The Research of Medical Science Review

Received: 20 December, 2024 ISSN: 3007-1208 | 3007-1216
Accepted: 20 January, 2025 Volume 3, Issue 1, 2025
Published: 27 January, 2025

SEVERITY OF HEAD TRAUMA IN ROAD TRAFFIC ACCIDENT PATIENTS AT HAYATABAD MEDICAL COMPLEX HOSPITAL, PESHAWAR

Muhammad Kamal[*1], Waseem Sajjad[2], Dr. Ghulam Mustafa[3], Salman Ahmad[4], Waheed Shah[5], Madiha Bibi[6], Kashif Khan[7]

*[*1]Surgical Technologist, Rehman Medical Institute Hayatabad Peshawar Pakistan)*
[2]Assistant Professor, Dir College of Nursing and Allied Health Sciences Dir Lower KP)
[3]Assistant Professor, Government College Faisalabad)
[4]Registered Nurse officer Peshawar Institute of Cardiology)
[5]Vice Principal Dir College of Nursing and Allied Health Sciences Dir Lower KP)
[6]OT Technologist PAF Hospital Islamabad)
[7]Surgical technologist HMC Peshawar)

[*1]waseemtimergara@gmail.com, [2]waseemtimergaragmail.com

Corresponding Author: *
DOI: https://doi.org/10.5281/zenodo.14753488

ABSTRACT

Background: *Trauma has increasingly been recognized as a significant public health concern in developing countries, often termed a "silent plague" due to its high prevalence and low levels of public awareness. Among various types of trauma, traumatic brain injuries (TBIs) are particularly alarming, as they contribute substantially to morbidity and mortality rates in low- and middle-income nations.*

Methods: *This Quantitative Cross Sectional research study of 361 patients investigates the epidemiology, injury patterns, and management outcomes of head trauma sustained in road traffic accidents (RTAs). Imaging studies revealed that 89.2% underwent CT or MRI scans to assess injury extent. Injury mechanisms showed 28.3% were pedestrians, while 71.7% were injured under other circumstances. The majority (70.4%) of patients were male.*

Results: *The results show varied injury types, including depressed (18.3%), linear (28%), non-depressed (19.7%), stellate (10.5%), and other fractures (23.5%). Loss of consciousness occurred in 59.6% of patients, with 65.1% experiencing mild duration. Glasgow Coma Scale scores indicated 37.7% mild, 32.7% moderate, and 29.6% severe head injuries. Imaging detected intracranial haemorrhage in 24.7% of patients, with 25.2% requiring intervention for raised intracranial pressure. Surgical intervention was required in 37.1% of cases, with craniotomy (11.9%) and craniotomy (9.1%) being most common. Male patients (70.4%) and pedestrians (28.3%) were disproportionately represented. Management strategies included observation (50.4%), medical therapy (19.9%), and surgical intervention (29.6%).*

Conclusion: *This study highlights the high burden of traumatic brain injuries (TBIs) from road traffic accidents, predominantly affecting males and pedestrians. The findings emphasize the need for prompt imaging, tailored interventions, and improved road safety*

measures to enhance patient outcomes and reduce the impact of TBIs in low- and middle-income countries.
Keywords: *(Road traffic accident, Glasgow coma scale, Traumatic brain injury)*

INTRODUCTION

Traumatic head injuries resulting from road traffic accidents (RTAs) are a significant public health concern, particularly in low- and middle-income countries (LMICs), where they contribute to higher morbidity and mortality rates. Despite their prevalence, head injuries often remain unrecognized due to a lack of public awareness. Surgical conditions of the head include simple wounds, including scalp lacerations as well as severe head injuries comprising of a wide traumatic brain injury TBI spectrum. Road traffic accidents, falls and violence especially have been touted as the leading causes of trauma, and hence death and disability all over the world. Among road traffic incidents, head injuries are partly caused by human errors, and more generally, pedestrian head injuries mainly arise from human errors.

1.1. Background of trauma in low- and middle-income countries (LMICs)

Basically, Trauma constitutes a major burden in LMICs through a variety of reasons including urbanization, infrastructure and emergency care access. Neck and head injuries as seen in many of these catastrophes are immensely important in the community because of their possible long term disability and even death. In contrast to infectious diseases, which have received much more global health focus and funding, trauma and its effects have been less conspicuous in LMICs. This lack of attention is particularly regrettable given the fact that in these regions road traffic accidents are on the increase; occasioned by increase in ownership of vehicles as well as inadequate and ineffective measures on road safety (Peden *et al.,* 2004).

1.2. Overview of head injuries as a public health concern

According to the WHO, TBI will rank third as the cause of global disease burden by the year 2030; the burden being felt most predominantly in LMIC (WHO, 2014). This situation is further worsened by unavailability of specialized heads' injury care, limited rehabilitation services and socio-economic constraints a head injured patient or his/her family encounters. Also, the cultural and societal beliefs toward trauma and head injury can affect primary and secondary intervention measures (Valent *et al.,* 2002).

1.3. Epidemiology of trauma and head injuries

1.3.1. Prevalence and impact of trauma in LMICs

Trauma is a leading killer in LMIC and one of the major causes of morbidity with road traffic accidents contributing to more than 1. 35 million deaths annually (World Health Organization, 2018). Such figures can be attributed to head injuries that are among the frequent consequences of a trauma. The increase in head injury in certain countries such as India and Nigeria has been reported to have risen in the recent past with an increase in vehicle use and urbanization as noted by Gururaj (2002) and Adeolu (2005). Head injuries are not just deadly in kind; many of the victims who sustain such injuries will spend the rest of their lives in vegetative states, with impaired cognitive and psychological functions. The economic burden of head injuries is also substantial, as affected individuals often require prolonged medical care and rehabilitation, placing a strain on already limited healthcare resources (Rogers *et al.,* 2000).

1.3.2. Comparison with high-income countries (HICs)

Compared to LMICs, HICs have witness a decrease in fatal trauma mainly because of better measures put in place to curb road carnage, enhanced health care provision and increased awareness on the effects of trauma. As to the reasons for the disparity in the observed outcomes between the developed and developing countries, several factors might be named: better equipment, highly qualified staff, and efficient trauma care (Mock *et al.,*2005). For example, organized pre-hospital care and trauma system care in health inner city countries have been determine that they can reduce mortality from head injuries because they ensure that right treatment is given at the right time (Rogers *et al.,* 2000). This is not the case for many LMICs where such systems are mostly lacking, resulting in delays of care and high mortality from diseases that ought to have been averted.

1.3.3. Factors contributing to higher morbidity and mortality in LMICs
These include among others; poor infrastructure, limited access to resources and inadequate human capital which are articulated below. These include:

Inadequate Healthcare Infrastructure: Most LMICs have an inadequate, poorly developed trauma care system and this cripples the delivery of timely and adequate trauma care. This has been occasioned by the lack of facilities endowed with specialized trauma care, lack of sophisticated equipment like computer tomography scan, and a dearth of skilled neurosurgeons and physical rehabilitation workers (Gosselin, 2009).

Delayed Access to Care: Delays to reach the facility in LMIC are occasioned by poor road network, no ambulance services, and cost barriers. These delays particularly in head injuries increase the complications and mortality rates (Kobusingye *et al*., 2002).

Lack of Public Awareness and Prevention Strategies: Including, and often more so, in LMICs, the awareness of people of the hazards of head injuries is very limited. This is accompanied by laxity in the observance of precaution measures such as the wearing of helmets by motorcyclists, or seat belts by car occupants (Nantulya & Reich, 2003).

1.4. Etiology and risk factors for head injuries
1.4.1. Human factors
Among road traffic incidents, head injuries are partly caused by human errors, and more generally, pedestrian head injuries mainly arise from human errors. Recklessness, lack of concentration, and interference with the heads vital organs by engaging in unlawful carriage of hazardous objects or reckless speeding, operation of vehicle under the influence of alcohol and ill-protected heads particularly the failure to wear helmets and seat belts all contribute to head injuries (Valent *et al.,* 2002). In LMICs, where some road safety laws are ineffective because they're rarely implemented, such behaviors are rife resulting in more crashes and related injuries.

1.4.2. Social and environmental contributors
Hence, cultural, social and environmental factors are also influential determinants of head injuries. Many LMICs seems to lack adequate infrastructure to accommodate the rate at which cities is expanding, road is congested, the available vehicles are old and poorly maintained and there is a poorly developed traffic control system (WHO, 2015). Also, the absence of efficient public means of transport puts others to inefficient means of transport including motor bikes that are risky in case of head injuries (Nantulya and Reich, 2002).

1.4.3. Role of car crashes in head injury incidence
Road traffic accidents are the major cause of head injuries all over the world and more so in LMICs. According to the WHO the global analysis indicates that road traffic injuries are the leading cause of deaths among the youth in the age of 15-29 years most especially in LMICs (World Health Organization, 2018). Common causes of head related injuries in car accidents are as follows; non-use of seat belts, poor maintenance of automobiles, and poorly constructed roads. Also, some of the LMICs lack strictly enforced traffic safety laws hence increasing the vulnerability of people to accidents and injuries.

1.4.4. Discussion on road safety and prevention strategies
Enhancing road safety is essential to prevent the cases of head injuries in LMICs. There should be an emphasis for the implementation of measures to reduce the risk of accidents, for instance, compulsory

wearing of helmets by motorcyclists and seat belt by all passengers. Government instituting public Heath also plays critical role in raising the awareness of the general public on the dangers of reckless driving behaviours, and safety precautions to be taken. Further, eradicating poorly constructed roads and putting into practice traffic control systems lower the incidence of accidents and as a result head injuries occur (Peden *et al.,* 2004).

1.5. Anatomical considerations in head injuries

1.5.1. Components of the head: skull, scalp, and brain

Skull is more of a brain case, therefore the head consists of the skull, the scalp, and the brain; and all these parts are vital in shielding the head from impacts. It is a bony structure that were designed to protect the brain as it is surrounded by the skull. The skin of the head besides being comprised of skin is made up of a soft tissue known as the scalp that is an insulator of shocks that are minor. The head contains one of the most important organs of the body; the brain is a sensitive structure in charge of the entire body. Damage to these components is disastrous, especially if it is the brain, or the head, that is affected (Valent *et al.,* 2002).

1.5.2. Vulnerability of different structures to injury

The degree of risk that the head constitutes as impact area depends on the type and intensity of the force applied. Sometimes, it may involve minor injuries such as head wounds, scalp cuts or skull fractures that might not be fatal but will produce discomfort in the head. Nonetheless, traumatic injuries, particularly TBI, can cause unimagined impairment of an individual's cognitive and motor functions. These can be open TBI wherein there is a direct blow to the head, closed TBI arising from acceleration or deceleration and penetrating TBI whereby there is a breach of the skull and brain tissue is injured (Faul *et al.,* 2010).

1.5.3. Classification of head injuries: minor vs severe

Gross head injuries are of two types major and minor depending on how deep the head has been injured and its clinical signs and symptoms. Slight injuries for example by blows on the head may lead to transient LOC, headache, dizziness etc. These injuries typically require no treatment more than adequate rest and either 'round-the-clock' or 'as-needed' medical care. On the other hand, serious forms of head injuries result into coma, or profound dementia, or disability for an extended period. There are usually surgical requirements for the treatment of severe TBIs and patients need to undergo rigorous rehabilitation in the areas of physical disability, Symbol of impaired cognition and emotion (Norton *et al.,* 2006).

1.5.4. Clinical manifestations and outcomes of traumatic brain injuries (TBI)

Common symptoms of TBI may also differ according to the gravity of the head injury and location of the affected brain cells. Acute symptoms of TBIs are headache, dizziness, nausea, vomiting, confusion, and amnesia or loss of consciousness. In more severe cases, the consequences can be asleep, seizures, problems with speech and understanding, complete immobility, and changes in behaviour and personality. Depending on their severity, the consequences of TBI can be from no trace at all to persistent disability or fatality. That is why it is possible to state that the prognosis for a patient with such injury depends on the nature and the severity of the trauma, the timeliness and efficacy of the treatment, and the general state of the patient's health (Corrigan *et al.,* 2014).

1.6. Public health implications of head injuries

1.6.1. Economic and social impacts on LMICs

The costs that head injury has on LMICs' economy and society are massive. Those who have very bad head injuries sometimes need lifelong care and the expenses can be overwhelming for families and states. In addition, the rate of 'employment handicap' or 'work loss' resulting from disability or fatality poses extensive implications for societies and economies. In many cases, the primary breadwinner in a family is affected, leading to increased poverty and reduces access to education and healthcare for dependents (Hyder *et al*., 2007).

1.6.2. Challenges in trauma care and healthcare infrastructure

Nowadays one of the most prominent problems in the context of administrations of LMIC is insufficient health care systems development. The point is that the majority of LMICs cannot boast of having specialized trauma centers or access to high-tech diagnostic or treatment facilities, including neurosurgery or rehabilitation hospitals. Besides these, there are also a few factors that hinder treatment, comprised of scarcity of skilled medical staff such as neurosurgeons, emergency medical technicians, and rehabilitation professionals, among others (Mock *et al.,* 2003).

1.6.3. Role of public awareness and education in mitigating head injuries

Both awareness and education of the public are very much essential part of every approach towards preventing devastating effects of head injury. In LMICs awareness of the risks associated with head injury and their consequences may be low; however, through public health interventions, awareness and understanding of reduced speed and correct personal protective measures like helmets and seatbelts besides seeking early treatment can be created. Other interventions which can be implemented includes use of schools, community centers and media in passing information throughout the society so as to create awareness of head injury precaution measures and how to handle them (WHO, 2006).

1.6.4. Case studies from LMICs: success and failure in trauma management

A few LMIC have good working models in place which have effectively made positive changes in the trajectory of significant head injuries. For instance, there has been a gradual enhancement of a national trauma registry in Rwanda, also advancing in the training of relevant healthcare workers. These efforts have helped promote better end results in trauma patients especially those with trauma head (Petroze *et al.,* 2014). Nevertheless, there are problems now: all over the world quite a few countries suffer from poor resources or poor development in health systems, and so there are many deaths and disabilities that can be avoided.

1.7. Current strategies and interventions in LMICs

1.7.1. Overview of trauma care systems in LMICs

Trauma care services in LMICs can be surprisingly rudimentary, with the majority of the nation's lacking the requisite assets as well as framework that would permit them to meet the needs of traumatized patients. But there are attempts being made to address this issue through the creation of national trauma registries, development of trauma centre and expert training on trauma. Studies of similar systems applied in different locations have demonstrated the results of this approach and have led to reduced mortality in trauma patients, together with better outcomes for patients who had suffered a head injury (Norton *et al.,* 2006).

1.7.2. The role of emergency medical services

EMS is involved in managing head injuries especially in the pre-hospital phase and this paper seeks to give a summary of the current knowledge on the subject. In most LMICs, though, EMS is lacking or poorly developed and thus the overall outcomes are worse including higher mortality rates. attempts that can be made to enhance the EMS systems such as education and training of the paramedics, development of ambulance services are crucial in increasing the quality of Head injured patient (Sasser *et al.,* 2005).

1.7.3. Preventive measures: road safety, helmet use, and legislation

Reduction of Road traffic accidents, efforts like safe road user crusades, implementation of helmet and seat belt regulations as well as enhancement of road standards is instrumental in the reduction of cases of head injuries in LMICs. Research have found that the above measures can bring down the incidences of Road Traffic Injuries and; hence, head injuries. For instance, compulsory helmet usage that was implemented in Vietnam cause the number of head injuries as well as death among motorcyclists to drop (Passmore *et al*., 2010).

1.7.4. Global health initiatives and their impact on reducing trauma-related mortality

By most global health organizations like the World Health Organization through their GAICC, there has been concerted efforts in raising awareness of the burden of injury in LMIC and call for injury control and trauma systems. These have played the role of resource mobilization, bringing together countries into partnerships, and sharing of know-how and good practice in the management of trauma. Hereby and thereby, several LMICs have had a positive incline in the reduction of trauma deaths including head injuries (WHO, 2010).

