Clinico-Demographic Profile of Traumatic Spinal Injury in a Tertiary Hospital

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Abstract. As of today, there has been a limited number of studies about the demographic profile of traumatic spinal injuries in our locality and our country. The objective of this study is to determine the clinico-demographic profile of patients with traumatic spinal injury admitted in our institution for the past 10 years. A chart review of 73 patients who satisfied the inclusion criteria with traumatic spinal injuries were reviewed. Traumatic spinal injury in the locality mostly affects ages 46-60 years with a mean age of 53.5. Males were most commonly affected, married and unemployed secondary to fall and motor vehicular accidents. The cervical spine is the most commonly affected area, resulting to an incomplete paraplegia with ASIA D score in most cases. These patients were mostly managed conservatively and improved upon discharge. Strict implementation of traffic rules and fall prevention should be emphasized by the government and the locality, and also increase the awareness of patients at risk for traumatic spinal injuries and its debilitating consequences.

Index Terms- traumatic spinal injuries, ASIA scoring, clinical profile, demographic profile

I. INTRODUCTION

The term 'spinal cord injury' (SCI) refers to damage to the spinal cord resulting from trauma (e.g. a car crash) or from disease or degeneration (e.g. cancer). There is currently no reliable estimate of the global prevalence, but it is estimated to have an annual global incidence of 40 to 80 cases per million population. According to the latest survey from the World Health Organization (WHO), worldwide, about 250, 000 to 500, 000 people suffer a spinal cord injury (SCI). Of this incident, approximately 90% of cases are due to traumatic causes, though the proportion of non-traumatic spinal cord injury is growing as well. Mortality risk is highest in the first year after injury and remains high compared to the general population. People with spinal cord injury are 2 to 5 times more likely to die prematurely than people without SCI, with those having poorer outcomes in the low- and middle-income population.[1]

Traumatic spinal injury (TSI) causes significant motor, sensory and autonomic dysfunction distally from the level of the injury. The current limitation of the pharmacological treatment to restore spinal cord function after injury in the clinical setting led to a number of preclinical studies that have rising neuroprotective and neuro-regenerative strategies with the potential to reduce neuronal death after central nervous system (CNS) injury, enhance the intrinsic growth capacity of post-mitotic neurons, or modify the CNS extracellular milieu that is hostile to neuronal growth.[2]

The American Spinal Injury Association (ASIA) Standards, which determines the motor function and pin-prick and light-touch sensory function is widely used in the SCI population, in both clinical and research. One limitation of this scoring system is its inability to assess pain, which is a common clinically relevant complication after traumatic SCI. Of note, there remained a paucity of outcome measures that comprehensively assess autonomic function of individuals with spinal cord injury.[3]

Although the incidence rate is low, traumatic spinal injuries usually have a great impact on society as this causes substantial burden to the affected individuals, their families, and society, because of expenses for treatments, rehabilitation, and the lost productivity. As of the moment, there is no definitive cure so more emphasis should be put on prevention.[4]

II. REVIEW OF LITERATURE

A. Spinal cord injury

Neural tissue injuries are divided into two etiologies: a) primary injury, wherein there is physical damage to the tissues caused by mechanical forces, and b) secondary injury, a result of the biologic response of the body initiated by the physical injury. Descriptive terms have been developed to describe the injury to the spinal cord. *Concussion* refers to physiologic disruption of neuronal cells without obvious anatomic injury. *Contusion*, the most common type of spinal cord injury, is when there is hematoma and swelling secondary to neural injury. *Laceration* is when there is disruption in the anatomic continuity of neural cells. According to experimental studies, the rate of force application, degree of neural tissue compression and the mechanism of injury likely determines the extent of neural tissue damage. The spinal cord can withstand a certain amount of axial displacement without sustaining structural or neurologic damage. The spinal cord on average can be stretched by 10% during normal physiologic movement, and can be as much as 18% of the longitudinal length, maximum stretching occurring between C2 and T1. [6]

