SURGICAL OUTCOME OF OPEN GLOBE INJURY AND ASSOCIATED PROGNOSTIC FACTORS AT JIMMA UNIVERSITY MEDICAL CENTER, SOUTH WEST ETHIOPIA

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ABSTRACT

Background:-*Ocular trauma is one of the most common preventable causes of eye morbidity worldwide. Among types of globe injury, open-globe injury is a significant cause of permanent vision loss globally. In Ethiopia, ocular injury is a public health problem that lacks health care service at a community level. Studies done in Ethiopia showed that open globe injury is common cause of monocular blindness mainly in the young productive age group.*

Objective*:-The aim of this study was to assess the surgical outcome of open globe injury at Jimma University medical center.*

Methods:*-The study employed a retrospective study design on illegible patients treated surgically for open globe injury at Jimma University medical center during the period of August 1, 2019 to June 1, 2021G.C. All collected data was entered into* ***EpiData4.6.0.2*** *and exported to* ***SPSS version 26*** *for further analysis. The descriptive finding of the study was reported as frequency, mean and standard deviation. Binary logistic regression analysis was used to identify predictors of the outcome and variables with p-value <0.05 were considered statistically significant.*

Result: *A total of 79 patients were included in the study. The mean age of patients was* ***24.08*** **±** ***17.157, M: F was 5.58:1*** *and 72.15% of the total cases were young patients (age range of 3 to 30years). Accident (playing, fall down, sport activities etc.) was found to be the main risk factor for OGI accounting for 51.9% (n=41) of cases followed by work related risks. Sharp objects were found to be the most common cause of OGI at all age group followed by blunt objects. Wood was found to be the most common object causing OGI followed by metal (all were sharp). About 87.4% of patients were presented with visual acuity in blindness range out of which 12.7% (n=10) were totally blind. Penetrating globe injury was found to be the most commonly occurred OGI. Patients with ruptured globe were presented with poorer presenting visual acuity (visual acuity of hand motion or worse). The cornea was found to be the most frequently injured structure. At the time of presentation, crystalline lens was either opaque or not visible in most of the cases. Most of the patients (about 80%) presented to the hospital after 24 hours of injury and about 82.3% of patients were managed within the first 24hours of arrival to the hospital.*

Repeated surgery was done only for 11(13.9%) patients. Cataract extraction, stich correction, secondary IOL insertion and pupiloplasty were done during the second surgery. During the follow up period, there were 4 keratitis and 1 endophthalmatis cases. Refraction was not done for 96.2% of patients during follow up period.

After 3 months of post-surgical management, ***60.8% (n=48)*** *of patients remained blind while 12.7% (n=10) of patients gained normal to near normal visual acuity and 26.6% (n=21) of patients got low visual acuity. Gross anatomy of the globe was maintained in 79.7% (63) of the cases while 16 patients developed phthisic bulbi. Multivariate logistic regression analysis showed that presenting poor visual acuity is an independent poor prognostic factor for final visual outcome while globe rupture was the independent poor prognostic factor for final globe anatomic outcome.*

Conclusion and recommendations:- *Open globe injury is a type of ocular trauma that causes devastating ocular morbidity resulting in significant socio-economic burden in the community. Most of patients with open globe injury developed blindness despite surgical management. Poor presenting visual acuity and globe rupture were found to be poor prognostic factors of final visual and globe anatomical outcome respectively. In order to prevent the burden of OGI, it is important to provide adequate health education for the community, more health professionals should be trained in the field of ophthalmology and the existing ophthalmic center should be strengthened and monitored for providing quality service.*

KEY Words:- *Open globe injury; surgical outcome; Prognostic factors; Jimma, Ethiopia.*

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ABBREVIATIONS AND ACRONYMS

BCVA……..Best corrected visual acuity

CGI……Closed globe injury

HM……..Hand motion

IOFB…….Intra Ocular Foreign Body

ISOT……..International Society of Ocular Trauma

JUSH…….Jimma University specialized hospital

LP……..Light perception

NLP……..No light perception

OGI……Open globe injury

PVP……pars plana vitrectomy

RAPD……..Relative afferent pupillary defect

RD…….Retinal Detachment

USEIR……..United States Eye Injury Registry

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CHAPTER 1: BACKGROUND AND STATEMENT OF THE PROBLEM

1.1. Back ground

An injury to the eye or its surrounding tissues is the most common cause for eye hospital attendance at emergency department which is yet preventable. Extent of the injury may range from simple superficial injuries to devastating penetrating injuries of the eyelids, lacrimal system, and globe(1). The injury to the globe can be closed or open (OGI) that is sub-classified as penetrating, perforating, globe rupture or intra ocular foreign body.

Epidemiologically, Ocular injuries are important and under-recognized cause of disabling eye morbidity that disproportionately affects the young age group. Different studies done in both developed and poor countries indicated that ocular injury is the most common cause of monocular blindness and commonly disable the productive age group (2–5). Ocular trauma is also the leading cause of non-congenital unilateral blindness in children and has a major impact on their quality of life. In addition to this, there are associated risks of amblyopia and unacceptable cosmoses which may have psychological impact(6).

According to the world health organization (WHO) 1997 article review report, the major risk factors for ocular injuries include age, gender, socioeconomic status and life style. World health organization Program for the Prevention of Blindness suggested that 55 million eye injuries restricting activities for more than one day occur each year and 750,000 cases require hospitalization each year. There are about 2.3 million people with bilateral low vision caused by ocular trauma and almost 19 million with unilateral blindness or low vision worldwide(7). Ocular trauma is estimated to be 10-27% of all cases examined in OPD, 38-65% of cases seen in emergency departments, 5-16% of all admissions in eye hospitals(1,7).

Open globe injury, defined as a full thickness wound on the globe, is a preventable main cause of substantial visual impairment and ocular morbidity around the world, with a higher prevalence in developing and underdeveloped countries (8). OGI is predicted to cause 3.5 injuries per 100,000 people worldwide, with more than 203,000 cases occurring each year (7,8).

OGI is mostly seen in the young, middle-aged, and male working population (men & boys account for about 80%) with age 10 to 30 at greatest risk (7–10). Despite advances in ophthalmic

surgery and equipment, the loss of vision due to OGI may be unavoidable leading to permanent visual impairment and blindness worldwide in a significant number of cases (7–11).

Classification of open-globe injuries based on presenting conditions like OTS category, type & zone of injury, and pupil condition help in prediction of visual outcome which may assist clinicians in selecting salvageable eyes for surgical repair(12).

Different studies done in both developed and under developed countries identified important predictive factors of the final visual acuity after open globe injury. These predictive factors include presenting visual acuity, wound location & length, mechanism of injury, OTS category, IOFB, vitreous loss, retinal detachment, additional vitrectomy surgery, and lens damage (9,13–15). Globe ruptures and perforating injuries are more catastrophic than other types of open globe injuries(13). The visual outcome is found to be better in eyes that require only primary repair(16). The need for having follow up for long duration is another challenge for the patient in cases of open globe injuries(9,17).

1.2. STATEMENT OF THE PROBLEM

Ocular injury is one of the most common causes of hospital attendance at an eye hospital emergency department and it is a major and under recognized cause of disabling ocular morbidity(1). World wide data showed that significantly high number (750,000) of ocular injury requires hospital admission every year(7).

Open globe injury, which is more common in developing and underdeveloped countries, is a leading cause of permanent vision loss and ocular morbidity around the world(8).

OGI is mostly seen in the young, middle-aged, and male working population(7–10). It generates a significant and often unnecessary toll in terms of medical care, human suffering, long-term disability, productivity loss, rehabilitation services, and socioeconomic cost besides the inevitable psychological impacts(1,11,22). A nationwide retrospective study done in USA on emergency department visits of patients with a primary diagnosis of OGI during 2006 to 2014 revealed the total cost associated with OGIs was $793 million(11). The Australian study

demonstrated that OGIs which accounted only for 2% of ocular injuries were responsible for 44% of expenditure on ocular injuries, which is estimated to cost about $155 million per year, at country level(13).

Some available Studies done in different African countries also indicated that ocular trauma is the most common cause of monocular blindness which causes a burden especially among productive age group and children(18–21). A study done in **Nigeria** showed that OGIs accounted for 75% of all injuries and it carries a poorer prognosis and more likely to require surgery and subsequently to suffer from long-term visual impairment(6). In a similar study, only 29.5% of cases were presented to eye care hospital within the first 24 hours of injuries indicating that the time delay in management is common(6). Another study done in Tanzania showed a significant delay in accessing appropriate specialist care following eye injury(23).

In Ethiopia, Ocular trauma is one of the commonest causes of emergency visit in eye clinic and accounts a significant percentage of major ocular surgeries(24). Different studies done in different parts of the country showed that globe trauma affected productive age group who are younger than 30 years of age in more than 63% of the cases(25–27). Among all types of ocular injuries that lacks health service at community level, OGIs had a poorer visual prognosis and different study shows a clear need for primary prevention and control measures(25,26,28–30). Another challenge in our country is the presence of inadequate ophthalmic centers for which patients have to travel long distance to get ophthalmic center that leads to delay of timely treatment(25,29).

In our country adequate information on globe injuries particularly on the outcomes and prognostic factors of surgically treated OGI is lacking even though it is important for clinical practice and for health planning(31) .

As it is observable, globe injury, especially open globe injury is an important cause of ocular morbidity worldwide in general and in Ethiopia as a country level. Therefore, it was important to have a study on open globe injuries and its surgical outcome related to different prognostic factors.

CHAPTER 2: Literature reviews

In order to conceptualize the study, the theoretical bases were reviewed from the existing related literatures and a conceptual framework was developed. The literature review tries to address the epidemiology of ocular trauma, demographic characteristics of globe injury, clinical Characteristics, surgical outcome and prognostic factors of OGI. Up-to-date and relevant international, regional and national literatures were reviewed with special emphasis to surgical outcome of OGI.

