Epidemiological Characteristics of Dorsal and Lumbar Spine Trauma Presenting to a Trauma Hospital in Kathmandu, Nepal: Formulation of a National Spine Policy

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Abstract:

Introduction: Outcome of spine injury treated in resource constrained regions may not be the same as in developed nations. The aim of the present study was to study the epidemiological characteristics, delay, complications, and outcome of surgically treated dorsal and lumbar trauma.

Methods: Retrospective study of dorsal and lumbar spine injury patients treated between December 2015 and August 2017. Patients were segregated into four groups based on the timing of surgery: 0-2 days, 3-7 days, 8-30 days, and more than 31 days. Only one operating room twice a week was allotted to spine surgery, and spine had to compete with orthopedic and surgical trauma for admission and surgery.

Results: Ninety-one patients (male 61) with mean age 33 years were operated for dorsal and lumbar spine injuries. 84% of the total patients sustained a fall, and 86.8% were from the periphery. Though 69.2% presented within 2 days, only 4.4% were operated within 2 days. Majority of the delay was due to unavailability of the operating room followed by financial constraints. Twenty-seven patients had complete deficit, 32 incomplete deficit, and 32 normal neurology. Four patients operated within 2 days improved their neurology, 7 incomplete deficit patients in 3-7 days group improved, 6 in 8-30 days group improved, whereas no patient in more than 31 days group improved. Overall 53.1% of neurologically incomplete deficit patients improved if operated within 30 days. No neurological improvement was seen in the 27 complete deficit patients. Wound infection, pulmonary contusion, and deep vein thrombosis were seen in 3 patients.

Conclusions: As expected 95.6% of our patients were treated more than 3 days after injury and 60% more than a week later, which may not be acceptable in advanced countries. Despite the delay, 53.1% had an improvement in neurology when operated within 30 days. Hence, surgery still holds the hope of neurological recovery and quicker rehabilitation.

Keywords:

Spine Injury, Dorsal, Lumbar, Epidemiology, Neurology, Nepal

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Introduction

The annual incidence of spinal cord injury (SCI) is 12.1 to 57.8 cases per million[1]. Cripps and Lee *et al.* report the annual incidence of spinal injuries between 236 and 1009 per million per year[2]. Majority of the data are from the western world or countries with advanced trauma care. Data from developing countries are scarce due to lack of a national trauma database.

In India, the prevalence of SCI ranged from 236 per million in contrast to 1800 per million in the USA[3]. Studies from Nepal have reported 149 cervical spine injuries between 2001 and 2004 and 233 SCI between 1997 and 2001[4,5]. However, both these studies were conducted in eastern region of Nepal more than 10 years ago. Since the last decade, Nepal has witnessed considerable socio-demographic changes. Hence, it is important that recent research and database reflect the current scenario of SCI in Nepal.

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Table 1. Comparative Table of Injury Time to Admission and to Surgery.

	0-2 days	3-7 days	8-30 days	>31 days
Injury to Admission	63 (69.2%)	20 (22.0%)	7 (7.7%)	1 (1.1%)
Admission to Surgery	11 (12.1%)	35 (38.4%)	42 (46.2%)	3 (3.3%)
Injury to Surgery	4 (4.4%)	26 (28.6%)	53 (58.2%)	8 (8.8%)

Table 2. Neurology (ASIA Score) in Patients Operated within 2 Days.

Pre op Neurology	Post op Neurology
3 B	3 C
1 C	1 D

Materials and Methods

After approval from the institutional review board, dorsal and lumbar spine trauma patients operated between December 2015 and August 2017 at National Trauma Center (a level I trauma center) were included in the study. National Trauma Center receives trauma victims from every region of Nepal. Majority of the spine injuries referred to this center required surgery. Though orthopedic and neurosurgeons also perform spine surgery, this center has only one dedicated spine surgeon. Spine trauma competes with general orthopedic trauma, general surgical, and neurological trauma for emergency admissions, in-patient bed and operating room space. One operating room twice a week is provided to the Spine Unit, and in the operating days, elective spine surgeries for other spine conditions have to be performed.

At the time of presentation to the emergency, standard trauma care for spine injuries was followed according to the Advanced Trauma Life Support Guidelines, and subsequently, the patient was admitted. A performa was filled from the time of presentation to the emergency till discharge of the patient. The performa contained demographic profile of the patient, mode of injury, transport, delay in surgery and cause of the delay, pre and post-surgery neurology according to the American Spinal Injury Association Score (ASIA) and in-hospital complications. The data was then stored in an Excel sheet and analyzed retrospectively.