1.8. Future directions and recommendations

1.8.1. Need for enhanced trauma care training and resources in LMICs

Huge gaps exist and training and resource in trauma care must be stepped up in LMICs. This is in the training of health care practitioners in head trauma, establishment of trauma hospitals, and offering of modern diagnostic and therapeutic facilities. Furthermore, measures have to be taken to increase access to rehabilitation services wherein head injury patients could benefit from – this is indispensable for patients' further treatment as well as improved quality of life (Zargaran *et al.,* 2018).

1.8.2. The potential role of technology in improving trauma outcomes

It is important to understand that technology could be of a paramount importance in enhancing sentinel events' prognosis in LMICs. For instance, telemedicine can be utilized in making a connection to a specialist in rural areas and mobile health applications may be applied in passing real-time information and support to the health practitioners on the ground. Further, the established common-use diagnostic equipment, including less expensive portable ultrasound devices, can assist in enhancing the early diagnosis and management of head injuries (O'Reilly *et al*., 2013).

1.8.3. Collaboration between LMICs and HMICs for knowledge transfer

Such knowledge implies that there must be active cooperation between LMICs and HICs so that the former can embrace the knowledge they need in the management of trauma. The HICs should also offer technical support as well as offer to train professional from LMICs on how to develop their trauma care systems. Further, collaborations of universities with hospitals in HICs and LMICs could provide new knowledge as well as help to come up with new approaches to the problem of trauma care in resource-deficient conditions (Mock *et al.,* 2015).

1.8.4. Importance of continued research and data collection on trauma and LMICs

The monitoring and collection of data should therefore continue in a bid to document the level of burden of trauma and head injuries in LMIC and ensure that strategies to deal with this burden are developed. This involves the creation of the national trauma registries in addition to data collection of head injuries incidence & outcomes besides the assessment of the efficiency of prevention & treatment methods. Moreover, the investigation of head injury effects on the prospective social and economic consequences can contribute to policy-making in the assignment of resources (Hyder *et al.,* 2007).

Thus, head injuries are a severe problem for the population of LMICs; those patients experience high morbidity and mortality levels. The paucity of appropriate trauma care services, patient delay in seeking care, and low level of public awareness of the various fatalities associated with head blows are other problems to be met. But there are also challenges that need improving by prevention policies, creating trauma networks, and applying the advance technology on the model of care. Understanding and analyzing such trajectories of LMICs and HICs remains crucial for trauma system equity and better quality of life in LMIC affected head injury patients.

1.9. Research gap

Surprisingly, even though RTAs are well recognized as a major public health problem, Moreover, while some research explores the epidemiology and management of head injuries in LMICs, there's a lack of focused on examination of severity and specially the type of surgery required among RTA patients at tertiary care facilities. Understanding the severity and most common surgery required in head trauma patients is crucial for refining emergency care protocols, optimizing resource allocation, and developing targeted interventions to enhance patient outcomes. Such research is highly relevant due to the fact that RTAs stem from social and environmental endogenous factors, for example; poor road condition, absence or inadequate traffic laws, and driver's related issues like distracted or improper conduct on the road (Valent *et al.,* 2002). The current literature review has again and again stressed on the fact that patients in LMICs have higher morbidity and mortality index when they suffer from head injuries and this is as compared to the indices in HICs (Hofman *et al.,* 2005). Despite increasing awareness of traumatic head injuries from road traffic accidents (RTAs) as a significant public health issue, a critical gap persists in understanding the severity of head trauma among RTA patients treated at Tertiary Care Hospital, While existing literature notes higher morbidity and mortality rates linked to head injuries in low- and middle-income countries (LMICs), such as Pakistan, few studies delve into the specific factors determining severity within this hospital context.

The study aims to bridge this gap by conducting a comprehensive Research for head trauma severity and the type of surgery is required among RTA patients at Tertiary Care Hospitals. Such research is highly relevant due to the fact that RTAs stem from social and environmental endogenous factors, for example; poor road condition, absence or inadequate traffic laws, and driver's related issues like distracted or improper conduct on the road. Hence, investigating head trauma severity among TBIs and more so among tertiary care facilities, where more severe cases are expected to be treated, is important for developing interventions that still can be implemented within the context of these settings.

1.10. Problem statement

Despite the increasing recognition of road traffic accidents (RTAs) as a significant public health challenge, particularly in low- and middle-income countries (LMICs), there is a critical gap in understanding the severity of traumatic brain injuries (TBIs) among RTA patients treated in tertiary care settings. Existing literature highlights elevated morbidity and mortality rates associated with head injuries; however, focused investigations into the determinants of injury severity and the specific surgical interventions required remain sparse. This deficiency limits the development of targeted emergency care protocols, resource allocation strategies, and effective interventions tailored to the needs of this high-risk population. Therefore, it is essential to systematically examine the patterns of TBI severity and the types of surgical management necessary for RTA patients in tertiary care hospitals to enhance clinical outcomes and inform public health initiatives.

1.11. Research questions

1. What are the distribution of head trauma severity among road traffic accident patients?
2. What are the most common types of head injuries in road traffic accident patients?
3. What surgical interventions are performed for varying severities of head trauma?

1.12. Objectives

Objectives of this study were:

1. To analyze severity of head trauma in road traffic accident patients.
2. To identify the most frequent type of head injury.
3. To decide the type of surgery required after analyzing the severity of head trauma.

REVIEW OF LITERATURE

Formisano *et al*. (2005) carried out a research with a view of assessing the rate of Road Traffic Accident (RTA) within patients who resumed driving after specimen brain injuries. This study intended to establish the degree of disability in the executive functioning of driving responsibility and risk of RTAs among clients with severe TBI. The specificity used in the research design involved employments of retrospective study made through the use of telephone interviews as a method of data collection. The study concerned the group of patients with severe brain injury, who were in coma for more than 48 hours. Patients suffering with such conditions were excluded from the study, however to obtain information regarding their driving pattern as well as RTAs post driving, caregivers of such patients were interviewed. The caregivers for a sample of ninety patients, who were severely brain injured, formed the sample population of the study. These caregivers filled a structured questionnaire which covered a range of elements correlating to the patients' driving ability after emergence from coma and their involvement in RTAs. The first aim was to evaluate the relationship between the degree of the brain trauma and the risk to have an involvement in an accident upon returning to drive a car. Outcome measurement in all the patients in the study was done by the Glasgow Coma Scale (GCS). When asked about their current status, the caregivers responded 29 among the 90 patients have gone back to driving, this was an estimated 32 % of the patients. Notably, 11 patients out of these 29 (38%) were involved in road traffic accidents when they resumed driving. This rate of accidents was particularly higher as compared to what the general population would have exposed to. Based on actual calculation of median timeframe of risk exposure for the patient population that has been involved in the study, the study found out that within that period, there were 11 RTAs recorded against 4. Meaning a rate 7 cases of that which would be anticipated in a similar cohort of population with no injuries. This finding suggested that patients with severe head injury were 2. This puts patients with severe brain injuries at a higher risk thus underlining the need for a more comprehensive evaluation when determining whether a patient is capable of operating a vehicle safely.

Ali *et al*. (2008) designed to assess to assess the incidence of complications in patients admitted with acute stroke in Peshawar, Pakistan because complications are known to influence the outcomes and rehabilitation of the affected patients. This paper defines stroke as a leading health condition with high prevalence of death rates and complications across the world. Thus in Pakistan the burden of stroke is high and knowledge of the common complications that occur in the acute phase after stroke need to be better understood so that patient care can be optimized. This prospective observational study was conducted over a one-year period, from March 2006 to February 2007, at two major healthcare facilities in Peshawar: Those departments include: The General Surgery and Neurosurgery Postgraduate Medical Institute situated in the Lady Reading Hospital and the Department of General Medicine, Hayatabad Medical Complex. Twenty-four patient variables were analysed in the study using 100 consecutive patients with acute stroke diagnosed and treated within 7 days from the onset of the disease. Patients were eligible if they met the WHO definition of acute stroke; however, those with subarachnoid hemorrhage were excluded. Every patient on admission had his/her neurological deficit and functional disability evaluated in order to establish the initial state. More studies were performed to decide what kind of stroke it was, by the method of bleeding, ischemic, or lacunar. The assessments were done on a daily basis throughout the period that the patients were admitted in the hospital with a view of determining whether complications had developed or not. The study followed up the patient until discharge or death and hence, gave an estimate of the acute stroke phase. In the study cohort, 58% were males and 42% were females; the mean age of the patients was 59 years. 98 years (± 11. 95 years). Out of hundred patients, thirty-two revolved intracerebral hemorrhage, sixty-four cerebral infarct and four lacunar infarct cases. The average length of stay of these patients was 6 days within which they developed the following complications. The commonest complications noted were aspiration pneumonias which occurred in 28 (23/83) patients, constipation which occurred in 28 (15/54) patients, chest infections which occurred in 27 (24/90) patients, dehydration which was 21 (17/81) and urinary tract infections which occurred in 12 (13/105) patients. Most notably, aspiration pneumonia took the role of a much more serious condition; it was mentioned to be the cause of death in 4 out of 7 patients who died during the study period, and therefore equaled to 57 percent of the total number of mortalities in the sample. This notwithstanding, a surprising 16 percent of the patients did not get any complications during their hospital stay. Nevertheless, the results of the present study confirm the fact that post-stroke complications are common and they may be associated with a great impact on the subsequent stroke evolution. This research points out that complications after the acute phase of stroke are frequent and threaten the prognosis and subsequent management of patients. Aspiration pneumonia, chest infection and UTI are some of the complications; this longer patient stay; this highlight the need for a stroke team. It should focus on the prevention of complications as well as early identification and management of any complications that may arise with an intent of enhancing patient status and minimizing deaths rates. Due to the fact that these complications are disastrous in the course of recovery from stroke, the study suggests that: There should be improved post-acute care protocols and there should be improved staffing qualm and training of the healthcare givers in the management of the acute phase of stroke.

Kumar *et al*. (2008) carried out specific case investigations of fatal vehicle related mishaps provide significant knowledge that is valuable in; consultancy in the formation of emergency response services, minimization of traumatogenic mortality in accident victims and enhancement of legal instruments especially in the rush hours when fatal mishaps are most probable. The research question focused on was to investigate the pattern of injuries and the fatal traumatic brain injuries due to vehicular accidents. This study was a descriptive cross sectional study of post-mortem report and clinical records of Road Traffic Accident victims who underwent autopsy between 2001 and 2005 at Department of Forensic Medicine and Toxicology, All India Institute of Medical Sciences, New Delhi. Regarding the gender distribution of the subjects, from the total number of 7008 MLA conducted in the time of the study, 35% of the cases consisted in 2472 subjects. 26.2 percent, out of all the cases, were vehicular incidents. Concerning the gender, more male than females were killed with an average male to female ratio of 7:1:49:1. The age group most affected was between 21-40 years of age which was 54% were pedestrians; among them, 24% or 1341 cases of the vehicular accident victims. It is evident from this studying of the demographic data that youths and more so the young male are most vulnerable to fatal road incidents thus calling for more emphasis to be placed on the sensitization and awareness creation among the youths.

Mushtaq *et al*. (2010a) conducted a study with objective to compare the size of the traumatic EDH, the GCS scores and overall outcome of patients. This cross-sectional study was retrospective and prospectively collected during one-year period from January 2004 to January 2005 in the department of neurosurgery at PIMS Islamabad. Altogether, 38 patients (>18 years) with confirmed EDH through CT scan were enrolled in the study, who took admission through the emergency department of the hospital. The patients' history and clinical assessments were made prior to the patients' emergency surgery. The objective of the study was therefore to compare the outcomes for the patients with established EDH against their size and initial GCS scores. The data collected were analyzed using statistical package for the social sciences (SPSS) software version 12. The patient group involved 38 patients, of which 22(78/3%) were males revealing a high male to female ratio of 11:1.7:1. The age was also significantly low averaging to 27 years for the patients involved in the study. 6 years. The EDHs were located in various regions of the brain: Twelve patients had temporoparietal EDH and6 had temporal hematoma, 5 had parieto occipital hematoma and 4 had frontal, 4 had parietal, 3 had frontoparietal and 2 having posterior fossa EDH and bilateral EDH respectively. This distribution provides the understanding of the variety of the EDH possibilities, which can involve various areas of the brain. According to the study done, it was concluded that there was a strong relationship between the size of the hematoma and GCS. More precisely, the experimental data indicates the favorable outcomes in the cases when the hematoma size was 30 milliliters and less. Three patients among 4 patients with such localized hematomas had GCS 13-15/15, this is a witness of mild trauma, and all these patients had a good outcome. However, there was one patient who had GCS of eight / fifteen but had severe disability. On the other hand, patients in this study sample with larger hematomas especially with the volume greater than 120ml had worse outcomes. Among three patients with such massive hematomas, one was in the vegetative state, one had a severe disability; one of the patients died. Such is the strong correlation of hematoma size to prognosis that such a dichotomy can practically be made. Even the GCS score on admission was found to have significant association with the results of the patients. Among the 9 patients with GCS scores between 3 and 8/15, which indicates severe brain injury, the outcomes varied: Two patients recovered very well, two had minor deficits, three patients were confined to wheel chairs, and one patient was in a vegetative state and one patient died. In light of all the observed variability it can be said that one of the key factors influencing prognosis is the initial neurological index. In the group with GCS between 13 and 15/15 there were only

fifteen patients, fourteen with excellent outcome and one with mild disability and no death in this group. This further reinforced the finding that higher GCS scores are associated with better outcomes.
Mushtaq *et al*. (2010b) assessed the surgical intervention and prognosis of depressed skull fractures in patients of Head Injury Unit, Hayatabad Medical Complex, Peshawar, Pakistan during October 2006 to October 2009. Depressed skull fractures, where a part of the skull is induced to move inwards needs surgery mostly if the depression is more than 5mm, or if it causes cosmetic alteration or if it is over sinuses. The work aims at identifying the demographic characters, etiological habits, clinical manifestations, surgical managements as well as the prognosis of the patients with depressed skull fracture. Thus, the present descriptive research involved only de-compressive surgical treatment of 48 patients with depressed skull fracture in a row. History was taken from every patient and included the mechanism of the fracture, the dates from the time of the initial injury, general clinical condition, besides the CT findings. Patients with a depression of more than 5 mm, cosmetic defect, and presence of the fractures over the sinuses were taken for surgery. In order to control the infections, all patients were given prophylactic antibiotics, while to control the seizures, all were given anticonvulsants. We found that the study population included slightly less females than males; two hundred females to two hundred and forty-two males. 2:1 or two patients to one control patient aged between 1 year and 63 years with a mean age of 14 years. 1 years. The highest frequency of the patients was observed in pediatric age, the majority being 26 (54. 1 %) of the total number of patients, whereas the second largest group was composed of 16-30 years' patients, 12 (25. The last 10 (20. 8%) of them were more than 30 years of age at their first visit to the clinic. The leading cause of injury was fall from height in 26 (54. 16%) of cases; followed by road traffic accident (RTA) in 15 (31. 25%) cases. There were other causes such as physical violence which was reported in 3 cases (6. 25%), and recreation in 1case (2. 08%) while miscellaneous causes were reported in 3 cases (6. 25%). Concerning the severity of the head injuries 35 patients (72. 91%) sustained mild head injuries, 7 (14. 58%) had moderate head injuries while 6 (12. 5%) had severe head injuries. Closed depressed skull fracture was observed in this study in 11 (22. 91 %) cases while compound depressed skull fracture was present in 37 (77. 09 %) cases. The fractures were distributed across various regions of the skull: Of the patients, there were 8 (16. 67%) at the frontal bone, 8 (16. 67%) in the fronto-parietal area, 10 (20. 8%) at the temporal area, 13 (27. 08%) at the parietal area, 5 (10. 41%) at the occipital area, 2 (4. 17%) over the superior of these, intracranial lesions 16 (33,3%) extradural hematoma, 15 (31,25%) contusions, 23 (47. 92%) Dural tears and 7 (14,58%) in-driven bone fragments cases were observed in the patients. The prognosis in the postoperative period was rather favorable, and the majority of the patients, 35 (72. However, complications were observed in some cases: In this group the following complications were noted: 6 patients (12. 5%) developed hemiparesis, 4 (8. 33%) had seizures afterwards 2 (4. 17%) stayed in vegetative state, 3 (6. 25%) of the patients developed meningitis, 2 (4. 17%) had surgical site wound infections, 1 patient developed pseudo meningocele.
Leijdesdorff *et al*. (2014) presented cross-sectional, hospital-based survey carried out in the Trauma Center West-Netherlands (TCWN) region had the purpose of describing the epidemiology of severe traumatic brain injury (STBI) patients hospitalized after RTAs and identify potential risk factors for hospital triage and outcomes. It involved cross sectional analysis of trauma registry data to determine cases of TBI among all RTA casualty regardless of their age that occurred in the mid-West region hospital in the Netherlands between the year 2003 and 2011. The head injuries sustained were graded and rated by AIS: where head injuries having AIS severity of 3 or more were considered STBI. The study also realized that out of the 12,503 RTA victims admitted to hospitals, 10 percent of them had STBI. However, the incidence was relatively higher among the different types of road users as presented below: For example, STBI incidence was 5. 4% among motorcyclists, 7. 4% among motorists, 9. 6% among cyclists, 12. Moped riders had the lowest percentage of the drug at 7% while the highest percentage who tested positive for the said drug was recorded among truck drivers at 15%. 1% among pedestrians. The overall study findings indicated that SBI was most prominent among the pedestrians with OR at 2. 25; 94% CI, 1. 78–2. This was lower than that of car drivers with an OR of 1.86 and followed by moped riders with OR at 1. 86 (95% CI, 1. 51–2. 30). The study also made a very important observation on the difference in the distribution of injuries among the different road user categories. For instance, the frequency of contusion was highly different; the frequency

