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A four year experience treating incomplete thoracolumbar spine injuries in an East African country

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ABSTRACT

Background: Traumatic spine injuries are one of the most common causes of disability and mortality.
Objective: To assess post op neurologic status in patients with incomplete thoracic and lumbar spine injuries at two teaching hospitals in Addis Ababa, Ethiopia.
Methods: Institution based retrospective cross-sectional study was conducted among 60 hospitalized patients in these hospitals from February 1, 2017–January 31, 2021.
Results: Forty five (75.0%) of the study participants were males. The mean age was 30.77 years (range: 12–65 year). Only 8(13.3%) patients were operated within 3 days of trauma. The most common injury site was the thoracolumbar junction (T11-L2) in 80.0%. Significant number of patients (56.7%) had sphincters dysfunction. Pedicle screw fixation with or without laminectomy was performed in 98.3%. After minimum six month follow up, 37(61.7%) patients had access to the physiotherapy. Thirty seven (61.7%) patients were non ambulatory (AIS B and C) at presentation, of which 29 (78.4%) were ambulatory on the follow-up. Overall, 54(90%) patients had neurologic improvement on the follow up and 37(61.7%) returned to work. Preoperative neurologic status and sphincter function were found to be significantly associated with treatment outcome with **P value 0 .000 and 0.002** respectively.
Conclusion: This study shows despite limited availability of post op physiotherapy, significant number of patientsreturned to work post-surgery. Preoperative neurologic function was an independent predictor of post-operative outcome.

1. Introduction

Spinal cord injury is a disabling injury which has a profound effect on an individual, family and society. Moreover patients with spinal cord injuries need well organized pre-hospital care, timely intervention and extensive postoperative rehabilitation facilities. Thousands of patients visit health care institutions for this problem around the world.[1,2]

Thoracic and lumbar spines consist of upper thoracic (T1-T10), thoracolumbar junction (T11-L2) and caudal lumbar spines (L2-L5). Upper thoracic spine (T1-T10) has unique characteristics due to presence of ribs which makes the level less mobile and gives additional strength. Thoracic and lumbar spines are the part with highest share of injuries. Out of these, the junctional level(T11-L1) is moreproneto injuries.[1,3]

Spinal cord injuries need early intervention and rehabilitation. Early decompression is the choice of majority of spine surgeons for an injured spine.[4] Despite this, patients in developing countries come late to health institution. Even after reaching to health facility there are many reasons likeavailability of resources like implants and patient's ability to pay for implants for delayed surgical intervention in developing countries.[5]

This study assesses postoperative neurologic function in thoracic and lumbar spine fractures with pre-operative incomplete neurologic status. It will provide some information on the benefit of surgery even in the absence of the ideal set up for spine trauma care.

Abbreviations: AAU, Addis Ababa University; AIS, American spine injury severity; ALERT, All African Leprosy Rehabilitation and Training Center; ASIA, American spine injury association; CT, Computed topography; ICU, Intensive care unit; L-spine, Lumbar Spine; LMICs, Low and middle income countries; LSPF, Long segment posterior fixation; MCM, Myungsung Christian Medical Center; MVA, Motor vehicle accident; PLC, Posterior ligament complex; Post op, Post operative; Pre op, Pre operative; SCI, Spinal cord injury; SSPF, Short segment posterior fixation; T-Spine, Thoracic spine; TASH, Tikur Anbesa Specialized Hospital; TL, Thoraco lumbar; TLICS, Thoracolumbar injury classification system; TSCI, Traumatic spinal cord injuries.

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2. Materials and methods

The study was conducted at ALERT and MCM Hospitals located in Addis Ababa, Ethiopia. It is an institution based retrospective cross sectional study of post-operative neurologic outcome of traumatic thoracic and lumbar spine fractures with incomplete preoperative neurologic status. Decision to operate was based on TLICS score of patients.

All patients who underwent surgery for traumatic thoracic and lumbar spine fractures with preoperative incomplete neurologic status between February 1, 2017 and January 31, 2021 who were on follow up for at least 6 months post-surgery were reviewed retrospectively.

Data was collected using structured questionnaires and phone interviews. The collected data was coded and entered into SPSS version 23.0 software for analysis. Participants' socio-demographic characteristics and other variables were presented using the relevant descriptive statistics. Bivariate analysis was done at 25% level of significance to screen out potentially significant independent variables. Multiple logistic regression was performed using the significant independent variables. The association between the dependent and independent variables was analyzed using Binary Logistic Regression. The adequacy of the final model was checked using the Hosmer and Lemeshow goodness of fit test and the final model fitted for the data well (p-value = 0.899). For Binary Logistic Regression, 95% confidence interval was calculated and variables with p-value ≤0.05 were considered as statistically significant. The neurologic outcome after 6 months of post operation was classified as non-ambulatory (AIS B or C) and ambulatory (AIS D or E),return to work was assessed by interviewing patients whether he/she returned to pre injury work or not. The final neurologic assessment was put as improved (if there was change from more affected scale to the next levels), the same (no change in the impairment scale) and deteriorated (if patient decreased to the more affected level from initial status).

