OCULAR MANIFESTATIONS IN PATIENTS WITH HEAD INJURY AT THE NEURO-SURGERY DEPARTMENT OF MUHIMBILI ORTHOPEDIC INSTITUTE.

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Mmed (Ophthalmology) Dissertation
Muhimbili University of Health and Allied Sciences
December, 2021.

Muhimbili University of Health and Allied Sciences

Department of Ophthalmology

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By

Rashid K. Mohamed,

A Dissertation Submitted in (Partial) Fulfillment of the Requirements for Degree of Master of Medicine (Ophthalmology) of Muhimbili University of Healthy and Allied Sciences

December, 2021.

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Science a dissertation entitled: **'*Ocular manifestations in patients with head injury presenting at the neuro-surgery department* of *Muhimbili Orthopedic institute'*** in (partial) fulfillment of the requirement for the degree of Master of Medicine (Ophthalmology) of Muhimbili University of Health and Allied Science.

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Prof. Milka M Mafwiri

(Supervisor)

Date_____

_____

Dr John Kisimbi

(Co-supervisor)

Date_____

DECLARATION AND COPYRIGHT

I, **Dr. Rashid Karu Mohamed**, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

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ACKNOWLEDGEMENT

I would like to sincerely thank my supervisors, Prof. Milka Mafwiri and Dr John Kisimbi for their tireless efforts in providing guidance throughout the preparation to the finalization of this dissertation. I would like also to thank the Heads of Ophthalmology department both for Muhimbili National Hospital (MNH) and Muhimbili University of Health and Allied Sciences (MUHAS), Dr Paul Nyaluke and Dr Celina Mhina respectively for their inputs and encouragement during the whole duration of my postgraduate studies. I am also truly grateful to all my teachers, for the guidance they provided and all Ophthalmology and Neuro-surgery staff at MNH and MOI for their assistance and support.

I would like to acknowledge the sacrifice that my wife, children and my mother had to make and their endless support during the years spent to make this study and entire course possible.

I'm foremost grateful to the Almighty God for standing by me and giving me the capability to accomplish this study.

DEDICATION

To my loving mother, Mrs. Adoy somo Abdi, for her endless love, support and prayer.

ABSTRACT

Background

Head injury refers to any alteration in mental or physical functioning relating to a blow to the head. It may be associated with ocular abnormalities such as ocular adnexal and internal structures injuries, globe injuries, neuro-ophthalmic abnormalities and orbital wall fractures. The eyes are frequently affected in head trauma due to their proximity to the head as well as the neural connections between the eye and the brain. The leading causes of head injuries are motor traffic accidents, assaults and fall from a height among others. Currently in Tanzania, there is an escalated number of motor cycles use among young adults as a source of employment. This has led to corresponding increase in road traffic accidents and significant numbers of patients with head injuries. Early recognition and intervention of ocular involvement can prevent devastating effect of visual disability and improve overall rehabilitations of the patient after head trauma.

Aim

The aim of the study was to assess ocular manifestations among patients with head injuries at Muhimbili Orthopedic Institute.

Methodology

This was a hospital based descriptive cross-sectional study among adult patients who were admitted at the neuro-surgery department at Muhimbili Orthopedic Institute (MOI) between October 2019 and January 2020.

Ethical approval for the study was obtained from the Research and Publication committee of Muhimbili University of Health and Allied Sciences. Permission to conduct the study was obtained from the executive director of Muhimbili Orthopedic Institute.

Consecutive sampling technique was employed and data was collected through history taking and ophthalmological assessment. All data were captured in the study questionnaire then analyzed using the Statistical Package for Social Sciences (SPSS) version 23. Data was presented as frequency tables/histogram. Chi squared test was used to compare differences between variables and p values of less than 0.05 was considered significant.

Results:

A total of 167 patients were included in the analysis. There were 147(82%) males and 30 (18%) females giving a male to female ratio of 5:1. The age range was from 18 to 59 years with a mean of 24.68 years. The commonest causes of head injury were road traffic accidents and assault which involved 117 (70.1%) and 29 (17.4%) patients respectively. Others were falls from height 11 (6.6%), domestic accidents 9 (5.4%) and sports at 1 (0.6%). Ocular abnormalities after head injury were found in 117 (70%) patients and it involved a total of 234 eyes. More than 30% of patients had visual threatening ocular involvement. The most common ocular presenting feature were ocular adnexae lid ecchymosis which occurred in 51 (22%) eyes.

Conclusion and recommendation.

A significant proportion of patient (70%) with head injury had ocular manifestations. These manifestations involved the globe, adenexae, anterior and posterior segment structures.

It is recommended that every patient with head injury should also be examined for eye injuries by an ophthalmologist along with routine management for head injury by neurosurgeon.

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CT Scan	Computer Tomography scan
GCS	Glasgow Coma Scale
LE	Left Eye
MNH	Muhimbili National Hospital
MOI	Muhimbili Orthopedics Institute
MRI	Magnetic Resonance Imaging
MUHAS	Muhimbili University of Health and Allied Sciences
MTA	Motor traffic accident
RE	Right Eye
USA	United States of America

DEFINITION OF TERMS

Amnesia: is a deficit in memory caused by brain damage, disease, or psychological trauma

Anterior segment: Anterior third of the eye that includes the structures in front of the vitreous humor; the cornea, anterior chamber, iris, ciliary body and lens**.**

Cataract: is a clouding of the lens in the eye which leads to a decrease in vision.

Chemosis: is the swelling (or edema) of the conjunctiva. It is due to the oozing of exudate from abnormally permeable capillaries.

Commotio retinae: traumatic disorganization of retinal photoreceptors and milky edema in the posterior pole;

Ecchymosis: It is an extravasation of blood in the thin layer of the skin that resulted from a rupture within the blood vessel causing the blood to leak into the layer of the skin.

Head injury: alteration in mental or physical functioning relating to a blow to the head**.**

Ophthalmoscope: An instrument used to view the posterior segment of the eye.

Papilloedema: is optic disc swelling that is caused by increased intracranial pressure due to any cause.

Posterior segment: Posterior two-thirds of the eye that includes the anterior hyaloid membrane and all of the optical structures behind it; the vitreous humor, retina, choroid and optic nerve.

Snellen chart: An eye chart used to measure visual acuity at a definite distance.

Slit lamp: An instrument consisting of a high-intensity light source and biomicroscope that can be used to examine the lids and anterior segment of the eye.

Traumatic Brain Injury (TBI): those in which there is evidence of involvement of the brain including concussion, loss of consciousness, post-traumatic amnesia, neurologic signs of brain injury or skull fractures.

Visual acuity: Sharpness of vision, measured by the ability to discern letters or numbers at a given distance according to a fixed standard.

CHAPTER ONE

INTRODUCTION

Head injury refers to any alteration in mental or physical functioning relating to a blow to the head. There is evidence of involvement of the brain including concussion, with loss of consciousness or post-traumatic amnesia, neurologic signs of brain injury or skull fractures (1). It includes open or closed head injuries resulting in impairments in cognition, language, memory, attention, reasoning, abstract thinking, judgement, problem-solving, sensory, perceptual and motor abilities and behavior, but it does not include brain injuries that are congenital, degenerative or induced by birth trauma (2). The terms traumatic brain injury and head injury are often used interchangeably. Head injury is an important public health problem (3). It is a common cause of death and major disabilities in trauma patients. After moderate to severe injury the disability is frequently characterized by a combination of physical and cognitive defects. The visual system is one of the systems frequently involved in head Injury. The eye is frequently involved in head trauma due to its proximity to the head as well as due to the neural connections between the eye and the brain (4).