ranged from 46. 6 % in cyclists to 74. 2% in motorcyclists. Basilar and open-skull fractures were least incident in motorcyclists at 22%. 6%, many of these was from moped riders which were at 51%. 5%. Also, hemorrhage frequencies varied between 44. From 9 % among motorists to 63. 6 % in the pedestrian, of which hemorrhages of subdural and subarachnoid tissues are presented most often. Multiple solitary predictive factors were established for in-ward mortality in the patient after STBI. These were age of patient, the GCS score of the patient and the kind of hemorrhage that was suffered by the patient. The study established that in-hospital mortality rates differed with the various road users where motor vehicle users had the lowest mortality rate of 4%. The lowest being 2% that was noted in moped riders and the highest at 14 %. 1% in motorists. However, studying the specific population in question more in detail, it was concluded that pedestrians are actually at the highest risk of STBI with a special focus on intracranial hemorrhage being a frequent consequence of that kind of injury.

Haroon *et al*. (2016) demonstrated the importance of post-operative serial CT scans in traumatology, with emphasis to the ways these scans affect the decision-making of neurosurgeons. Due to possible changes in the plain CT images seen in Serial CT scans, post-surgical, the study is set to establish the impact of the observed changes to future clinical management. In this study, 212 patients admitted to the Neurosurgery ward with head trauma that required surgical operation were used. These patients were also closely followed by routine post-operative CT scans in an effort to monitor there conditions. The rationale of these scans was to identify any alterations in the brain condition, for example, the worsening or new growths of existing pathological areas, or development of new ones. In this analysis, the authors wanted to classify such changes and how they affected future management plans by neurosurgeons. Therefore, to determine any considerable change after the surgeries, the authors of this study kept track of 212 patients with trauma using post-operative CT scan. Of these patients, 39 (18.3%) had significant changes in their CT findings. These alterations comprised either progressive development of previous lesions, relapses of earlier lesions which can be treated or new lesions — which have never been treated before. Of the study participants who had these significant changes, post-operative CT scan showed that 22 patients (56.4%) required further surgery on the affected area. As for the analysis of patients' outcomes, it was revealed that 137 out of 212 patients (64, 6 percent) were discharged with successful outcomes, therefore, surgery outcomes were successful. But, seventy-five patients (35. 3%) recorded poor results which indicate complications or relatively unfavorable recovery. Among the study group total mortality observed was12 percent. 3% of 26 Patients died from their injuries or complications arising from the same. Interestingly, out of these 26 deceased patients, 12, constituting 47 % or 47. 1%, had some changes on their post-operative CT scans. Furthermore, of the 12 patients, six (23 per cent) needed additional surgical procedures based on the results of follow-up CT scans. These findings emphasize the significance of post-operative CT scans in identifying alterations, which may be life threatening and influence the outcomes at different time frames and suggest that timely surgeries must be performed when these changes are observed.

Siddique *et al*. (2016) found out the incidence rate of ICH in patients who have experienced head trauma, by conducting a CT scan on all of them. This research is aimed at identifying both the prevalence of hemorrhages and the differential diagnosis as seen through CT scans in patients they bring in with a range of head injuries. This was done with a group of 165 patients who were recommended for CT scan for brain following head injury. Patient underwent CT scan with no use of contrast mediums. These patients went through CT scan and did not receive contrast agents. Scans were made on the axial plane with a slice interval of 10 mm and the scans were taken from the foramen magnum to the vertex of the skull. Regarding intracranial hemorrhage, the Reviewer of each patient's first CT scan for any abnormality in the scan. For the purpose of the study, a structured Performa was designed and employed to record pertinent information related to the patient such as patient Name, Age, Sex, Type of Head Injury and CT findings. To minimize the potential confounding among the group of patients, patients with coagulopathies or those on anticoagulation therapy were excluded because those patients will have higher risk for spontaneous intracranial hemorrhage. The quantitative data were however analysed using SPSS version 10 where the mean and standard deviation were established for numeric variables like age while the frequency and percentage were established for the categorical variables like sex and type of head injury.

Rehman *et al*. (2018) conducted an observational study was designed with the intent of identifying the factors that affect the results of the management of patients with acute subdural hematoma (ASDH) following head injury. The study was a cross-sectional wound infection surveillance study conducted from January 2015 to June 2016 in the Department of Neurosurgery, Hayatabad Medical Complex Peshawar including all the patients who needed surgical evacuation of ASDH. Detailed information was obtained on the demographical data and other characteristics of the patients, their preoperative clinical and imaging findings, intraoperative findings and, other postoperative complications. The first objective was to evaluate the effect of these factors on patients' outcomes. Gradually, the number of patients involved in the study was calculated to be 67 with the mean age level being 38. When it came to job tenure, the participants' average remained with their current employer for 4 years ± 13. 1 SD. Of these patients, majority were male patients at 79 percent. 1%, 53 patients were in the other groups of the study as depicted in the subfigure below; other 20%. Only 9% or specifically; 14 patients were female. The leading cause of injury that predisposes a patient to ASDH was road traffic accidents, contributing to 52 percent. Out of all the patients, only 2 % of the cases 35 patients had reported gastro intestinal problems. This was then succeeded by falls, which constituted 31% of the difference. Three per cent of the cases (21patients), physical abuses, which accounted for 14 per cent of the causes of readmission within the study period of Pseudomonas infection 9 per cent of cases (10 patients), and one case (1. 5 per cent) in which the patient suffered from a crush injury. New waves GCS at admission was 7 Hours with mean 7, for medical patients the value for GCS was 12 for meanwhile surgical patients it was 9 for mean. 6 (± 2. 1 SD) which shows their rather poor health state due to a majority of chronic diseases among the patients. Injury to surgery interval was another significant predictor; we defined it as the number of days between injury and surgery and average was 7. Two hours (± 3. 6 standard deviations), and minimum time of 1 hour and maximum time of 16 hours. The success of the study was assessed according to the Glasgow Outcome Scale (GOS) view, which is widely used to assess the progress that is made in cases with brain trauma. The study findings showed that out of the sixty cases 38 belonged to the younger age group. Out of 322 patients, favorable outcome of the surgery was recorded in 8% patients with GOS score of 4 to 5. However, sixty-one percent of patients reported using herbals and supplements, thus raising a question on the efficacy of the herbals and supplements in relation to the prescription drugs. 2% (41 patients) had an unfavorable outcome with GOS 1, 2 or, 3. The total mortality level was significantly increased and made up 38%. 8 percent, similarly to the number of patients (26). The study also noted several variables that are closely related to the final results and the following are some of them. In particular, it has been found that the predictors of poor outcome included pupillary abnormalities at presentation among other factors. These abnormalities, which are suggestive of very poor brain function were established to have significant relationship with poor outcome on an analysis done at p < 0 .001. Another major factor identified was the CT brain scan showing midline shift which was also found to have a positive correlation with poor outcomes tested on an analysis of p = 0.01. Furthermore, the duration between the injury and the surgery proved to be extremely critical; the longer it takes, the worse the outcome in terms of significance level of p = 0. 05. Another factor that emerged as having significant correlation with the outcomes was the GCS score at the time of arrival; the lower the score, the worse the prognosis, p = 0. 001. Coincidentally, the study also showed that other factors including the gender of the patient, the mechanism of injury, the age of the patient and whether they had other intracranial or intracerebral traumatic lesions, did not impact on the postoperative outcome. More specifically, gender possessed p-value of 0. 37 the mechanism of injury showed a p-value of 0. Further, the ANOVA analysis corresponds to the following p-values: 3, gender =0.881, 4, height =0.727, and 5, weight = 0.770; whereas, 6, age had a p-value of 0. 95, and the presence of other traumatic lesions had p=0. 1, meaning that there was not a high relationship between them and the final results. Arguing the evidence, this study emphasizes the role of certain clinical markers in early outcomes of the patients who underwent decompressed surgery for ASDH. The need to assess the patients within the first hour of arrival was pointed out as extremely useful as well as Glasgow Coma Scale score, pupil response, the time of surgery and radiological features like midline shift. However, age, gender, the mechanism of injury and additional traumatic lesions, influencing clinical outcomes, do not affect the results of treatment in this group

of patients and once again stress the need for timely and individualized interventions based on the most significant clinical predictors.
Khan *et al*. (2020) reported in their article that TBI is now considered to be amongst the major causes of death and disability in the global population and the situation in Pakistan also reflects the same trend. The purpose of this research was to outline the epidemiologic profile of TBI patients in Pakistan and their early outcomes on admission to the health care facility. This research was a cross-sectional study done in the Department of Pathology, Lady Reading Hospital Peshawar for the year from 1st January 2019, to 31st December 2019. This research therefore utilized data collection by extracting information from the hospital records particularly on the extent of TBI which was operationalized according to GCS. The GCS scores were used to classify TBI into three categories: mild which is on a range of 13 to 15, moderate on a GCS of 9 to 12 and severe on a GCS of less than 8. All statistical analysis was done with the use of SPSS version 23. The patients' data of 5047 patients with TBI were included in this study. Male patients comprised the greater proportion of the patients with 3689 (73. 1 %) while female patients comprised 1358 (26. 9 %). The most affected age brackets were the children below 10 years (25. 6%) and the young adults of between 21 and 30 years (20. 1%). Road traffic accidents were the major preparative causes of TBI contributing to 38 per cent. Eight percent (8%) of the cases, followed by falls which contributed 32 % of the cases, (n=1960). 7% (1649) of all the reported injuries were as a result of transportation related incidences. It is important to note that, where the severity of TBI was concerned, the majority of the patients or 4710. After the initial review, initial basic intervention, and evaluation, the early results of the patients were divided into four classifications. By far the most frequently reported consequence was this of being 'disposed (discharged),' of which there were 67. Consequently, it will benefit 2% (n = 3393) of the cases. A smaller proportion, 9. 3 per cent (n=470), needed admission for further management, suggesting need of further interventions. The study summarized an overall epidemiological status of Pakistan for TBI to give understanding to the burden of this condition in the population. Nonetheless, the research has shocked the world since millions of people experience mild TBI but the fault diagnosis clogs the hospitals today meaning that later repercussions could be missing for long. Thus, there is a call for large-scale research on such population in order to determine the extent of those affected by mild TBI (MTBI) in the Pakistani population as well as worldwide.
Khan *et al*. (2021) aimed at assessing the Epidemiological characterization and initial impact of, traumatic brain injury, patients in Pakistan, with a focus on data from Lady Reading Hospital, Peshawar. TBI is a major cause of morbidity and mortality globally and more so in Pakistan because of multiple factors in the socio-economic and health sectors. It is the objective of this research to describe and explain the demographic characteristics, antecedents and early results of TBI cases in the region with the call for better management and more research on mild TBI since this type of injury may not be easily detected. This cross-sectional study was carried out using patients' files in Lady Reading Hospital, Peshawar and the study period was from 1st January to 31st December, 2019. The data extracted was patients' age, sex, the type of trauma and the result at presentation to the ED. The extent of TBI was determined using the GCS and the TBI was further subdivided into mild TBI, moderate TBI, and severe TBI categories. The referral profile in the ED was categorized into four outcomes, including admissions, discharged (disposed), detained and disposed, and referred to another facility. South African TBI patients covered in the study included 5047, out of which a high proportion of patients were male (73. 1%, n= 3689), while female patients accounted for the remaining 26%. 9% or (n=1358) of the cases. The age distribution showed that the most affected were children of 0-10 years age (25. 6%) and young people of 21-30 years (20. 1%). In this distribution one can see that the comparatively young persons, both children and young adults are at higher risk for TBIs perhaps because they are active and indulge in risky behaviour. Road Traffic Accidents (RTAs) became the main cause of TBI with 38 cases found. 32% of the injuries, which was trailed by 8% (n=1960) of cases of falls that were reported. 7 percent or 1649 of the injuries. Therefore, this finding is consistent with worldwide trends in which RTAs and falls are acknowledged major causes of TBIs, especially in LMICs such as Pakistan where traffic laws and safety provisions could be lax. As for TBI severity, the majority of TBIs were identified as mild (93. 6%, n=4710). It is evident that cases of mild TBI are very rampant and this could be attributed to delayed presentation, under diagnosis and poor documentation especially from developing countries. From

the ED referral to the other settings, the immediate outcome included discharge, as reported as follows; 67. 2 per cent (3393/167547) of the patients were discharged after initial assessment and first aid treatment. Only 9. The results also showed that of these patients 3% (n=470) needed admission for further management demonstrating that the most of TBI patients were not severe enough to warrant admission for extensive hospitalization. At the same time, such an approach questions the sufficiency of early follow-up and contemplates a possibility of various complications in discharged patients, especially those with mild TBI. This work can be considered as a demographic description of the TBI situation in Pakistan, which corresponds to the general picture of TBI epidemiology in LMIC. The large number of patients with mild TBIs and the high discharge rate imply that plenty of patients recover rapidly, but that mild TBI patients may not be diagnosed and adequately treated. These conclusions suggest that there is a necessity of the population-based investigations to analyze the actual prevalence and the potential consequences of mild TBIs more profound as well as the necessity to strengthen the public health measures in order to decrease the rates of TBIs, especially those resulting from RTAs and falls.