2. 1. Epidemiology, Risk factors, demographic characteristics and Clinical Features of Ocular Injury

Globe injuries are remained the most serious public health problem in in the world, even in developed nations. It is clearly understood that trauma to the eye is one of the most common disabling condition especially in young and productive age group.

The analysis of the United States Eye Injury Registry (USEIR) of 31 July 1998 showed that 58% of the patients presented with ocular injury were aged less than 30 years with highest male to female ratio(32) . According to the same study, the injury happened at home in 41% followed by at industrial area in 14%(32). The analysis of this study showed that 20.5% of the total injuries were work related (96% were male)(32). This study also revealed that the cornea was the most frequently involved tissue in 52% of the reported injuries followed by the retina in 46% and the sclera in 31%(32).

Another study done at University hospital ***Achen, Germany*** between 2005 and 2015 revealed that open globe injury most commonly affected male with two age peaks. The first peak age was **20–40** years and the second peak was ***60*** - **80** years(33). According to this study, males accounted 65% and females were 35% (all were above the age of 60 years). The most common cause of injury was domestic syncopal episodes (47%) and Work-related injuries occurred exclusively in men in 8.8%(33).

The study done to evaluate the clinical features and visual outcome of OGIs in ***western Turkey*** between 2009 and 2013 showed that the mean age of OGI was **36 +/- 20.07** with male

predominance (77.6%)(34). This study also revealed that the most common cause of OGI is domestic in 28.3% and work related in 22%. In the younger age group, game and sport accidents were the main cause (58.3%)(34). Additionally, this study indicated that 49.1% of open globe injuries were in **Zone I,** followed by zone II (38.4%), and zone III (12.6%) while Hyphema was associated in 76.7% of cases, followed by iris prolapse (57.9%), vitreous hemorrhage (52.2%), laceration on eyelid and/or eyebrow (34%), RD (29.6%) and IOFB (8.8%) were common clinical signs during admission(34).

A study done on the medical records of 321 patients with OGIs at **Asan Medical Center, Seoul, Korea,** from Oct 1989 to Dec 2003 showed male predominance (82.24%) and the mean age of trauma was 38.8 +/- 17.5 years(35). This study also revealed that half of all injuries occurred in zone **I** and **77.9% cases** of these patients had an initial VA of 4/200 or worse in the damaged eye concluding that the zone of injury was significantly correlated with initial visual acuity(35).

The study done on pediatric ocular trauma admitted to the **Lithuanian University of Health Sciences Hospital** from Jan 2008 to Dec 2013 showed home as the leading place of eye injury accounting for 60.4% of the cases followed by outdoor, school, and sport activities in 31.7%, 5.2% & 2.2% respectively(36). This study revealed that CGI were the most common type of eye injury (53.4%), while OGI accounted for 28.7%, burns 9.3%(36). The common zone of injury according to this study was **zone I** in **73.7%**, zone **II** in **15.8%** and zone III in **10.5%** of OGIs cases which was common during preschool age(36). Hypotony, iris laceration, traumatic cataract, vitreous prolapse and uveitis were the most common presentations of OGI, while hyphema, secondary glaucoma and retinal edema were the initial diagnoses significantly related with CGI(36).

A multi-center retrospective clinical study of patients aged 65 years and above managed for eye injury between 2001 and 2007 at 4 hospitals in ***southwestern Nigeria*** showed that eye injury occurred most commonly on the farm (37.2%) and during farm related activities (35.9%) in the elderly patients but for female elders, the injury was most frequently at home and during a fight/dispute(37). In this study, male to female ratio was 1.9 : 1 and the mean age of trauma was 70.0 ± 5.4 years for males & 70.1 ± 5.7 years for females(37). This study also showed that even though CGI is the most common injury (85.9%), OGI was associated with higher incidence of hospitalization and visual impairment(37).

In ***Ethiopia***, a retrospective study done at **Menelik II Hospital** on all patients with OGI operated on between January to December 1998 showed that 8.4% of the total eye operations done in the major operating room during the study period was due to perforating ocular injury(24). According to this study, male to female ratio was 3:1 and the average age was 19.4 years with 75.5% patients being aged 30 years or younger(24). In the finding of this study the most common causes of perforating ocular injuries were wood (32.8%), metal(28.4) and stone objects in (14.2%) which are mostly occurred at working area(24). This study also showed that the cornea was involved in 74% of cases and about 89.7% of patients had pre-operative VA recorded as blind in the involved eye(24). In children, accidental injuries were found to be the most common cause(24).

Another study done in Ethiopia on records of 245 patients who sustained either open or closed globe injury and treated at ***Gondar University Referral Hospital*** between Sept 2008 and Feb 2012 identified that 50.6% of injuries were CGI and 49.4% were OGI(31). The median age of patients was 22 years (Range: 4 to 78 years), male to female ratio was 4.7:1, and Wood, Stone and metal were the cause of injury in 31.8%, 24.1% & 10.6% cases respectively(31).

A prospective hospital based study done on all patients (171 patients) presented with ocular injury to ***Jimma University Specialized Hospital, south west Ethiopia*** during Apr. to Sep. 2009 showed that the overall prevalence of ocular injury was **3.03%**(38)**.** According to this study, nearly 99% of ocular injuries were mechanical and 53. 2% were work- related. The study also discovered that CGI injuries accounted for 57.6% of the cases, while OGI injuries accounted for 42.4 percent (38).

2.2. Surgical outcome and prognostic factors of open globe injury

Open globe injury that is defined as a full thickness wound of the ocular wall is an important ocular morbidity worldwide. Different scholars suggested that the prognosis and surgical outcome of OGIs is determined by different presenting factors. In order to highlight presenting prognostic factors of open globe injury, some relevant and available literatures are reviewed and summarized in the following paragraphs.

A r**etrospective** comparative consecutive case series study done on 56 open globe injury in UK between 1 Jan 2014 and 15 March 2016 showed that the final visual acuity at 6–12 months was related to the presenting visual acuity, OTS and to the time lapse between injury and primary repair(39).

A retrospective study done on patients admitted to the ***Royal Brisbane Hospital, Queensland, Australia*** from 1992 to 2003 for either primary repair or definitive surgical management of an OGI revealed that poor prognostic factors for final VA were poor initial VA, a large laceration **>10 mm** and the presence of a relative afferent pupil defect(40). This study also showed that rural patients had a significantly worse final VA than city dwellers and had higher rates of endophthalmitis and enucleation. This study also found that about 53% of patients remained with final visual acuity of counting finger or worse(40).

A retrospective study done on case records of 669 patients during 2003 to 2008 in **central India** showed that age, preoperative VA, mode of injury, and time lag between injury and surgery were factors significantly associated with final visual outcome after followed for a minimum of 4 months. Most of the patients (about 43%) remained with visual acuity of counting finger or worse(41).

A Retrospective study done between September 2008 and March 2014 at **Nagasaki University Hospital**, **Japan** found that Zone III injuries had statistically significantly poor prognostic factor compared to other zones in OGI(42). This study also showed that poor VA at first visit, ruptured globe, history of PKP, retinal detachment, vitreous hemorrhage, and dislocation of crystalline lens were considered as poor prognostic factors while **PPV** had a good prognostic value in OGI associated with posterior segment involvement(42).

A retrospective study done on medical records of 107 OGI patients treated at **Manchester Royal Eye Hospital between** Jan 1, 1998 and Jan 1, 2003 Showed that blunt injuries associated with adnexal trauma, presenting visual acuity, the presence of RAPD or RD, and the absence of a red reflex are associated with a significantly higher rate of subsequent enucleation which was 12% in this study(43).

A study done on chart records of 633 (787 eyes) OGI patients referred to a tertiary referral clinic in **Ankara, Turkey** between Jan. 1998 and Jan. 2016 who had average follow up time of 8.2 ±

15.2 (1–180 month) revealed that initial **VA < 20/200**, OTS category 1, zone 3 injury, additional vitrectomy surgery, and lens damage were found to be the main variables related with poor visual outcome(15).

The study done on pediatric ocular trauma admitted to the **Lithuanian University of Health Sciences Hospital** from Jan 2008 to Dec 2013 showed that a good visual outcome was significantly related with CGI, while VA of 0.03–0.1 and severe visual impairment (NLP) was related with OGI depending on OTS(36).

Similarly a cross-sectional study done at ***Ekiti State University Teaching Hospital***, ***Ado Ekiti***, ***Nigeria*** between Jan 2010 and Dec 2018 on 194 emergency eye injuries with surgical intervention concluded that factors like delayed presentation, pre-operative VA and delayed surgical intervention were responsible for poor visual outcome and about $4/5^{th}$ of patients remained with visual acuity of blindness despite treatment(44).

A prospective study done at ***Southern Africa (Medunsa),*** from January 2001 to November 2002 on 100 children with full thickness eye injury identified wound size greater than **11mm** in length, mixed corneo-scleral wound and involvement of lens and posterior segment as indicators of poor visual outcome(45). However, patient's age and delay of presentation to hospital were not of prognostic value in this study(45).

In Ethiopia different available studies revealed that OGI accounts for significant percentage of the eye trauma and is associated with poor prognosis.

A study done on records of 245 patients who sustained either open or closed globe injury and treated at **Gondar University Referral Hospital** between Sept 2008 and Feb 2012 identified that 49.4% cases remained blind in the injured eye after treatment(31). This study concluded that open globe injuries had a poorer visual prognosis, and presenting VA and type of injury were found to be important prognostic factors of visual outcomes(31).

Another study done at Menelik II Hospital which reviewed charts of all patients (204 patients) with OGI who were operated during the period of Jan. to Dec. 1998 showed that 76.6% of cases had VA of less than 3/60 (CF < 3 metres) and 19.1% cases with ruptured globe were eviscerate(24). The study added that about 2/3 of patients remained blind after surgical treatment

due to failure to treat complications. In this study, severity of the trauma was found to be one of the prognostic factors used to predict the final visual outcome(24).

