. The inclusion and exclusion criteria are listed in Table 1.

Evaluation: All patients were assessed clinically by using the American Spinal Injury Association (ASIA) scoring and grading system. Apart from clinical parameters, the demographic parameters like age, gender, mechanism of injury, and timing of injury were also included in the study. Radiological evaluation for stability was assessed by using TLISC scoring system (Image 1& 2). All these patients had MR imaging done either at institute (1.5 Tesla) or at the referral center (0.3 to 1.5 Tesla). MRI findings were analysed into two groups **a)** contusion and **b)** oedema on the backdrop of time of injury and timing of MRI. The patients who presented within 8hrs of injury were treated with Inj. Methyl prednisolone (n=4) in accordance with NASCIS -2 recommendations. The patients were further divided arbitrarily into two groups as per the timing of surgery

following the injury into early (≤ 1week) and late (> 1week). The preoperative plan was decided by a collegium of neurosurgeons of the department in the preoperative period. Surgical decompression was performed based on TLISC Score>3 patients (Image 3). All these patients were followed up in outpatient department at regular intervals. More than or equal to 1 grade change in ASIA grade from the date of admission to 6months follow up was taken as improvement. Functional grading was done by using functional independent measure (FIM) scale at admission and 6 months follow up.

III. Results:

Study population:

Total of 25 patients were enrolled during the study period (Nov 2014 to Aug 2016). The descriptive analysis is provided in Table 2. Maximum number of patients in present study corresponds to below 30yrs (60%). Mean age for all patients in the present study 39.13 yrs (ranging from 0-60yrs). Age groups were divided in to 2 categories, ≤30yrs and >30 yrs for analysis. Among the patients 88% were males. Most common mode of injury was road traffic accidents (56%) followed by falls (40%). Patients with ASIA grade D (40%) were the commonest to present to our institute, followed by grade A (32%). The percentage of improvement in ≤30yrs group was 40% when compared to >30yrs group where it was 60% .

Clinical parameters: The initial neurological grade and follow up grade at 6 months labelled in Table 3. More than equal to 1 ASIA grade change in neurological status from date of admission to 6months follow up was taken as improvement. No patient died post operatively at 6month follow up . The improvement in ASIA grade D was 90% followed by grade C which is around 75%.. Two grade improvement noted in 1patient of ASIA grade C who improved to grade E at 6 months follow up.

Imageology: Based on MRI findings, the percentage of improvement in oedema group was 75%, whereas 14% in the contusion group improved (Table 4).

Timing of surgery: Percentage of improvement in ≤ 7days surgery group was 48% as compared to 42% in >7days surgery group.

FIM score improvement: Maximum improvement in average FIM score at 6months follow up noted in ASIA grade D, with improvement in average score from 92/126 to 142/126(Table 5).

Post operative complications: Maximum follow-up was available for 18 months, with minimum follow up of 6months (average- 12.3 months). Post operatively 1 patients had chest infection, 1 patient had wound collection, 2 patients had bedsores, and 3 patients had UTI. No patient was died at 6 months follow up.

IV. Discussion

Numerous studies in the literature shown how various factors like age, gender, etiology, ASIA grades, level of injury, timing of surgery etc. had influence on the outcomes.

Demography & outcome:. According to National Spinal Cord Injury Statistical Center (NSCISC, Birmingham, Alabama, 2012)[1] the average age at injury is 41yrs with 80% of SCI reported in males. In present study average age was 39.13 yrs with 85% cases being males. Most common etiology, according to NSCISC, motor vehicular accidents corresponds to 39%. In the present study, RTA contributed to 56% of cases.

Clinical parameters: Several studies have focused on initial neurological grade, level of injury affecting outcome.

Coleman et al., (2004)[2] opined that the severity of the injury was the primary predictor of outcome in acute SCI , reported that ASIA C&D had marked recovery as compared to ASIA B which did better than group A.

Burns et al, (1997)[3] studied the effect of age and initial neurologic status on recovery of ambulation in patients with incomplete injuries. They concluded that in patients with ASIA grade D, prognosis for recovery to independent ambulation was excellent irrespective of age. In present study no patients in ASIA grade A improved at 6months, Improvement was noted in 75% and 90% of patients with grade C and D respectively. No patient had neurological grade deterioration.

MR imaging & outcome: Number of studies proved that MRI had been gold standard in prognostication of spinal cord injury.

