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Original Research Article

Study of Spinal Cord Injury in Tertiary Care Hospital of Bhopal City

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Abstract

Objectives: To evaluate outcome and prognosis of spinal cord injury in patients admitted in Tertiary care hospital of Bhopal from July 2019 to June 2021.

Methods: Consecutive Spinal cord injury cases admitted from July 2019 to June 2021 were evaluated on a preformed proforma for demographic factors, epidemiological data and neurological status.

Exclusion criterion – Patient admitted after 15 days of injury, Patient operated outside and Patients sustaining spinal column injury without cord involvement or with nerve root injury

Results: In 140 cases of Spinal cord injury, 73 were cervical and 67 had thoracolumbar injuries, with male to female ratio of 3.8:1 and 71% in the age group of 20–49 years. Around 79% patients were from rural background. Among the causes of injury, 53% patients had a road traffic accident and 28% had fall from height. Fall of heavy object overhead and back (10.7%), fall with heavy object overhead (3.0%) and fall following electric shock (4.0%) were uncommon causes. Complete paralysis was found in 20.5% cervical and 23.3% in thoracic injuries. Extremity and rib fractures (10.6%) and head injuries (7.2%) were common associated injuries. About 55% cases were initially attended at non-specialized centers.

Conclusion: The present study found no significant difference in the length of stay and degree of neurological recovery between the patients treated by non-operative and operative methods. Therefore, the value of surgery in the management of spinal cord injury remains undefined and must await the performance of a rigorously controlled, randomized, prospective study.

Introduction

Road traffic accidents are becoming popular these days leading to an increased chances of Spinal cord injury. Epidemiology of a particular ailment is

connected to social, environmental, cultural and biological issues and thus fluctuates from region to region. Considering this injury it has a close relation with increased risk of morbidity and mortality.[1] The importance of epidemiological studies in planning prevention strategies as well as clinical and community services for persons with spinal cord injury (SCI) is well established. They provide a baseline to monitor the effectiveness of interventions.[2]

Early admission and treatment in case of spinal cord injury becomes crucial for resource allocation and thus should be particularly helpful for developing countries, which have restricted resources.

In various studies the incidence of Spinal cord injury varies from 9.2 to 56.1 per million [3–13], which is influenced by social, economic, geographical, demographic and political characteristics of the region. [2,4,9,10]

However, in spite of its prominence, there are hardly any appropriate epidemiological studies from developing countries. However, there are very insufficient hospital-based Indian pilot demographic studies and evidences from these too has mottled depending on the region and the rural or urban population catered by the hospital. [14]

Because of the intrinsic hitches in carrying out epidemiological studies. Hence this study was conducted to determine the demographic and epidemiological data and neurological status of patients with Spinal cord injury in our institute.

Materials and Methods

This prospective observational study was conducted from July 2019 to June 2021 in the Department of Surgery in our tertiary care hospital. All consecutive cases of Spinal cord injuries admitted in the department were evaluated for neurological status according to the International Standards for Neurological Classification of Spinal Cord Injury, including the American Spinal Injury Association Scale (ASIA).[3] A prestructured proforma was used for evaluation which included demographic parameters such as age, gender, marital status, locality, educational status, income, profession. In the epidemiological variables, mechanism of injury, time of arrival in our unit after injury, mode of transport used during transfer of patient, position of patient during transfer, any previous hospitalization, the type of care provided during initial admission at other health-care facility and associated injuries were noted.

Therapeutic decisions were made according to generally accepted principles[4] rather than to a predetermined protocol.

In general, cervical injuries were treated initially by cervical collar or Cervical traction. Skull tongs was not considered a surgical procedure for the purposes of this study. Operation was considered for patients showing radiological evidence of compromise of the spinal canal or malalignment of the vertebral column or unstable fracture with or without cord compression. For patients with injuries of the thoracic, thoracolumbar or lumbosacral spine initial management was bedrest with postural reduction. Surgical intervention was considered for radiological evidence of spinal canal compromise, failure to achieve reduction and unstable fracture.

Results

Out of 7300 trauma cases admitted in the department during the study period, 140 cases (1.9%) were of Spinal cord injury. Complete paralysis below the injury level was found in 51 and 58 cases in cervical and thoracolumbar injuries, respectively. Out of all 140 cases, 111were males and 29 were females, the male : Female ratio is 3.8:1.