Ethical clearance and approval letter was obtained from the ethical clearance committee of Addis Ababa University (AAU) College of health science.

3. Results

A total of 64 patients in ALERT and MCM Hospitals were eligible for this study but three of them were not followed and one patient died before post-operative 6 month follow up. Hence 60 patients were included in the main analysis of the result. Forty five (75%) of the study participants were males. The mean age of the study participants was 30.77 years (range: 12–65 years) and majority of the study participants, 54(90%), were in the age group of ≤40 years. One fourth of the patients were farmers. Fall from height accounts for most of the causes (n = 32, 53.3%) followed by motor vehicle accident and an object on patients.

Thoracolumbar junctional level (T11-L2) was the most commonly affected site (n = 48; 80.0%) followed by lumbar (n = 11; 18.3%) and thoracic, n = 1; 1.7% (Table 1). In 42(70.0%) study participants, the pattern of fracture was burst type followed by fracture dislocation (n = 12; 20%), chance fractures (n = 3; 5.0%) and compression fractures (n = 2; 3.3%). Majority of the patients (n = 52; 86.7%) were operated after 3rd day of trauma and only 8(13.3%) were operated within 3 days of trauma.

Twenty three (38.3%) patients classified as AIS D, 22(36.7%) as AIS C and 15(25.0%) were scored as AIS B. There was bladder sphincter disturbance in 26 (43.3%) patients, and in 8(13.3%) both urinary and bowel sphincters were affected. Significant number of study participants 53(88.3%) had no associated other site injuries (Table 1).

For more than half of patients (n = 35; 58.3%) Pedicle screw fixation with index level laminectomy was performed. Pedicle screw fixation without laminectomy (n = 24; 40%) and only laminectomy without instrumentation (n = 1) were the other types of procedures performed. In thirty five (58.3%) patients, short construct (one level up and down) was done. Two level up and one down was the next most commonly performed procedure (n = 12; 20.0%). This is due to economic reasons as patients pay out of pocket for implants. Long construct (two levels up and down) was done in 6(10.0%) patients. Other procedures (n = 7; 11.7%) includes one level up and two down including index level and only two adjacent levels were fused in patients with dislocation.

Majority of patients (n = 37; 61.7%) had access to physiotherapy. But there was difficulty in assessing exact duration for each patient. Twenty two (36.7%) patients didn't have wheel chairs.

After a minimum of six months follow up, 32(53.3%) patients had neurologic status of AIS E score followed by AIS D score (n = 19; 31.7%). Patients who were classified as AIS B and C accounted for 15% (Table 4). From those 15 study participants who were classified as AIS B initially, three of them classified as AIS B, four as AIS C, seven of them as AIS D and one of them as AIS E on follow-up (Table 2).

Out of 34(56.7%) patients who had sphincter dysfunction preoperatively, 21(61.8%) had improvement on follow-up. Significant improvement (69.0%) was observed in those patients who had only bladder dysfunction compared to those who had bladder and bowel dysfunction (50.0%) (Table 3).

Out of 37 patients who had access to physiotherapy, 32(86.5%) showed neurologic improvement. Twenty three patients had no access to physiotherapy and there was neurologic improvement in 20(86.9%) (Table 4).

More than half of study participants (n = 37; 61.7%) returned to work. In those who didn't some of the reasons reported were unable to work due to partial recovery or urinary retention in 20(33.3%) and still on rest or planning to change work in 3(5%).

Table 1
Pre-operative findings (level of injury, neurologic status and associated injuries) of the study participants in ALERT and MCM Hospital, February 1, 2017–January 31, 2021 (n = 60).

Variable		Frequency	Percent %
Level of injury	Thoracic (T1-T10)	1	1.7
	Thoracolumbar (T11-L2)	48	80.0
	Lumbar (L3-L5)	11	18.3
Preoperative ASIA score	ASIA "B"	15	25.0
	ASIA "C"	22	36.7
	ASIA "D"	23	38.3
Preoperative sphincter status	Only bladder dysfunction	26	43.3
	Both bladder and bowel dysfunction	8	13.3
	Continent	26	43.3
Associated injury	Head	1	1.7
	Chest	1	1.7
	Abdominopelvic	2	3.3
	Extremities	3	5.0
	None	53	88.3

Table 2
Neurologic status of the study participants on follow up, n = 60.