Patients were divided into four groups according to the time of presentation and surgery: Very Early 0-2 days, Early 3-7 days, Delayed 8-30 days, and Late 31 days and more. None of the patients received intravenous steroids. The patients were discharged at 14th postoperative day after suture removal and were evaluated at three months.

Results

One hundred and twenty-five spine trauma patients were surgically operated between December 2015 and August 2017 at the Spine Unit, National Trauma Center, Kathmandu, Nepal. The total number of dorsal and lumbar spine trauma operated upon was 91. All surgeries were performed by the posterior approach. The male to female ratio was 2.03:1 with a mean age of 33.07 years. Twelve (13.2%) patients were from Kathmandu, and the rest (86.8%) were from outside Kathmandu.

Eighty-four percent of patients sustained fall injuries (fall from tree or cliff) and only 15% sustained road traffic accidents. All the patients were transported in ordinary ambulances without any spine board. 69.2% patients presented within 2 days of injury, whereas 22.0% within 3-7 days, 7.7% within 8-30 days, and 1.1% after 31 days of injury. Table 1 shows the comparison between the time of injury to presentation in the hospital and surgery time.

There were 34 fractures in the dorsal spine, 10 fractures in the dorsolumbar junction, and 47 in the lumbar spine. 5.5% had *Arbeitsgemeinschaft für Osteosynthesefragen* Classification (AO) A3 injury, 28.6% had AO A4 injury, whereas 41.8% had AO B2 injury and 19.8% had AO C injury.

On presentation, 29.6% had complete neurological deficit (ASIA A), whereas 35.2% had incomplete deficit (ASIA B, C, D), and 35.2% had normal neurology (ASIA E). Six weeks post-surgery 4 incomplete deficit patients improved to normal neurology. None of the complete deficit patients recovered their neurological status post-surgery.

Only 4.4% patients were operated within 2 days, whereas 28.6% were operated within 3-7 days, and the majority (58.2%) were operated within 8-30 days. However, 8.8% were operated after 30 days.

The majority of the delay was due to unavailability of the operating room (55%) and inability to pay for the spine implants by the patient and his family (34%). Since 34% of the patients and their family members could not arrange sufficient money for the pedicle screw construct, their surgery was delayed. Comorbidities contributed to 4.4% delay in surgery.

Table 2 shows the neurological outcome of the operated patients. The 4 patients operated within 2 days recovered their neurological status by one ASIA grade (Table 3). Six patients with incomplete neurological deficit recovered by at least one ASIA grade when operated with 3-7 days (Table 4). Table 5 shows that only 6 of 18 incomplete deficit patients recovered by at least one ASIA grade when operated within 8-30 days, whereas none of the patients improved when operated after 31 days.

One patient with complete deficit developed deep vein thrombosis post-surgery and was managed with low molecular weight heparin and warfarin and was discharged three weeks later after Doppler resolution. One patient had a

Table 3. Neurology in Patient Operated between 3 and 7 Days.

Pre op Neurology	Post op	Neurological	Status		
9 A	9 A				
3 C			1 C	2 D	
4 D					4 E
11 E					11 E

Table 4. Neurology in Patients Operated between 8 and 30 Days.

Pre op Neurology	Post op	Neurological	Status	
14 A	14 A			
7 B		5 B	2 C	
7 C			3 C	4 D
4 D				4 D
20 E				20 E

Table 5. Neurology in Patients Operated after 31 Days.

Pre op Neurology	Post op Neurological Status
4 A	4 A
2 B	2 B
1 D	1 D
1 E	1 E

wound hematoma which was evacuated, and 1 patient developed pneumonitis which resolved with medical management.

Discussion

Management of SCI in developing countries differs from countries with advanced trauma care. The emergency trauma team is well equipped in extricating victims from the site of accident. Medical team reaches the accident site within an hour either by road or air ambulances which are staffed with basic life support trained personnel and equipment. The spine trauma patients also receive priority in surgery. Studies from western literature have shown better outcomes when SCI are operated early.