Table 1 Distribution as per AIS (ASIA Impairment Scale) grade

ASIA Grade	Cervical - 73	Thoracolumbar - 67	Total - 140
A	29 (39.7%)	35 (52.2%)	64 (45.7%)
B	7 (9.5%)	6 (8.9%)	13 (9.2%)
C	9 (12.3%)	5 (7.4%)	14 (10%)
D	17 (23.2%)	10 (14.9%)	27 (19.2%)
E	11 (15%)	11 (16.4%)	22 (15.7%)

About 52.1% cases had injuries in cervical region and 47.8% cases had injuries in thoracolumbar region. Seventy-one percent cases were in the age range of 20–49 years (Table 2).

Table 2 Age distribution in patients with spinal cord injury as compared with percentage distribution in the general population

Age Group	Age distribution in General population (%)	Age distribution among patients with spinal cord injury (Total – 140)
Less than 19 years	40.8 %	18(12.6%)
20 to 49 years	37.2 %	99(71.1%)
50 to 69 years	19.5 %	20(14.4%)
More than 70 years	2.5 %	3(1.9%)

Table 3 Gender distribution in patients with spinal cord injury

Age Group	Total - 140	Male – 111(79.2%)	Female – 29(20.7%)
Less than 19 years	18 (12.6%)	11(69.2%)	7 (30.8%)
20 to 49 years	99 (71.1%)	82 (83.1%)	17 (16.9%)
50 to 69 years	20 (14.4%)	16 (80.6%)	4 (19.4%)
More than 70 years	3 (1.9%)	2 (66.6%)	1 (33.3%)

Table 4: Relation between Occupation and incidence of spinal cord injury

Type of Job	Total - 140
Laborer	63 (45.1%)
Driver / Delivery Person	15 (10.8%)
Office Job	10 (7.5%)
Business	9 (6.4%)
Students	11 (8%)
House wife	23 (16.8%)
Miscellaneous	9 (6.4%)

Table 5: Distribution of patients with spinal cord injury as per mechanism of injury

Mechanism of Injury	Total - 140
Road Traffic Accidents	97 (69.4%)
Fall from Height	26 (18.8%)
Fall of heavy object overhead / back	9 (6.5%)
Miscellaneous	8 (5.4%)

Table 6: Various associated injuries with spinal cord injury

Associated Injury	Total	Cervical	Thoracolumbar
Head Injury or Face injury	25 (17.8%)	17 (23.5%)	8 (12.7%)
Single Fracture - Extremity	24 (17.1%)	12 (17.2%)	12 (18.2%)
Multiple Fracture - Extremities	11 (7.8%)	4 (6.2%)	7 (10.4%)
Chest injuries	11 (7.8%)	2 (2.7%)	9 (13.4 %)
Abdominal injuries	5 (3.5 %)	1 (1.3%)	4 (6%)
Total	76/140 (54.28%)	36 / 73 (49.31%)	40 / 67 (59.7%)

Table 7 MRI finding and Management of spinal cord injuries

MRI Findings Grade	Cervical SCI		Thoracolumbar SCI	
	Number (Total – 73)	Management	Number (Total – 67)	Management
Cord compression or contusion with Unstable Fracture	36	Surgical decompression with Fixation by Plating and/or Cage	24	Surgical decompression with Fixation by Pedicle screw
Cord compression with stable Fracture	13	Surgical decompression with Fixation by Plating and/or Cage	14	Surgical decompression with Fixation by Pedicle screw
Cord contusion without fracture	24	Cervical collar	29	Conservative

Table 8: Operated and Non-operated Groups

Level of Injury	Total	Operated	Non-operated
Cervical	73	34 (47.4%)	39 (52.6%)
Thoracolumbar	67	26 (38.8%)	41 (61.2%)
Total	140	60 (42.8%)	80 (57.2%)

Table 9: Relationship between severity of spinal cord injury and surgical or non-surgical treatment done.