B. Prevalence of spinal injury

According to the WHO's latest survey, as many as 500, 000 people suffer each year, wherein pre-mature death occurs 2 to 5 times more likely in affected individuals, with poorer rate in the low- and middle-income countries. It was noted in the study

that it occurs frequently in ages 20-29 years and 70 years and up, more commonly in male (at least 2:1) and approximately 90% of cases are due to traumatic injuries, which includes motor vehicular accident, sports-related injury and fall from a height.3 In one of the recent studies, most spinal cord injury occurs in 35–54-year age group, which was in accordance to the recent study with the same team[4,6]. However, in other developing counties,[7,8] such as India, [9] Turkey and Iran in the early 2000, [10,11] ages from 20-40-year age group are at high risk for traumatic spinal cord injury. In a review conducted last 2010 about the incidence of spinal cord injury worldwide, the mean age of patients was similar to the reports in other developed countries [7] such as the Netherlands, Norway, and Canada, [12,13,14] the mean age of TSCI patients was over 40 years.

In a study conducted in Manitoba, Canada, they identified the persons at risk of traumatic and nontraumatic and noted an increasing incidence of SCI from 22.0 to 46.5 per million from 1981 to 2007. The increasing mean age have significant implications with regards to care and rehabilitation program for these individuals.[18] In a study conducted in Iceland from 1975 up to 2009 by Knutsdottir, S et al, the average incidence increases from 30 per million population in 1975 to 33.5 per million population in 2009. Their findings concluded an increasing incidence of sports-related accident and incomplete spinal cord injury secondary to fall in the elderly. Prevention strategies are the focused in these areas. [18] In Scotland, a retrospective review was conducted from 1994 up to 2013. Over the 20-year period, the incidence did not increase significantly, however, the mean age at the time of injury increased from 44.1 to 52.6 years. The study concluded that demographic profile in SCI are subject to change. In this particular study, they noted an increasing population of older patients suffering from SCI and with high level of tetraplegia, so preventive measures were adjusted to provide optimum care for the target population.[19]

Currently, no definitive cure for spinal cord injury has been developed that is why more emphasis should be put in prevention. The incidence of traumatic spinal cord injury varies in different regions. In the study conducted by Hong-Yong et al., they mentioned Australia reported a rate of 14.5 per million in 1998/1999, southeastern Anatolia Turkey reported 12.06 per million during 1990–1999 and Canada reported 42.4–51.4 per million during 1997–2001. In their previous investigation, the crude incidence rate was 23.7 per million during 2004–2008 in Tianjin. It was noted in the study that the results of the study are somewhat the same with most developing countries wherein motor vehicular accidents and fall are the leading cause of TSI, but the mean age compared to other studies were older. Preventive programs then were focused in traffic injuries and prevention of fall in the community.[4]

III. MATERIAL AND METHODS

This is a descriptive study (medical records review) which aimed to determine the clinico-demographic profile of patients who suffered from traumatic spinal injury in West Visayas State University Medical Center.

A. Study population

The study analyzed all patients who satisfied the inclusion criteria and were admitted in West Visayas State University from January 1, 2007 to December 31, 2016.

B. Inclusion and Exclusion Criteria

Inclusion Criteria

- All patients who suffered from traumatic spinal injury admitted in West Visayas State University Medical Center from January 1, 2007 to December 31, 2016.
- Referral from other institution with established neurologic deficit related to the recent injury prior to transfer.

Exclusion Criteria

- Incomplete medical records
- Pathologic fractures and fragility fractures
- Patients with established neurologic deficit from previous diseases

C. Methodology

The charts of all patients with traumatic spinal injury who satisfied the inclusion and exclusion criteria were collected from the Medical Records Section of the West Visayas State University Medical Center. A letter of request was sent to the Head of the Research Section, the Head of the Records Section and the Medical Center Chief. The *International Classification of Diseases Version 10 with the diagnostic code T09.3, "Injury to spinal cord, level unspecified"*, was used to generate the number of patients admitted at West Visayas State University Medical Center (WVSU-MC) from 2007 to 2016. The local registry for spine trauma has not been established in the locality and was generated for the first time. A case of spinal cord injury is defined as 'the occurrence of an acute lesion of neural elements in the spinal canal (spinal cord and cauda equina), resulting in temporary or permanent sensory deficit, motor deficit, or bladder/bowel dysfunction'.[4] By reviewing the medical records using diagnostic code T09.3, a total of 105 patients was generated. After implementing the inclusion and exclusion criteria, 73 of the 105 patients qualified for the study.