Tariq *et al*. (2021) assessed the status of patients who were surgically managed for depressed skull fractures with dural laceration especially their neurological status and complications. This cross-sectional study was conducted over a period of six months in Department of Neurosurgery in Hayatabad Medical Complex, Peshawar and gives theoretical information about the significant factors relating to the patient's prognosis and some difficulties met when treating such lesions. One hundred and fifty-five patients were analyzed in the presented descriptive case series, all of them had depressed skull fractures associated with dural tear and surgical management. On arrival, the neurological status of the patients was ascertained with the use of the Glasgow Coma Scale which was an important predictor of the condition and possible results of the patients. It also looked at postoperative morbidity and mortality and evaluated how the characteristics of the injury (for example penetrating head injury) affected the result. The other parameter extracted from the database showed the average of GCS on arrival was 10. 64 ± 2. To do so, the authors reported a mean AOS score of 33, suggesting that the cohort of patients described had moderate to severe TBI. Among the patients, 21. 9% (n = 32) were scored for GCS of 8 or lesser therefore implying severe brain injury. Sixty-one point two percent (n= 203) had severe head injury evidenced by GCS of 8 and lesser. 1% (n = 123) of patients had higher GCS> 8, that implies less severe head injury. The mortality in this study was 8 % even with surgical intervention. 4% (n = 13): the authors stress the seriousness of brain injuries that accompanied depressed skull fractures and Dural tears. I found that the commonest postoperative adverse outcome was progressive neurological deficit (PND) in 13. Five percent (5%) of the patients, (n = 21) showed symptoms of anemia. This complication is a major consideration in the care of such injuries, because it could cause minimization of rather important injured limb function in the overall functional status of a patient. One of the interesting things discovered in this research is an influence of penetrating head injuries to poor postoperative results. Furthermore, penetrating trauma was found to be associated with unfavorable outcomes of patients with a statistically significant relationship of p = 0. 046. This means that penetrating trauma leads to severe cerebral injury and has poorer prognosis as compared with other types of trauma. This study gave special emphasis on the Glasgow Coma Scale postulating it to play a pivotal role in predicting the prognosis of patients with depressed skull fracture and Dural tears. An important and close correlation between the GCS score at the initial examination and the neurological condition can be noted and there is a connection with both short-term and long-term prognoses. Recent studies in the surgical treatment of these lesions seem to reflect good results in two thirds of the cases, while one third of the patients will have severe disability.

Yahoo *et al*. (2021) reported that TBI is an international health concern that has put a high risk to morbidity and mortality of patients of all ages. They further establish that the occurrence of TBI in a patient depends on the quality of emergency medical treatment that is accorded soon after the occurrence of the injury. Organized and Early Management of TBI's squarely hinge on adequate and timely treatment since it can effectually decrease both the short term and long term consequences. This cross-sectional study was designed to identify demographic profile and clinical course of TBI patients attending in the emergency department (ED) in Jinnah Postgraduate Medical Centre (JPMC) in Karachi, Pakistan. Due to the size and status of JPMC as a leading public healthcare facility it offers valuable information both on the barriers facing and success of the management of TBI in the context of resource constraint environment. The specifics of TBI in this regard are important in order to facilitate the design of prevention and treatment efforts, as well as to refine the emergency care practices that can help minimize the impact of a TBI and promote better post-accident recovery. The study used a cross-sectional survey design; data was collected from patients' paper and electronic charts admitted with TBI at the Neurosurgical Emergency Department of JPMC. A cross-sectional study was used to sample all patients with TBI regardless of age for the study period under consideration. This data entailed patient's demographical information, the causes of the injury, severity of TBI which was determined by the Glasgow Coma Scale and the immediate subsequent status of the patient after receiving treatment in the ED. The outcomes were further grouped depending on whether patients were discharged on completion of treatment, admitted to the hospital for other interventions or managed within the specialty of emergency medicine. The study also established that over the period under consideration, 5,546 TBI cases were reported and on average about 56. 5 patients per day. This high volume indicates the huge toll that TBI has on the population that is served by this health facility. The analysis of the data also showed a significant gender divide; 73. 1% of TBI cases that happen to males, I observed that a pattern seen in almost all countries, where men engage in more risky behaviour as a result of driving cars or engaging themselves in heavy tasks. Of all the TBI cases, the children aged below 10 years were 26 % meaning that this is a very risky age group. This statistic therefore calls for specific preventative interventions especially with regard to falls which were reported as the second most common cause of TBI in this work. Among all the cases of TBI, road traffic accidents were identified to be the leading cause in 39 percent of the cases. This is in concord with the acknowledgment of RTAs as a leading cause of TBI in other parts of the globe particularly from countries that have relatively loose traffic laws and road control mechanisms. The high rate of RTAs requires heightened sensitization and implementation of means to reduce incidence of such accidents such as increased use of different media in advancing the issue of road safety standards, provision of quality roads, and enhanced provisions of the country's laws governing road usage. Slightly below accidental falls were the second leading because which contributed to 32 percent of the cases. 2% of TBIs. This is especially the case among the children and the older people, who are most likely to fall because of lack of supervision, dangerous conditions in the area, or poor balance and muscle weakness. Regarding the injury's severity, most of the TBIs were determined as mild injury, with 72. And of all patients categorized in this group, only 8% will actually fall while they are in the hospital. From this it can be concluded that TBI's are not rare however most of them do not have serious impact on one's health. But the study also revealed the fact that only lesser than 5 percent of the TBIs identified as severe and that too were most likely to result in poor outcomes including the fatal one. Outcomes of the study regarding patients' disposition demonstrated that TBI patients who had additional treatment needed was only 10 percent, the bits of information indicated that most of the TBI patients (67 percent) could be discharged after initial stabilization in the ED. This suggests that the vast majority of TBI that are defined as mild can be well treated provided the right emergency care is sought thus eliminating the need for lengthy hospital stays. But, the same research established that 16 percent essential more extensive care within the ED before being discharged, this is an indication that… The mortality of TBI patients in the ED was at 2 %. 2 % but all these deaths were occurred in the patients having severe head injury. This underlines the significance, which has to be given to early evaluation and treatment of subjects with severe TBI cases.

Ashraf *et al*. (2022) performed to examine trends of maxillofacial injuries and the probability of having an additional injury among motorcyclists with road traffic accidents. The study was conducted at the Oral and Maxillofacial Surgery Unit, Hayatabad Medical Complex, Peshawar from the 4th of December, 2019 to the 20th of February, 2021. The study was descriptive and cross-sectional in design involving 386 patients who had been involved in RTAs of any age and gender. All patients were clinically and radiographically examined, to diagnose and localize maxillofacial fractures. The study concluded that the large percentage of the patients who formed the study population was mainly motorcyclists noting that 79% of patients were from road traffic accidents. Concerning the demographic status, it was quite startling that 76 percent of the injured patients were young males, whereas only 24 percent were females. This means that there is a gender differentiation in cases of such accidents and this could be attributed by the high number of male operators of motorcycles in the region. In the presented group of 304 motorcycle-related maxillofacial trauma patients, an interesting feature was revealed concerning helmet wearing. As to the protective gear, only 38 patients (12. 5%) had a helmet on during the time of the accident, and the rest did not. This fact only underlines the necessity to pay more attention to the protection with a helmet which, in turn, can lower the degree of received trauma. The study also established that the most prevalent regions of the maxillofacial fractures among the injured were. The mandible was found to be the most commonly fractured site, with a score of 46. 7% of the cases. This occurrence can be attributed to the situation that the mandible is always exposed and within the line of fire during high-energy impacts, especially if the players are not armed with protective items such as helmets. The paper reaffirms that young male motorcyclists are particularly at a high risk of maxillofacial injuries in RTAs and that many of these could be avoided if helmets were worn. Mandible was identified as the most frequently affected skeletal structure, which underlines the importance of such actions as encouragement of helmet usage and further toughening of traffic laws. Such conclusions might be useful for prevention campaigns of maxillofacial injuries in motorcyclists that can further enhance road safety and enhance the quality of life of the patients.

Amir *et al*. (2023) presented a research adopting an exploratory, analytical study on clients admitted at the Neurosurgery Department of Hayatabad Medical Complex Peshawar, with specific reference to clients who had visited the ED with head injuries. In particular, the analysed material involved 1,055 patients with GCS of 8 or higher and who underwent in-patient medical treatment after the first abnormal computed tomography scan. These patients also had a repeat CT scan before leaving the hospital and the findings were as follows. The criteria involved only those patients who had an initial abnormal CT scan and took at least one more CT scan subsequently. A thorough data collection exercise was done involving capturing of demographic and physical health related data such as age, sex, medical history and results of physical tests. It also kept detailed records of all the CT scans done and evaluated changes in radiological features (improvement or worsening) from time to time. The decisions having to do with neurosurgical intervention were dependent upon clinical and radiological assessment's capturing the need for ongoing monitoring in the management of head injuries in the acute phase, on this study. A total of 3,456 patients with suspected head injury were presented in the emergency department in the course of the three-year study. Among these, 1,055 patients qualified for this research study. In the demographic analysis the mean age of the patients was given to be 39 years. 5 years, majority of the respondents are male accounting to 67.7%. All the patients in the study had a follow-up CT scan after their first abnormal CT scan in order to assess their changes in their intracranial condition. Detailed CT scan analysis revealed that 95 patients (9. 0%) demonstrated new or worsening evidence of intracranial disease on repeat imaging, defined by radiological worsened CT appearances. Furthermore, 40 patients (3. 7%) had neurological worsening that was defined as worsening of GCS or new focal neurological abnormalities to interpret the importance of close clinical observation. Furthermore, 110 patients (10. 4%) required neurosurgical procedures and the decision about doing them was made with consideration of repeat CT scan findings and clinical status. This research therefore emphasizes the very importance of repeat CT scan in the management of traumatic head injuries. It is very useful to diagnose traumatic intracranial disease in its early stage when such a patient has not been show obvious neurological worsening yet. With repeat scans, there is increased identification of neurological abnormalities, therefore the right neurosurgical management is achieved which is very vital. It is also useful in the process of planning the care continuum and management of head trauma in the acute care environment but also, stresses the need for active monitoring and reassessment of the patients with TBI for the detectability and detection of the new pathologies. The identified outcomes support the use of repeat CT examinations in the treatment of patient with head injury since early interventions may dramatically shift the patient care outcome.

Ahmad *et al*. (2023) aimed to assess the relationship between helmet uses on the severity of the traumatic brain injury among motorbike riders. This study of 400 head injured male patients who had met with motorbike accidents were included after they had been treated at neurosurgery department of JPMC Karachi from July-2017 to Dec-2020. The study divided the patients into two equal groups: Group A was comprised of 200 riders with helmet while the Group B comprised of 200 riders without helmet. The case notes of these patients were reviewed in order to evaluate several factors including the results of Computerized Tomography (CT) scans, hospital stay, complications (morbidity and mortality) GCS and GOS at the time of discharge. These differences claimed that there is a difference between the two groups. However, a significantly higher percentage of non-helmeted patients (51%) needed the admission to the Intensive Care Unit (ICU) while only 35% of the helmeted patients. Hospital stay was also an order of non-helmeted patient that was 10 days as opposed to helmeted patients of 5 days. Mortality rates also supported the Argument of helmets protecting the patients' heads; 25% non-helmeted patient died compared to 7% helmeted patient. In outcomes, we are 59. Five percent of the helmeted group had a favorable outcome at the time of discharge, and it was far better from the 35% witnessed in the non-helmeted group. Conversely, 40. Overall, evidences showed that 5% of the patients wearing the helmet retrieved poor outcomes, while the corresponding figure for the patients who were not wearing the helmet was as high as 64%. In other words the authors concluded that the lack of a helmet mandated connotes abnormal imaging findings, higher rates of complications, worse outcomes and lower GCS on discharge. The lack of a helmet was evidently associated with an increased risk of developing pathological brain injuries, increased complications and longer hospitalization periods after head impact.

MATERIALS AND METHODS

3.1. Study design

This research work adopted cross sectional descriptive research design. A cross-sectional research design is the one whereby data is gathered at one point in time either from the whole population or a sample of the population (Levin 2006). Research of this type enables an investigation into the magnitude and qualities of the population of interest without altering it. This design was particularly appropriate for the study goals and objectives which sought to establish and document patient's characteristics with head trauma resulting from RTA in a hospital setting. Cross-sectional design also permits to collect data regarding various variables among the study population at a specific period that is why it is effective and suitable for this research (Mann, 2003).

3.2. Area of study

The study took place in the Hayatabad Medical Complex (HMC) Peshawar; it is one of the large tertiary care centers with a significant intake of patients across the region (Hayatabad Medical Complex, 2023). The reason for choosing HMC was made on the basis of its capabilities to perform large numbers traumatized patients, including RTAs. The identified patients of the hospital are diverse and include those of different ages, which allows to consider this hospital sample as relatively representative for diversity of RTA victims and having appropriate prevalence and characteristics of head trauma. Infrastructure and existence of specialized departments in the hospital show that the hospital in question is well-prepared to furnish the required information for this study (Hayatabad Medical Complex, 2023).

3.3. Duration of study

After the approval of the research synopsis 4 months are required. This period was chosen to afford the adequate number of participants while still making sure that the data gathered can be analyzed in full. A number of cross-sectional studies may take up to 4 months so that the researchers are able to collect data at different time points and under different circumstances which should increase sample representativeness (Setia *et al*., 2016). It also reduces the incidences where the study results depict variations in the RTA incidences or the hospital admission rates due to seasonal influences.

3.4. Sampling technique

In this study, a non-probability convenience sampling technique was applied in this study. Convenience sampling is where the subjects of the research are chosen based on the fact that they are easily accessible and they qualify for the study (Etikan *et al*., 2016). Despite these limitations the method was adopted because of practicalities; for instance, it is time consuming and available resources can sometimes be limited.

Convenience sampling is used most often in clinical environment for the purpose of collecting data from available patients who fulfil the defined inclusion criteria (Bornstein *et al*., 2013). However, because of the speed and effectiveness in data collection within a given time this technique was deemed appropriate for the study.

3.5. Sample size and procedure

The study covered 361 patients and the sample size was determined by using prevalence rate from a previous study. As mentioned by (Khan *et al*., 2021) the identified prevalence of head trauma for the RTA had been estimated to be 38 percent. This prevalence was used to determine the sample size using the following formula: This prevalence was used to determine the sample size using the following formula:

$$n = \frac{P(1-P) \times Z^2}{E^2}$$

Where:

- P is the prevalence rate (38.3% or 0.383)
- Z is the Z-score corresponding to the desired confidence level (typically 1.96 for a 95% confidence interval)
- E is the margin of error (often set at 0.05 for a 95% confidence level)

This calculation helps to decrease the amount of variation from the sample to the overall population prevalence, which in this case relates to RTA patients' head trauma prevalence.

3.6. Inclusion criteria

Patients selected for this study had head trauma that occurred from road traffic accident were included.

3.7. Exclusion criteria

Those patients who have sustaining head trauma causes from other than RTAs were excluded from the study.

3.8. Glasgow coma scale (GCS)

The Glasgow Coma Scale (GCS) is a neurological scale used to objectively assess a patient's level of consciousness following trauma, particularly head injuries. It evaluates three components: Eye Opening (E), Verbal Response (V), and Motor Response (M), with a cumulative score ranging from 3 (deep coma or death) to 15 (fully awake person). (Middleton *et al*, 2012)

3.8.1. GCS scoring breakdown

1. Eye Opening (E):

- 4: Spontaneous (opens eyes without stimulation).
- 3: To speech (opens eyes in response to voice but not spontaneously).
- 2: To pain (opens eyes only in response to painful stimulus).
- 1: None (no eye-opening).

2. Verbal Response (V):

- 5: Oriented (answers coherently, knows time, place, and person).
- 4: Confused (able to speak but confused or disoriented).
- 3: Inappropriate words (random or incoherent words, no full sentences).
- 2: Incomprehensible sounds (moaning or unintelligible sounds).
- 1: None (no verbal response).

\3. Motor Response (M):

- 6: Obeys commands (follows simple instructions).
- 5: Localizes pain (purposeful movement towards a painful stimulus).

- 4: Withdraws from pain (pulls away from painful stimulus).
- 3: Abnormal flexion (decorticate posturing in response to pain).
- 2: Abnormal extension (decerebrate posturing in response to pain).
- 1: None (no motor response).