ASIA Grade on admission	Total Patients	Operated	Non-operated
A	64 (45.7%)	28 (43.7%)	36 (56.3%)
B	13 (9.2%)	3 (23%)	10 (67%)
C	14 (10%)	4 (28.5%)	10 (71.5%)
D	27 (19.2%)	3 (11.1%)	24 (88.9%)
E	22 (15.7%)	2 (9%)	20 (91%)
Total	140	60	80

Table 10: Frequency of complications in Operated and Non-operated Groups

Complications	Total no.	No. in Operated Group	No. in Non-operated Group
Respiratory	39	11 (19.8%)	28 (35%)
Thromboembolic	22	13 (23.3%)	09 (11.2%)
Gastrointestinal	04	02 (3.3%)	02 (2.5%)
Urinary	31	16 (26.6%)	15 (18.7%)
Pressure sores	52	34 (56.6%)	18 (22.5%)

Table 11: Mortality in Operated and Non-operated Groups

Time of Death	Total no.	No. in Operated Group	No. in Non-operated Group
In Hospital	5	3	2
After Discharge	8	5	3
Total	13	8	5

In total, 63 laborers (45.19%), 15 drivers/Delivery person (10.8%), 10 persons with office job(7.5%), 9 businessman, 11 students and 23 housewives sustained spinal injury resulting from different mechanisms (Table 3). In all, 97 (69.4%) sustained injuries due to road traffic accident followed by 26 (18.8%) cases due to fall from height. Nine patients (6.5%) sustained trauma following fall of heavy object over head or back while removing mud from dry well for increasing its depth or placing or removing grain bags in storage area.

In all, 76(54.28%) patients sustained different types of associated injuries out of which 24 (17.1%) patients had single fracture, and 11 (7.8%) patients had multiple fractures of extremities. 25 (17.8%) patients sustained head injury / face injury and 11 (7.8%) sustained multiple rib fractures. The associated injuries were more common in patients sustaining Spinal cord injury at thoracolumbar region (Table 5).

Ninety percent of these patients were transported for medical aid in vehicles with proper positioning for SCI. One hundred four patients (55%) were initially admitted to primary health centers or

private hospitals where specialized services were unavailable.

The relationship between surgical and non-surgical management and the admission variables, complication rates, mortality rates, length of stay, and neurological recovery are described in the tables 7 to 11. However, each parameter identified is not entirely independent, and the significance of any individual test should be interpreted in the context of these multiple summaries.

Table 8 shows the level of the vertebral column injury and the influence of this variable on selection for surgical treatment. There was a highly significant relationship between level of injury and treatment (X2, $p<0.001$): approximately 47% of patients with cervical injuries had surgery, whereas below this level at least 38% of the patients had surgery. As the site of injury progressed caudally, the proportion of cases undergoing surgical treatment decreased

Table 9 compares the severity of the cord injury at admission in the operated and non-operated groups, according to the ASIA Severity Scale. There was no significant difference in severity of cord injury on admission between the operated and non-operated groups (2-tail T-test, pooled variance estimate, $p = 0.79$). In both treatment groups approximately 35% of patients sustained complete cord injuries and 65% had incomplete injuries.

The primary indication for surgery in the operated patients is shown in Table 7. When the principal indication for surgery was examined in relationship to the severity of the spinal cord injury there was no significant difference between complete and incomplete injuries (X2, $p = 0.13$).

Five categories of complications were analyzed (Table 10). A respiratory complication was defined as one episode of atelectasis, pneumonia, aspiration pneumonitis or severe respiratory insufficiency. A thrombo-embolic complication was one episode of either ilio-femoral thrombosis or pulmonary embolism.

Complications affecting the gastro-intestinal tract were either stress ulceration leading to clinically observed gastro-intestinal haemorrhage or prolonged paralytic ileus. Genito-urinary complications tabulated included only acute infectious episodes, bacteruria associated with pyrexia, pyelonephritis or acute epididymo-orchitis. Pressure sores were recorded by anatomic location and depth and four grades were coded: cutaneous erythema only, partial thickness skin loss, full thickness skin loss extending down to, but not involving the subcutaneous tissues, and subcutaneous soft tissue loss exposing underlying bone. Pressure sores were the most common complication, affecting 37% patients. Respiratory complications affected 25.5% of patients and thrombo-embolic events 17.3%. Of the five categories only thrombo-embolic complications were found to show a significant difference (X2, $p = 0.018$) related to operative treatment, occurring more than twice as frequently in the operated patients as in the non-operated (22.9% and 9.9%, respectively).

The mortality rates and the time of the deaths are summarized in Table 11. A total of 13 patients died during the study period for an overall mortality rate of 10.1%. There were 5 deaths in the non-operated group (13.0%) as opposed to 8 (13.5%) in the operated group, an insignificant difference.