Several theories have been proposed of how the eye is injured in head injuries. In penetrating brain injury, there may be physical damage to the ocular structures, visual pathway, visual cortex, and/or other vision-related structures of the brain. In non-penetrating or closed-head injury, displacement, stretching, and shearing forces may damage areas of the brain, including those associated with vision. Direct ocular trauma also contributes to the visual dysfunction in patients with head injuries (5).

Road traffic accidents, falls from height, assault and domestic accidents all account for a significant proportion of causes of head injuries (6,7). Such injuries affect the active and productive age group in their prime life. Neuro ophthalmologists and neuro-surgeons play essential roles in picking up the neuro ophthalmic signs in head injuries, not only to localize the lesion, but also to save the life of the patients and to predict the prognosis and the likely outcome. The assessment of such patients can be challenging and detailed examination may not be always possible in the acute setting (8).

Classification of Ocular manifestation of head injuries

Eye involvement in head injuries ranges from injuries to ocular adnexae, anterior and posterior segment, orbital fractures and neuro-ophthalmic manifestations (9).

Ocular adnexal injuries- These may include ecchymosis, lid laceration, sub conjunctival hemorrhage, chemosis and infectious conjunctivitis among others (7,10).

Anterior segment injuries- These may involve corneal epithelial defects, corneal laceration, scleral laceration, globe rupture, iris sphincter tears and traumatic cataract among others.

Posterior segment injuries- These may lead to vitreous hemorrhage, papilledema, traumatic optic neuropathy, retinal hemorrhages, retinal detachment, commotio retinae and choroidal rupture among others.

Orbital fractures- Any of the bones surrounding the eye can be fractured, or broken. These fractures can be orbital rim fracture, blowout fracture and orbital floor fracture (11).

Neuro- ophthalmic manifestations include:

Traumatic optic neuropathy- The optic nerve can be injured at different parts mainly from intra-orbital to intracranial portion or anywhere along its path. Traumatic optic neuropathy may result from different mechanisms including, indirect injury following injury to the frontal bone which causes transmission of forces to the optic canal resulting in contusion and necrosis of the optic nerve because the nerve sheath is tightly adherent to the bony canal (12).

Traumatic third nerve Palsy-Severe head trauma causes isolated oculomotor nerve palsy by direct or indirect mechanism. Direct oculomotor injury is caused by rootlet avulsion, fascicular injury or decreased blood supply following trauma (13). Injury to the nerve may also be associated with subarachnoid hemorrhage following trauma. Indirect injury can be caused by pressure on the third nerve by an expanding extradural or subdural hematoma.

Traumatic fourth nerve palsy- The Trochlear nerve is frequently involved in head injuries because it is the thinnest and longest intracranial nerve. The nerve is entirely motor in function and supplies only the superior oblique muscle of the eyeball (14).

Traumatic sixth nerve palsy- The abducens nerve is commonly vulnerable nerve to injuries due to its long extra cerebral intracranial course. The nerve supplies the lateral rectus muscles. Recovery following trauma may occur after 5- 8 months or sometimes

permanent paresis may result, a condition whose correction may require surgical squint correction. (15)

Traumatic chiasmal Syndrome- Trauma is a rare cause of chiasmal syndrome. Traumatic chiasmal syndrome is a rare cranial nerve injury syndrome seen following head injury, usually associated with anterior skull base fractures (16).

REVIEW OF LITERATURE

Magnitude of head injury

The magnitude of head injury in the developed world for instance in USA according to the study by Faul et al and data from Centre for disease control (CDC) indicate that each year 1.7 million people sustain head injuries. Between 3.2 and 5.3 million persons (1.1%-1.7% of US population) live with long-term disability from head injuries (17). In European Union approximately 7.7 million people who have experienced head injuries have disabilities and about 30-50% of these are associated with ocular and visual defects. In Germany a study by Langloise reported the incidence of head injuries to be 332 per 100,000 of the adult population per year (18).

Few studies that have been done in Africa including that of Ciuffreda KJ et al in South Africa, which showed the prevalence of head injury to be 316 cases per 100 000 per head of population per year (19).

The proportion of ocular manifestations among patients with head injuries.

In a study by Brahm et al in the USA, 75.4% of all inpatients with moderate to severe head injury had ocular involvement. Among the outpatients with mild head injury subjective ocular complaints were reported in 75.8 % (20). A study by Kulkarni et al which was conducted in London reported a higher prevalence of ocular involvement of 83.5% in closed head injury patients (21). The two studies showed very high proportions of ocular involvement in head injury. On the contrary, Kowal et al in study conducted in New Zealand found a lower ocular involvement in the range of 30-50% among closed head injury patients (14). Another study among 108 patients done by Rao kvm et al in India, found ocular manifestations in only 35.18% patients, among these, 63.15% had uni-ocular manifestations and 36.84% showed bilateral ocular manifestation (22). Falk et al noted that higher incidences of ocular findings are seen when ophthalmologists participate in the examination of patients with head injuries (23).

A few studies have been conducted in Africa and have shown varying proportions of ocular manifestations. A study among 225 patients which was conducted in Nigeria by Odebode et al, reported that ocular and visual complications were seen in 57(25. 3%)

patients with head injuries (7), while a study among 147 patients with head injuries conducted in Kenya by Masila et al reported that 101(68%) patients had ocular involvement (24). A study in Tanzania by Stanlaus et al showed a prevalence of ocular manifestation in patient with head injury at 65% (36).

Causes of head injuries

Head injuries result from several causes. In a study by Pelletier et al in United Kingdom on of assessment of ocular trauma associated with head and neck injuries, it was noted that road traffic accidents were the leading causes and severity of head injury was correlated directly to lack of proper seatbelt or helmet use (25). A study which was conducted in India by Rao KVM et al found similar trend that road traffic accidents were the commonest causes of head injury in 84% of patients. (22).

Studies in Africa also showed similar results where road traffic accidents were noted to be the commonest causes of head injury in majority of patients. In a study in Nigeria by Odebode et al noted that countries where traffic regulations and speed limits are not strictly observed and unlicensed careless driving is not punished, road accidents were noted as leading cause of head injuries (7). A study in Kenya by Masila et al found that the leading causes of head injury were road traffic accidents at (44.9%) and assaults at (42.2%) (24). A studies, conducted in Tanzania by Raspecious et al on factors associated with road traffic accident reported motorcycles as the leading cause of road traffic accident at 53.4% followed closely by motor vehicle at 42% and bicycles at 3.7% (26). Other study conducted at MUHAS by John Stanslaus et al on ocular trauma among head injury patient showed also road accident as the as the major cause of head injury at 68.2% (36).

Ocular manifestation of head injuries

Head injuries are commonly accompanied by ocular injuries. These injuries may involve ocular adnexa, anterior and posterior segment and neuro-ophthalmic abnormalities.