ASIA Score	Frequency	Percent %
ASIA B	3	5.0
ASIA C	6	10.0
ASIA D	19	31.7
ASIA E	32	53.3

Table 3
Comparison of Sphincter function before and after surgery, n = 60.

Sphincter status	At Admission		On Follow up	
	Frequency	Percent %	Frequency	Percent %
Only bladder dysfunction	26	43.3	8	13.3
Only bowel dysfunction	0	0	1	1.7
Both affected	8	13.3	4	6.7
Continent	26	43.3	47	78.3

Table 4
Comparing neurologic outcome in physiotherapy and no physiotherapy groups.

Initial score			Postoperative outcome	
			Improved	Same
ASIA B	Physiotherapy	10	8	2
	No physiotherapy	6	5	1
ASIA C	Physiotherapy	14	14	0
	No physiotherapy	7	5	2
ASIA D	Physiotherapy	13	10	3
	No physiotherapy	10	10	0
Total		60	52	8

NB: No patient has deteriorated on follow-up.

After minimum six months post operation follow up, from the total study participants, 51(85.0%) were ambulatory.

Bivariate analysis was done using 25% level of significance to screen out potentially associated independent factors. From the analysis, initial sphincter function (**P-value = 0.002**) and preoperative neurologic score (**P-value = 0.000**) were significantly associated with postoperative neurologic outcome. Preoperative neurologic status is the independent predictor which affects postoperative outcome. The more severely affected the patient preoperatively, the poor postoperative functional status (Table 5).

Bivariate analysis was also done for each independent variable to screen out potentially associated variables with return to pre injury work. Type of job, level of spine injury, initial neurologic score as well as sphincter status and associated injuries were independent variables which were significantly associated at 25% level of significance. However, only initial neurologic score was significantly associated with return to work in the Multiple Logistic Regression Model at 5% level of significance**(AOR = 2.561,95% CI: 1.030, 6.367).**

4. Discussion

In low and middle income countries (LMICs), there is scarcity of spine treatment centers and expertise for patients who sustain spine injuries. Few studies were conducted on outcome of these patients in Sub-Saharan Africa.

The distribution of age and sex in this study appear comparable to what was found in studies done in African countries.[1,5-7] The large number of young men with TSCIs in our study reflects the high prevalence of workplace injuries, since young men tend to engage in more risky working conditions and driving habits. In our study 90.0% of our patients were younger than age 40 years.

In this study farmers accounted for 25% of the study participants which is comparable with study done in India (23.3%) on epidemiology of spine injury.[8]

In this study fall from high injuries comprises 53.3% of cases which is similar to study done previously in our country.[9] Also studies done in Pakistan and India showed similar results. Large number of falling from height injury can be due to common practice of climbing on trees to collect fruits. The main cause of TSCI in all developed countries is traffic accidents followed by falls.[8,10,11]

Thoracolumbar junction which is considered from T11- L2 was the commonest site of trauma accounting for 80.0% of cases followed by lumbar and thoracic spine. Unpublished study in Ethiopia[12] and study from Germany showed similar results.[13] Another study done in Ethiopia showed lumbar area is more common than thoracic area without considering thoracolumbar junction as a separate entity.[1] Burst fracture pattern was the most common type in this study accounting for 70% followed by fracture dislocation (20%). Study done at university of Minnesota, Minneapolis, reported 77.6% had burst fracture followed by fracture dislocation (15.5%) which is similar to this finding.[14] Whereas a study from India reported the predominant type of bony lesion was a wedge compression fracture (53%), followed by a fracture dislocation (29%).[15]

Other site injuries which are associated with thoracolumbar spine fractures were head, chest, extremities and abdominal injuries. In our study there were only seven patients who had associated other site injuries with extremities involvement were the most common. Another study done in our country showed head injuries followed by chest injuries were the most commonly associated other site injuries in thoracolumbar spine trauma. But patients with complete neurologic status were involved in this study and severity of trauma in these patients possibly contributed to the injuries.[12]

Early operation might allow immediate mobilization, facilitate care, and lead to pain reduction and prevention of secondary trauma to the spinal cord caused by local instability. Early stabilization of thoracic spine fractures within 3 days after severe trauma contributes to reduced morbidity and mortality.[16] But in our study only 13.3% of the patients were operated within 3 days.

In this study 98.3% of the patients were treated with pedicle screw fusion and short segment construct was used in 58.3%. Study done in Tanzania revealed similar finding in which total of 74 thoracic/lumbar fractures all treated with posterior thoracic or lumbar laminectomy and fusion with pedicle screw. Short-segment fixation was used in 86%.[5] Another study in Ethiopia showed that all the patients who were operated for thoracic and lumbar injuries were treated with posterior fusion and stabilization using pedicle screws and rods.[14]

Among patients who were incontinent preoperatively, 61.8% (n = 21) of patients showed improved sphincter control after minimum six months follow-up. From patients who had affected bladder sphincter, 69.2% of the patients had improvement while 50% in those who had both bladder and bowel sphincters dysfunction. Study done in USA showed improvement in 69.0% of the patients who were treated with anterior decompression for thoracolumbar spine fractures with incomplete neurologic deficits.[14] In this study, patients who were treated with posterior or posterolateral decompression showed less improvement (33.0%).