Kulkarni et al, (1988)[4] were first to characterize three MRI signal patterns for the prognostication of acute spinal cord injury (SCI): (1) haemorrhage in the cord (2) oedema of the cord and (3) a combination of haemorrhage and oedema. Prognostication patterns used today are variations of these original patterns.

Silberstein et al, (1992)[5] described the following MRI patterns, describing the four pathologies of acute spinal cord injuries 1.Haemorrhage pattern 2.Edema pattern 3.Contusion pattern 4.Transaction pattern.

Ramon et al, (1997)[6] described 6 patterns of MRI in acute spinal cord injury.

In present study MR Imageology of TLJ spine categorised into 2 groups, named as oedema and

contusion groups. Out of 25 patients 16 patients had oedema, 7 patients had contusion and 2 patients had normal MRI. One patient in contusion group improved at 6 months follow up, whereas the percentage of improvement in oedema group was 75%.

Timing of surgery & outcome: Controversy exists regarding timing of surgery in SCI. Proponents of both early and late surgery can be found in the literature. Till now 22 studies attempted to define optimal timing of surgery for acute traumatic SCI, 9 utilised the 24 hr limit to define an early decompression(Botel u et al,1997, Duh M et al 1994, Guest J et al,2002, Levi L et al.1991, Pollard M et al.2003 etc[7-14]), 8 used 72 hrs (Vaccaro A et al, 1997, McKinley et al, 2004, Chipman J et al, 2004, Croce M et al, 2001, Kerwin A et al, 2005, Mirza S et al, 1999, Sapkas G et al, 2007, Schinkel et al, 2006[15-23]) and 4 used other bench marks such as 8hrs, 48 hrs or 4 days(Cengiz S et al, 2008, Ng W.Fehling Mn et al, 1999, Clohisy J et al,1992, Chen L et al,1997[24-27]). Interestingly, none of the studies have reported adverse neurological outcomes with early surgical intervention.
All these studies have brought a paradigm shift in favour of early surgical intervention. The rationale behind this is based on the pathophysiology of acute SCI indicate that there are both primary and secondary mechanisms that lead to neurological injury. Preventing and mitigating the secondary mechanisms is where opportunity for neuroprotection lies and where most attempts at therapeutic intervention staged.

Fehlings et al, 2012 (STASCIS TRIAL)[28], in an multicenter, international, prospective study in adults aged 16–80 with cervical SCI, concluded that decompression prior to 24 hrs after injury is significantly associated with improved neurological outcome at 6 months follow up. In present study, due to delay in referrals, poor respiratory status and/or time for traction, there was considerable delay prior to surgical decompression. Because of these reasons we categorized into two groups such as those operated within 7 days of injury considered as early surgical group, those were operated after 7 days considered as late surgical group. The percentage of improvement was 48% in early surgical group (≤7 days), whereas it was 42% in late surgical group(≥ 7 days) . Inj. methylprednisolone as per NASCIS II trial was given to only 4 patients attended to emergency department within 8 hrs of injury. One patient belong to ASIA B who did not have improvement ,the other 3patients were ASIA D at admission improved to ASIA E at 6 months follow up.

Functional outcome:

Functional Independent Measure (FIM) scoring system is often used to assess the disability at admission and also to predict long term outcome. All the patients in present study were analyzed by measuring FIM at admission & at 6 months follow up. Overall improvement in average FIM Score for each grade was studied. Maximum functional improvement noted in ASIA D followed by C grade at 6 months followup.

Limitations of study: - Present study has the following limitations. The major limitations of the present study were a small sample size, with non-uniformity in imaging and timing of surgery.

V. Conclusions

ASIA grade D&C spinal injuries and patients having oedema in MR Imageology have better improvement when compared with ASIA Agrade & MRI contusion group. Significant improvement in average FIM score noted in incomplete cervical injury patients (ASIA grade D) at 6 months follow up.

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Table 1: Inclusion and exclusion criteria

Inclusion criteria	**Exclusion criteria**
1. Spinal injuries from T11—L1. 2. Patients presented within a week following injury. 3. Patients who were managed surgically.	1. Associated Cervical, T1-T10,L2-S1 spine injuries & head injuries. 2. Patients with penetrating injuries. 3. Patients who were managed conservatively. 4. Arrival at institute after 7 days of injury.