A prospective hospital based study done on all patients (171 patients) presented with ocular injury to **Jimma University Specialized Hospital**, **south west Ethiopia** from April to September 2009 showed that OGI were more severe and had significantly worse visual outcome than CGI(38). This study found that late presentation, poor presenting VA, open globe injury and presence of complications were the risk factors identified for poor final visual acuity outcome in ocular trauma(38).

CONCEPTUAL FRAME WORKS

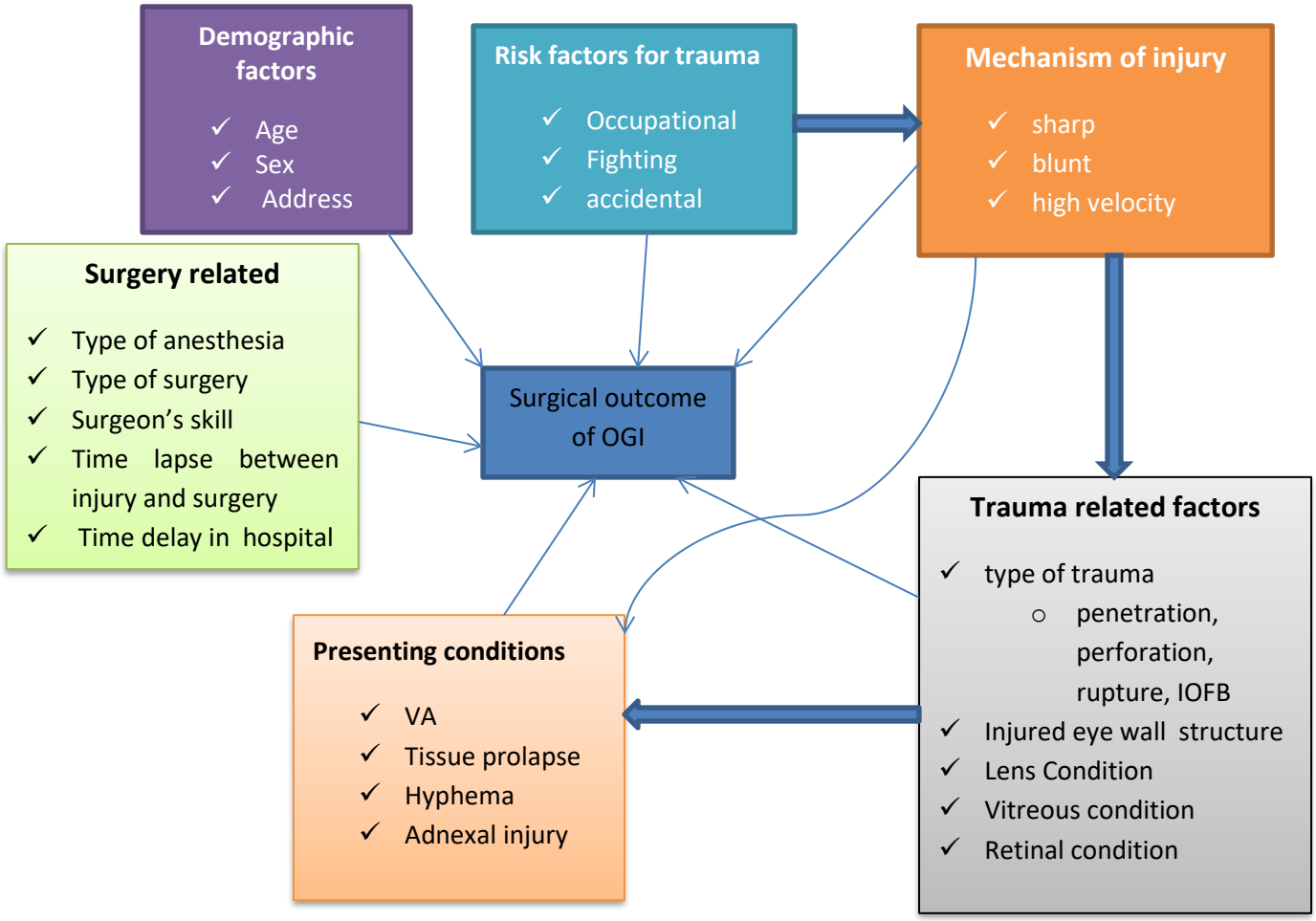

Figure 1: Conceptual framework developed after reviewing different literatures.

CHAPTER 3: SIGNIFICANCE OF THE STUDY

3.1. SIGNIFICANCE OF STUDY

Ethiopia is one of the largest countries in Africa ranking second by population number with estimated current population of more than 117 million according to Worldometer elaboration of the United Nations data. In this large country with huge amount of population, there are few ophthalmic centers to provide sufficient care for the community. Similarly there is limited evidence based information regarding ophthalmology and few researches were done on ocular trauma and particularly no literature on similar topic was seen during review in the country within the past two decades even though it is needed for clinical practice, program managers and policy makers.

There was only one retrospective study done on outcome of open globe injury in Ethiopia before twenty years which used the term globe perforation throughout its explanation. Since globe perforation is only one type of open globe injury, it is difficult to generalize that the study included all types of open globe injury.

Even though a prospective study was done on **Pattern and prognostic factors of ocular injuries** at Jimma University medical center, it was generalized study on both CGI & OGI, and it didn't indicate the surgical outcome of OGI.

For these reasons, the current study is planned to be done on surgical outcome of open globe injury and associated prognostic factors to assess the importance of doing surgery on OGI. Therefore, this study is believed to be the first study on this specific topic in Ethiopia and it will assess the surgical outcome of open globe injury and associated risk factors. This study is also believed to be a starting point for further study on the same topic in the future. The result of this study will also help to see the pit falls in managing open globe injury in Jimma University medical center and to modify the previous approach to develop clear guide line.

CHAPTER 4: OBJECTIVES

4.1. General Objective

- To assess the surgical outcome of open globe injury in Jimma University medical center

4.2. Specific objectives

- To evaluate the visual outcome of surgically managed OGI
- To assess the anatomic outcome of surgically managed OGI
- To determine the prognostic factors of surgically managed OGI
- To see the management pit falls in managing OGIs at Jimma University medical center

CHAPTER 5: METHODS AND MATERIALS

5.1. Study area and period:

The study was conducted at ***Jimma University medical center*** which is located in Oromia regional state. This center is the only tertiary hospital in south western Ethiopia and has a well-organized ophthalmic center with experienced senior specialists. The study is conducted between August **1, 2019 to June 1, 2021G.C.**

5.2. Study design

A cross-sectional retrospective study was employed

5.3. Population

5.3.1. *Source population*

The source population was all patients with open globe injury who were treated surgically at Jimma University Medical Center during the period of August **1, 2019 to June 1, 2021G.C.**

5.3.2. *Study Population*

All illegible patients in the source population were included

5.4. Sampling technique and sample size

Census technique is used

5.4. Eligibility criteria

5.4.1. *Inclusion criteria:*

All patients who were surgically treated for OGI at Jimma University Medical Center during the period of August 1, 2019 to June 1, 2021G.C and attended post-operative follow up at least for 3 months.

5.4.2. *Exclusion criteria:*

1. Charts which lacks complete information
2. Patients who came with complications like endophthalmits or phthisic bulbi at the time of arrival to the hospital
3. Patient who were known to have chronic ocular disease with poor vision prior to trauma.
4. Patients who had history of surgical management on OGI elsewhere before presentation to Jimma University Medical Center

5.5. Study Variables

5.5.1. *Independent Variables*

- Age
- Sex
- Address
- Presenting VA

- Type of OGI
    - penetrating
    - Perforating,
    - Rupture,
    - IOFB
- Injured eye wall structure
- Risk factors for injury
- Materials causing injury

- Mechanism of injury
- Tissue prolapse
- Lens condition
- Vitreous condition and Retinal condition
- Type of surgery
- Type of anesthesia
- Level of surgeon's qualification
- Time delay in hospital before surgery
- Total Time lapse between injury and arrival to the hospital

5.5.2. *Dependent Variable*

Surgical outcome of open globe injury (both anatomical and functional)

5.6. Data collection procedures

Chart number of patients was obtained from major operation room log book and the chart was retrieved from card room by assigned card room workers and kept safely so that it can be available when needed. The data was collected by ophthalmology residents using a structured questioner during the period of August 1, 2021 to September 30, 2021.

5.7. Data quality control

Data collectors were provided one day training on the content of the data, ethical issues, how to use the data collection guide and tools prior to data collection. The process of data collection was

supervised daily by principal investigator and encountered problems were discussed with data collectors and solved immediately.

5.8. Data entry, analysis and interpretations

The data was checked manually for completeness and consistency, and coded. Then data was entered to ***EpiData4.6.0.2*** and then exported to ***SPSS version 26.0*** for analysis. First descriptive analysis was done. Mean and frequency distribution was used. To identify factors determining outcome of the open globe injury logistic regression analysis was used. First bivariate logistic regression analysis was done to select candidate variables for final analysis and candidate variables with ***p<0.25*** were entered into multivariate logistic regression analysis to determine associations. Odds ratio with 95% confidence interval was calculated and all variables with ***p-value less than 0.05*** were accepted as statistically significant association.

5.9. Ethical consideration

The study was conducted after obtaining ethical clearance from the Ethical review Board of Jimma University Institute of Health Sciences. Permission was also obtained from JUMC. The name and other identifications were not exposed to people who were not involved in the study. All information were kept confidential and only used for study purpose.

5.10. Dissemination plan

The finding of this study will be presented to the Jimma University medical college department of ophthalmology, it will also be presented on national OSE meetings and it will be available to all interested person or organization. It will be also published on reputable journals.

5.11. Operational definitions

Accidental: - unexpected events. E.g. falling down, road traffic, playing, household material, etc

Visual outcome classification

Good Visual acuity outcome: - Visual acuity of 6/18 or better

Poor Visual acuity outcome: -Visual acuity less than 6/18.