In our study AIS D was the most common initial neurologic score (38.3%) followed by AIS C (33.3%) and AIS B (28.3%). This finding is similar with studies done in India, USA and Germany which showed AIS D was the most common followed by AIS C.[13,14,17,18] Overall 54(90%)

Table 5
Bivariate and multivariate analysis for factors associated with postoperative neurologic outcome in study population.

Variable		Outcome after 6 mo		P-value	COR(95% CI),PV	AOR(95% CI),PV
		Non ambulatory	Ambulatory			
ASIA score	ASIA B	8	8	**.000**	**22.400(2.724,184.226)**	**.033(.003,.415)**
	ASIA C	1	20		**PV: .004**	**PV; .008**
	ASIA D	0	23			
Total		9	51			
Initial sphincter status	Only bladder	5	21	**.002**	**1.521(0.883,2.620)**	**1.257(.51,3.071)**
	Both	4	4		**PV: .130**	**PV; .616**
	continent	0	26			
Total		9	51			

Note: AOR, Adjusted odds ratio; CI, Confidence interval; COR, Crude odds ratio; PV,P-value.

Table 6
Comparative data by different authors on patients operated for thoracic and lumbar spine injuries.

Author	Series size	Improvement
Bradford [23]	16 *(all incomplete SCI)*	88.0%
Wiberg[24]	30 *(all incomplete)*	83.0%
Jun [32]	13 (8; incomplete SCI)	92.0%
Pandy s. [22]	36 *(all incomplete SCI)*	67.0%
Rath[25]	169/34*(Total;169, incomplete;34)*	76.5% *(for incomplete)*
Lee [33]	56 *(50% had cervical spine injury)*	53.6% *(for both complete and incomplete)*
Aebi[34]	30/13 *(total, 30/incomplete SCI, 13)*	71.4% *(for both), 77.0%(for incomplete)*
SahluA.et al [29]	73 (*both complete/incomplete)*	51% (for both)
Present study	60 *(all incomplete)*	90.0%

patients had one or more grade neurologic improvement on the follow up. Thirty seven (61.7%) patients were non ambulatory (ASIA B and C) at presentation, out which 29 (78.4%) were ambulatory (ASIA D and E) on the follow up. In our study from the total of 60 patients, 17 (28.3%) were ASIA B at presentation. Among these three (17.6%) of them remain same, six (35.3%) improved one level to ASIA C, seven (41.2%) improved to ASIA D and one (5.9%) improved to ASIA E. From those who were ASIA C at the presentation, there was no patient who deteriorated or remained same. There are various reported results on patients operated for thoracolumbar spine injuries in different setups. Please see Table 6 for comparison with other studies.

Compared to other study results, there is significant post-operative improvement in our patients (Table 5). This may be attributed to high prevalence of trauma in our country among younger population (mean age: 30.7 y) compared to study done in South Korea (mean age: 50.9 ± 17.1) and Germany (mean age: 44.3).[13,19] But study from India and Switzerland which had comparable mean age (33.7 and 33.8 respectively) with our study (30.7) had lower postoperative neurologic improvement.[18,20] Moreover, some of the compared studies included both complete and incomplete thoracolumbar spine injuries.[19] Cervical spine injuries were also included in South Korean study.[19]

Study done in America revealed 70% of patients returned to full-time work and another 8% were considered capable [21]. In our study 61.7% of the patients returned to pre injury or related work. Considering low access or absence of rehabilitation centers in our country, this is an encouraging result.

5. Conclusion

Limitations of the study are: it is institution based retrospective study using medical records and phone interviews as the main source of the data. Fusion of the fracture couldn't be assessed and the medical records maybe incomplete.

Despite limited resources, this study showed good postoperative recovery which has significant impact on return to pre-injury social role of the patient. Pre-operative neurologic function was an independent predictor of post-operative outcome.

Credit author statement

Developing idea for Study, Editing original draft: Azarias K.Admasu, MD, FCS (ECSA) Preparing revised draft for publication Developing idea for study, Data collection: Sisay Kebede, MD Writing up original draft.

Declaration of competing interest

This manuscript, in part or in full, has not been previously published elsewhere. We, Azarias K. Admasu and Sisay Kebede, certify that this manuscript is a unique submission and is not being considered for publication with any other source in any medium. To the best of our knowledge, no conflict of interest, financial or other exists. We have included acknowledgements after the conclusion.

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