According to the study by Falk NS et al of the primary care optometric evaluation of the head injury patients in United Kingdom, ecchymosis and sub conjunctival hemorrhage were the commonest findings seen in the ocular adnexa. Corneal and scleral lacerations, traumatic cataract was frequently seen in the anterior segment. Posterior segment

manifestations included vitreous hemorrhage, retinal hemorrhage, retinal detachment, macular hole, and optic neuropathy (23).

In a study by Rao kvm Ratna et al in India the common neuro-ophthalmic manifestations found were pupillary abnormalities which were seen in 22 patients (57.89%) (22). Papilloedema was found to be the commonest neuro-ophthalmic manifestation in head injuries in a study by Odebode et al in Nigeria (7). A study by Kowal et al on ocular motor cranial nerve palsy motility disorders were the frequently encountered neuro-ophthalmic complications. In that study 70 of 164 patients with head injury had cranial nerve palsies, 16 of these had third nerve palsy, 38 had fourth nerve palsy and 16 had sixth nerve palsy. The cranial nerves are susceptible to injury because of their long course at the base of the skull (27).

A study in Africa that was conducted in Kenya by Masila et all found out that lid laceration, ecchymosis, subconjunctival hemorrhage, corneal epithelial defects, corneal laceration, scleral laceration, pupillary abnormalities, traumatic cataract were the most common anterior segment manifestations. In the posterior segment vitreous hemorrhage, papilledema, optic neuropathy, and retinal hemorrhage were found to be the most common findings. Optic neuropathy with relative afferent pupillary defect and oculomotor nerve palsy were other noted neuro-ophthalmic manifestations of head injuries in this study (24).

PROBLEM STATEMENT

Head injuries are among the most common types of trauma encountered in emergency departments on daily basis. In Tanzania and many developing countries there has been increase use of motor-cycles as a source of employment especially among youths in recent years. This coupled with substandard issuance of driving licenses and laxity in enforcing traffic rules among law enforcing agencies has led to surge in road traffic accident, a number of which cause head injuries. Studies have shown that the most common cause of head injury is road traffic accidents. However, violence, construction accident, and sports are other causes of traumatic head injury. (7)

The eye is frequently involved in head injury due to its proximity to the head as well as neural connections between the eye and the brain (22). The proportion of ocular involvement among patients with head injury differ from country to country as well as on the causes of injury. Ocular abnormalities are frequent manifestations of patients with head injuries. A number of potential visual impairing eye injuries may be missed during ocular examination in the acute phase of trauma. Examination like fundus examination is not easily performed during acute phase because of inflammation of different ocular structures and others injuries like vitreous hemorrhage which may obscure fundus examination so therefore retinal detachment and optic nerve avulsion may not be identified during this stage.

Early diagnosis of visual problems following head injury is essential to maximize the overall rehabilitation potential of patients with head injuries and prevent irreversible ocular and visual system abnormalities. There are many patients who sustain head injuries in Tanzania and specifically in Dar-es-Salaam, such patients are managed at the Muhimbili orthopedic Institute (MOI).

RATIONALE

The study would create awareness among health care providers at MOI and the Ophthalmology department on the common ocular manifestations among patients with head injuries through dissemination of the study report. Finding from the study would paved way for close inter departmental cooperation in terms of consultations regarding patients with head injury who are getting admitted in Muhimbili Orthopedic Institute (MOI). Results of this study would also formed a basis for further research on the spectrum of ocular injuries during head injuries.

CONCEPTUAL FRAMEWORK

Patients with head trauma require multidisciplinary team care. The care given depend on the nature and the types of injuries sustained by patients. The team may involve orthopedic surgeon, general surgeon, neurologists and ophthalmologist among others. All these specialist work hand in hand as a team to provide comprehensive care to these patients. The Ophthalmologist role is to identify ocular and visual pathway involvement in head injury and initiate appropriate management to prevent devastating impact of visual impairments which may hampers social, economic and academic development of an individual. Visual impairment and disability lead to increased dependence and impaired quality of life an individual (18).

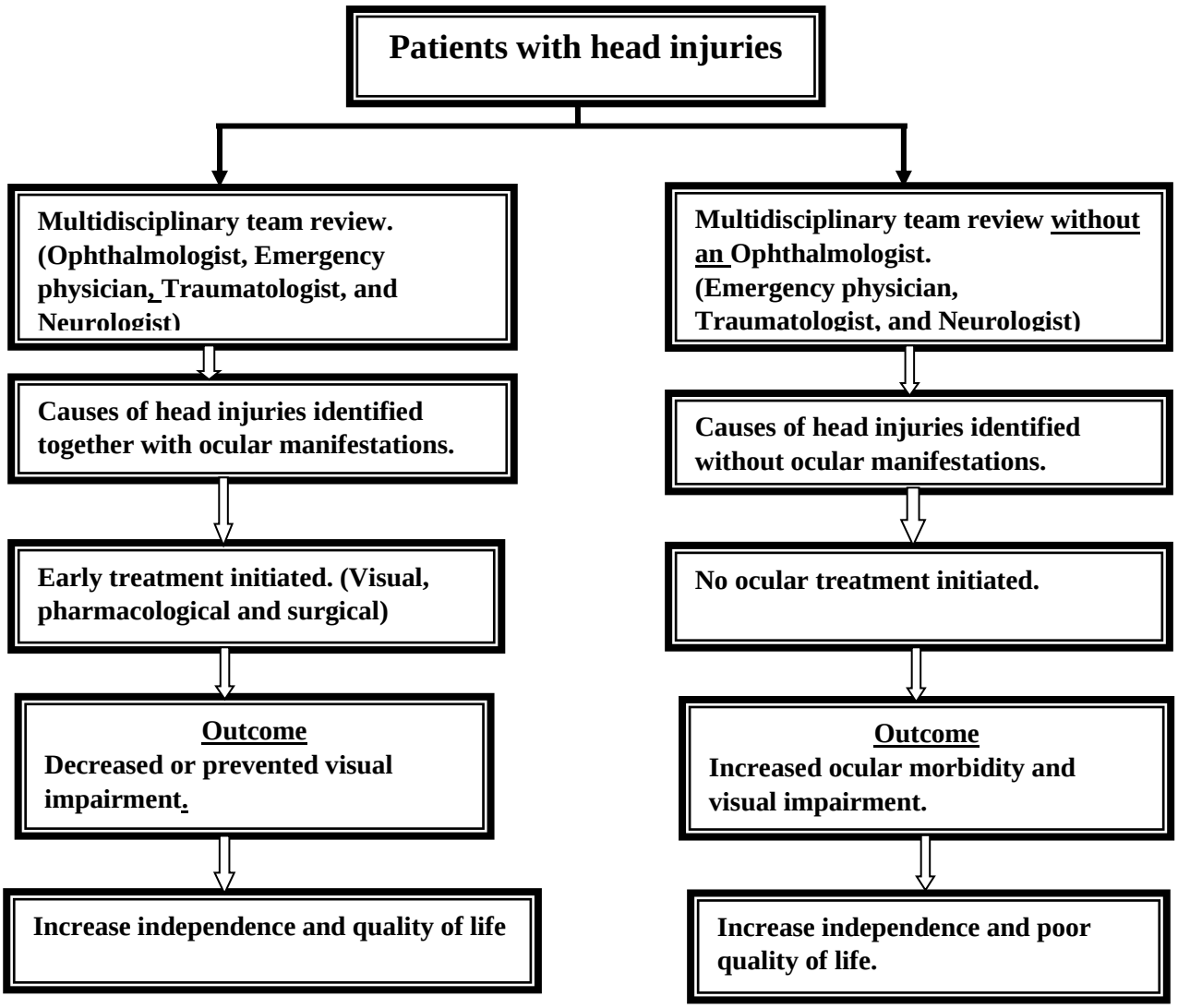

Figure 1: Conceptual Framework

REASERCH QUESTIONS

1. What is the proportion of patients with ocular manifestations among patients with head injury at neuro-surgery department in MOI?
2. What are the ocular manifestations of head injury according the causes among patients with head injury at neuro-surgery department in MOI?
3. What are the ocular manifestations of head injury according to the severity among patients with head injury at neuro-surgery department in MOI?