GCS Classification for Severity of Head Trauma

According to **WHO recommendations** and clinical standards:

1. **Mild Head Trauma**: GCS score **13–15**

Indicates a high level of consciousness with minimal impairment. Most patients with mild trauma recover without major intervention.

2. **Moderate Head Trauma**: GCS score **9–12**

Suggests significant injury requiring close monitoring and possible intervention. Patients may experience confusion, amnesia, or brief loss of consciousness.

3. **Severe Head Trauma**: GCS score **≤8**

Denotes a critical condition, often requiring advanced airway management and intensive care. Indicates a high risk of mortality or long-term neurological deficits 3-8.

3.9. Statistical analysis

The data was analyzed using statistical tools possibly Statistic Product and Service Solutions (SPSS, V22) since they make statistical analysis easier in handling datasets (Pallant, 2016).

RESULTS AND DISCUSSION

4.1. Gender distribution among patients

Table 4.1 The percentage of males and females among 361 patients with head trauma is shown. The data reveals a marked gender disparity, with a higher incidence in males compared to females: The data reveals a marked gender disparity, with a higher incidence in males compared to females. An aggregate of 254 patients was male of whom 70. 4% at that. This is a relatively large majority which indicates that males are for more often engaged in accidents resulting in head injury in RTAs. This has been clearly evidenced in several epidemiological studies where males are found to be at a higher risk because of the involvement in high risk activities, occupational risks, higher risk taking behaviour such as driving at very high speeds and substance use (Hyder *et al*., 2007).

There were 107, female patients which constituted 29. 6% of the total patients. It is also important to note that females have fewer incidences of TBI than their male counterparts however they may present with different results and manifestations. Again some investigations have implied possible increased susceptibilities of females within 30-days aftermath of concussion and the possibility of their reporting worse symptoms following mild TBI than males (Bazarian *et al*., 2010).

Table 4. 1: Gender distribution of participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	254	70.4	70.4	70.4
	Female	107	29.6	29.6	100.0
	Total	361	100.0	100.0	

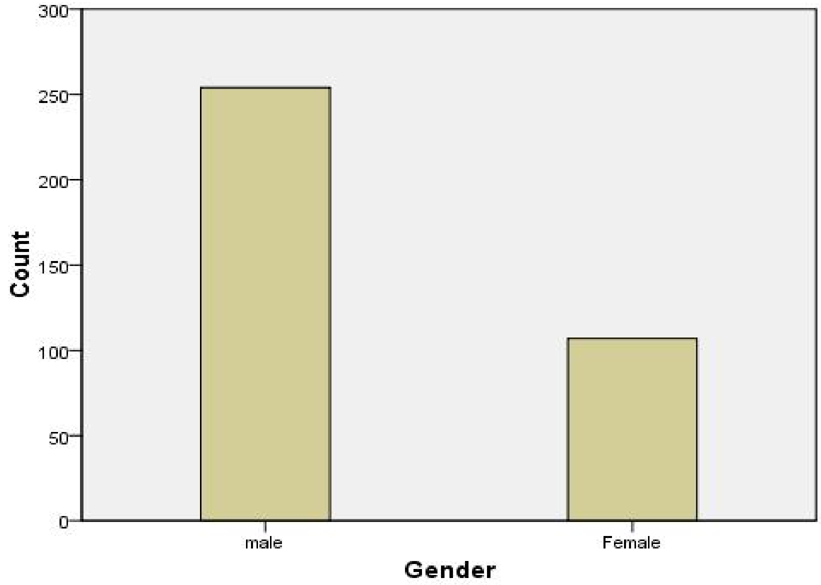

Figure 4. 1: Gender distribution of participants

4.2. Distribution of patients according to nature of injuries

The kind of injuries incidences among the study participants are described in Table 4.2 which shows the detailed record of the 361 cases noted. This categorization assists in determining the number of various types of cranial injuries sustained by patients who had head injuries resulting from RTAs.

These were identified in 66 subjects, this being an 18% prevalence. Moreover, 3% of the total cases. Depressed fractures occur when a part of the skull is driven inwards toward the brain and commonly come with dangerous possibilities of intracranial injury because the bone fragment may intrude into the brain matter (Rubin & Adams, 2012). Slightly less frequent but also quite widespread were linear fractures that were identified in 101 participants, or 28.0% of the cases. Simple fractures are common and they present a lesion on the cranial bone that forms like a line without any movement of the bones. These are usually less extensive as compared to other forms of fractures but carry the risk of an associated head injury (Auen *et al*., 2013).

These fractures were identified in 71 patients constituting 19 percent of the entire sample. 7% of the cases. Non-depressed fractures do not entail the penetration of the skull and its inward compression which means that, in most cases, they cannot be expected to directly cause brain damage. They however might be followed by complications like epidural hematomas in case they have a complication of vascular injury (Helmy *et al*., 2007).

These were the least common in the study and they were identified in 38 instances, that is, 10. 5%. Craze fractures are cracks whose center spreads outwards in the form of a star and are usually called stellate fractures. These fractures may suggest a high energy mechanism and a possibility of a greater level of head injury (Hu *et al*., 2016). The rest, 85 cases (23. 5%), were identified with other forms of injuries. This may actually encompass a whole lot of cranial injury which may not fit into the preceding main categories; this may include complicated fractures, basilar skull injuries, among others.

Table 4. 2: Road traffic accident type of injury has occurred Cross tabulation

Type	Frequency	Percent	Valid Percent	Cumulative Percent
Depressed Fracture	66	18.3	18.3	18.3
Linear Fracture	101	28.0	28.0	46.3

Non- depressed Fracture	71	19.7	19.7	65.9
Stellate Fracture	38	10.5	10.5	76.5
Other	85	23.5	23.5	100.0
Total	361	100.0	100.0	

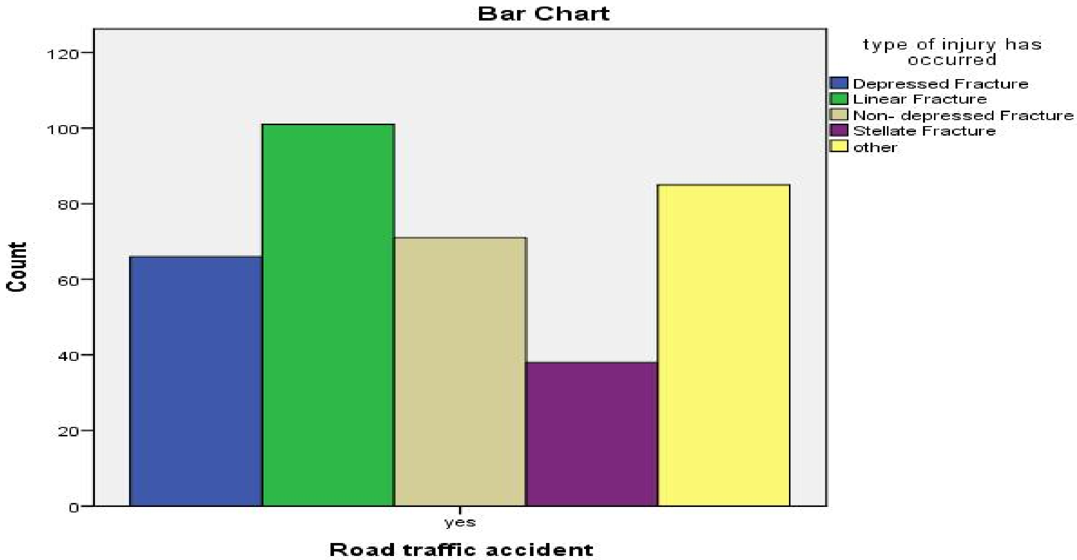

Figure 4. 2: Road traffic accident type of injury has occurred Cross tabulation

4.3. Distribution of patients experiencing loss of consciousness post-road traffic accident

This table as shown in table 4.3, reveals the degree of loss of consciousness of the study participants, who had head trauma resulting from RTA. The findings reveal more information about this clinical sign in the context of the occurrence bearing relationship to the degree of injury. From the 361 participants, 215 participants or 59.6% of the participants reported to have had a temporary or brief loss of consciousness after the road traffic accident. Concussion and loss of consciousness: According to McCrory *et al*., (2017), people who experienced loss of consciousness are likely to sustain more serious head injury. The fact that significantly higher percentage of patients lost consciousness indicates the neurological evaluation of the patients and indicates that the accidents put the patients in neurological jeopardy that requires prompt medical assessment and treatment.

On the other hand, 146 participants (40.4%) had no reports of any loss of consciousness during the ICU stay. This means that, the lack of this symptom is not enough to completely rule out head trauma but may suggest minor brain injury or different types of injury (Faul *et al*., 2010). Some patients will remain conscious but they may also need close observation to make sure that no significant injury is overlooked as the cardinal signs of a brain injury are not always easily recognizable. These two groups sum up to 100%, a pointer that all the 361 cases are clearly explained within this distribution. From this it is clear that a majority of patients (59. 6%) had lost consciousness and therefore this should form part of the parameters when evaluating the seriousness of head injuries resulting from road traffic accidents.

Table 4. 3: Loss of consciousness

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	215	59.6	59.6	59.6
	No	146	40.4	40.4	100.0
	Total	361	100.0	100.0	

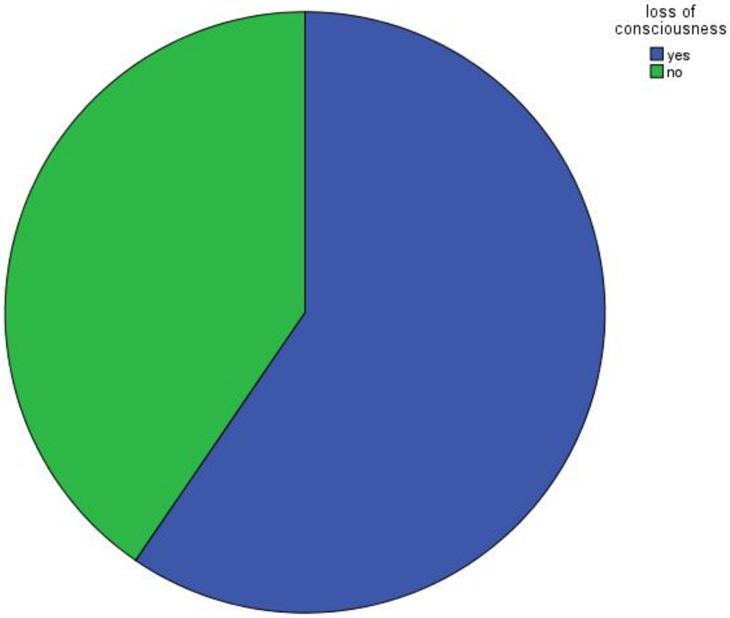

Figure 4. 3: Loss of consciousness

4.4. Duration of loss of consciousness among patient's post-road traffic accidents

Table 4.4 measures the total overall period of Patients' Loss Of consciousness (LOC) which may be incurred through Road Traffic Accidents (RTAs), with regard to the extent as well as possible consequence of head injuries. Duration of LOS is considered as the marker of the severity of brain damage and is employed in the classification of severity of head injury (Saatman *et al*., 2008). Mild Duration of Loss of Consciousness: Of the total participants 361, 235 (65. 1%) of the participants had mild duration of LOC. Mild duration usually defines a short period, normally less than thirty minutes, of loss of consciousness. This implies that despite the fact that these patients had an acute neuroscience defect lasting less than 24 hours, it was of small duration and which prognosis is frequently regarded as less severe and better (Borg *et al*., 2004).

Moderate Duration of Loss of Consciousness: Some 90 patients (24. 9 per cent) had a moderate duration of LOC. This category most often means loss of consciousness ranging from 30 minutes to 24 hours. Intermediate and long LOC presents a more formidable effect on the brain function since complications such as post-traumatic amnesia or cognitive dysfunction may be expected. Patients with moderate LOC duration may need more attention to be paid on them and more physiotherapy intervention (Roozenbeek *et al*., 2013).

Severe Duration of Loss of Consciousness: The remaining 36 patients (10. 0%) get Intent, developed a severe duration of LOC, or unconsciousness in excess of 24 hours. Severe LOC duration is in high risk of lasting neurological deficit and can result in persistent vegetative state or severe post-traumatic brain dysfunction. This group is the most susceptible to the disease and this explains why they would need extensive medical attention and follow up (Levin *et al*., 2001). The sum total of all these categories is 100% which actually implies that all the 361 patients have been covered. The data proves that the most of patients (65. 1%) had only a temporary condition of being out of consciousness, which confirms that most of the head injuries for them were of low severity. Nevertheless, the observations made for moderate and severe durations compare to RTA indicate that substantial brain damage may occur in these injuries and that early as well as long-term management should be considered.

Table 4. 4: Duration of loss of consciousness

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild	235	65.1	65.1	65.1

Moderate	90	24.9	24.9	90.0
Severe	36	10.0	10.0	100.0
Total	361	100.0	100.0	

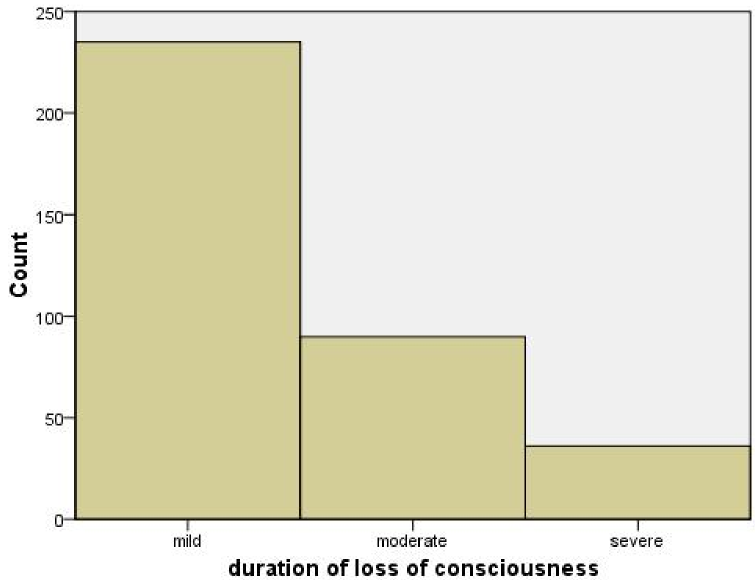

Figure 4. 4: Duration of loss of consciousness

4.5. Glasgow coma scale (GCS) scores on admission

Table 4.4 gives details of the GCS scores that had been documented on admission with patients who had head injuries resulting from road traffic accidents. The GCS is a pre-eminent tool that is applied to evaluate a patient's level of consciousness and neurological functioning that aids in the identification of the extent of head injuries (Teasdale & Jennett, 1974). Of the 361 patients, 136 (37. 7%) patients had mild GCS, according to the study conducted by the researchers. The GCS score which varies between 13 and 15 suggests that these patients should have been awake, or had only faint neurological deficit. A low GCS means although the patients received head injury, their awareness was still intact to some degree, and this is usually associated with less severe brain damage (Haines, 2013).

Moderate GCS score that is between 9 and 12 was given to 32.7% of the patients and it included 118 participants. This score range shows more severe alteration of consciousness and usually points to a moderate degree of brain disorder. Patients who will be in the middle of GCS scale will have some level of consciousness impairment such as disorientation, confused state or inability to focus on a single idea (DeMatteo *et al*., 2011). The rest 107 patients (29. 6%) had severe GCS score ranging from 3 to 8. This severe extent of impairment is characteristic of crucial brain injuries, in which a patient can be unconscious or have a decreased level of wakefulness. Higher GCS means increased severity of neurological outcomes might need much medical interventional and close monitoring (Brain Trauma Foundation, 2016).

The totality of these classifications makes it to 100%, so does it entail all the 361 cases in this distribution below. The analysis of the data indicates that the majority of patients, 37. 7%, had GT Suple of head injuries, which may point out the fact that a rather large number of patients experienced higher levels of consciousness at the time of admission. The distribution shown below reflects the range of head injuries in road traffic accidents and reveals one of GCS's applications in the assessment and classification of the trauma intensity at the primary stage of treatment.

