Original Research Article

International Journal of Medical and Health Research
ISSN: 2454-9142
Received: 24-12-2019; Accepted: 19-01-2020; Published: 26-01-2020
www.medicalsciencejournal.com
Volume 6; Issue 1; 2020; Page No. 213-217

Assessment of factors responsible for head injury and patterns of head Injury in Bihar

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Abstract
The most prominent and vulnerable part of human body is head which made it more vulnerable for injury in road traffic accidents. Head injury has been defined as a morbid state resulting from gross or subtle structural changes in the scalp, skull, and/or the contents of the skull, produced by mechanical forces. Most common vehicular accidents happen with two wheelers as they constitute main vehicle fleet in India. Hence based on above findings the present study was planned for Assessment of Different Factors Responsible and Different Patterns for the Head Injury in Bihar Population.
The present study was planned in Department of Surgery, Vardhman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar. In the present study 50 cases of the different age and sex undergone the head injury were enrolled and evaluated for the underlying parameters. Clinical information included age, gender, mode of trauma, interval between trauma and medical aid provided, duration of stay in the hospital, complaints like vomiting, convulsions, ENT bleeding, headache, level of consciousness, associated bony injuries, vital signs, pulse rate, body temperature, blood pressure, respiratory rate, pupillary reflexes, radiological examination findings, brain computerized tomography (CT) scan findings, interventions, and outcome. The severity of the head injury was quantified using GCS.
The data generated from the present study concluded that most common cause of head injury overall was road traffic accidents. The victims were mostly males of the age group 21-30 years. Most of the patients of head injury were managed conservatively.

Keywords: head injury, tertiary care hospital, glasgow coma scale, outcome, etc

Introduction
Every day, men, women and children suffer head injuries. A trip or fall, a car accident, a sports injury – these everyday injuries can range in severity from concussion to coma. Traumatic Brain Injury (TBI) can be fatal or, in survivors, can produce persistent problems that significantly affect the livelihood and well-being of millions around the globe. India has the rather unenviable distinction of having the highest rate of head injury in the world. In India, more than 100,000 lives are lost every year with over 1 million suffering from serious head injuries.
In India, 1 out of 6 trauma victims die, while in the United States this figure is 1 out of 200. This seemingly unbreachable gap speaks volumes of the perfected PTC procedures in US and their near absence in India. Half of those who die from TBI do so within the first two hours of injury. It is now known that only a portion of neurological damage occurs at the moment of impact (primary injury); damage progresses during the ensuing minutes, hours and days. The secondary brain injury can result in increased mortality and disability.
Consequently, the early and appropriate management of TBI is critical to the survival of these patients. This while being a critical factor in the overall prospects of a patient is yet to be fully appreciated. In 1991, 60,000 people were killed in road traffic accidents (RTA's), as compared to 24,600 in 1980. This figure is now closing in on 100,000 deaths per year.
Ninety-five percent of trauma victims in India do not receive optimal care during the "golden hour" period after an injury is sustained, in which health care administration is critical. The outcome of TBI is drastically correlated to the response of pre-hospital care and rehabilitation. Thirty percent of those who currently die from head injuries could be saved if quality care were available to them sooner. Most road traffic accident victims are in the 20- to 40-year age group, the main bread-earners of the family, putting the whole family below the poverty line in many cases while depriving society of vital drivers of economy as in many cases these are entrepreneurs or professionals.
Pedestrians and motorcyclists are the most common victims of road traffic accidents in India. By 2050, India will have the greatest number of automobiles on the planet, overtaking the United States.
A head injury is any injury that results in trauma to the skull or brain. The terms traumatic brain injury and head injury are often used interchangeably in the medical literature [1]. Because head injuries cover such a broad scope of injuries, there are many causes—including accidents, falls, physical assault, or traffic accidents—that can cause head injuries.
The number of new cases is 1.7 million in the United States each year, with about 3% of these incidents leading to death. Adults have head injuries more frequently than any age group resulting from falls, motor vehicle crashes, colliding or being struck by an object, or assaults. Children, however, may experience head injuries from accidental falls or intentional causes (such as being struck or shaken) leading to hospitalization [2]. Acquired brain injury (ABI) is a term

used to differentiate brain injuries occurring after birth from injury, from a genetic disorder, or from a congenital disorder [3].