In the study, the total number of patients was identified, and the demographic details of patients were age, sex, civil status and occupation. As for the clinical profile, mechanism of injury, level of injury, severity, initial ASIA score, diagnostics, management and conditions upon discharge were determined. The age was divided into 5 groups: 0-15, 16-30, 31-45, 46-60 and beyond 60 years of age. Sex was categorized into male and female. Marital status was categorized into single, married and others (widow, divorce). The mechanism of injury included motor vehicular accident (MVA), fall, gunshot, and others (alleged mauling, sports injury, etc). Most common occupation of the subjects were identified. The level of injury was categorized into 5 areas: cervical, cervicothoracic junction, thoracic, thoracolumbar junction and lumbar. The American Spinal Injury Association (ASIA) grading scale was used to determine the motor and sensory functions below the injury segment. For the severity of the injury, it was categorized into complete quadriplegic, incomplete quadriplegic, complete paraplegic and incomplete. Management was categorized to either nonoperative, which includes Halo vest, application of Gardner-Well tongs and bracing, or operative which includes

procedures like anterior decompression, posterior decompression with instrumentation and luque rod application.

D. Data Processing and Analysis

Statistical Package for Social Sciences (SPSS) version 23 (Chicago, Illinois) was used to perform descriptive analysis of the data gathered. To implement preventive programs purposefully, the age, sex, marital status, occupation, mechanism of injury, level of injury, severity, initial ASIA classification, diagnostics, treatments and conditions upon discharge were analyzed descriptively.

A data collection form was used to collect the following data: age, sex, civil status, occupation, mechanism of injury, level of injury, severity, initial ASIA classification, diagnostics, management and conditions upon discharge. Hospital numbers, instead of names or initials, were used to identify each patient. These data were analyzed, processed and cross-tabulated.

E. Ethical Considerations

A letter of approval was obtained from the West Visayas State University Unified Biomedical Research Ethics Review Committee. In order to preserve the confidentiality of the cases, the hospital number of the patients instead of their names or initials were recorded in the study. Non-disclosure of data collected was strictly practiced. The variables of concern were the only thing retrieved from the medical records for the purpose of the study.

IV. RESULTS

A total of 73 patients out of the 105 generated from the data base qualified for the study. The trend in incidence is shown in Figure 1.

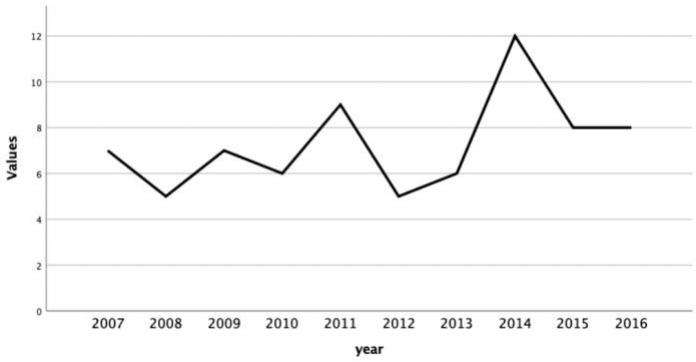

Figure 1. Incidence of Traumatic Spinal Injury per year

The results of the demographic and clinical profile of patients is shown in Table 1 and Table 2, respectively.

Table 1. Demographic data of patients with Traumatic Spinal Injury

Variables	%
Age	
• 0 – 15	2.7
• 16 – 30	11.0
• 31 – 45	34.2
• ***46 – 60***	***38.4***
• 60 and up	13.7
Marital Status	
• ***Married***	***80.8***
• Single	19.2
Sex	
• ***Male***	***93.2***
• Female	6.8
Occupation	
• ***Unemployed***	***43.8***
• Laborers	13.7
• Farmers	9.6
• Government employee	9.6
• Others	23.3

Mechanism of injury

Fall (57.6%) and motor vehicular accidents (26%) were the most common cause of traumatic spinal injury in both sex and age groups. In this report, there were 5 patients who sustained gunshot injury (6.8%). Others (9.6%) that were reported in this study includes: two (2) cases of stab wound at the thoracic area, two (2) secondary to sports injury, one (1) case secondary from an alleged mauling and two (2) cases secondary to self-hanging. Figure 2 shows the relationship between etiology and other variables.