Table 2: Descriptive analysis of study participants (N=25)

Parameter	**Frequency**	**Percent**
I. Age group		
30 and below	15	60
Above 30	10	40
II.Gender		
Female	3	12
Male	22	88
III. Mechanism of injury		
RTA	14	56
Fall	10	40
Others	1	4
IV.ASIA GRADE		
A	8	32
B	1	4
C	4	16
D	10	40
E	2	8
V.MRI		
Edema	16	64
Contusion	7	28
Normal	2	8

Table 3: Improvement in ASIA grades at 6 months follow-up

Follow up 6months	**ASIA grades**					**Total after 6months**
	A	**B**	**C**	**D**	**E**	
A	8	0	0	0	0	8
C	0	1	1	0	0	2
D	0	0	2	1	0	3
E	0	0	1	9	2	12
Mortality	0	0	0	0	0	0
Total	8	1	4	10	2	25

Note: No patient improved or deteriorated to group B and hence grade B has not been charted

Table 4: Outcome in relation to MRI findings

Table: 4		**Outcome**		**Total**
		Static	Improved	
MRI	**Edema**	4 25%	12 75%	16 100.0%
	Contusion	6 85.71%	1 14.29%	7 100.0%

Table 5: FIM scores in pre- and at 6 months follow-up

ASIA Grade	Average Pre op FIM score	Average follow up FIM score
A	72	81
B	74	81
C	89	114
D	92	124

Image 1& 2 showing T1, T2 WI of dorsolumbar spine showing D12 burst fracture with thecal sac compression.

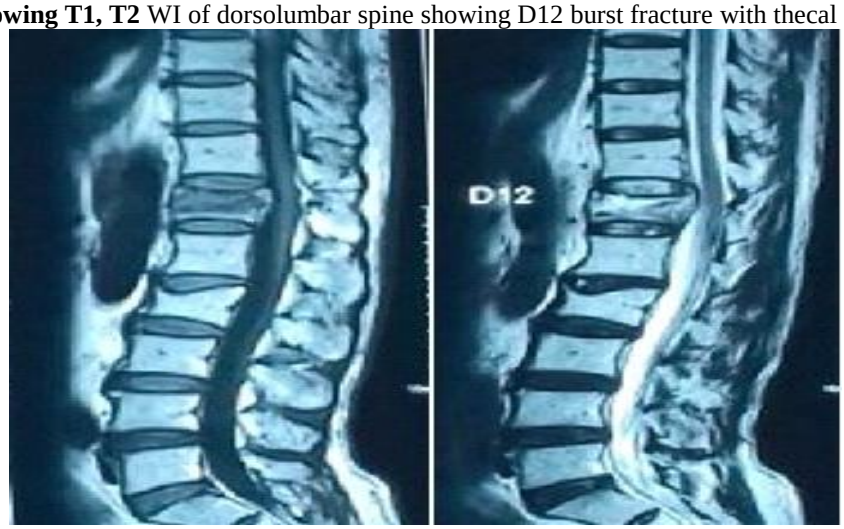
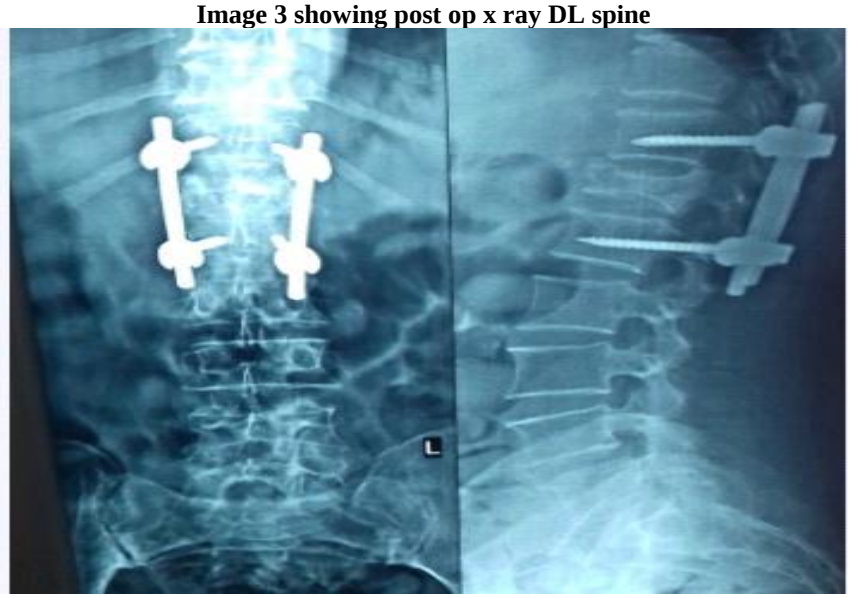


Image 3 showing post op x ray DL spine



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