Unlike a broken bone where trauma to the body is obvious, head trauma can sometimes be conspicuous or inconspicuous. In the case of an open head injury, the skull is cracked and broken by an object that makes contact with the brain. This leads to bleeding. Other obvious symptoms can be neurological in nature. The person may become sleepy, behave abnormally, lose consciousness, vomit, develop a severe headache, have mismatched pupil sizes, and/or be unable to move certain parts of the body. While these symptoms happen immediately after a head injury occurs, many problems can develop later in life. Alzheimer's disease, for example, is much more likely to develop in a person who has experienced a head injury [4].

Brain damage, which is the destruction or degeneration of brain cells, is a common occurrence in those who experience a head injury. Neurotoxicity is another cause of brain damage that typically refers to selective, chemically induced neuron/brain damage.

Head injuries include both injuries to the brain and those to other parts of the head, such as the scalp and skull. Head injuries can be closed or open. A closed (non-missile) head injury is where the dura mater remains intact. The skull can be fractured, but not necessarily. A penetrating head injury occurs when an object pierces the skull and breaches the dura mater. Brain injuries may be diffuse, occurring over a wide area, or focal, located in a small, specific area. A head injury may cause skull fracture, which may or may not be associated with injury to the brain. Some patients may have linear or depressed skull fractures. If intracranial hemorrhage occurs, a hematoma within the skull can put pressure on the brain. Types of intracranial hemorrhage include subdural, subarachnoid, extradural, and intraparenchymal hematoma. Craniotomy surgeries are used in these cases to lessen the pressure by draining off the blood.

Brain injury can occur at the site of impact, but can also be at the opposite side of the skull due to a contrecoup effect (the impact to the head can cause the brain to move within the skull, causing the brain to impact the interior of the skull opposite the head-impact). If the impact causes the head to move, the injury may be worsened, because the brain may ricochet inside the skull causing additional impacts, or the brain may stay relatively still (due to inertia) but be hit by the moving skull (both are contrecoup injuries).

A concussion is a form of a mild traumatic brain injury (TBI). This injury is a result due to a blow to the head that could make the person's physical, cognitive, and emotional behaviors irregular. Symptoms may include clumsiness, fatigue, confusion, nausea, blurry vision, headaches, and others. Mild concussions are associated with sequelae. Severity is measured using various concussion grading systems.

A slightly greater injury is associated with both anterograde and retrograde amnesia (inability to remember events before or after the injury). The amount of time that the amnesia is present correlates with the severity of the injury. In all cases, the patients develop post-concussion syndrome, which includes memory problems, dizziness, tiredness, sickness and depression. Cerebral concussion is the most common head injury seen in children [5].

Head injuries can be caused by a large variety of reasons. All of these causes can be put into two categories used to classify head injuries; those that occur from impact (blows) and those that occur from shaking [20]. Common causes of head injury due to impact are motor vehicle traffic collisions, home and occupational accidents, falls, assault, and sports related accidents. Head injuries from shaking are most common amongst infants and children [6].

According to the United States CDC, 32% of traumatic brain injuries (another, more specific, term for head injuries) are caused by falls, 10% by assaults, 16.5% by being struck by or against something, 17% by motor vehicle accidents, and 21% by other/unknown ways. In addition, the highest rate of injury is among children ages 0–14 and adults age 65 and older. Brain injuries that include brain damage can also be brought on by exposure to toxic chemicals, lack of oxygen, tumors, infections, and stroke. Possible causes of widespread brain damage include birth hypoxia, prolonged hypoxia (shortage of oxygen), poisoning by teratogens (including alcohol), infection, and neurological illness. Brain tumors can increase intracranial pressure, causing brain damage [7].