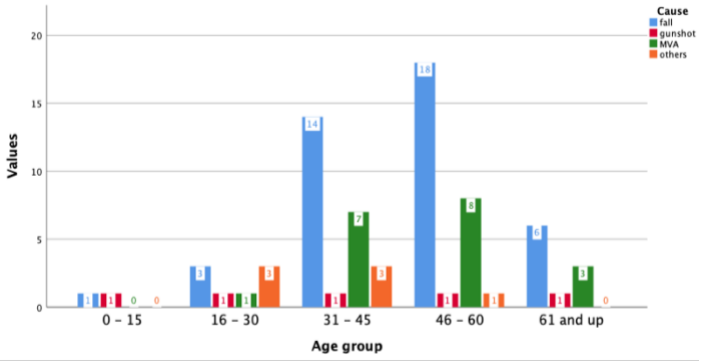

Figure 2. Etiology by age group

Diagnostics

Of the 73 patients with traumatic spinal injuries, most were diagnosed clinically using the American Spinal Injury Association (ASIA) grading scale and with plain radiograph. Only 30% and 26% of the cases were able to undergo CT scan and MRI, respectively, mostly for pre-operative planning prior to doing surgery.

Treatment

Traumatic spinal injuries in this institution were mostly managed nonoperatively consisting of 86.3% of the cases. Only 13.7% of the study population were able to undergo surgical management.

Condition upon discharge

Majority of the patient showed signs of improvement upon discharge. Those who requested to go home or went home

against medical advice were included in the 32.9% which showed no signs of improvement or deteriorated.

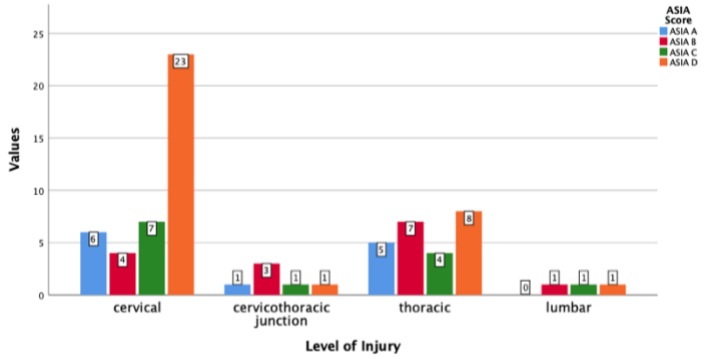

Figure 3. ASIA scoring on each level of injury.

Table 2. Clinical profile of patients with Traumatic Spinal Injury

Variables	%
Etiology/Cause	
• ***Fall***	***57.6***
• Motor vehicular accident	26.0
• Gunshot	6.8
• Others	9.6
Level of injury	
• ***Cervical***	***54.8***
• Cervicothoracic junction	8.2
• Thoracic	32.9
• Thoracolumbar junction	0
• Lumbar	4.1
ASIA Score	
• A	16.4
• B	20.5
• C	17.8
• ***D***	***45.3***
Severity	
• Complete quadriplegia	8.2
• ***Incomplete quadriplegia***	***52.1***
• Complete paraplegia	6.8
• Incomplete paraplegia	32.9
Diagnostics	
• Plain radiograph	100
• CT scan	30
• MRI	26
Management	
• Nonoperative	***86.3***
• Operative	13.7
Conditions upon discharge	
• ***Improved***	***52.1***
• Unimproved	32.9
• Expired	15

V. DISCUSSION

Traumatic spinal injury is one of the most serious injuries, which not only affects the individual, but the entire family. Currently, studies regarding the epidemiological profile of patients who suffered from traumatic spinal injuries is scarce in the country, but is needed for better implementation of strategies to decrease the incidence.