Globe outcome classification

Good globe outcome----------grossly normal globe

Poor globe outcome----------phthisic globe globe

Poor documentation……Charts with incompletely documented physical findings (e.g. charts lacking visual acuity at each visit), charts lacking operation note.

CHAPTER 6: RESULTS

Participant enrolment

During the two years study period which was from August 1, 2019 to June 1, 2021G.C, the data documented on OR log book showed that 325 surgical repair was done for open globe injuries.

Out of the total 325 card numbers obtained from the **OR** logbook, only ***255 (78.46%)*** cards could be retrieved and the remaining 70 charts were not available in card room. Out of the retrieved patient charts, only 79 were illegible for this study.

The detail information about the charts

Retrieved charts from Card room with their specific categories out of 325 charts documented on OR logbook		
Charts with 3 or more months follow up	**79**	**30.98%**
Charts with up to 6 weeks follow up	**18**	**7.05%**
Charts with up to 1st week follow up	**55**	**21.6%**
Charts with no follow up at all	**70**	**27.45%**
Excluded charts by exclusion criteria	**1 5**	**5.88%**
Charts with unrelated diagnosis but which was registered on OR log book	**18**	**7.1%**
Total	**255**	**100%**

6.1. Socio demographic Factors

In this study the mean age of the patients was found to be 24.08 $\pm$ ***17.157 years*** (range of 3 to 70years). Patients of age 11-20 were found to account the highest number of OGI *29.11% (n=23)* and *72.15% (n=57)* of patients were in the age range of 3 to 30years while only 2 patients were at age of 61-70years. Out of a total of 79 patients involved in the study, 67(84.8%) were males. Jimma zone residents accounted 48.1% (n=38) of the total patients and the remaining 51.9% (n=41) came from areas out of Jimma zone. (Table 1)

Table 1: Socio-demographic characteristics of participants

Socio-demographic characteristics(N=79)		N (%)
Age of participants	Mean age➔ ***24.08 ± 17.157*** Age range ➔ ***3 to 70***	
Age group	1-10	20 (25.3)
	11-20	23 (29.1)
	21-30	14 (17.7)
	31-40	9 (11.4)
	41-50	4 (5.1)
	51-60	7 (8.9)
	61-70	2 (2.5)
Sex(Gender)	Male	67 (84.8)
	Female	12 (15.2)
Address of participants	Jimma Zone	38 (48.1)
	Out of Jimma Zone	41 (51.9)

6.2. Risk factor, mechanism of injury and objects involved in OGI

Accidental cause was the main risk factor for OGI at all age group for both sexes and it accounted for 51.9% (n=41) of cases followed by work related injury in 34.2% (both forming & none farming). Fighting ranked third accounting for 13.9% (n=11) of cases. (Figure 1)

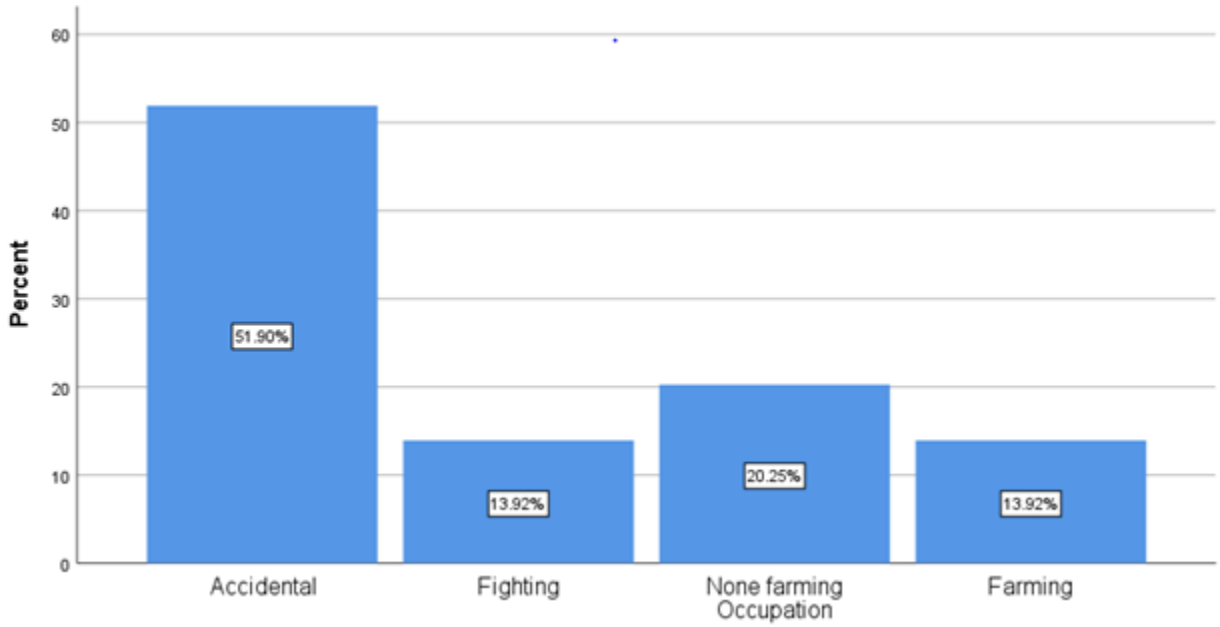

Figure 1: ***Risk factors of OGI***

Sharp materials were found to be the most common cause of OGI accounting for 69.6% (n=55) followed by blunt objects which accounted for 27.8% (n=22) and bullet which accounted for only 2.5% (n=2). All females (n=12) were injured by sharp object. Most injuries occurred by sharp objects were due to accident (40.5%; n=32). (Figure 2)

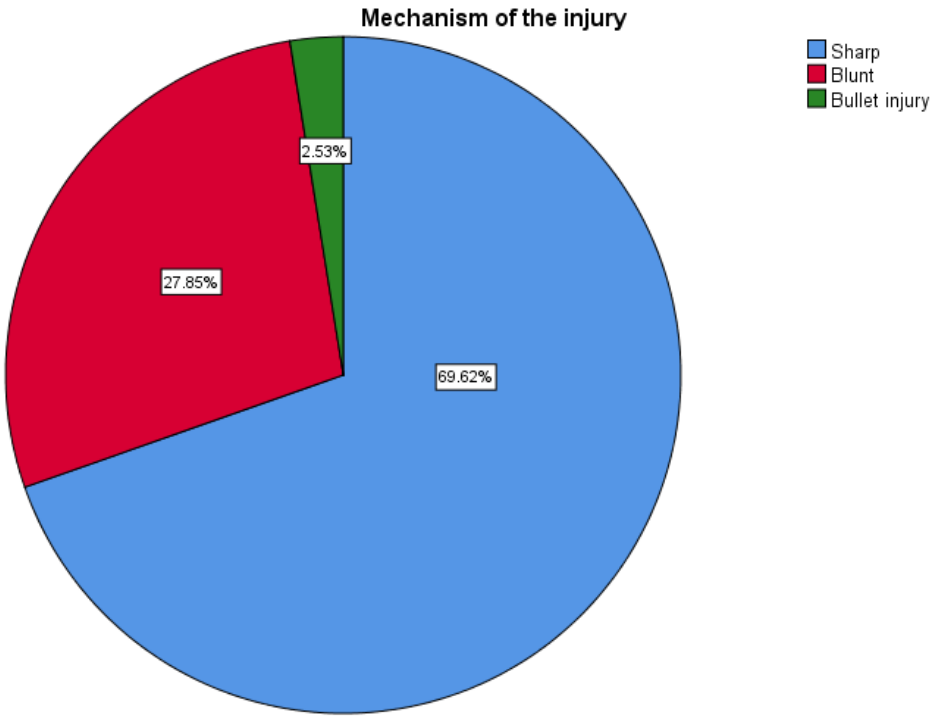

Figure 2: mechanism of injury

Wooden object was found to cause 64.6% (n=51) of the OGI followed by metal in 20.3% (n=16), and stone in 6.3% (n=5). Most of wooden objects (34/51) involved in trauma were sharp while all metals involved in trauma were sharp. (Table 2)

Table 2: M*aterial involved in trauma*

Involved material	Frequency	Percent
wood	**51**	64.6
Metal	**16**	20.3
Stone	**5**	2.5
Animal horn/ nail	**3**	3.8
Glass	**2**	6.3
Clenched hand	**1**	1.3
Plastic	**1**	1.3
Total	**79**	**100.0**

6.4. Presenting Physical findings

According to WHO visual acuity classification, the presenting visual acuity was found to be normal to near normal in ***6.3% (n=5)*** of patients, low visual acuity in ***6.3% (n=5)*** and blindness in *87.4% (n=69)* where total blindness accounted for 12.7% (n=10) of cases. (Table 3)

Table 3: Presenting visual acuity

Presenting visual acuity	frequency	Percent
No perception of light	10	12.7
Light perception to hand motion	52	65.8
Better than hand motion but < 1/60	3	3.8
< 3/60 to >/=1/60	4	5.1
3/60 to 6/60	2	2.5
6/24 to 6/48	3	3.8
6/10 to 6/18	2	2.5
6/4 to 6/7.5	3	3.8
Total	**79**	**100.0**

Penetrating globe injury was found to be the most common type of open globe injury (68.4%; n=54). Globe rupture is ranked second (22.8%; n=18). OGI with IOFB accounted for 6.3% (n=5) and only 2 (2.5%) patients presented with partial evisceration of the globe. In patients with IOFB, the foreign body was intra-stromal with full thickness corneal penetration and in anterior chamber for 2 and 3 patients respectively. Patients with ruptured globe are found to present with poor visual acuity (visual acuity of hand motion or worse). (Figure 3)