Table 4. 5: GCS score on admission

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild	136	37.7	37.7	37.7
	moderate	118	32.7	32.7	70.4
	severe	107	29.6	29.6	100.0
	Total	361	100.0	100.0	

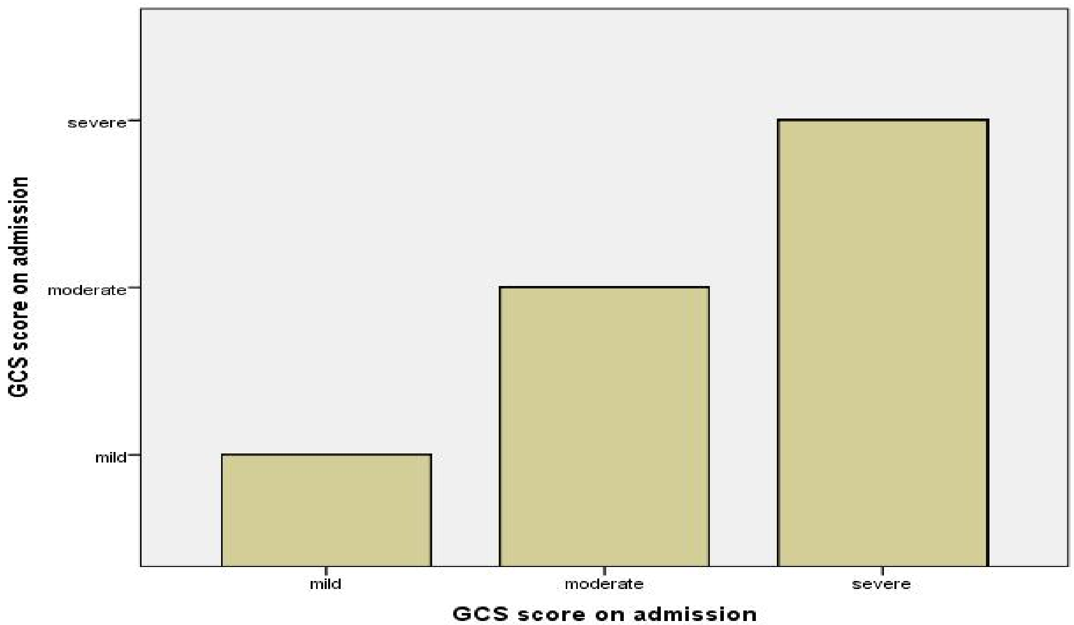

Figure 4. 5: GCS score on admission

4.6. Imaging studies performed to assess head trauma

Table 4.6, in present investigation, provided a comprehensive overview of the utilization of CT or MRI in evaluating head trauma among the studied participants. Based on findings of the present study, it was found that these imaging modalities are necessary tools in diagnosing and assessing the extent of brain injury, especially the given below traumatic events like road traffic accidents.

Out of total 361 patients, 322 participants (89.2%) underwent either a CT or MRI scan. The use of imaging is imperative in the management of head trauma as it allows for the visualization of internal injuries, such as hemorrhages, fractures, and other structural abnormalities (Mayer *et al*., 2017). CT scans are particularly useful for rapid assessment in acute settings due to their wide availability and speed, while MRI provides more detailed images of soft tissues and is often used for follow-up or in cases where CT findings are inconclusive (Smith & Hills, 2014). Conversely, 39 patients (10.8%) did not receive a CT or MI scan, while less common, there are cases where imaging may be deemed unnecessary based on the clinical assessment of the patient or due to resource constraints (Hollis *et al*., 2021). The absence of imaging in these patients may indicate either a less severe presentation of head trauma or limitations in access to imaging resources.

The cumulative total of these group equals 100%, confirming that all 361 cases were accounted for in this distribution. The data showed that a significant majority of patients (89.2%) underwent imaging studies, reflecting the standard practice of utilizing CT or MRI to comprehensively evaluate head injuries and guide subsequent management.

Table 4. 6: CT/MRI scan performed to assess the extent of head trauma

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	yes	322	89.2	89.2	89.2
	no	39	10.8	10.8	100.0
	Total	361	100.0	100.0	

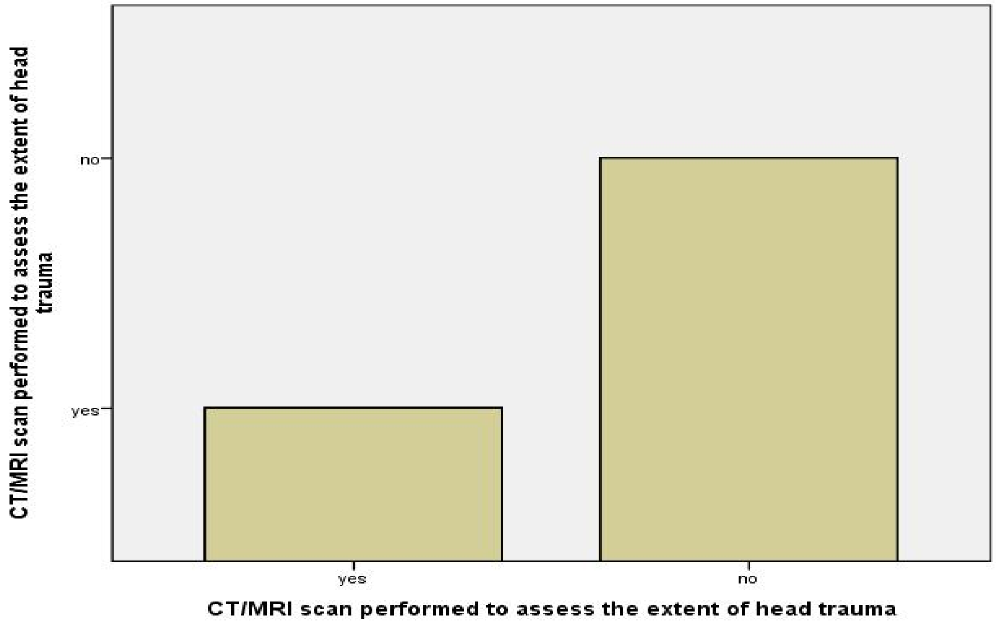

Figure 4. 6: CT/MRI scan performed to assess the extent of head trauma

4.7. Imaging results for detecting intracranial hemorrhage (ICH)

The data was derived from imaging of the head using CT or MRI can for intracranial hemorrhage (ICH) for the 361 patients who had head injury from road traffic accidents. Intracranial hemorrhage is a severe type of hemorrhage that develops inside the skull that has the potential to affect patients' prognosis (Mayer *et al*., 2012).

Of the patients, 89 patients (24.7%) had features of ICH on their investigations. It has to be noted that ICH is associated with intracranial hypertension, brain tissue injury and even potentially fatal outcomes. Since ICH is identified on imaging, its treatment and prevention of unfavorable progression of neurological status becomes crucial (Broderick *et al*., 2007). Indeed, the relatively high percentage should awaken the interest of clinicians to get imaging done in the head trauma patients to rule or look for such important conditions (Table 4.7).

The other 272 patients (75. 3%) where later found to have no signs of ICH on imaging. However, it is essential to note that these patients did not present any signs of bleeding within the skull however this does not eliminate other form of brain injury such as contusion or diffuse axonal injury which may be present in these patients but may not be characterized by ICH. However, as mentioned earlier studies, patients characterized by the lack of ICH have been found to have relatively better prognosis than that observed in patients illustrating hemorrhagic features (Stocchetti *et al*., 2005). The total of these findings is 100% hence it is clear that all the 361 patients have been traced in this imaging evaluation. Of the patients 75. 3% had no detected ICH, which means while less serious complications in terms of bleeding are associated with the majority of head trauma cases, a considerable number do present with this mortality-prone condition. This underpins the importance of imaging in the initial assessment and planned management of patients with acute head injury.

Table 4. 7: Any signs of intracranial hemorrhage detected on imaging

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	yes	89	24.7	24.7	24.7
	no	272	75.3	75.3	100.0
	Total	361	100.0	100.0	

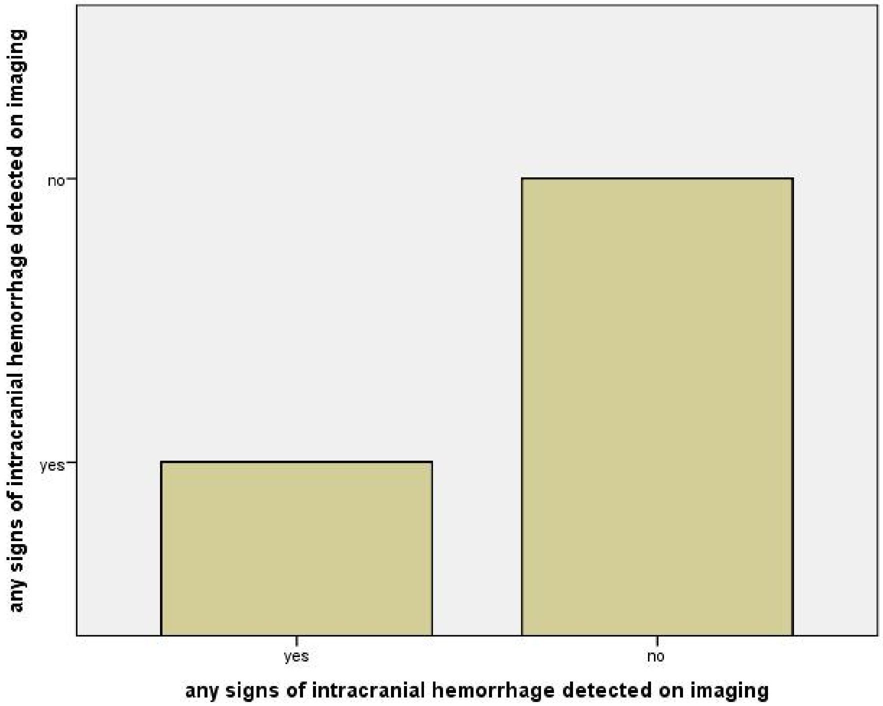

Figure 4. 7: Any signs of intracranial hemorrhage detected on imaging

4.8. Incidence of raised intracranial pressure requiring intervention

Table 4.8 describes the augmentation of intracranial pressure as well as the need for appropriate treatment in patients who had their head injured through road traffic accidents. Increased ICP is a serious condition, which if not well managed, results in a number of complications and can cause Brain Herniation and death (Carney *et al*., 2017). Out of the 361 patients, 91 (25.2%) patients had signs of /or increased ICP which required treatment. This in turn leads to intracranial hypertension and this can be caused by conditions such intracranial hemorrhage, cerebral edema, or mass effect secondary to brain injury. Other ways in controlling raised ICP are by use of medications such as mannitol, which is an osmotic diuretic, hyperventilation or through surgeries like decompressed craniotomy (Cooper *et al*., 2011). A third of patients were found to have raised ICP and this under underscores the extent of head injuries in this group and the importance of early and efficient management to avoid further extension of the primary brain injury. It should be noted that 270 of the surveyed patients or 74. 8% presented no need for intervention in case of increased ICP. These patients did not perhaps suffer raised ICP that would precipitate immediate action but may have suffered different types of head injuries demanding medical interventions. A failure to observe raised ICP in these patients essentialisation denotes a less unfavorable influence on the clinical correlation as well as the cerebral performance (Stocchetti *et al*., 2012). The sum total of all these groups adds up to 100% and all the remaining 361 patients have been computerized. A large portion (74. 8%) did not have elevated ICP and thus required some form of intervention indicating that as much as head trauma has serious complications they are not always present. This just reiterates fluctuations in the degree of head injuries and the significance of ICP in cases in which it may be hazardous to patients' lives.

Table 4. 8: Any evidence of raised intracranial pressure requiring intervention

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Yes	91	25.2	25.2	25.2
	No	270	74.8	74.8	100.0
	Total	361	100.0	100.0	

Figure 4. 8: Any evidence of raised intracranial pressure requiring intervention

4.9. Requirement for Intubation or Mechanical Ventilation in Patients

Table 4.9 discusses the indication of intubation or mechanical ventilation in head injured Road Traffic Accident patients. Endotracheal intubation and mechanical ventilation are the essential procedures utilized to control the airway and ensure adequate oxygenation especially in situations where the individuals cannot breathe independently as a result of their injuries (Jaber *et al*., 2010). Patients Requiring Intubation or Mechanical Ventilation: In the present study, 361 patients participated and of them 72 patients (19. 9%) have intubation or mechanical ventilation. This intervention is used on patients who had head injury, those with a difficult airway, those patients who are fully alert but whose condition can deteriorate dramatically and those with features of respiratory distress. The patient should be early intubated and mechanically ventilated as well as in patients with elevated ICP as this will help avoid hypoxia, which in turn is deleterious to the neurological injured individuals Brain Trauma Foundation, 2016). Given that, it may be concluded that injuries in this group of patients were quite serious, as 18% of the patients required such interventions.

Patients Not Requiring Intubation or Mechanical Ventilation: Consequently, 289 patients did not require intubation and mechanical ventilation accounting to 80. This seems to imply that although these patients received head injuries, the rest of their bodies was not as compromised in respiratory or neurological ways. That is why the possibility of spontaneous breathing and airway protection mainly determines a favorable outcome with a decreased probability of developing complications stemming from invasive procedures (Carney *et al*., 2017). The total percentage is 100% of all the cases. Summing up all the cases, it gives 100 percent, 361 in number. These figures suggest that the patients in this study was not as severe as expected because only 19.9% of the patients, undergone any of these aggressive procedures. However, the 19. Nine percent who did need intubation or mechanical ventilation points that, in patients with TBI, there is need to ensure one can deal with advanced strategies in dealing with airway and ventilation after trauma.

Table 4. 9: Patient require intubation or mechanical ventilation

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Yes	72	19.9	19.9	19.9
	No	289	80.1	80.1	100.0
	Total	361	100.0	100.0	

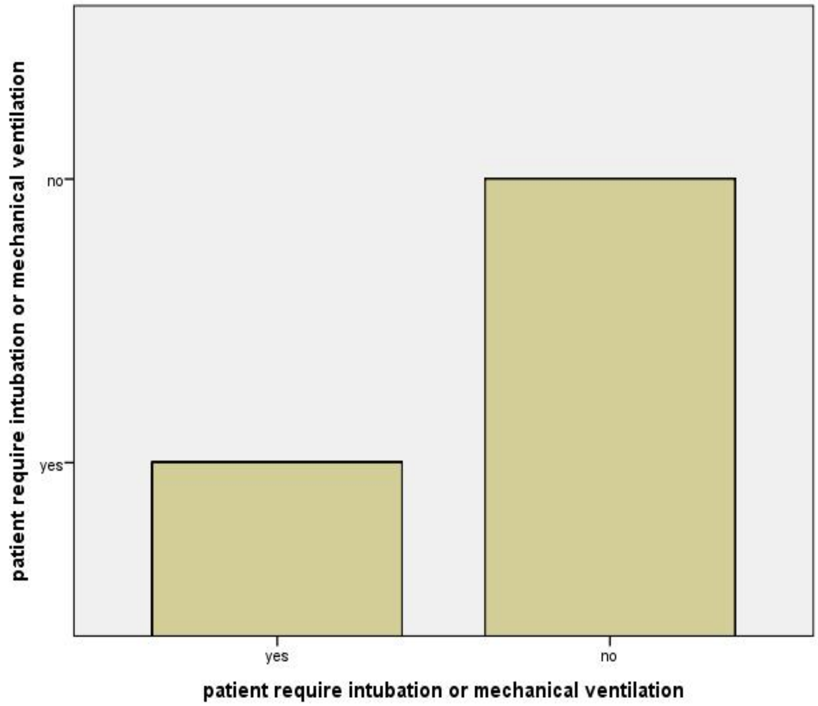

Figure 4. 9: Patient require intubation or mechanical ventilation

4.10. Circumstances of injury among patients

Table 4.10 also gives information on how the 361 patients sustained their injuries with clear differentiation between those hit as pedestrian and those hit under other forms. In injury epidemiology, context is essential to later design appropriate prevention plans and to have a better view of the patient's result (Peden *et al.*, 2004). Of all participant 102 (28. 3%) patients got their injuries while walking or as pedestrians. Among the various users of the road, pedestrians are some of the most endangered especially because they are always in contact with vehicles; especially in urban areas. Those in this category are susceptible to mild to severe injuries including HITH, fractures and internal injuries because the carriages lack protective barriers (World Health Organization, 2018). Such a high percentage shows the potential of improving the stature of pedestrians through better-designed crosswalks, traffic calming devices and administration of road safety education messages. Only 259 of the patients in the study (71. 7%) sustained the injuries in other types of scenarios than being a pedestrian. These may comprise of people who are involved in an auto accident whether as a driver or a passenger, cyclist or people who are involved in other related accidents. The use of motor vehicles for instance is one of the major causes of traumatic injuries globally, and the extent of injury is often a function of variables such as speed, kind of vehicle and the use of cushioning measures for instance, seat belts (Vaca *et al.*, 2014).