There are a few methods used to diagnose a head injury. A healthcare professional will ask the patient questions revolving around the injury as well as questions to help determine in what ways the injury is affecting function. In addition to this hearing, vision, balance, and reflexes may also be assessed as an indicator of the severity of the injury. A non-contrast CT of the head should be performed immediately in all those who have suffered a moderate or severe head injury. A CT is an imaging technique that allows physicians to see inside the head without surgery in order to determine if there is internal bleeding or swelling in the brain. Computed tomography (CT) has become the diagnostic modality of choice for head trauma due to its accuracy, reliability, safety, and wide availability. The changes in microcirculation, impaired auto-regulation, cerebral edema, and axonal injury start as soon as a head injury occurs and manifest as clinical, biochemical, and radiological changes [25]. An MRI may also be conducted to determine if someone has abnormal growths or tumors in the brain or to determine if the patient has had a stroke [8].

Glasgow Coma Scale (GCS) is the most widely used scoring system used to assess the level of severity of a brain injury. This method is based on objective observations of specific traits to determine the severity of a brain injury. It is based on three traits eye-opening, verbal response, and motor response, gauged as described below. Based on the Glasgow Coma Scale severity is classified as follows, severe brain injuries score 3-8, moderate brain injuries score 9-12 and mild score 13-15.

There are several imaging techniques that can aid in diagnosing and assessing the extent of brain damage, such as computed tomography (CT) scan, magnetic resonance imaging (MRI), diffusion tensor imaging (DTI) and magnetic resonance spectroscopy (MRS), positron emission tomography (PET), single-photon emission tomography (SPECT). CT scans and MRI are the two techniques widely used and are the most effective. CT scans can show brain bleeds, fractures of the skull, fluid build-up in the brain that will lead to increased cranial pressure. MRI is able to better detect smaller injuries, detect damage within the brain, diffuse axonal injury, injuries to the brainstem, posterior fossa, and subtemporal and sub frontal regions. However, patients with pacemakers, metallic implants, or other metal

within their bodies are unable to have an MRI done. Typically, the other imaging techniques are not used in a clinical setting because of the cost, lack of availability.

Most head injuries are of a benign nature and require no treatment beyond analgesics such as acetaminophen. Non-steroidal painkillers such as ibuprofen are avoided since they could make any potential bleeding worse. Due to the high risk of even minor brain injuries, close monitoring for potential complications such as intracranial bleeding. If the brain has been severely damaged by trauma, a neurosurgical evaluation may be useful. Treatments may involve controlling elevated intracranial pressure. This can include sedation, paralytics, cerebrospinal fluid diversion. Second-line alternatives include decompressive craniectomy (Jagannathan *et al*. found a net 65% favorable outcomes rate in pediatric patients), barbiturate coma, hypertonic saline, and hypothermia. Although all of these methods have potential benefits, there has been no randomized study that has shown unequivocal benefit.

Clinicians will often consult clinical decision support rules such as the Canadian CT Head Rule or the New Orleans/Charity Head injury/Trauma Rule to decide if the patient needs further imaging studies or observation only. Rules like these are usually studied in depth by multiple research groups with large patient cohorts to ensure accuracy given the risk of adverse events in this area. There is a subspecialty certification available for brain injury medicine that signifies expertise in the treatment of brain injury [9].

In children with uncomplicated minor head injuries the risk of intracranial bleeding over the next year is rare at 2 cases per 1 million. In some cases transient neurological disturbances may occur, lasting minutes to hours. Malignant post traumatic cerebral swelling can develop unexpectedly in stable patients after an injury, as can post-traumatic seizures. Recovery in children with neurologic deficits will vary. Children with neurologic deficits who improve daily are more likely to recover, while those who are vegetative for months are less likely to improve. Most patients without deficits have full recovery. However, persons who sustain head trauma resulting in unconsciousness for an hour or more have twice the risk of developing Alzheimer's disease later in life [10].