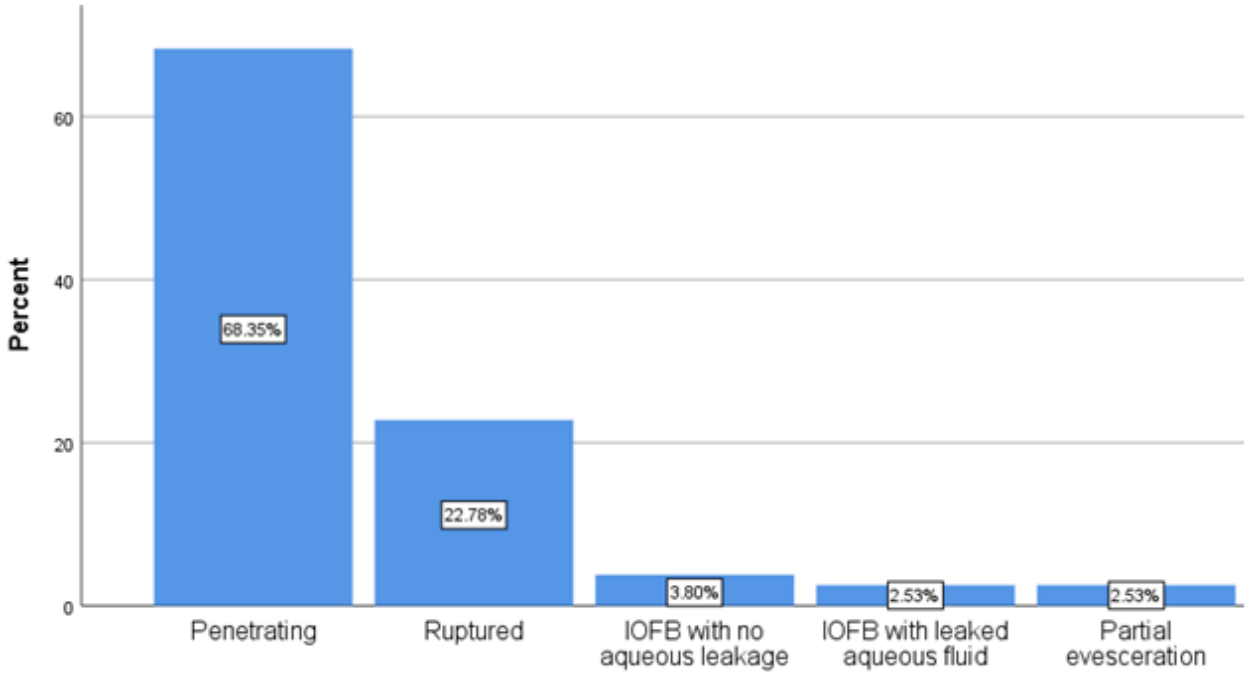

Figure 3: Type of open globe injuries

Open globe injury was associated with adnexal involvement only in 3.8% (n=3) of cases and the associated adnexal injuries were eye lid laceration in 2.5% (n=2) and orbital bone fracture in 1.5% (n=1).

Cornea was found to be the most commonly injured structure associated with open globe injury. In general, cornea is involved in 93.7% (n=74) of all open globe injuries while sclera was involved in 34.1% (n=27) of cases.
Scleral injury without corneal involvement accounted for 6.3% (n=5) of open globe injury cases. (Table 4)
Patients with scleral involvement had poor presenting visual acuity compared to others.

Table 4: Eye wall structures involved in OGI

Eye wall structure	Frequency	Percent
Corneal laceration alone	40	50.6
Cornea and sclera	22	27.8
Corneal laceration involving limbus	12	15.2
Only scleral	5	6.3
Total	**79**	**100.0**

During presentation, 46.8% (n=37) of patients had formed (deep) anterior chamber while 53.2% (n=42) patients presented with collapsed anterior chamber. Hyphema was presenting finding in

15.2% (n=12) of patients.

Out of the total 79 patients, 67.1% (n=53) of patients presented with intra ocular tissue prolapse and the prolapsed tissue was uvea in 54.4% (n=43) of cases followed by vitreous prolapse in 8.9% (n=7) of patients and combined uvea & vitreous prolapse was found in 3.8% (n=3) of cases.

At the time of presentation, 26.6% (n=21) of patients have intact & clear lens and 30.4% (n=24) of patients presented with lens opacity. In 43% (n=34) of patients, the lens was not visible due to distorted anterior structures.

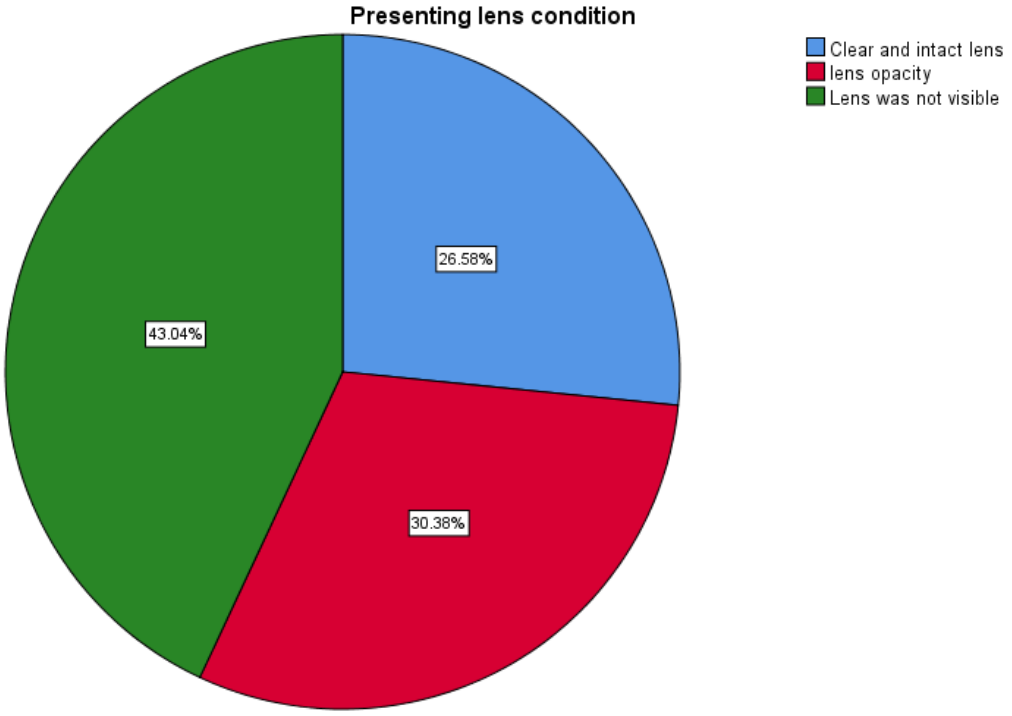

Figure 4: ***Lens status at the time of presentation***

6.5. Presentation to the hospital and surgical management

Out of the total patients, 63.3% (n=50) were referred from nearby health institution while the remaining 36.7% (n=29) came directly. Patients coming from areas out of Jimma zone were found to be referred more frequently. (Table 5)

Out of referred patients, 54% of them were given first aid at referring center. Topical antibiotics, patching, steroid eye drop, TAT & pain killers, and PO antibiotics were among first aids given at the referring centers. (Table 5)

About 79.7% of patients arrived to the hospital after 24 hours of injury. The finding showed that patients coming from Jimma zone have relatively earlier arrival than those coming from areas out of Jimma zone. Most of our patients (82.3%; n=65) were managed surgically within the first 24 hours of arrival to the hospital. (Table 5)

Table 5: referral status, provided first aid, time lag between injury and management, type of used anesthesia and level of surgeon's qualification

Patients' referral status		**Patients from Jimma zone**		**Patients from areas out of Jimma zone**	
No referral history		50% **(n=19)**		14.4% **(n=10)**	
Referred		50% **(n=19**)		75.6% **(n=31)**	
Provided first aid among referred patients (n=27)					
Provided first aid	Topical antibiotics	Topical steroid	patching	TAT & pain killer	PO antibiotis	Only pain killer
Frequency	8 (29.6%)	5 (18.5%)	5 (18.5%)	4 (14.8%)	3 (11.1%)	2 (7.4%)
Time lag between injury and arrival					
Time lag of arrival	Within the first 12 hrs	Between 12 hrs & 24 hrs	Between 24hrs & 48 hrs	Between 48 hrs & 72 hrs	After 72 hrs
Number of patients	12 (15.2%)	4 (5.1%)	34 (43%)	6 (7.6%)	23 (29.1%)
Time lag between arrival to hospital & surgical management					
Time lag	Less than 12hrs	Between 12hrs to 24hrs	Between 24hrs to 48hrs	Between 48hrs & 72hrs	After 72 hrs
Number of patients	46 (58.2%)	19 (24.1%)	9 (11.4%)	3 (3.8%)	2 (2.5%)
Time lapse between arrival to the hospital and surgical management in relation to type of anesthesia					
Type of anesthesia	Time lag between arrival and surgery				
	Less than 12 hrs	Between 12hrs & 24hrs	Between 24hrs & 48hrs	Between 48hrs & 72hrs	After 72 hrs
GA	4	8	5	1	1
RB block	42	11	4	2	1
Level of surgeon's qualification					
		Type of used anesthesia			
		General anesthesia	Retro bulbar anesthesia	Total	
Surgeon	**Resident**	7	39	46	
	General Ophthalmologist	12	21	33	
Total		**19**	**60**	**79**	

Globe repair was done for all 78 patients and only intra-stromal foreign body removal was done for the remaining 1 patient.
There was history of second surgery for 11(13.9%) patients. Repeated surgery was done only once in all cases. Cataract extraction (n=6), stich correction (n=2), secondary IOL insertion (n=2) and pupilopilasty (n=1) were done during the second surgery.