OBJECTIVES

BROAD OBJECTIVE

To assess ocular manifestations in patients with Head injury presenting at Neuro-surgery department at MOI.

Specific objectives

1. To determine the proportion of patients with ocular manifestations among patients with head injury.
2. To determine ocular manifestations in head injury according to causes among patients with head injury at neuro-surgery department in MOI.
3. To assess the ocular manifestations in head injury according to severity among patients with head injury at neuro-surgery department in MOI.

CHAPTER TWO

METHODOLOGY

Study design

This was a hospital based descriptive cross-sectional study.

Study area.

The study was conducted at the neuro-surgery department of MOI and the adult eye clinic at Muhimbili National Hospital (MNH). MOI is located within MNH area in Ilala district of Dar-es-Salaam, Tanzania. The institute provides tertiary care in traumatology and neurosurgery. The neuro-surgery department at MOI admits and conducts various clinics for patients with neurological and orthopedic disorders every day. On average twenty patients with head injury are treated at MOI per month. The eye clinic at MNH is equipped with all necessary eye equipment (slit lamps bio microscopy, direct and indirect ophthalmoscopes, tonometer and fundus camera) and provides tertiary services to patients suffering from eye conditions.

Study period.

The study was conducted from October 2019 to January 2020.

Study population

Adult patients who had sustained head injury within a week and admitted at the Neuro-surgery department at MOI during the study period.

Inclusion criteria

Patients diagnosed with head injury admitted at neuro-surgery department at MOI.

Exclusion criteria

1. Patients with history of pre-existing ocular comorbidity. These would falsely increase the proportion of ocular manifestation.
2. Patients who presented more than 1 week since sustaining injury.

Sampling technique

Consecutive sampling of all adult patients admitted at neuro-surgery with diagnosis of head injury during the study period. Consecutive sampling technique was used to recruit all adult patients admitted at MOI with a diagnosis of head injury during the study period until the sample size was reached.

Sample size estimation

The sample size was estimated using the calculation of sample size for prevalence studies as follows:

$n= [z2\ P\ (100\%-P)]\ /d2$

Where

n = required sample size

z= statistic value for the level of confidence (1.96)

P= expected prevalence in percentage

d= margin of error

From the study conducted in Nigeria by Odebode et al, Prevalence of ocular abnormalities in patients with head injuries was 25.3% (7).

z = 1.96,

d = 7%

$$\frac{[1.96^2 X 25.3 X\ (100-25.3)]}{7^2}$$

Thus the minimum sample size required was 148 patients.

STUDY VARIABLES

Independent variables

These was age, sex, address, occupation, laterality, duration of symptoms, Glasgow coma scale, visual acuity and ocular symptom

Dependent variables

Ocular manifestations considered as dependent variables are lid ecchymosis, chemosis, corneal abrasion, scleral laceration, vitreous hemorrhage, papilledema, retinal detachment and neuro ophthalmic features among others.

Study tools

1. A semi-structured questionnaire was used to collect data which consist of following parts.

(a) Baseline information which included the demographic characteristics of the study participants including patient's initials, age, gender, occupation, residency, and date of admission.

(b) Information relating to injuries/mechanisms and causes of injuries.

(c) Patients Glasgow coma scale

(d) Chief ocular complains.

(e) Details of ocular finding from ocular adnexia, anterior segment, posterior segment and neuro ophthalmic manifestation.

Ocular assessment involves inspection for evidences of soft tissue injury like oedema, laceration and ecchymosis of eyelids. Anterior segment findings include conjunctiva chemosis, cornea-sclera laceration, corneal abrasion, anterior chamber hyphema and crystalline lens opacification. Pupillary abnormalities were assessed and recorded. Additionally, posterior segment features including vitreous hemorrhage, vitreous detachment, macular edema, retinal detachment, retinal hemorrhage and optic disc changes are also contained in part (e) of the questionnaire.

(f) Extra-ocular motility test and diagnostic finding as per the Computer tomography (CT) and MRI scan.

2. Snellen's chart for literate, tumbling E and Landolt C charts for the illiterate was used to assess the VA.
3. A torch to assess for pupillary light reaction.
4. Intraocular pressure was measured by rebound tonometer/I care tonometry whenever necessary. It doesn't require use of slit lamp, staining or topical anesthesia.
5. Posterior segment examination was carried out using direct/indirect ophthalmoscope and +28D lense after pupil dilatation using cyclopentolate 1% and tropicamide 0.5% eye drops.

The questionnaire was pretested before on patients with head injury who were not included in the study before commencement of the study. All the equipment that was used for examination are routinely used in the department and are very reliable. The person using these instruments is competent individual who clearly understand how these instruments are working. The instruments are regularly serviced to ensure their reliability and also to enhance their life span generally.

Data collection procedure

All patients admitted in the neurosurgery department with a diagnosis of head injury that have been sustained within 1 week were informed about the study. Those who agreed to participate in the study were requested to sign a written informed consent form and were recruited in the study. The investigator recruited consecutively patients who fulfilled the required criteria. Patients were seen in the ward within the first 24 hours, information on the demographic data, causes of injury, and Glasgow coma scale were taken from case note as recorded by neuro-surgeon. All patients had their GCS determined during admission by neuro-surgeon to assess the severity of their head injury. The GCS is based on eye opening, verbal and motor responses to stimuli of different intensity. The patients were then reviewed for symptoms and signs of ocular trauma associated with head injury. The face and ocular adnexa were then inspected for features or facial asymmetry, facial swelling, adnexal wounds, hemorrhage and lacerations. Patients then underwent a through ophthalmic evaluation as follows:

Uncorrected and corrected (with pin hole) visual acuity was taken for conscious patients, using Snellen's chart for literate, tumbling E and Landolt C charts for the illiterate at distance of six meters from the point of fixation. Pupillary examination was performed using a pen touch to assess direct, consensual, and relative afferent pupillary defect (RAPD) light reflexes. Ocular motility was tested using a mobile fixation target to determine any extra ocular motility disorder wherever possible. This was then followed by assessment of the visual field using the confrontational visual test.