In the US 80.7% of SCI occurred in males[6], and a study from Bangladesh revealed 84% to be male patients[7]. In our study, the incidence of dorsal and lumbar spine trauma was also more in males. Unlike the previous studies from the US and Bangladesh, the incidence of SCI in male patients was 67%. This reduced incidence may have been due to a larger number of females in the hilly region of Nepal climbing trees to chop wood for firewood or falling from a cliff or hill while grazing cattle.

From an average of 26.8 years in Turkey to 55.5 years in USA, the mean age of spinal injury differs in many countries. In a hospital based study by *Agarwal et al*. in India, the age ranged from 20 to 39 years[8]. The mean age of 33.07 years in our study is similar to many studies, and this reflects that spinal injury occurs in young active individuals who have a major contribution in their family and society.

86.8% patients were from outside Kathmandu. This may be due to few spine fellowship trained orthopedic and neurosurgeons in the periphery, lack of operating room facility and spine instruments and implants.

Unlike the western world where road traffic accidents are the major cause of spine injury, fall injuries are the leading cause of spine trauma in developing countries[9]. Similar to the studies by *Shrestha et al. and Lakhey et al*.[4,5], 84% of our patients sustained fall injury. The fall was either from a tree or a cliff. In rural Nepal, wood is still used to light the kitchen fire; therefore, people climb trees to chop the branches. Also, in the countryside, people graze their cattle in the hills and sustain fall injury. These are preventable causes and programs focusing on preventive strategies should be disseminated in the rural areas. Unlike western countries, road traffic accidents constituted only 15% of spine trauma.

Though 69.2% of the total patients presented to the hospital within 2 days of injury, only 4.4% were operated within 2 days, and the majority (86.8%) were operated between 3 and 30 days. There was a considerable delay in surgery, and the two important causes of the delay were unavailability of operating room and procurement of implants. Availability of operating room for spine trauma surgery is a major issue at the hospital since this is tertiary referral trauma hospital catering to all types of trauma and also elective orthopedic surgery. Also, this hospital is the only tertiary level, referral trauma hospital, hence the number of all trauma patients is huge. Majority of the spine injury patients referred to this center require spine surgery.

The Government of Nepal has recently established an insurance scheme in which a spine injured patient undergoing spine surgery will be covered surgical expenses to a maximum of 962 USD (1 USD = 104 NPR). Expenses more than 962 USD has to be paid by the patient. This amount is sufficient to cover the surgical, laboratory, bed, and medi-

cine charges; however, it is not enough to cover the implant cost. Hence, arranging finance for the implants proved to be a major source of delay for the surgery. If the policy included the cost of implants, then most of the patients would have had their surgery early.

Although none of the complete deficit patients improved their neurology, 11 of the 12 incomplete deficit patients when operated within 7 days of injury improved their neurological status by at least one ASIA grade. Hence, early surgery should be attempted as emphasized by *Haroop JS et al.* to bring about a favorable neurological outcome[10].

Limitations of the Study

This was a retrospective single hospital based study. We did not include dorsal and lumbar spine trauma patients that were managed conservatively or who died. The long-term complications of SCI were also not included, and we did not consider the rehabilitation and societal integration of these patients. Due to the geographical and financial constraints, this study has a limited follow-up period. For evaluating patients on a long-term basis, community or home based rehabilitation medical personnel should be utilized.

Conclusion

80% of the world's population lives in healthcare constrained countries[11]. Especially in a country like Nepal, where there is no epidemiological data recording, improper mode of SCI victim transportation, delay in transport and surgery; statistics and outcome of the SCI patients in 20% of the developed countries do not reflect on SCI care of the developing or third world countries. As expected, 95.6% of our patients were treated more than 3 days after injury and 60% more than a week later which may not be acceptable in advanced countries. Despite the delay, 53.1% had an improvement in neurology when operated within 30 days. Hence, surgery still holds the hope of neurological recovery and quicker rehabilitation.

Since SCI is associated with permanent disability, with no immediate cure, prevention is the only effective mode of treatment. Correct epidemiological data regarding SCI is the initial step in developing a national spine injury policy and prevention program.

Conflicts of Interest: The authors declare that there are no relevant conflicts of interest.

Author Contributions: All authors were involved in the study. The first and the corresponding author were involved in the manuscript preparation. Santosh Paudel and Ganesh Gurung were involved in data collection. Siddharth Dhungana was involved in statistics, and Yoshiharu Kawaguchi was involved in project development, intellectual advice, and manuscript mentoring. All authors have read the manuscript and approved it.

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