Table 6: The details of performed surgical management

Type of Surgery	Frequency	Percent
corneal repair	24	30.4
Corneal and scleral repair	23	29.1
Repair, cortex wash/lensectomy and IOL inserted	9	11.4
Repair, cortex wash/lensectomy and IOL not inserted	7	8.9
Corneal and limbal repair	6	7.6
scleral repair	5	6.3
IOFB removal and repair	2	2.5
IOFB removal, repair, cortex wash/lensectomy and IOL not inserted	2	2.5
IOFB removal	1	1.3
Total	**79**	**100.0**

6.6. Surgical management outcome after 3 months

After 3 months of follow up, the Cornea is found to be transparent in 75.9% (n=60) of cases, cornea is scared in 22.8 %(n=18) and corneal edema is found on 1 patient (table 7).

Intra ocular pressure was measured only for 9 patients out of whom the measurement showed normotensive for **6** patients, elevated IOP for **1** patient and hypotonic IOP level was found in **2** patients. After 3 months follow up, 55 (69.6%) patients were found to have deep anterior chamber while 24(30.4%) patients had shallow anterior chamber.

After 3 months follow up, the lens was not visible in 40.5 % (n=32) of cases while it was transparent in 19% (n=15) cases and opaque in 7.6% (n=6) cases. The status of the lens was not commented in 7.6% (n=6) of cases. (Table 7)
Posterior segment examination was done only for 4 patients during the 3 months follow up, two patients had vitreous opacity while 2 patients had no detected abnormality. Posterior segment of 38 (48.1%) was not commented while the fundus was not visible due to media opacity in 46.8 % (n=37) of cases. (Table 7)

Table 7: Corneal, lens and posterior segment status after 3 months post-surgical management

Corneal status after 3 months post-surgical management			
	Corneal status		
	Transparent cornea	Corneal scar	Corneal edema
Frequency	60 (75.9%)	17 (21.5%)	2 (2.6)

Lens status after 3 months post-surgical management						
	Lens status					
	Lens was not visible	Transparent	IOL in place	Not commented	opaque	Aphakic
Frequency	32 (40.5%)	15 (19%)	14 (17.7%)	6 (7.6%)	6 (7.6%)	6 (7.6%)

Posterior segment status after 3 months post-surgical management				
	posterior segment status			
	No abnormality was detected	Vitreous opacity	Media opacity to visualize	was not commented
Frequency	2 (2.5%)	2 (2.5%)	37 (46.8 %)	38 (48.1%)

During the period of follow up, 4 patients developed keratitis and one patient developed endophthalmitis.

Out of the total patients included in this study, refraction was done only for 3 patients during the 3 months post-surgical management follow up.

Based on WHO visual acuity classification, visual acuity after 3 months was found to be normal to near in 12.7% (n=10) of cases, low visual acuity in 26.6% (n=21) of cases and 60.8% (n=48) were found to be blind with total blindness z for 23.5% (n=20). (Table 8)

Table 8: ***Presenting visual acuity and Visual acuity after 3 months***

Visual acuity	Frequency	
	Presentation	After 3 months
6/4 to 6/7.5	**3** (3.8%)	6 (7.6%)
6/10 to 6/18	2 (2.5%)	4 (5.1%)
6/24 to 6/48	**3** (3.8%)	**2** (2.5%)
6/60 to 3/60	**2** (2.5%)	**5** (6.3%)
< 3/60 to 1/60	**4** (5.1%)	**14** (17.7%)
Better than hand motion but < 1/60	**3** (3.8%)	**8** (10.1%)
Light perception to hand motion	**52** (65.8%)	**20** (25.3%)
No perception of light	**10** (12.7%)	**20** (25.3%)

After 3 months of follow up, the globe of 63(79.7%) is found to be normal grossly and the remaining 16(20.3%) developed phthisic bulbi. There was no evisceration or enucleation at all.

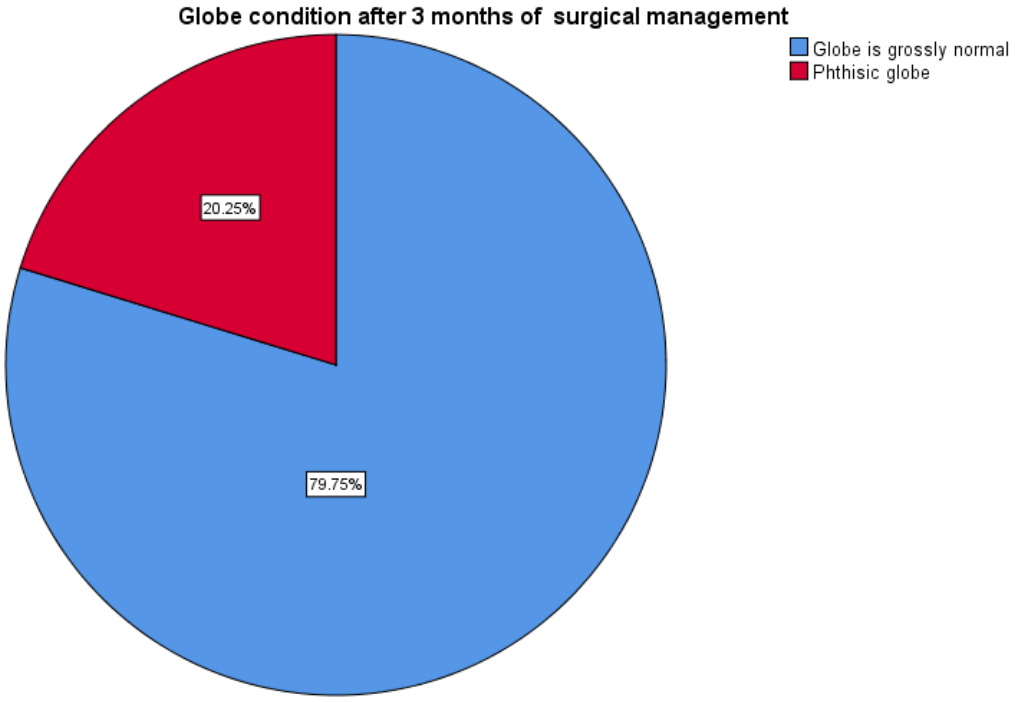

Figure 5: globe anatomic outcome after 3 months of post-surgical management

Both visual acuity outcome and gross anatomical outcome of the globe after 3 months post-surgical management follow up were found to be comparable among patients operated by residents and general ophthalmologists. Patients who were operated under general anesthesia showed better globe anatomical outcome than retro bulbar block (Table 9)

Table 9: Visual acuity outcome and gross anatomical outcome of the globe among patients operated by residents and general ophthalmologists

Level of surgeons qualification	Visual acuity outcome after 3 months of post-surgical management		Gross anatomical outcome of the globe after 3 months post-surgical management	
	Good outcome n (%)	Poor outcome n (%)	Good outcome n (%)	Poor outcome n(%)
Residents	6 (13%)	40 (87%)	37 (80.4%)	9(19.6%)
General ophthalmologists	4 (12.1%)	29(87.9%)	26 (78.8%)	7 (21.2%)
Type of anesthesia	Visual acuity outcome after 3 months of post-surgical management		Gross anatomical outcome of the globe after 3 months post-surgical management	
	Good outcome n (%)	Poor outcome n (%)	Good outcome n(%)	Poor outcome n(%)
GA	2 (10.5%)	17(89.5%)	16(84.2%)	3(15.8%)
Retro bulbar block	8 (13.3%)	52 (86.7%)	47(78.3%)	13(21.7%)

6.7. Predictors for final poor outcome among study participants

Patients presented with OGI with scleral involvement were found to have poor final visual outcome than non-scleral involving OGI (*COR=13, 95% CI= 2.596 - 65.736 & P=0.002*). Presenting visual acuity of hand motion or worse was found to be associated with poor final visual outcome than those coming with visual acuity better than hand motion (*COR=26.67 , 95%CI=4.869-146.048 and P<000*). Presenting collapsed anterior chamber was also found to increase the risk of poor final visual outcome than formed anterior chamber (*COR=9.4, 95%CI=1.807- 49.013 and P= 0.008*). Patients with presenting lens opacity and those with invisible lens were found to have increased poor final visual outcome (*COR= 14, 95%CI=1.588-126.123 & P=0.018*) and (*COR=20, 95%CI=2.306-178.872 & P=0.007*) respectively.

Table 10: showing independent variables and visual treatment outcome in bivariate logistic regression

N	Independent Variable	Catagory	Final visual acuity outcome		Sig	COR	CI (95%)
			Good n (%)	Poor n (%)			
1	Address	In jimma zone	7 (18.4%)	31 (81.6%)	0.15	0.35	0.083-1.466
		Out of Jimma zone	3 (7.3%)	38 (92.7%)	1		
2	Risk factor	Farming	3 (27.3%)	8 (72.7%)	1		
		None farming occupation	2 (12.5%)	14 (87.5%)	.342	2.625	.359-19.182
		Fighting	2 (18.2%)	9 (81.8%)	.613	1.688	.222-12.809
		Accident	3 (7.3%)	38 (92.7%)	.085	4.750	.807-27.960
3	First aid at refering center	First aid given	2 (7.4%)	25 (92.6%)	1		
		First aid not given	6 (26.1%)	7 (73.9%)	0.09	4.412	.794-24.510
4	Involved Eye wall structure in OGI	Cornea only	5 (12.5%)	35 (87.5%)	1		
		Cornea and limbus	5 (41.7%)	7 (58.3%)	.061	6.333	.918-43.681
		Corneo sclera or sclera	0 (0.0%)	27 (100.0%)	.002	13.062	2.596-65.736
5	Presenting visual acuity	Visual acuity better than hand motion	8 (47.1%)	9 (52.9%)	1		
		Visual acuity of hand motion or worse	2 (3.2%)	60 (96.8%)	.000	26.667	4.869-146.048
6	Presenting anterior chamber	Formed AC	8 (32.0%)	17 (68.0%)	1		
		Collapsed AC	2 (4.8%)	40 (95.2%)	.008	9.412	1.807-49.013
		Hyphema	0 (0.0%)	12 (100.0%)	.999	760223455.459	.000