Slit lamp examination was done for ambulant subjects who could be evaluated in the ophthalmology clinic. In the clinic, the anterior segment was examined for corneal epithelial defects, haziness, and laceration, presence of hyphema, iris for tears and

synechia. The lens was assessed for presence or absence of lens opacity, subluxation and dislocation.

Posterior segment examination was done using 90D and/or 78D lenses on slit lamp, or with indirect ophthalmoscopy using +20D lenses after pupillary dilatation using cyclopentolate 1% or tropicamide 1% eye drops. Both eyes of each patient were evaluated for vitreous hemorrhage, retinal hemorrhage or detachment, optic disc for papilledema, disc hemorrhage and optic neuropathy.

Eleven bedridden patients could not be transferred to the eye clinic and were evaluated in the neurosurgery ward. Inspection, ocular examination with torch and indirect ophthalmoscopy were performed. Visual acuity was not taken in all patient who were in unconscious or confused. All the findings were ascertained by an experienced ophthalmologist before being recorded in the structured questionnaire. Patients found with ocular conditions were managed accordingly.

Review of CT scans or an MRI images and reports of all patients was done. The diagnosis reached after the imaging investigation were noted and recorded in the questionnaire. Patients on follow up clinic who were already recruited were removed from the sampling list to avoid double recruitment.

A nurse was used as a research assistant and was trained on recruiting patients with head injury, taking baseline information from caretakers by interview, retrieving patient's treatments records and organizing patients visit to the Ophthalmology clinic.

Data management

All collected data were treated with confidentiality and stored in locked cabinets, encrypted computers and was not to be revealed to anybody outside the research team. All questionnaires were checked for completeness before data is transferred.

Data analysis

The study data was transferred from the hand-written data forms into a data spreadsheet for analysis. The data was analyzed with the help of the statistical package for social sciences (SPSS) (version 23,) IBM LTD, Carolina, USA. Data was presented as frequency tables/histogram. Chi squared test was used to compare differences between variables. Ocular findings were associated with severity of head injury using Glasgow coma scale (GCS) and neurological findings using Chi square test of associations.

Ethical considerations

Ethical approval to carry out this study was obtained from the Research and Publication Committees of MUHAS on 19nd Augusts 2019. Permission to conduct the study in MOI was obtained from the Executive Director of MOI on 7th October 2019. The study was explained to the patients or caretakers who signed a written consent after agreeing to take part in the study. Those who refused to take part in the study were not penalized in anyway. All patient found with ocular manifestations were managed accordingly. All data collected was treated with strict confidentiality. Codes instead of names of patients were used. The study imposed no risk to patients.

CHAPTER THREE

RESULTS

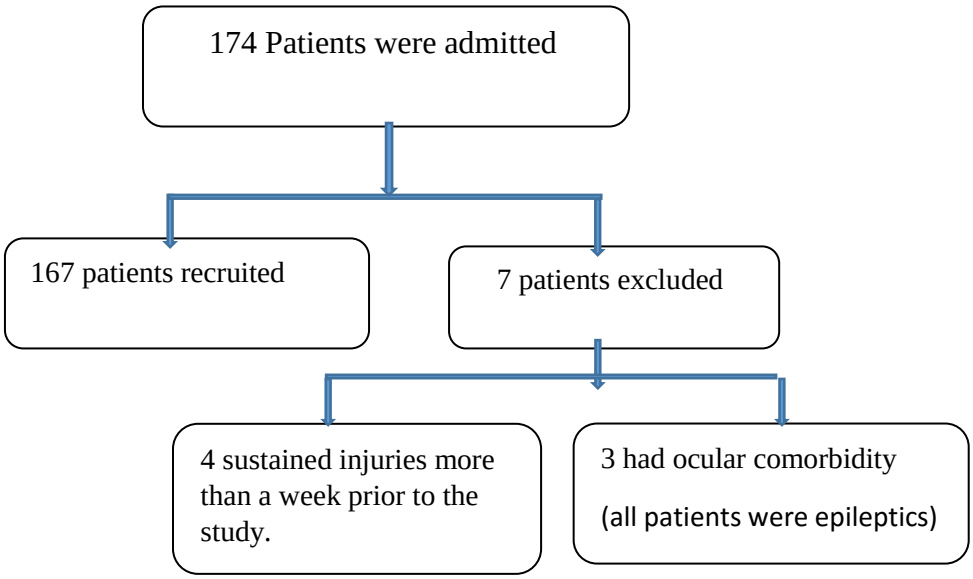

FIGURE 2: FLOW DIAGRAM OF STUDY PATIENTS

One hundred and seventy-four patients sustained head injury and all were admitted at neuro-surgery department during the study period. Seven patients were excluded. One hundred and sixty-seven patients were recruited for the study and were all included in the analysis.

TABLE 1: DEMOGRAPHIC CHARACTERISTICS OF STUDY PARTICIPANTS (N=167)

Characteristic	Category	Frequency	Percentage
Sex			
	Male	137	82%
	Female	30	18%
Age group (Years)			
	18-27	54	32.3%
	28-37	68	40.7%
	38-47	38	22.8%
	48+	7	4.2%
	Median (IQR)	30 (26, 38)	100.0

There were one hundred and thirty-seven (82%) male, thirty (18%) were female. The most frequently involved age group was between twenty-eight and thirty-seven

TABLE 2: CAUSES OF TRAUMA AMONG PATIENTS WITH HEAD INJURY.

Cause of injury	No(%)
RTA	117 (70.1)
Assault:	29 (17.4)
Fall from height	11 (6.6)
Domestic accident	9 (5.4)
Sports	1 (0.6)
Total	167 (100)

The commonest causes of head injury were road traffic accidents (70.1%) followed by assaults (17.4%).

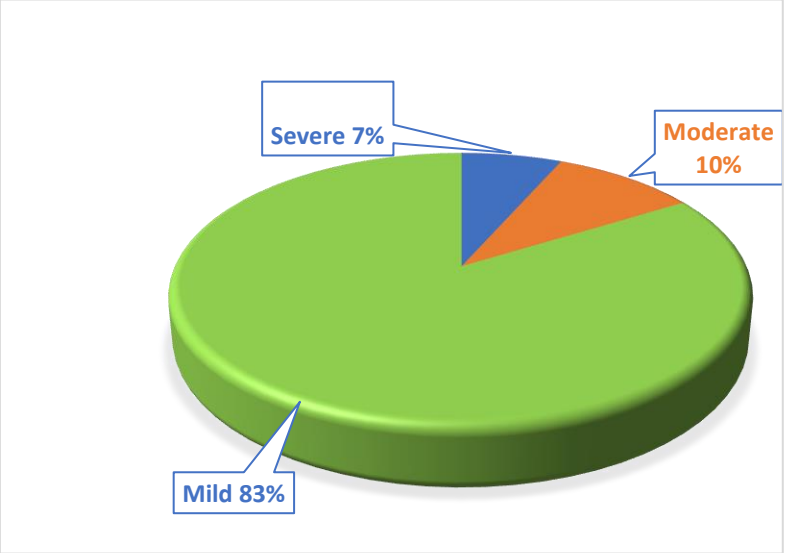

FIGURE 3: SEVERITY OF HEAD INJURY AS PER GCS

TABLE 3: OCULAR TRAUMA ACCORDING TO SEVERITY OF HEAD INJURY.