Head injury may be associated with a neck injury. Bruises on the back or neck, neck pain, or pain radiating to the arms are signs of cervical spine injury and merit spinal immobilization via application of a cervical collar and possibly a longboard. If the neurological exam is normal this is reassuring. Reassessment is needed if there is a worsening headache, seizure, one-sided weakness, or has persistent vomiting.

To combat overuse of Head CT Scans yielding negative intracranial hemorrhage, which unnecessarily exposes patients to radiation and increase time in the hospital and cost of the visit, multiple clinical decision support rules have been developed to help clinicians weigh the option to scan a patient with a head injury. Among these are the Canadian Head CT rule, the PECARN Head Injury/Trauma Algorithm, and the New Orleans/Charity Head Injury/Trauma Rule all help clinicians make these decisions using easily obtained information and noninvasive practices.

Brain injuries are very hard to predict in the outcome. Many tests and specialists are needed to determine the likelihood of the prognosis.

People with minor brain damage can have debilitating side effects; not just severe brain damage has debilitating effects. The side- effects of a brain injury depend on location and the body's response to injury. Even a mild concussion can have long term effects that may not resolve.

The most prominent and vulnerable part of human body is head which made it more vulnerable for injury in road traffic accidents. Head injury has been defined as a morbid state resulting from gross or subtle structural changes in the scalp, skull, and/or the contents of the skull, produced by mechanical forces. Most common vehicular accidents happen with two wheelers as they constitute main vehicle fleet in India. Hence based on above findings the present study was planned for Assessment of Different Factors Responsible and Different Patterns for the Head Injury in Bihar Population.

Methodology

The present study was planned in Department of Surgery, Vardhman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar. In the present study 50 cases of the different age and sex undergone the head injury were enrolled and evaluated for the underlying parameters.

Clinical information included age, gender, mode of trauma, interval between trauma and medical aid provided, duration of stay in the hospital, complaints like vomiting, convulsions, ENT bleeding, headache, level of consciousness, associated bony injuries, vital signs, pulse rate, body temperature, blood pressure, respiratory rate, pupillary reflexes, radiological examination findings, brain computerized tomography (CT) scan findings, interventions, and outcome. The severity of the head injury was quantified using GCS.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Results & Discussion

In the world with a huge population density, the road traffic density is also increasing. In India, for individuals older than four years of age, more life years are lost due to traffic accidents than cardiovascular diseases. India accounts for about 10% of road accident fatalities worldwide. WHO defined the accident as, "an unexpected, unplanned occurrence that may involve injury"? Head injury has been defined as, "a morbid state, resulting from gross or subtle structural changes in the scalp, skull, and/or the contents of the skull, produced by mechanical forces".

In India, the developing economy and growing population simultaneously made a strong impact on increase in motor vehicle population. This increase in motorization along with expansion of the road network has brought not only rural economic development in India but also some adverse effects such as the increase in road accidents.1 Road traffic injuries (RTI) ranked fourth among the leading causes of death in the world.2 Almost 1.3 million people die in road traffic accidents (RTA) every year and 20 to 50 million people suffer non-fatal injuries, with many sustaining a disability because of their injury.