7	Presenting crystalline lens condition	Intact and clear lens	8 (38.1%)	13 (61.9%)	1		
		Lens Opacity	1 (4.2%)	23 (95.8%)	.018	14.154	1.588-126.123
		Lens was not visible	1 (2.9%)	33 (97.1%)	.007	20.308	2.306-178.872
8	Time lapse between injury and arrival to the hospital	within the first 24 hours	1 (6.3%)	15 (93.8%)	1		
		After 24 hours to 48 hours	2 (5.9%)	32 (94.1%)	.959	1.067	.090-12.706
		After 48 hours	7 (24.1%)	22 (75.9%)	.163	.210	.023-1.883
9	Type of surgical management	corneal repair	2 (12.5%)	22 (87.5%)	1		
		Corneal and limbal repair	6 (83.3%)	0 (16.7%)	.999	.000	.000
		Corneo-scleral or scleral repair	16 (0.0%)	12(100.0%)	.011	8.250	1.617-42.090
		IOFB removal with/without repair	19 (9.5%)	2 (90.5%)	.889	1.158	.148-9.029

Patients presented with OGI caused by blunt trauma were found to have high risk of poor final globe anatomic outcome (***COR=6.8, 95%CI= 2.064-22.434 & P=0.002***). Ruptured globe and sclera involving eye wall injury were also found to increase the risk of poor final globe anatomic outcome with (***COR=12.5, 95%CI=3.160-49.443 & P=0.000***) and (***COR=13, 95%CI=2.596-65.736 & P=0.002***) than other type of OGI and eye wall injury that didn't involve the sclera respectively with and respectively. In addition to these, patients who were presented with invisible crystalline lens were found to have poorer final globe anatomic outcome than patients presented with clear crystalline lens or lens opacity (***COR= 9.56, 95%CI=1.133-80.733 & P=.038***).

Table 11: showing independent variables and globe outcome in bivariate logistic regression

N	Independent V.	Category	Globe outcome		Sig	COR	CI (95%)
			Good n(%)	Poor n(%)			
1	Mechanism of injury	Sharp	49 (89.1%)	6 (10.9%)	**1**		
		Blunt	12 (54.5%)	10 (45.5%)	.002	6.806	2.064-22.434
		bullet	2 (100.0%)	0 (0.0%)	.999	.000	.000
2	Involved material	wood	37 (72.5%)	14 (27.5%)	**1**		
		Metal	15 (93.8%)	1 (6.3%)	.108	.176	.021-1.461
		Glass	2 (100.0%)	0 (0.0%)	.999	.000	.000

		Stone	4 (80.0%)	1 (20.0%)	.721	.661	.068-6.434
		Clenched hand	1 (100.0%)	0 (0.0%)	1.000	.000	.000
		Animal horn/ nail	3 (100.0%)	0 (0.0%)	.999	.000	.000
		Plastic	1 (100.0%)	0 (0.0%)	1.000	.000	.000
3	Type of globe injury	Penetrating	50 (92.6%)	4 (7.4%)	1		
		Ruptured globe	9 (50.0%)	9 (50.0%)	.000	12.500	3.160-49.443
		Partial evisceration	4 (80.0%)	1 (20.0%)	.355	3.125	.279-35.017
		Intra ocular FB	4 (80%)	1(20%)	.999	2019343 5535.639	.000
4	Involved eye wall steucture	Corneal injury alone	38 (95.0%)	2 (5.0%)	1		
		Corneal and limbal injury	9 (75.0%)	3 (25.0%)	.061	6.333	.918-43.681
		Corneo-scleral or scleral injury	16 (59.3%)	11 (40.7%)	.002	13.062	2.596-65.736
5	Presenting anterior chamber	Formed anterior chamber	22 (88.0%)	3 (12.0%)	1		
		Collapsed anterior chamber	32 (76.2%)	10 (23.8%)	.246	2.292	.565-9.291
		Hyphema	9 (75.0%)	3 (25.0%)	.325	2.444	.413-14.471
6	Presenting crystalline lens	Intact and clear lens	20 (95.2%)	1 (4.8%)	1		
		Lens opacity	20 (83.3%)	4 (16.7%)	.233	4.000	.410-39.000
		lens was not visible	23 (67.6%)	11 (32.4%)	.038	9.565	1.133-80.733

6.8. Independent Predictors of poor treatment outcome

Multivariate logistic regression analysis was carried out to identify independent predictors of poor outcome. Accordingly, presenting poor visual acuity (visual acuity of hand motion to no light perception) was found to be a single independent poor prognostic factor for final visual outcome (***P=0.001***, ***OR=51.8*** and ***95%CI=5.225-513.563***). Similarly globe rupture was found to be an independent poor prognostic factor for final globe anatomic outcome (***P=.000***, ***OR= 12.5*** & ***95%CI= 3.160 - 49.443***) (table 11).

Table 12: Independent predictors of poor treatment outcome

N	Independent Variables	Category	VA outcome after 3 months		COR (95%CI)	AOR (95%CI)	p-value
			Good n (%)	Poor n (%)			
1	Presenting Visual acuity	Visual acuity better than hand motion	8 (47.1%)	9 (52.9%)	1		
		Visual acuity of hand motion to no light perception	**2 (3.2%)**	**60 (96.8%)**	26.667 (4.869-146.048)	**51.8 (5.225-513.563**	**.001**

N	Independent Variables	**Category**	**Globe outcome after 3 months**		COR (95%CI)	AOR(95%CI)	p-value
			Good n (%)	Poor n (%)			
1	Type of open globe injury	Penetrating	50 (92.6%)	4 (7.4%)	**1**		
		Ruptured globe	9 (50.0%)	9 (50.0%)	12.5 (3.160-49.443)	12.5 (3.16-49.443)	.000
		Partial evisceration	4(80.0%)	1(20.0%)	3.125 (.279-35.017)	3.125 (.279-35.017)	.355
		Intra ocular FB	0 (0.0%)	2(100.0%)	20193435535.639 (.000)	20193435.535 (0.000)	.999

CHAPTER 7: Discussion

7.1. Socio demography of patients

The mean age of patients with OGI was **24.08 ± 17.157** years, males were 5.58 times injured and 72.15% of the total cases were in the age range of 3 to 30years indicating that the young productive age group was more vulnerable for open globe injury (OGI). This mean age is the age at which most people are active and engaged in different work and recreational activities that make them more vulnerable to ocular injury and in our setup, males are more involved in outdoor activities and have more aggressive behaviors to get OGI than females. This finding has a similarity with a 1998 USEIR finding in which 58% of patients with ocular injury were aged less than 30 years with highest male to female ratio(32). Our study also showed close similarity with the study done at Gondar University hospital(31) and at Minilik II hospital which revealed mean age of 22 years and 19.4years(24) respectively. Other studies showed higher mean age of patients with OGI; 36 +/- 20.07 in western Turkey(34) and 38.8 +/- 17.5 years in **Asan Medical Center, Seoul, Korea.** This mean age difference may be due to the difference in population composition. The male predominance showed similarity with other studies which were done in **western Turkey**(34), **Asan Medical Center, Seoul, Korea**(35), Germany(33), at Minilik II hospital(24) and at Gondar University hospital(31).

7.2. Visual acuity and globe anatomy outcome of post-surgical management

Out of the total 79 patients, *60.8% (n=48)* of patients remained blind according to WHO Visual acuity classification out of which 20 patients were totally blind (NLP). This high percentage of blindness outcome has a similarity with the findings of studies done in ***Australia*** which showed that about 53% of patients remained with visual acuity of counting finger or worse (40), **central India** in which about 43% of patients remained with final visual acuity of counting finger or worse(41), **Nigeria** where about 4/5th of patients remained with visual acuity of blindness despite treatment (44), at **Menelik II Hospital**(24) and at **Gondar University Referral Hospital**(31). This high percentage of blindness may be due to delay in presentation to the hospital (about 80% of our patients were presented to the hospital after 24 hours of injury). The other possible reason may be patients who had regular follow up were those with poor vision (about 69% of managed OGI patients didn't have regular follow up to be included in the study). Refraction was also not well practiced in our cases and this may also contributed to the high percentage of poor visual outcome. Future cataract extraction for those remained with opaque lens and the possibility of corneal transplantation for patients with corneal scar may reduce this high percentage of blindness.

Multivariate logistic regression analysis showed that presenting poor visual acuity (visual acuity of hand motion or worse) was a single independent poor prognostic factor for final visual outcome. This finding has a similarity with studies done in **UK**(39), at ***Royal Brisbane Hospital, Queensland, Australiastudy***(40), in central India(41), at **Nagasaki University Hospital**, **Japan**(42), at a tertiary referral clinic in Ankara, Turkey(15), in ***Nigeria***(44) and at **Jimma University Specialized Hospital**(38) which showed that the final visual acuity was related to

presenting visual acuity.
In our study, OTS, RPAD documentation and wound size measurement was not done to see their effect on final visual or anatomic outcome. Other presenting factors like types of open globe injury, delayed presentation, damaged lens and structural site of injury were not associated with final visual outcome in this study although they were prognostic factors in other studies.

Three months after surgical management, gross anatomy of the globe was maintained in 79.7% (n=63) of cases while 16 patients developed phthisic bulbi. A multivariate logistic regression analysis showed that globe rupture was a strong poor prognostic factor for final globe outcome after 3 months post-surgical management. **A retrospective** study done at **Manchester Royal Eye Hospital** Showed blunt injuries associated with adnexal trauma, presenting visual acuity, RAPD or RD, and the absence of a red reflex as associated factors for significantly higher rate of enucleation(43) but there was no evisceration or enucleation in our cases.