The sum of these percentages is 100% by which is covered all the circumstances of how the patients got their injuries. The fact that 28.3% of patients were injured while walking around. Meanwhile, the 71.7 % injured under other circumstances gives a more comprehensive view of road traffic injuries which occur in different modes and in other situations.

Table 4. 10: Injured as a pedestrian/walking

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	102	28.3	28.3	28.3
	no	259	71.7	71.7	100.0
	Total	361	100.0	100.0	

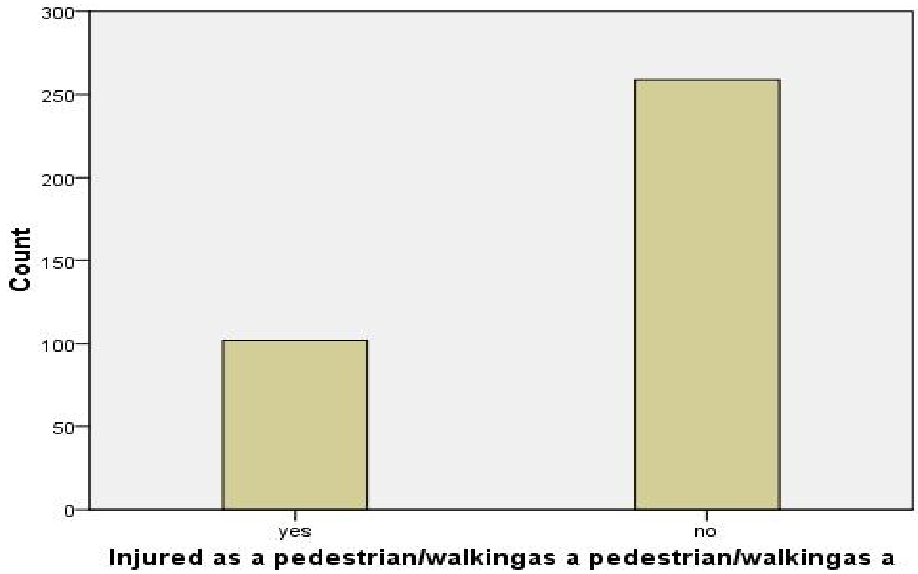

Figure 4. 10: Injured as a pedestrian/walking

4.11. Initial management strategies for head trauma

In Table 4.11, summary of early management of head trauma in 361 patients' Retrospective case study and analysis. The management plan is determined by the increased severity of the injury, clinical presentation and investigations carried out with the purpose of preventing secondary brain injury and optimizing the results (Brain Trauma Foundation, 2016). Most patients, 182 patients (50. 4%) were treated non-surgically using only observation. Observation is used mainly in the cases of mild head trauma or in patients with clinically stable condition who do not require an active management. This strategy entails frequent assessment of the neurological state with a view of identifying any possible clinical decline that requires increased intervention (Stiell *et al*., 2005). Observation is applied in half of the cases, which indicates the fact that the majority of this population suffers from minor injuries with a low likelihood of complications.

In 363 patients, 19. 9% underwent medical therapy as one of the initial treatment for the disease. Medical management is the use of mannitol or hypertonic saline in cases of increase intracranial pressure, an anti-seizure medication to prevent seizures and analgesia for pain. As earlier noted, in patients with moderate head injuries, or any signs of rising ICP, medical management is crucial in initial stabilization of the patient with view of avoiding worsening of the neurological injury (Cooper *et al*., 2004).

Of the above, surgical treatment was required in 107 patients (29. 6%). Some of the surgeries may encompass craniotomy for removal of hematomas, decompressed craniotomy to reduce the ICP or fixation of skull fractures. In general, the decision for surgical management depends on imaging studies including; the presence of more than 10 ml intracranial bleed or mass effect and the clinical state of the patient as depicted in earlier works by Bullock *et al*., (2006). That one of the three patients, patients of this compromising demographic of the population, required surgical management underlines the gravity of injuries for such patients and the necessity of prompt highly specialized neurosurgical intervention.

Table 4. 11: Initial management strategy for the head trauma

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Observation	182	50.4	50.4	50.4
	Medical therapy	72	19.9	19.9	70.4
	Surgical intervention	107	29.6	29.6	100.0
	Total	361	100.0	100.0	

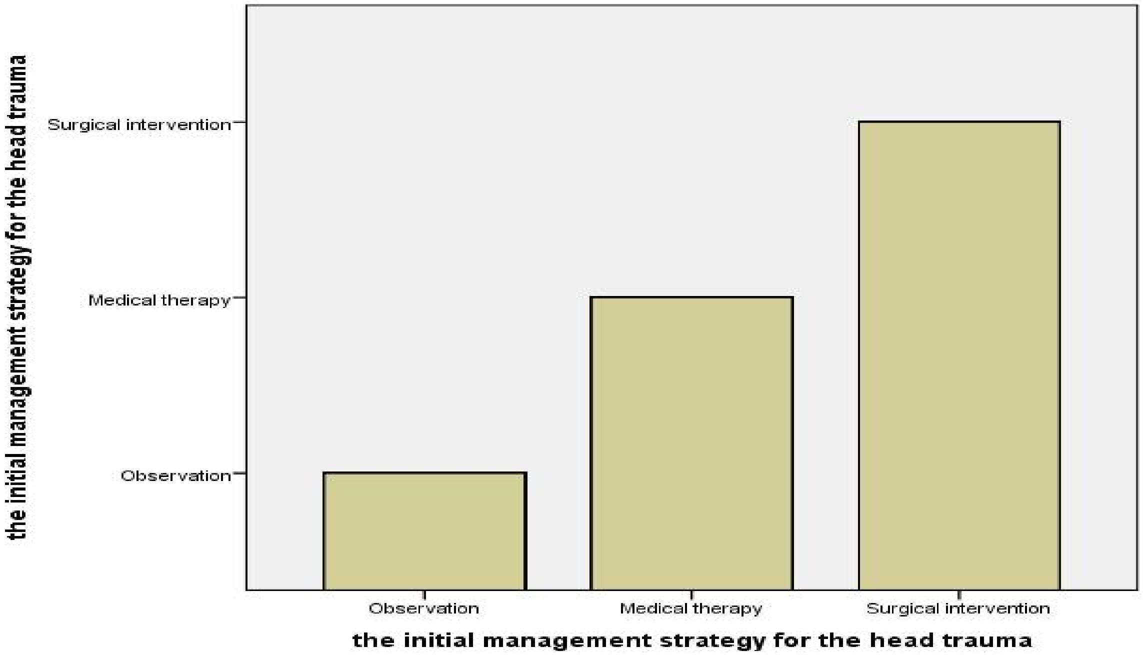

Figure 4. 11: Initial management strategy for the head trauma

4.12. Types of surgeries performed on patients with head trauma

Table 4.12 discusses the operations conducted on different patient with head injuries and the nature of the injury increases the level of understanding of the assessment made on the patients. From among 361 patients, different surgeries were performed, as there is a great variety of TBI management requirements. The types of surgeries are outlined below: The types of surgeries are outlined below:

A total of 43 patients (11. 9%) had craniotomy done to them which is an operation that requires the surgeon to remove a portion of the skull bones to access the brain. The most common application of this surgery is to drain out blood clots (hematomas) or to repair a damaged part of the brain or to relieve pressure within the skull. Craniotomy is mainly used in conditions such as intracranial hemorrhage and contusion which is likely to worsen the patient's neurological state (Bullock *et al*., 2006). Craniotomy, a procedure in which a piece of the skull is removed in order to decrease intracranial pressure (ICP) was performed in thirty-three patients (9. 1%). This procedure is mostly done for patients with raised intra cranial pressure or brain oedema that does not yield to conservative management. Decompressive craniotomy is a potentially beneficial procedure in victims with severe TBI but comes at some cost; it also possesses possible long-term effects (Hutchinson *et al*., 2016).

Decompressive surgery was done at 22 (6. 1%) patients. This term most commonly applies to actions that are taken to reduce intracranial pressure such as, for example, decompressive craniotomy. They are useful in cases with the signs of herniation or massive effect from the hematomas or brain edemas, preventing additional unfavorable outcomes for the patient's neurological state (Cooper *et al*., 2011). Evacuation of a hematoma was performed in fifteen patients (4. 2%). It involves the use of surgery to evacuate hematomas

which are intracerebral or intracranial hematomas. Early removal of hematomas, for instance, epidural or subdural hematomas – is essential to avoid enlargement of a lesion and secondary brain injury (Bullock *et al*., 2006).
Skull fracture was another condition which 11 patients (3. 0%) required surgery to have it fixed. Surgery is required in depressed skull fracture if the foramen magnum has been breached, or if there is a brain injury in the area of the fracture. This process is all about preserving the life of the brain and most probably healing of the skull (Zachar, 2019). Six patients (1. 7%) had dural repair, which treats the torn or injured outermost layer of the tissues enveloping the brain and spinal cord called the dura mater. Skull fissures or surgeries can also cause dural tears, and result in cerebrospinal fluid leak, enhancement of infection and other related complications (Greenberg, 2019).
Shunt Placement: Four patients (1. 1%) underwent shunt placement that is the process of placing a shunt to manage hydrocephalus by holding cerebrospinal fluids in place. This intervention is quite important when one is trapped in a situation whereby the presence of excessive fluid is leading to raised intracranial pressure and pressure on some important structures of the brain such as the brainstem (Poca & Sahuquillo, 2005). The majority of patients that infected with TB did not need surgery it means 227 patients (62. 9%). This group most probably comprised patients with less severe injuries that would require little intervention such as observation, medical treatment or less aggressive interventions.
The cumulative percentages are a hundred percent; it will be noted that majority of patients 62. 9 percent require no surgery. However, among those who did need surgery craniotomy (11. 9%) and craniotomy (9. 1 %). These results also have underlined the variability of the head trauma and the need to choose a particular surgical strategy to get the best outcomes in therapy.

Table 4. 12: Type of surgery required

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	craniotomy	43	11.9	11.9	11.9
	craniotomy	33	9.1	9.1	21.1
	decompressive surgery	22	6.1	6.1	27.1
	evacuation of hematoma	15	4.2	4.2	31.3
	repair of skull fracture	11	3.0	3.0	34.3
	Dural repair	6	1.7	1.7	36.0
	shunt placement	4	1.1	1.1	37.1
	no need for surgery	227	62.9	62.9	100.0
	Total	361	100.0	100.0	

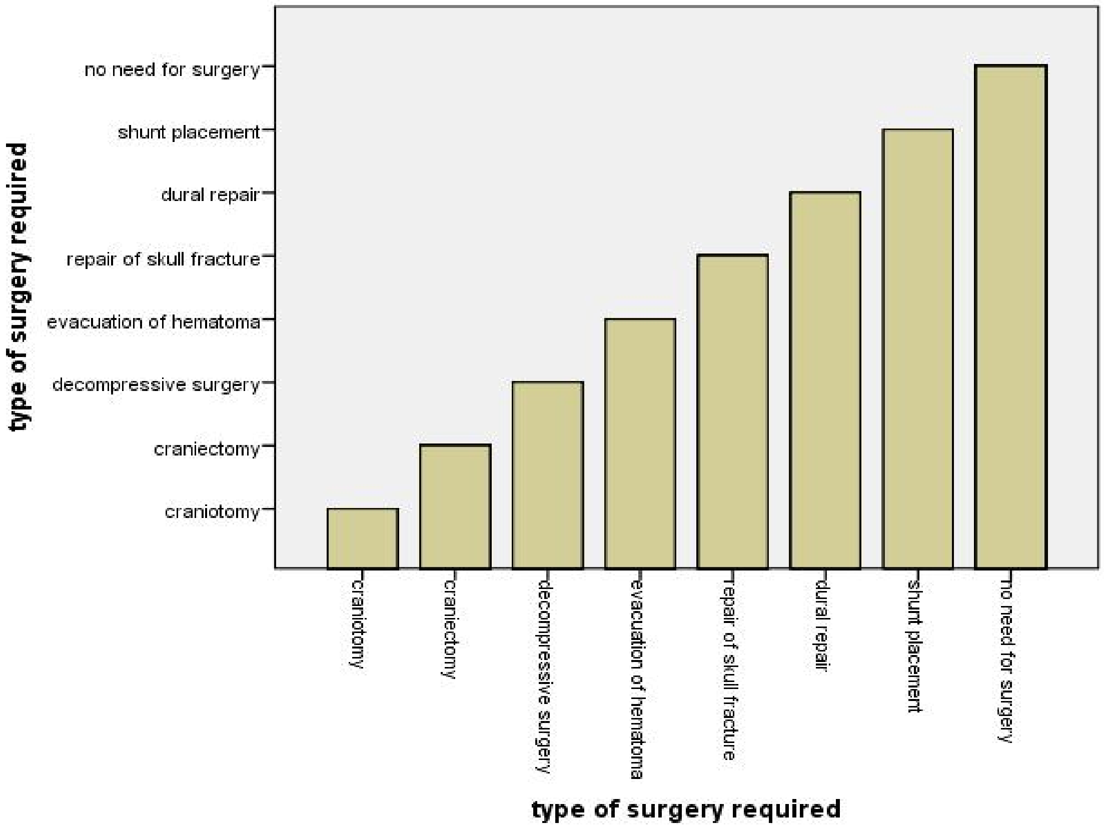

Figure 4. 12: Type of surgery required

4.13. Conclusion

In present investigation, it was noted that 28% of studied participant were facing linear fractures while 19.7% and 18.3% were found facing non-depressed and depressed fractures, respectively. Out of these 361 patients, 59.6% experienced loss of consciousness after road traffic accident. Moreover, a fair majority of the participants (65.1%) suffered a mild duration of unconsciousness while 24.9% faced moderate unconsciousness duration. It was further noted that GCS scores showed that 37.7% patients had mild injuries, 32.7% met moderate injuries while the remaining 29.6% faced severe head injuries. ICH detection was also questioned in this study and imaging revealed that 24.7% participants showed signs of IHC while the others did not show any related signs.

Evidence of raised intracranial pressure requiring interventions was exhibited at 25.2% of patients, while 74.8% did not require any such intervention. A small number of participants (19.9% only) were in need of intubation of mechanical ventilation because of their injuries and 28.3% responded that they faced head injuries while they were walking while the others were having different circumstances. Regarding management strategies, the most common one was observation, followed by surgical intervention and medical therapy (50.4%, 29.6% and 19.9%, respectively). In present study, the participants were asked about different types of strategies performed. Out of the selected participants, 11.9% underwent craniotomy, 9.1% were undergone through craniectomy, and only 1.1% were processed through shunt placement which was very rare. It was also noted that 62.9% of head injury patients did not require any surgery.

CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

This study highlights the significant burden of traumatic brain injuries (TBI) resulting from road traffic accidents (RTAs) in a developing country setting. The findings indicate that TBIs are predominantly observed in male patients, with pedestrians showing a higher incidence of injury. The diverse injury types and the need for varied management strategies emphasize the complexity of treating head trauma. The high rate of loss of consciousness and the occurrence of intracranial hemorrhages underscore the critical need for timely diagnosis, often through imaging, and tailored intervention to mitigate long-term consequences. The results advocate for improving public awareness of road safety measures and enhancing healthcare infrastructure to support effective management and improve outcomes for patients with head injuries. This study provides valuable insight into the epidemiological patterns of RTAs and their consequences, serving as a foundation for further research and policy development aimed at reducing the incidence and severity of TBIs in low- and middle-income countries.

5.2. Recommendations

Based on the findings of the present investigation, several key recommendations can be made to enhance the management and outcomes of head trauma patients:

Given that a significant proportion of patients experienced linear fractures (28%), non-depressed fractures (19.7%), and depressed fractures (18.3%), it is crucial to implement comprehensive fracture management protocols. For patients with linear and non-depressed fractures, conservative management and close monitoring may suffice, whereas those with depressed fractures may require more aggressive intervention to prevent complications. Enhanced training for emergency personnel on the identification and management of these fracture types can improve patient outcomes.

The high incidence of loss of consciousness (59.6%), particularly with mild durations (65.1%), underscores the need for timely and effective assessment upon presentation. The Glasgow Coma Scale (GCS) results highlight a substantial portion of patients with moderate to severe head injuries (62.3%). It is recommended that initial assessments include thorough GCS scoring to guide immediate management and triage. Imaging studies revealing intracranial hemorrhage (24.7%) and raised intracranial pressure (25.2%) point to the importance of prompt imaging and continuous monitoring. Institutions should ensure that protocols for rapid imaging and assessment are in place to detect and manage these critical conditions early. Furthermore, the relatively low rate of intubation and mechanical ventilation (19.9%) suggests that a majority of patients can be managed conservatively, emphasizing the need for tailored intervention strategies based on individual patient needs.

The predominance of observation (50.4%) as a management strategy, with a significant number undergoing surgical interventions (29.6%), indicates a need for further refinement of management protocols to balance observation and intervention effectively. Establishing clear criteria for surgical intervention versus conservative management can optimize resource use and patient outcomes. Lastly, the finding that 62.9% of patients did not require surgery reinforces the value of non-invasive management options. Continued research into less invasive treatment methods and improved diagnostic tools can further reduce the need for surgical interventions and enhance overall care for head trauma patients.

Implementing these recommendations could improve the quality of care, optimize resource utilization, and enhance patient recovery in head trauma cases.

REFERENCES

Aiken, A. H., Smith, K. J., & DeLone, D. R. (2013). Craniofacial Trauma: Analysis of Fracture Patterns and Management. Clinics in Plastic Surgery, 40(1), 29-41.

Ali, M., Ali, L., & Roghani, I. S. (2003). Surgical management of depressed skull fracture. *Journal of Postgraduate Medical Institute*, *17*(1).

Ali, M., Khan, Y., & Khan, H. (2008). Complications of cerebrovascular accident in two tertiary care hospitals of Peshawar, Pakistan.

Ashraf, N., Shah, K., Muhammad, S., Kamal, A., & Siraj, A. (2022). Pattern of motorcycle related maxillofacial injuries in patients presenting to a tertiary care hospital in Pakistan: A cross-sectional study. *Journal of Khyber College of Dentistry*, *12*(1), 67-70.

Balestreri, M., Czosnyka, M., Hutchinson, P., Steiner, L. A., Hiler, M., Smielewski, P., & Pickard, J. D. (2004). Impact of intracranial pressure and cerebral perfusion pressure on severe disability and mortality after head injury. Neurocritical Care, 1(1), 129-136.
Bazarian, J. J., Blyth, B., & Cimpello, L. (2010). Sex differences in outcome after mild traumatic brain injury. Journal of Neurotrauma, 27(3), 527-539.
Borg, J., Holm, L., Cassidy, J. D., Peloso, P. M., Carroll, L. J., von Holst, H., & Ericson, K. (2004). Diagnostic procedures in mild traumatic brain injury: results of the WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury. Journal of Rehabilitation Medicine, 36(43), 61-75.
Bornstein, M. H., Jager, J., & Putnick, D. L. (2013). Sampling in Developmental Science: Situations, Shortcomings, Solutions, and Standards. Developmental Review, 33(4), 357–370.
Broderick, J. P., Adeoye, O., & Elm, J. (2007). Head trauma: Imaging and outcome. New England Journal of Medicine, 357(16), 1632-1633.
Bullock, M. R., Chesnut, R., Ghajar, J., Gordon, D., Hartl, R., Newell, D. W., ... & Wilberger, J. (2006). Surgical management of traumatic brain injury. Neurosurgery, 58(Supplement_3), S2-6.
Carney, N., Totten, A. M., O'Reilly, C., Ullman, J. S., Hawryluk, G. W., Bell, M. J., ... & Ghajar, J. (2017). Guidelines for the management of severe traumatic brain injury, fourth edition. Neurosurgery, 80(1), 6-15.
Carroll, L. J., Cassidy, J. D., Holm, L., Kraus, J., & Coronado, V. G. (2004). Methodological issues and research recommendations for mild traumatic brain injury: the WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury. Journal of Rehabilitation Medicine, 36(43), 113-125.
Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2011). Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences. Routledge.
Cooper, D. J., Myles, P. S., McDermott, F. T., Murray, L., Laidlaw, J., Cooper, G., ... & Wolfe, R. (2004). Prehospital hypertonic saline resuscitation of patients with hypotension and severe traumatic brain injury: a randomized controlled trial. JAMA, 291(11), 1350-1357.
DeMatteo, C., Dismuke, S., & Hwang, D. (2011). The Glasgow Coma Scale and its use in trauma care. Journal of Trauma and Acute Care Surgery, 70(1), 139-144.
Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of Convenience Sampling and Purposive Sampling. American Journal of Theoretical and Applied Statistics, 5(1), 1-4.
Faul, M., Xu, L., Wald, M. M., & Coronado, V. G. (2010). Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations, and Deaths. Centers for Disease Control and Prevention (CDC).
Formisano, R., Bivona, U., Brunelli, S., Giustini, M., Longo, E., & Taggi, F. (2005). A preliminary investigation of road traffic accident rate after severe brain injury. *Brain injury*, *19*(3), 159-163.
Greenberg, M. S. (2019). Handbook of Neurosurgery. Thieme.
Haines, D. E. (2013). Fundamentals of Neuroanatomy for Rehabilitation. Elsevier Health Sciences.
Hameed, H., Ayub, S., & Begum, F. (2023). Role of repeat CT scan brain in mild to moderate head injury. *BMC Journal of Medical Sciences*, *4*(2), 34-37.
Haroon, A., Wahid, G., Samad, M., ur Rehman, Z., & Khan, M. M. (2016). IMPACT OF POST OPERATIVE CT ON THE DECISION OF A NEUROSURGEON IN CASE OF TRAUMATIC HEAD INJURY. *KJMS*, *9*(3), 354.
Hayatabad Medical Complex. (2023). About Us. [Link to the hospital's official website or publication].
Helmy, A., Stovell, M. G., & Menon, D. K. (2007). Traumatic brain injury: An overview of pathobiology with emphasis on changes in microcirculation. Brain Pathology, 17(3), 308-317.
Hollis, S., & Campbell, M. J. (2021). Methodology of clinical research: Principles and practices. Springer.
Hu, K., Du, H., & Gu, J. (2016). A review of radiographic features of skull fractures in trauma patients. Radiology Research and Practice, 2016.
Hutchinson, P. J., Kolias, A. G., Timofeev, I. S., Corteen, E. A., Czosnyka, M., Timothy, J., ... & Anderson, P. J. (2016). Decompressive craniectomy for traumatic intracranial hypertension. New England Journal of Medicine, 375(12), 1119-1130.

Hyder, A. A., Wunderlich, C. A., Puvanachandra, P., Gururaj, G., & Kobusingye, O. C. (2007). The impact of traumatic brain injuries: a global perspective. NeuroRehabilitation, 22(5), 341-353.

Jaber, S., Jung, B., & Sebbane, M. (2010). Intubation and ventilation in traumatic brain injury patients. Intensive Care Medicine, 36(3), 413-414.

Kadam, P., & Bhalerao, S. (2010). Sample size calculation. International Journal of Ayurveda Research, 1(1), 55–57.

Khan, H., Rajar, I., Memon, A. R., Naeem, N., & Haque, Z. U. (2019). Etiology and Surgical outcome of chronic Subdural hematoma at Tertiary Care Hospital. *The Professional Medical Journal*, *26*(12), 2156-2161.

Khan, M., Yaqoob, U., Hassan, Z., & Uddin, M. M. (2020). Immediate Outcomes of Traumatic Brain Injury at a Tertiary Care Hospital Of Pakistan-A Retrospective Study.

Khan, M., Yaqoob, U., Hassan, Z., & Uddin, M. M. (2021). Emergency Department Referral Profile of Traumatic Brain Injury Records at a Tertiary Care Hospital of Pakistan. *Updates in Emergency Medicine*, *1*(1), 21-27.

Kumar, A., Lalwani, S., Agrawal, D., Rautji, R., & Dogra, T. D. (2008). Fatal road traffic accidents and their relationship with head injuries: An epidemiological survey of five years. *Indian journal of neurotrauma*, *5*(02), 63-67.

Leijdesdorff, H. A., van Dijck, J. T., Krijnen, P., Vleggeert-Lankamp, C. L., Schipper, I. B., & Regional Trauma Center West-Netherlands' Research Group. (2014). Injury pattern, hospital triage, and mortality of 1250 patients with severe traumatic brain injury caused by road traffic accidents. *Journal of neurotrauma*, *31*(5), 459-465.

Levin, H. S., Gary, H. E., Eisenberg, H. M., Ruff, R. M., Barth, J. T., Kreutzer, J., & High Jr, W. M. (2001). Neurobehavioral outcome 1 year after severe head injury. Experience of the Traumatic Coma Data Bank. Journal of Neurosurgery, 73(5), 699-709.

Levin, K. A. (2006). Study design III: Cross-sectional studies. Evidence-Based Dentistry, 7(1), 24–25.

Maas, A. I., Menon, D. K., Adelson, P. D., Andelic, N., Bell, M. J., Belli, A., ... & Manley, G. T. (2017). Traumatic brain injury: integrated approaches to improve prevention, clinical care, and research. The Lancet Neurology, 16(12), 987-1048.

Mann, C. J. (2003). Observational research methods. Research design II: cohort, cross sectional, and case-control studies. Emergency Medicine Journal, 20(1), 54–60.

Mayer, A. R., Dodd, A. B., & Wu, T. (2017). Imaging in head trauma: A review. Journal of Neurotrauma, 34(10), 1885-1892.

Mayer, S. A., Rincon, F., & Sacco, R. L. (2012). Intracranial hemorrhage. Lancet Neurology, 11(2), 105-116.

McCrory, P., Meeuwisse, W. H., Aubry, M., Cantu, R., Dvořák, J., Echemendia, R. J., ... & Turner, M. (2017). Consensus statement on concussion in sport—the 5th International Conference on Concussion in Sport held in Berlin, October 2016. British Journal of Sports Medicine, 51(11), 838-847.

Middleton, P. M. (2012). Practical use of the Glasgow Coma Scale; a comprehensive narrative review of GCS methodology. Australasian Emergency Nursing Journal, 15(3), 170-183.

Noman, M. A., Khattack, A. U., & Ayub, S. (2013). To Study the Factors of Favorable Clinical Outcome of Traumatic Brain Injury Due to Firearm. *Pakistan Journal Of Neurological Surgery*, *17*(1), 47-50.

Peden, M., Scurfield, R., Sleet, D., Mohan, D., Hyder, A. A., Jarawan, E., & Mathers, C. (2004). World report on road traffic injury prevention. World Health Organization.

Poca, M. A., & Sahuquillo, J. (2005). Short-term and long-term outcome in hydrocephalus management. Neurosurgery Clinics of North America, 16(3), 415-427.

Rehman, L., & Karachi, N. J. (2010). Association of outcome of traumatic extradural hematoma with Glasgow Coma Scale and hematoma size. *Ann Pak Inst Med Sci*, *6*(3), 133-138.

Rehman, Z., Khan, M. M., & Ayub, S. (2018). Factors predicting early outcome of acute subdural haematoma: Our experience. *KJMS*, *11*(2), 285.

Roozenbeek, B., Maas, A. I., & Menon, D. K. (2013). Changing patterns in the epidemiology of traumatic brain injury. Nature Reviews Neurology, 9(4), 231-236.

Rosenfeld, J. V., Maas, A. I., Bragge, P., Morganti-Kossmann, M. C., Manley, G. T., & Gruen, R. L. (2012). Early management of severe traumatic brain injury. The Lancet, 380(9847), 1088-1098.

Rubin, M. A., & Adams, R. D. (2012). Fractures of the Cranial Vault. In Adams and Victor's Principles of Neurology, 10th Edition.

Saatman, K. E., Duhaime, A. C., Bullock, R., Maas, A. I., Valadka, A., & Manley, G. T. (2008). Classification of traumatic brain injury for targeted therapies. Journal of Neurotrauma, 25(7), 719-738.

Setia, M. S. (2016). Methodology Series Module 3: Cross-sectional Studies. Indian Journal of Dermatology, 61(3), 261–264.

Siddique, U., Gul, H., Nawab, K., Roghani, I. S., Afridi, Z., & Dawar, N. A. (2016). Intracranial Hemorrhage In Patients With Head Trauma On Computed Tomography Scan. *Pakistan journal of Radiology*, *26*(3).

Smith, D., & Hill, D. (2014). The role of CT and MRI in traumatic brain injury. American Journal of Roentgenology, 203(3), 632-641.

Stiell, I. G., Clement, C. M., Rowe, B. H., Schull, M. J., Brison, R., Cass, D., ... & Holroyd, B. (2005). Comparison of the Canadian CT Head Rule and the New Orleans Criteria in patients with minor head injury. JAMA, 294(12), 1511-1518.

Stocchetti, N., Citerio, G., & Oddo, M. (2012). Intracranial pressure monitoring in traumatic brain injury. Lancet Neurology, 11(9), 833-841.

Stocchetti, N., Penny, K., Dearden, M., Braakman, R., Cohadon, F., Iannotti, F., ... & Karimi, A. (2005). Intracranial pressure monitoring in severe head injury: Why, when and for whom? Acta Neurochirurgica Supplementum, 95, 3-5.

Tariq, M., Mian, M. A., Filza, F., Ayub, S., Khan, S. D., & Jalal, K. (2021). Outcome of patients operated for depressed skull fracture with dural tear. *Pakistan Journal of Neurological Surgery*, *25*(2), 126-133.

Teasdale, G., & Jennett, B. (1974). Assessment of coma and impaired consciousness: A practical scale. The Lancet, 304(7872), 81-84.

Vaca, F. E., & Anderson, C. L. (2014). Motor vehicle trauma and safety. Emergency Medicine Clinics of North America, 32(4), 1011-1030.

World Health Organization. (2018). Global status report on road safety 2018. World Health Organization.

Yaqoob, U., Javeed, F., Rehman, L., Pahwani, M., Madni, S., & Muizz-ud-Din, M. Emergency Department Outcome of Patients with Traumatic Brain Injury: A Cross-sectional Study from Pakistan.

Zachar, J. J. (2019). Management of Depressed Skull Fractures. In M. S. Greenberg, Handbook of Neurosurgery (pp. 539-540). Thieme.