

Profile of Ocular Trauma Patients presenting to the National Eye Referral Hospital, Asmara, Eritrea

Oluwafemi Adekunmi Ibrahim (✉ fmibra@gmail.com)

Orotta College of Medicine and Health Sciences (OCMHS)

Danait Michael

Orotta College of Medicine and Health Sciences (OCMHS)

Hermela Misghna

Orotta College of Medicine and Health Sciences (OCMHS)

Amir Ibrahim

Orotta College of Medicine and Health Sciences (OCMHS)

Rut Russom

Orotta College of Medicine and Health Sciences (OCMHS)

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Abstract

Background

Ocular trauma is a significant disabling health problem and a leading cause of visual impairment and loss worldwide. These injuries have many diverse costs including human suffering, long term disabilities, loss of productivity and economic hardship. Therefore, assessing the profile of ocular trauma, the etiology and its outcome is critical to the prevention of ocular injuries

Methods

This cross-sectional study was conducted on ocular trauma patients presenting to Berhan Ayni National Eye Referral Hospital from August – November, 2018. Data on demography, presenting visual acuity, type of injury and visual outcome were collected using a standardized questionnaire. The types of injuries were classified according to Birmingham Eye Trauma Terminology System. Pearson Chi-Square test (χ^2)/or Fisher's exact test in the Crosstab procedure was used to evaluate the relationship between specific variables. Logistic regression models were constructed to assess risk factors associated with blindness.

Result

280 patients were seen with ocular trauma in the hospital during the study period. Males were 198 (70.7%) and peak age was 18–40 years. Ocular injury commonly occurred at home (31.8%), street and high way (31.4%) and workplace (28.9%). 24.7% of the injury was work-related. Common causes of injury were blunt objects (37.5%), sharp objects (31.1%) and fall (12.5%). 27.8% had open globe injury (OGI). Blindness was associated with rural residence ($p < 0.0001$), presentation greater than 24 hours ($p = 0.04$), non-use of eye protection goggles ($p = 0.007$), open globe injury ($p = 0.018$), posterior segment involvement ($p < 0.0001$) and hospitalization ($p < 0.0001$).

Conclusion

Immediate and comprehensive medical care is mandatory for ocular trauma patients. Educating the public especially at home and workplace is essential to prevent eye injuries.

Background

Ocular trauma is a significant disabling health problem and a leading cause of visual impairment and loss worldwide. It is an event of public health importance which sometimes is overlooked in most societies especially in the developing countries.^{1,2} It has been estimated that 90% of all ocular injuries

are avoidable.^{1,3} Worldwide, the global annual incidence of ocular trauma is around 55 million with approximately 1.6 million people blind from eye injuries, additional 2.3 million with bilateral visual impairment and 19 million with unilateral blindness.^{4,5} This make ocular trauma the most common cause of unilateral blindness.^{4,6}

Ocular injuries have many diverse costs including human suffering, long term disabilities, loss of productivity and economic hardship.^{1,4,7} Being male, lower socioeconomic status, being younger, being involved in certain occupation like construction, mining, wood and metal works, sports - boxing, racket sports and road traffic accidents are some of the known risk factors associated with ocular trauma.^{4,8-11} Moreover, the pattern of ocular injuries is influenced by several factors: the environment, socioeconomic status, life style and availability of eye safety measures at work.^{11,12}

There is no published study on profile, presentation and risk factors of ocular trauma in patients living in the study area. Therefore, in view of public health importance, this study would provide information on pattern, presentation and risk factors of ocular trauma patients presenting to the National Eye Referral Hospital in Asmara, Eritrea. Also, this study would serve as the basis for planning and implementing preventive and curative measures to be undertaken by respective stakeholders.

Materials And Design

Study design

We conducted a single centre cross-sectional study at the Berhan Ayni National Referral Hospital (BANRH), Asmara in Eritrea. All data were collected using multiple approaches – patients' charts, standardized questionnaire and clinical examination. The patients were recruited from the outpatient department (OPD), emergency unit, minor operating theatre (OT) and major OT to ensure no patient was missed. All new patients presenting to the BANRH with ocular injuries during the study period were included.