There was no significant visual acuity outcome or gross globe anatomical outcome difference among patients operated by residents and general ophthalmologists after 3 months post-surgical management follow up. Patients who were operated under general anesthesia showed better globe anatomical outcome than retro bulbar block but this difference was not statically significant.

7.3. Presenting Physical findings, associated presenting factors and post treatment outcomes other than visual and globe outcome

The presenting visual acuity in 87.4% (n=69) of our cases were in blindness category with total blindness accounting for 12.7% (n=10) of the cases. This finding is in agreement with the study done at Menelik II hospital which showed presenting visual acuity in blindness category in 89.7% of patients(24).

In our study, accident was found to be the main risk factor for OGI and this finding has a similarity with the study done in western Turkey in which accident (game & sport activities) was the cause for *58.3%* of OGI(34). Sharp material was found to be the most cause of OGI at all age group accounting for 69.6%. All females were injured by sharp object. In this study, wood was found to be the most common object causing OGI followed by metal. This finding is in agreement to the study done at **Menelik II** hospital(24) and Gondar University hospital(31) which revealed wood as the most commonly involved object in OGI followed by metal and stone respectively.

Penetrating globe injury was the most commonly occurred injury (68.4%; n=54) followed by ruptured globe (22.8%; n=18) while OGI with IOFB accounted for 6.3% (n=5) and only 2 patients were presented with partial evisceration of the globe. The frequency of IOFB has a close similarity with a Turkey study that showed IOFB frequency in (8.8%) of cases(34). Patients with

ruptured globe were presented with poorer presenting visual acuity (visual acuity of hand motion or worse) and this finding has a similarity with a study done at **Asan Medical Center, Seoul, Korea,** which concluded the zone of injury as significant factor correlated with initial visual acuity(35).

Cornea was the most commonly involved structure in this study (in 93.7%; n=74 cases) and sclera was involved in 34.1% (n=27) of the cases. This finding has a similarity to the USEIR(32), Western Turkey(34), **Asan Medical Center, Seoul, Korea**(35) and Menelik II Hospital(24) studies in which cornea was found to be the most commonly involved structure. Intra ocular tissue prolapse was found in 67.1% (n=53) of cases during presentation and the prolapsed tissue was uvea in *81.13% (n=43)* of cases. This has a similarity with the western Turkey study finding in which iris prolapse occurred in 57.9% of cases(34).

First aid provision at referring center was only in 54% of referred cases. Most of patients in our study ***(79.9%)*** arrived at hospital after 24 hours of injury. This delay may be due to geographic distance from the hospital and absence of ophthalmic centers at nearby hospitals for early management and possible early referral. Surgical management was done within the first 24hours after hospital arrival for 82.3% (n=65) patients. Nine patients ***(11.4%)*** were operated within 24 to 48 hours and the remaining 5 patients were operated after 48hours of presentation. Most of patients with delayed surgery were GA cases and those need decision of senior ophthalmologists.

8. Conclusions

This study has shown that young males at productive age group were more vulnerable for OGI indicating that OGI causes significant socioeconomic burden. After 3 months of follow up, most of our patients remained blind despite surgical management and regular follow up. The presenting poor visual acuity was strongly associated with poor final visual outcome. The gross anatomy of the globe was maintained in 79.7% of patients. Globe rupture was found to be an independent poor prognostic factor for final globe anatomic outcome.

Poor chart keeping, infrequent IOP measurement, Poor examination of posterior segment, poor documentation of findings and poor refraction rate were among some detected pitfalls in managing OGI in our hospital.

Strength and limitations

Strength

This study is the first in its kind in the center of the study since no similar study was conducted on this specific topic.

Limitation of the study

1. Being retrospective study
2. Inability to get all charts from card room and poor follow up (Only 30.98% of cases could be entered into the study)
3. Poor documentation of patient's history & physical findings, and posterior segment evaluation
4. Included patients may be those with poorer vision since poor vision can be the reason for regular follow up than others

Recommendations

1. For JUDO

a. To improve chart keeping by orienting card room workers and other staffs ta handle patients chart safely and to avoid giving charts to the patients. Orienting and strengthening the hospital guards can also help in preventing patients not to take charts to their home. The department should also provide fasteners or any available material to fasten (bind) patients chart together to maintain completeness of patient's chart.

b. To improve documentation of patients finding by preparing history sheet & physical examination formats or check lists to make the patients information complete

c. To improve thorough evaluation of post-operative patients by orienting all involved health workers to take detail post-operative progressive note and to completely document all physical findings

d. To encourage and reinforce the practice refraction for all post-operative patients as needed.

e. To improve provision of health education at hospital level and to use mass media for providing health education for the community to increase the awareness of importance of early presentation to the hospital and the importance of regular follow up.

2. For the zonal health bureau

a. To provide training for health workers on ocular management in general and on how to care for globe injury at referring center.

b. To work in collaboration with JUDO in providing health education for the community on eye injuries and others as needed

3. For Oromia health bureau and FMOH

a. To train more health professional in the field of ophthalmology in order to increase quality service and to minimize the cost and burdens of traveling long for getting eye care.

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ANNEX: QUESTIONNAIRE

Chart No. ----------

Chart code. ……..

Socio-demographic history

1. Age ----------
2. Sex
    - ○ Male
    - ○ Female
3. Address ----------

History related to the ocular injury

4. What was the risk factor for injury
    - ○ Farming
    - ○ Fighting
    - ○ Non farming work
    - ○ Accidental (specify it)……
5. Mechanism of injury
    - ○ Sharp
    - ○ Blunt
    - ○ Bullet
6. Material that is involved in trauma
    - ○ Wood
    - ○ Metal
    - ○ Glass
    - ○ Stone
    - ○ Clenched hand

- ○ Animal horn
- ○ Other (specify)----------

7. How she/he came to the hospital?
   - ○ Referred from nearby health institution
   - ○ The patient came directly to this hospital
8. If the patient came with referral, was the patient given first aid at that health institution
   - ○ Yes
   - ○ No
9. If the answer for question **No.9** is '**YES'**, what was done there?
   - ○ Medication is given
     i. Specify the drug if possible ----------

   - ○ Patching was done
   - ○ Lid repair
   - ○ Unknown

PHYSICAL FINDINGS DURING PRESENTATION TO THE HOSPITAL

10. Presenting VA
    - ○ ----------
    - ○ Not recorded
11. Is there involvement of Ocular adnexa?
    - ○ YES
    - ○ NO
12. If the answer of question **No.12** is **YES,** What was the involved adnexal injury?
    - ○ Lid laceration
    - ○ lid edema

- ○ Orbital bone fracture
- ○ Others (specify)…….

13. What was the type of Globe injury?

- ○ Penetrating
- ○ Ruptured globe
- ○ Perforation
- ○ IOFB with no aqueous leakage
- ○ IOFB with leaked aqueous fluid
- ○ Others (specify)……
- ○ Partial evesceration

14. If there is IOFB, where is the site of **IOFB**?

- ○ Intra stromal with full thickness penetration of the cornea
- ○ In the anterior chamber
- ○ In the lens
- ○ In the posterior chamber
- ○ Others (specify)…….

15. Which eye wall structure is involved in OGI?

- ○ **Corneal laceration alone**
- ○ **Corneal laceration involving limbus**
- ○ **Cornea and sclera (corneo-scleral)**
- ○ **Only sclera**

16. What was the condition of anterior chamber?

- ○ Formed anterior chamber
- ○ Collapsed anterior chamber
- ○ hyphema

17. Was there prolapsed intra ocular tissue?

- ○ Yes
- ○ NO

18. If the answer of question **No. 18** is '**YES'**, what tissue was prolapsed?

- ○ Uvea
- ○ Vitreous
- ○ Vitreous and Uvea

19. What was the condition of crystalline lens during the time of presentation?

- ○ Intact and clear lens
- ○ Lens opacity
- ○ Ruptured lens (Capsular breach)
- ○ Sub-laxation
- ○ Anteriorly dislocated
- ○ Posteriorly dislocated

20. What was the time lapse between injury and arrival to the hospital?

- ○ ----------

21. The total time elapsed between arrival to the hospital and the surgery?

- ○ Within 12 hours
- ○ 12 hours to 24 hours
- ○ More than 24 hours to 48hours
- ○ 48 hours to 72 hours
- ○ After 72 hours

22. What kind of surgery was done?

- ○ Corneal repair
- ○ Corneal and limbal repair
- ○ Corneal & scleral repair
- ○ Scleral repair

- ○ IOFB removal
- ○ IOFB removal and globe repair
- ○ Repair and Cortex wash/ lensectomy
    i. IOL inserted
    ii. IOL not inserted

23. What type of anesthesia was given?

- ○ GA
- ○ Retro bulbar block (RB)

24. Who did the surgery?

- ○ Resident
- ○ General ophthalmologist
- ○ Sub-specialist
- ○

25. What was the condition of the patient's eye after 3 months post-operative period?

- ○ VA ----------
- ○ IOP ----------
- ○ Corneal condition----------
- ○ Anterior chamber
    i. Deep Ac
    ii. Shallow Ac
- ○ Condition of the lens----------
- ○ Condition of the Vitreous and retina----------
- ○ Phthisic globe
- ○ Eviscerated globe

26. Is there any history of repeated surgery?

- ○ Yes
- ○ NO

27. If the answer of question **No. 31** is "YES',

- ○ How many times was the surgery done? ----------
- ○ What was the reason of repeated surgery? ----------

- ○ What surgery was done? ----------
- ○ What was the time lapse between the first and repeated surgery? ----------

28. Was there any infection developed during the period of 3 months follow up?

- ○ Yes
- ○ No

29. If the answer for question No. 33 is 'YES", what was it?

- ○ Keratitis
- ○ Endophthalmitis
- ○ Panophthalmitis
- ○ Others(specify) ----------

30. Was the patient applying Post-operative medications as prescribed by physician?

- ○ Yes
- ○ No

31. Was the patient refracted during the post-operative period after surgical management of OGI?

- ○ YES
- ○ NO