Mean lengths of hospital stay for patients surviving to first discharge (excluding the 5 deaths during the first admission) were 51.3 days and 45.9 days for the operated and non-operated groups respectively, which were not significantly different (2-tailed T-test, pooled variance estimate, $p = 0.28$). Neurological recovery was analyzed only in patients surviving to full follow-up, and thus the 13 patients who

died before full follow-up, and the further 8 patients lost to follow-up, who did not meet the six month criteria, were excluded. For both the operated and non-operated groups there was an improvement in neurological function.

Neurological recovery was significantly affected by the severity of the cord injury and the combined trauma burden. Improved recovery was related to decreasing severity of cord injury.

Discussion:

The knowledge of the epidemiology of Spinal cord injury is important for planning and developing resources to provide adequate treatment and rehabilitation, as it has significant personal, bio-psychological impact and socio-economic consequences. [5]

The male to female ratio varied from 1.6:1 to 13.5:1 in different studies. [5–14,16–18] We found that males were four times (3.8:1) more prone for Spinal cord injury when compared with females. This could be due to the fact that in most families, males are primary earning member of the family and hence get exposed to greater risk. Seventy-one percent were in the age range of 20–49 years which is in accordance with previous studies.[5,8–11,14,16,17] Uneducated laborer, drivers, delivery personal were more prone for SCI. RTA was major cause of Spinal cord injury. We observed that in rural area the parapets on the roof of houses and side wall of stairs are either of low height or completely lacking making them a source of fall. Fall from tree is another major cause of injury in rural settings [6,14,17]. Most of the children in rural area climb trees for playing and sustain injury during jumps or accidental fall.

In rural areas the wells require regular digging and repair. During these activities, accidental fall in well or fall of heavy object or mud over head or back results in Spinal cord injury. Fall of grain bags while stocking or taking out from storing places is also a common cause for fall of heavy object on back.

RTA is commonest cause of Spinal cord injury in developed countries ranging from 35.0 to 77.4% of total injuries. [7,8,10–12,14,18] In our study 97 (69.4%) cases sustained injury following RTA.

The incidence of head injuries in cervical region was 52.1% cases and incidence of injuries in thoracolumbar region was 47.8% , it is comparable to the incidence as reported by Martin et al and Mathur etal [9,18] in the ratio of 51.2:48.8.

The incidence of complete tetraplegia and paraplegia (AIS A) in different studies varies from 4.8 to 50.6% and 16.0 to 85.1%, respectively. [1,3–5,7,9–14,16] We found 39.7% of cervical and 52.2% cases of thoracolumbar injuries belong to AIS A.

The incidence of associated injuries in other studies varies from 21.4 to 52.0%., [10,18]. Head injuries were more commonly associated with cervical injuries while chest and abdomen injuries were more commonly associated with thoracolumbar spinal cord injuries. During early management, such patients are immobilized with splint or skeletal traction, thus making patients more prone to develop pressures sores. The delay in recovery from head injuries usually results in chest complications and pressure sore development. Chest injuries also increases the risk of pressure sores and chest infection.

Placement of urinary catheter and daily evacuation of bowel is essential in management of SCI patients. In our series, a total of 55% patients were initially attended by centers where specialized services were not available, but most of the patients were properly immobilized / splinted during transport.

In the present report, patients were not randomly assigned to treatment groups. However, objective data collection and statistical techniques were used which

partly compensate for this lack of randomization.

The more extensive injuries were more likely to result in surgical treatment, with about 45% cases undergoing surgery. The high frequency of surgical management of these cases suggests that the surgeons considered such injuries unstable or difficult to reduce or to maintain in reduction non-operatively, or they identified associated compression of the cord or nerve roots which required surgical relief either as the primary treatment or after non-operative methods had been tried unsuccessfully

Study of the effect of the treatment regime on the complication rates indicates that surgery does no significantly affect the complications, and this is in agreement with the report of Ahn et al. [11]

The low hospital mortality rate (3.5%) in the operated group indicates that surgery does not endanger survival in spinal cord injured patients. Indeed 4 of the 5 hospital deaths in the non-operative group occurred in cervical injuries, and these were from respiratory failure.

In contrast to other reports [11,12] which found that surgery reduced the length of hospitalization, the present study found no significant difference in the length of stay for those patients undergoing operation. There was no significant difference in the degree of neurological recovery between the two treatment groups when assessed by the percent change method: the mean percent improvement was 32.8% for the operated patients and 34.8% for the non-operated patients.

Therefore, the value of surgery in the management of spinal cord injury remains undefined and must await the performance of a rigorously controlled, randomized, prospective study. [20]

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