Severity of head injury	**Presence of ocular trauma**		**Total**
	YES No(%)	NO No(%)	
Mild	90(69)	39(31)	129(100)
Moderate	16(59)	11(41)	27(100)
Severe	9(81)	2(19)	11(100)
Total	117(70)	50(30)	167(100)

Ocular manifestations occurred in highest frequency among patient who had severe head injury (81%)

TABLE 4: PROPORTION OF PATIENTS WITH OCULAR MANIFESTATIONS BY SEX AND AGE

Ocular manifestation	Sex, n (%)			Age group, n (%)				
	Male	Female	Chi2 (P-value)	18-27	28-37	38-47	48+	Chi2 (P-value)
Yes	96(70.1)	21(70)	0.001(0.994)	43(79.6)	45(66.2)	24(63.2)	2(28.6)	3.716(0.294)
No	41(29.9)	9(30)		11(20.4)	23(33.8)	14(36.9)	5(71.4)	
Total	137(100)	30(100)		54(100)	54(100)	38(100)	7(100)	

The difference in the proportion of males and females with ocular manifestations was statistically insignificant with a p value of 0.9.

TABLE 5: BEST CORRECTED VISUAL ACUITY IN 266 EYES

Visual Acuity category		No (%)
6/6-6/18	Normal Vision	184 (69.1%)
<6/18-6/60	Visual Impairment	47 (17.6%)
<6/60-3/60	Severe Visual Impairment	32 (12%)
<3/60- NLP	Blind	3 (0.1%)
Total		266 (100%)

Visual Acuity was taken in one hundred and thirty-three patients (two hundred and sixty-six eyes). Majority of the eyes, 184 (69%) had normal vision while three were blind**.**

TABLE 6: OCULAR TRAUMA ACCORDING TO THE CAUSE OF HEAD INJURY.

Cause of head injury	Presence of ocular trauma		Total
	Yes	No	
Motor Traffic Accidents	87(74.3%)	30(25.6%)	117(100%)
Assault	19(72%)	10(28%)	29(100%)
Fall from height	6(54.5%)	5 (45.5%)	11(100%)
Domestic accident	3(33.3%)	6(66.7%)	9(100%)
Others(sports)	0(16.6%)	1(83%)	1(100%)
Total	115(69%)	52(31%)	167(100%)

Ocular trauma occurred in all causes of head injury. The highest frequency was reported in motor traffic accidents (74.3%), followed by assaults (72%).

TABLE 7: OCULAR MANIFESTATION IN PATIENTS WITH HEAD INJURY (N=234 EYES)

Ocular diagnosis	No of eyes.
Ocular adnexae	
Lid Ecchymosis	51 (22%)
Lid laceration	13 (5.5%)
Chemosis	20 (8.5%)
Sub-conjunctival hemorrhage	44 (19%)
Anterior segment	
Corneal Epithelial defect	18 (5.3%)
Scleral laceration	2 (0.8%)
Posterior segment	
Vitreous hemorrhage	4 (1.7%)
Papilloedema	12 (5.1%)
Optic neuropathy	6 (2,5%)
Retinal hemorrhage	9 (4%)
Macular Edema	3 (1.2%)
Neuro-ophthalmic	
Pupillary abnormalities	31 (13.2%)
3rd nerve palsy	3 (0.8%)
6th nerve palsy	2 (0.8%)
Orbital fractures	13 (4%)
Globe rupture	3 (5.5%)
Total	234 (100%)

The most common ocular manifestation among ocular adnexae, was lid ecchymosis which occurred in 51 (22%) eyes. In the anterior segment, corneal epithelial defects were the most frequent manifestation that occurred in 18 (5.3%) eyes.

TABLE 8: OCULAR MANIFESTATION ACCORDING TO SEVERITY OF HEAD INJURY.

Ocular manifestation	Severity of head injury			Total No(%)
	Mild No(%)	Moderate No(%)	Severe No(%)	
Ocular adnexae				
Lid Ecchymosis	35(68.6)	10(19.6)	11(21.5)	51(100)
Lid laceration	4 (30.7)	3(23)	6(46.5)	13(100)
Chemosis	11(55)	4(20)	5(25)	20 (100)
Sub-conjunctival hemorrhage	32(72.7)	10(22.7)	2(4.6)	44 (100)
Anterior segment				
Corneal Epithelial defect	5(27.7)	4(22.3)	9(50)	18 (100)
Scleral laceration	1(50)	1(50)	0(0)	2 (100)
Posterior segment				
Vitreous hemorrhage	0(0)	1(25)	3(75)	4 (100)
Papilloedema	0(0)	3(25)	9(75)	12 (100)
Optic neuropathy	0(0)	2(33.3)	4(66.7)	6 (100)
Retinal hemorrhage	0(0)	4(44.4)	5(33.4)	9 (100)
Macular Edema	0(0)	1(33.3)	2(66.7)	3 (100)
Neuro-ophthalmic				
Pupillary abnormalities	12(38.7)	4(12.9)	15(48.3)	31 (100)
3rd nerve palsy	0(0)	2(66.6)	1(33.4)	3 (100)
6th nerve palsy	0(0)	1(50)	1(50)	2 (100)
Orbital fractures	0(0)	5(38.4)	8(61.5)	13 (100)
Globe rupture	0(0)	1(33.3)	2(66.7)	3 (100)
Total	104(44.4)	50(21.3)	80(34.3)	234 (100)

Ocular manifestations were seen in all degrees of head injury with highest frequency (44.4%) occurring in mild head injury. However, vitreous hemorrhage, optic neuropathy, globe rupture and orbital fracture occurred only in moderate to severe injury head.

CHAPTER FOUR

DISCUSSION:

Head injury is an important public health problem in this error of high speed traffic and industrialization. Head injuries are usually associated with ocular manifestations that may or may not have the potential to impair vision. The aim of this study was to assess the ocular manifestations among patients with head injury.

This study has shown a significant number of the head injuries (82%) occurred in males compared to females (18%). Similar findings were reported in other studies (21, 25). Kulkarni (21) and Pelletier found 97% males and 3% females and 81% males and 19% females respectively. The higher number of males in the current study relate to the various outdoor activities that predisposed males to head injuries. More males operate motor vehicles and motor-cycles than females and thus are more vulnerable to motor traffic accidents that lead to head injuries. However, a study in Tanzania by Stanslaus et al reported no much differences in the incidences of ocular trauma between males and females, in which 64.4% of male and 69% of female had ocular trauma (36). The difference in gender between the two studies is due the fact that, currently a lot of young men are motor-cycling as an employment, leading to a lot of motor-cycle accidents**.**

The commonest affected age group in this study was between 28-37 years. Other studies (21) also showed similar finding. Kulkarni et (21) found young adult males (21–30 years) were more vulnerable to head injury. Odebodeet et al (7) showed 21–30 years as peak group for head injuries while Sharma et al. showed a peak during 21–40 years. (8). The vulnerability of this young age to head injuries is due to involvement of young males in risky occupations including motor-cycle riding and building and contraction where fall from the height is common.