Table 1: Age & No. of Cases

Age	No. of Cases
1 – 10 years	5
10 – 20 years	6
21 – 30 years	12
31 – 40 years	11
41 – 50 years	6
51 – 60 years	10
Total	50
Sex	
Males	35
Females	15
Total	50

Table 2: Parameters of injury

Type of injury	No. of cases
Head injury	8
Head, neck, face injuries	16
Head + other body injuries	26
Total	50
Mode of trauma	
Road Traffic Accident	24
Fall from height	12
Fall from bus/train	3
Slipped from ground	6
Unknown	5
Total	50
Level of consciousness	
Fully conscious	34
Semiconscious	13
Unconscious	3
Total	50

Table 3: Fracture of vault

Fracture of vault	No. of Cases
None	2
Fissured of vault	6
Fissure of base	1
Depressed	2
Comminuted	2
Fissured + depressed	2
Fissured of vault and base	4
Fissured + depressed + comminuted	1
Depressed + comminuted	1
Crush	3
Craniotomy/ burr holes/ drain/ other surgical procedures	2

In this study, Males clearly outnumbered females with male to female ratio. Similar findings were observed in other studies such as Thube *et al*, Patil *et al*, Shivkumar *et al*. [11, 13] This gender bias could be because males work outdoor and hence are more commonly exposed to road traffic accidents, assaults and occupational injuries [14]. In the age group analysis of victims, maximum incidence was in age group of 21-30 years followed by 31-40 years and least in group 0 to 10 years. Similar findings were observed by other researchers [15] except Akang et and Lai *et al* who observed that the peak age of such victims was in fourth decade [16, 17]. This could be because young adults are the prime bread earners of the family and remain outdoors during most of the day. Furthermore, young people are by nature indulge in more violent activities. People in extremes of the ages usually remain indoors whereas children are confined within residential premises only.

Studies from developed countries have reported lesser involvement of pedestrians probably due to the fact that in developed countries pedestrians are scarce on the roads and there is a lesser preponderance of people jaywalking.

The most productive years of life leading to serious economic loss to the families. Tendency for frequent violations of traffic rules and not using proper safety measures are the main causes of such high fatality. The increasing number of motorized vehicles makes roads more dangerous for those road users who use alternative modes of transport – notably those who walk, cycle and use motorcycles.

The predominance of contusions and lacerations in scalp can be explained by the heavy blunt force, loose areolar space available for blood accumulation beneath scalp, minimal musculature of the scalp and the velocity of victim at the time of fall on the ground. The most common type of skull fracture was linear / fissured fracture followed by depressed fracture and least common was sutural fracture. This is consistent with Reddy A *et al*. [18], Shivkumar BC *et al*. [19], Pothireddy S and Karukutla N [20] and Kakeri SR *et al*. [21] Skull fractures observed in this study can be explained by restricted movement of the head receiving maximum force, more striking surface area of skull in all directions, least protection offered by the minimal scalp musculature when compared to limbs and other parts of the body.

Head injury is the result of variety of mechanisms including motor vehicle and motor cycle accidents, pedestrians being struck by motor vehicles, falls from heights, occupational hazards, assaults, riots and bomb blasts [22, 23]. Penetrating injury is most often due to gunshots but sometimes other types of blunt objects can violate the skull. Most commonly, traumatic brain injury occurs in the presence of additional injuries to other major organ systems but it can also occur in isolation.

In today's world with more opportunities, people are travelling more by road, rail and airways. India has second highest reported mortality rate of 29.2 per 100000 people from road traffic injuries. Injuries are reported to be the seventh leading cause of death (11% of all deaths) in India, with road traffic injuries making up to 78% of them (WHO, 1999). According to a report of the Ministry of Home Affairs, Government of India, one accident occurs every two minutes, and one suicide every five minutes in India, with the accident rate corresponding to 45 per 100 000 population. India has 1% of vehicles in the world; but it accounts for about 6% of the total cases of unintentional injuries. Every 4 minutes, a person killed or injured in India due to RTA. Head injuries account for one quarter to one third of all accidental deaths, and for two thirds of trauma deaths in hospitals. Road traffic injures account for 2.1% of global mortality. India accounts for about 10% of road accident fatalities worldwide [24].

Conclusion

The data generated from the present study concluded that most common cause of head injury overall was road traffic accidents. The victims were mostly males of the age group 21-30 years. Most of the patients of head injury were managed conservatively.

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