In this study, the 45-60 age group is the most commonly affected and 80% of the population are male (ratio of 13.6:1 vs female). The most common mechanism of injury is secondary to fall, followed by motor vehicular accidents. As noted from previous studies in developing countries, fall was the most likely cause due to the fact that the ratio of cars per person in developing countries were much less than developed ones. In comparison with other developing counties, [7,8] such as India, [9] Turkey and Iran in the early 2000, [10,11] ages from 20-40-year age group were at high risk for traumatic spinal injury. In a review conducted last 2010 about the incidence of spinal cord injury worldwide, the mean age of TSCI patients was similar to the reports in other developed countries such as the Netherlands, Norway, and Canada, [12,13,14] the mean age of TSCI patients was over 40 years. And in all studies mentioned, motor vehicular and fall are the most common cause of injury, with male as the most commonly affected sex.

In a study by Hong-yong et al., [4] occupation was mentioned, in contrast to other studies that it was rarely mentioned, he reported that most of the population affected were unemployed individuals, followed by peasants and workers. In this study, it is noted that majority of affected individual are unemployed, followed by laborers and farmers.

With regards to the level of injury, initial ASIA scoring and severity, as noted in other previous studies by Hong-yong et. al. [4] and McCammon [17], cervical spine was the most commonly affected area, which will eventually lead to either a complete or incomplete quadriplegia. In developing countries, wherein the most common injury is fall, ASIA A and D predominates, whereas in developed countries where motor vehicular accidents were the most common etiology, ASIA A and B predominates. This translates to the fact that in developed countries, the cause of spinal injury is due to a high velocity injury secondary to motor vehicular accidents as compared to fall in developing countries, which leads to a higher percentage of complete quadriplegia vs incomplete quadriplegia. When compared to other levels of the spinal column, the strength and accessory structures of cervical vertebrae are weak in a very mobile area, which maybe one of the reasons for its vulnerability. In the study, the cervical area accounts for 54.8% of the total population, followed by the thoracic spine (32.9%). ASIA D (45.2%) and ASIA B (20.5%) predominates secondary to the most common mechanism of injury which is fall. With severity, most patients suffered incomplete quadriplegia.

Most of the cases were diagnosed clinically using plain radiographs and ASIA grading. The population mostly affected in this study were unemployed, and this could be one of the factors why only 28% and 27.4% of the cases were able to undergo CT scan and MRI, respectively. Those who consented for operation are the ones with complete radiographs, CT scan and MRI to be used for pre-operative planning.

In terms of the management, majority of the cases were managed nonoperatively (86.3%) with Gardner-Wells tong application, rigid cervical collar and bracing. Economic status was one of the limiting factors why patients were not able to undergo surgical procedures for better stability of the injury because of the high cost of spine implants. Most of the patients improved upon discharge in terms of pain but not motor and sensory recovery. 15% of the patients with ASIA grade A and B succumbed to death secondary to complications (acute respiratory failure, hospital acquired pneumonia, and urosepsis). The 13.7% of patients who were managed operatively were mostly under pay accommodation, had shorter hospital stay and with note of improvement prior to discharge. Eleven patients expired secondary to acute respiratory failure (10%) as the most common cause, followed by hospital acquired pneumonia (3%) and urosepsis (2%).

VI. CONCLUSION

This is the first study in the institution, and even in the region which determined the population at risk and the most common cause of traumatic spinal injury. The results of this study revealed that fall was the most common mechanism of affecting the 46-60 years age group, followed by motor vehicular accident. Unemployed, married, males are at a higher risk, and the most common level of injury is the cervical area, causing either complete or incomplete quadriplegia with an ASIA D score. Diagnosis of traumatic spinal injuries in this study were made on the basis of physical examination using the ASIA scoring and plain radiographs. Most of the patients were managed conservatively.

Efforts in the community should be focused in fall prevention, enact strict traffic rules, and high risk work places should provide safety guidelines for the workers. Many of these patients lose their jobs after being discharge because of the disability brought about by injury.

May the data presented in this study serve as a basis to increase awareness of the population at risk, the debilitating effects of spinal injury to the family and increase awareness of the government and non-government offices, especially in the health sector, to better address the problems identified.

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