The proportion of ocular involvement among patients with head injury differ from country to country as well as on the causes of injury. The eye is frequently involved due to its proximity to the head as well as due to the neural connections between the eye and the brain (22). In our study among all the head injury patients, 117 (70%) had ocular manifestation. This proportion is higher than in the previous study in Tanzania by Stanlaus et al which showed a prevalence of 65% (36). Our findings show that ocular manifestations

are commoner among patients injured through motor-traffic accidents. The increase in motor-traffic accidents has therefore increased the proportion of ocular manifestations in patients with head injury. The importance of reducing these accidents cannot be over-emphasized.

In our study motor traffic accident was the most frequent cause of head injury at 70%. Traffic accidents were responsible for the greater proportion of head injuries associated with ocular manifestations. In many series worldwide, traffic accident constitutes the leading cause of head injury which is shown in studies by Odebode, (7), Kulkarni (21), Masila (24) and Sabates (29). Motorized transportation has been on increase in recent years without a corresponding increase in road infrastructures and this has led to the increase in road traffic accidents. Higher numbers of motor vehicle accidents may also be due to unlicensed reckless driving that is often treated with laxity by some law enforcers even when they break traffic rules and regulations. Poor compliancy to safety rules and driving motorcycles without formal training were identified as commonest causes of motorcycle accidents in Morogoro region, in Tanzania in a study by Museru at et all (33).

This study showed ocular injuries are common finding in head injured patients. They occurred in all causes of head injury. The highest frequency was reported in motor traffic accident (74.2%) followed by assault (72%). They occur either because of direct trauma to the ocular structures or indirectly through injury to the ocular adnexae, anterior and posterior segments of the globe. In our study lid ecchymosis and sub conjunctival hemorrhage were the commonest findings seen in the ocular adnexae. Lid ecchymosis occurred in 18% in our study, which was comparable to 22%–27% in other studies. (6,7,10)

In the current study sixteen patients had corneal epithelial defects, while two had scleral laceration. The finding that corneal epithelial defect occurred frequently indicates the need for early ophthalmological review of affected patients. This is because if infected a corneal epithelial defect could end up with corneal ulcer that can either heal with a scar or perforates if not treated in time to impair vision or loss of an eye.

Posterior segment manifestations included vitreo-retinal hemorrhage and optic neuropathy among other findings. The 6 eyes found with optic neuropathy in the acute phase of injury

indicating the possibility of a pre-existing optic neuropathy. Endemic optic neuropathy is a common finding in young patients in Dar es Salaam (34). Pre-existing optic neurophy has been reported in previous studies. Moster et also reported traumatic optic neuropathy in 18% of patients (32). Traumatic optic nerve damage may result from direct trauma to the nerve as a result of mechanical compression from a fracture fragment or indirect damage from oedema or ischemia.

Among the neuro-ophthalmic features, pupillary abnormalities were the commonest observation at 12%. The eye and its adnexa are innervated by half of the cranial nerves, and 38% of all fibers in the central nervous system are concerned with visual function, so clinical findings of neuro- ophthalmological interest are frequently noted with head injury (30). Pupillary signs including size, and reaction to light are of grave importance in indicating the site and severity of injury and in the prognosis of head injury. pupillary manifestations could also indicate optic neuropathy that could slowly progress to optic atrophy and visual impairment. It is important to ascertain and manage optic neuropathy in time to prevent progression to optic atrophy. An early ophthalmological review is indicated for this. Patients should not wait until they have been discharged to have an ophthalmological evaluation.

The study showed 5 patients who presented with traumatic ocular motor abnormalities. Three eyes had the 3^{rd} cranial nerves palsy while two had 6^{th} nerve palsy. Third cranial nerve was the commonest nerve involved in study by Van Stavern et al (35). Our study reported lower incidence of ocular motor nerve involvement as compared to other studies. Traumatic third nerve palsy may result in aberrant regeneration of the third cranial nerve. The full blown features of aberrant regeneration syndrome may or may not be present during initial stage of trauma but the problem can occur many months later.

The incidence of 6^{th} nerve palsy paly was (0.5%) in our study, this varies from what was reported by Odebode et al study (7) which found in severe head injuries at 27%. The mechanism of its palsy, secondary to severe head injuries, has been attributed to avulsion or contusion of the nerve at the base of the posterior clinoid process, where it lies beneath the rigid petrospheniod ligament. Orbital complications were reported in 16 eyes (4.6%) in our study. Orbital fractures were seen in 13 eyes (3.8%), globe rupture 3 eyes (0.8%). All

the 3 eyes which sustained globe rupture underwent evisceration due extensive damages to their eyes. Moreover, findings from this study show severe ocular manifestations that are likely to cause visual loss or loss of the eye like globe rupture and vitreous hemorrhage occurred mainly in severe head injuries mainly due to motor traffic accidents. There is a need to increase efforts to reduce motor traffic accidents thereby reducing mortality, visual morbidity and visual impairment due to head injuries.

CHAPTER FIVE

CONCLUSSION

The proportion of ocular manifestations among patients with head injury at MOI is high and has comparatively increased by 5% in the past 10 years. Road traffic accidents and assaults are the leading cause of head injury and ocular manifestations occurred more in patients with head injury due to motor traffic accidents. Eyelid eccymosis and sub-conjunctiva hemorrhage were the commonest mild ocular manifestations. Severe ocular manifestations constituted corneal epithelia defects, papilledema, pupillary abnormalities and orbital fractures.

RECOMMENDATIONS

In order to improve visual outcome and prevent visual loss, every patient with head injury should be examined for eye signs by an ophthalmologist alongside routine management for head injury by neurosurgeon. Proper early ophthalmic assessment of head injury patients is important for immediate medical attention and appropriate surgical or non-surgical management of the patient in aiding quick rehabilitation. Efforts to reduce motor traffic accidents that lead to head-injury and eventual visual impairment and loss of eyes need be employed.

LIMITATATION AND MITIGATION

The study describes pattern of ocular manifestation among patient with head injury presenting at Muhimbili orthopedic institute hence the result cannot be generalized to the whole country. However, Muhimbili orthopedic institute is a tertiary hospital which receives patients referred from different part of the country there by increasing the generalization of our findings.

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APPENDIX
DATA SHEET

Ocular manifestations of patient with head injury presenting at neuro-surgery department in MOI.

Part 1

a) Baseline information

1. Patient initials…….

2. Age……

3. Sex……

a) Male b) Female

3. Occupation -……

& Address……

4. I.P. No……

5. Date of Admission:……..

b) Information on cause of injury.

6. Causes of injury:

a). RTA: pedestrian/non-motorized/two wheeler / closed vehicle

b). fall: Home / workplace <6ft/6ft

C) . Domestic accident

d). Industrial /blast/falling object

e). Assault: Blunt/sharp weapon

f). others……..

c) Glassgow's coma scale.

7. Glasgow's coma scale on admission: ……..

8. Severity of head injury as per Glasgow's coma scale

a) Mild

b) Moderate

c) Severe

9). Is the eye involved in head injury?

a) Yes

b) No

10). which side is involved?

a) RE

b) LE

11. Chief ocular complains: Onset/ Course / duration. RE, LE

a) RE

b) LE

c) Bilateral

e) Ocular examination.

12. Visual acuity on admission RE.

a) Good(6/4-6/18)
b) Poor(6/18-3/60)
c) Blind(< 3/60)

13. Visual acuity on admission LE.

a) Good (6/4-6/18)

b) Poor (6/18-3/60)

c) Blind (< 3/60)

14. Eyelids (RE, LE).

a) None

b) Ecchymosis

d) Lacerations
e) Ptosis

15. Conjunctiva (RE, LE)

a) None

b) Chemosis

c) Laceration

d) Subconjunctival hemorrhage

16. Globe (RE, LE)

a) None

b) Blunt injuries

c) Perforating injuries

17. Orbital fracture (RE, LE)

a) None

b) Medial wall

c) Inferior wall

d) Superior wall

e) Lateral

f) Floor

18. Perforation (RE, LE)

a) None

b) Corneal Perforation

c) Corneal scleral perforation

d) Scleral perforation

e) Rupture

19, anterior chamber (RE, LE)

a) No hyphema
b) Hyphema present

20. Pupils (RE, LE)

a) Normal

b) Dilated

21. Iris (RE, LE)

a) Normal
b) Tear

22. Lens (RE, LE)

a) Normal
b) Subluxated
c) Dislocated

f) Posterior segment Examination

23. Vitreous (RE, LE)

a) Normal

b) Hemorrhage

c) Prolapse

24. Retina (RE, LE)

a) Normal

b) Hemorrhage

C) Macular Edema

d) Detachment

25. Ocular Motility (RE, LE)

a) Full gaze

b) Restricted

Neuro- ophthalmic Examination.

26. Any involvement of cranial Nerve (RE, LE)

a) No b) Yes

27. Nerve involved (RE, LE)

a) Optic nerve

b) Oculomotor nerve

c) Trochlear Nerve

d) Abducent nerve

28. CT scan diagnosis

a) Brain……
b) Orbit……

29. Ocular Diagnosis

a) RE ……
b) LE ……
c) Bilateral……

CONSENT FORM :(a) ENGLISH VERSION

Title: Ocular manifestations of patient with head injury presenting at neuro-surgery department in MOI.

Greetings! I am Dr. Rashid Karu, a 2nd year resident in the Department of Ophthalmology at Muhimbili University of Health and Allied Sciences (MUHAS).

I am conducting a study with the above title as part of my study program.

Aim of the study: To determine ocular manifestations of patient with head injury presenting at neuro-surgery department in MOI.

Participation in this study: All patients aged over 16 years with head injury presenting at MOI neuro-surgery department between June and December 2019.

This study involves taking history about general information about head injury and ocular problems.

It also involves measurement of visual acuity by different charts, measurement of intraocular pressure and examination of anterior and posterior segment of the eyes. History and physical examination will both be performed by me, the principal investigator or volunteer assistant. If you decide not to participate in this study, your care will not be affected in any way and he/she will still receive appropriate care, as any other patient at the hospital.

Risks: This study will have no physical risks to you since the above means of measurements are painless and non-invasive procedures. Management of your eye problem will proceed accordingly and will not be impacted by research considerations. However any reported subject discomfort will be immediately addressed and mitigated.

Benefits: If you agree to participate in this study, your will benefit by having different measurements evaluating presence of ocular problem and if found will be managed accordingly. The results of the study will also help bridge the gap of knowledge to both

medical personnel and community on importance of seeking early ocular care in patients with head injury and therefore starting early visual therapy.

Confidentiality: All data collected will be treated with strict confidentiality and stored in locked cabinets, encrypted computers and will not be revealed to anybody outside the research team.

Cost: Patients will not be required to make any payments to participate in this study and there will be no financial compensation for participation.

Who to contact: For further information, questions or queries, you can contact:

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I, _____ have read/been told the contents of this form. My questions have been answered. I agree to participate in this study.

Signature of patient_____

Signature of researcher_____

Date of signed consent_____

FOMU YA RIDHAA YA KUSHIRIKI KATIKA UTAFITI

Jina la utafiti: Matatizo ya macho katika wagonjwa wanaoumia kichwa wanaohudhuria idara ya upusuaji Na fahamu katika shule ya mifupa ya muhimbili.

Habari, Mimi Ni Dkt Rashid karu, mwanafunzi WA mwaka wa pili wa udaktari bingwa wa magomjwa ya macho katika Chuo Kikuu Cha Afya na Sayansi Shirikishi Muhimbili (MUHAS). Ninafanya utafiti wenye jina la hapo juu kama sehemu ya mafunzo yangu.

Lengo la utafiti: Kuangalia kuwepo kwa matatizo ya macho katika wagonjwa wenye wanaumia kichwa wanaohudhuria idara ya neuro-surgery katika MOI.

Ushiriki katika utafiti: Mgonjwa mwenye umri wa miaka Zaidi ya miaka 16 watakaohudhuria idara ya neuro-surgery kati ya Juni hadi Disemba 2019.

Utafiti huu utahusisha kuchukua maelezo ya jumla kuhusu mgonjwa, hali yake ya ya macho.

Pia utahusisha kupima uwezo wa macho kuona, kupima presha ya macho na kuchunguza sehemu ya mbele na ndani ya jicho. Kuchukua maelezo na kumpima mgonjwa kutafanya na mimi, mtafiti mkuu au mtafiti msaidizi.

Kama ukiamua kutoshiriki katika utafiti huu, huduma ya mgonjwa haitaathirika kwa namna yoyote na atapata huduma stahiki kama wagonjwa wengine hapa idarani.

Madhara : Utafiti huu hauna madhara yoyote kwa sababu vipimo vilivyatajwa hapo juu havileti maumivu. Mataibau ya mgonjwa yataendele kama ianvyostahiki na hayataathiriwa na utafiti huu. Kama ikionaekana mgonjwa anajisikia vibaya, suala hilo litahighulikiwa kwa harak.

Faida : Kama ukikubali kushiriki katika utafiti huu, utafaidika kwa kufanyiwa vipimo mbalimbali kuangalia kama ana tatizo lolote la amcho , na tatizo likionekana atapatiwa matibabu stahiki.

Matokeo ya utafiti huu yatasaidia kuongeza ufahamu kwa wahudumu wa afya na jamii kuusu umuhimu wa kupata huduma za macho mapema kwa wagonjwa naoumia kitchwa na hivyo kuanzishiwa matatibabu ya macho mapema.

Usiri : Taarifa zote zitakazokusanywa zitawekwa kwa usiri mkubwa na kuhifadhiwa katia sanduku lililofungwa na kompyuta iliyofungwa na hazitadhihirishwa kwa mtu yoyote asiyehusika kwenye utafiti huu.

Gharama : Mgonjwa hatahitajika kutoa malipo yoyote ili kushiriki katika utafiti na hatolipwa kwa ajili ya kushiriki katika utafiti.

Mawasiliano : Kwa maelezo zaidi, maswali au dukuduku, unaweza kuwasiliana na:

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Signature:
Sahihi ya makubaliano:
Mimi, _____,
Nimesoma/nimesomewa maelezo yote yaliyomo kwenye fomu hii na nimeelewa. Maswali yangu yamejibiwa na niko tayari kushiriki.
Sahihi ya mshiriki _____
Sahihi ya mtafiti _____
Tarehe _____