Study setting and period

This study was conducted at Berhan Ayni National Referral Hospital (BANRH), Asmara from August 2018 – November 2018. BANRH is the only National Referral Eye Hospital in Eritrea. BANRH was selected for the study because it is a tertiary level hospital where most ocular trauma cases in Asmara (and even the whole country) are referred to. This will give a better overview of eye injuries in the city and a proxy for the country.

Data collection

The data was collected using a well-structured questionnaire developed for this study. The presenting vision on both eyes was measured using tumbling E Snellens visual acuity (VA) chart at 6 metres in all cooperative patients. Classification of World Health Organization for visual acuity was used. Each patient

was then examined (after VA assessment) with the slit lamp. Slit lamp bio-microscopy with + 90 D lens or indirect ophthalmoscopy with + 20 D lens was done to assess the posterior segments. The intraocular pressure was assessed in closed globe injury using the non-contact tonometer. Further examinations like B-scan ultrasound, CT scan were done as required. Operational definitions of ocular trauma was according to the Birmingham Eye Trauma Terminology System (BETTS).¹³

Data analysis

The data was analysed using Statistical Package for Social Sciences (SPSS) (Version 22.0; IBM, Chicago, IL, U.S.A.). The dependent variable was ocular trauma and independent variables were socio-demographic data (sex, age, residence (rural/ urban), the place where trauma occurred, type of object that causes trauma, occasion of trauma, affected eye, type of injury, affected ocular structure, time of presentation, and visual acuity (VA) at presentation. Mean \pm 1 standard deviations (SD) and inter-quartile range (IQR) were computed for specific continuous variables. Relationship between specific independent and dependent variables was tested using Pearson Chi-square (χ^2) test or Fischer's exact test in the crosstab procedures. Binary logistic regression with backward variable removal (backward: conditional), was undertaken to identify parameters independently associated with increased odds of blindness and poor outcome. Univariate and multivariable logistic regression models were subsequently fitted and crude and adjusted odds ratios (OR), 95% confidence intervals (95% CI) reported. All *p*-values were two-sided and statistical significance was set at < 0.05 .

Ethical Consideration

Ethical approval

for the study was obtained from the Eritrean Ministry of Health Research Ethical Committee and Orotta College of Medicine and Health Sciences Scientific and Ethical Committee. Informed written consent was obtained from all participants after extensive explanation of the study objective/or purpose, study procedures and possible adverse effects. All participants were duly informed of their rights to refuse or terminate their participation in the study. Information on the maintenance of data confidentiality and integrity was also provided. The study protocol adhered to the tenets of the Declaration of Helsinki for research involving human subjects.

Results

Socio-demographic characteristics

A total of 280 patients with ocular trauma were seen and among whom 70.7% (198) were males and 29.3% (82) were females (male to female ratio – 2.4:1). The patients' aged from 5 to 93 years, with a mean age of 27.3 ± 18.0 years [27.8 ± 17.7 years for males and 25.4 ± 18.6 years for females]. About 35.7% (100) of the ocular trauma occurred in children (0–16 years old) and 24.3% (68) in 17–29 years

old. However, as age increases, the percentage of ocular trauma decreases in both males and females (Fig. 1).

The ocular trauma was common among the urban residents (69.3%) compared to the people living in the rural area (30.7%) and it occurred in same proportion in both gender despite residence (Table 1). Home was the main location of ocular trauma, 31.8% (89), followed by street and highway 31.4% (88), work 28.9% (81) and school 7.1% (20) (Table 1). The majority of injuries among males occurred in the street and highway (36.9%, n = 73) and at home for the females (57.3%, n = 47) with a $p < 0.001$.

Work-related injuries were seen in 25% (70) of the patients. The occupation associated with work related injury were farmers and metal- and wood-workers (27.1%, n = 19 each), students (24.2%, n = 17), housewives (12.9%, n = 9) and army officers (8.7%, n = 6). Maleness was associated with work-related injuries (81.4 %, n = 57/70, $p = 0.023$) (Table 1). Eye protective devices were worn by 10.7% (n = 30) at the time of injury. Eye injuries occurred accidentally in 70.4% (197), assault in 28.6% (80) and self-inflicted in 1.0% (3). Alcohol-related injuries were seen in 13 (4.6%) patients. Eye injury was caused by blunt objects in 37.5% (105), sharp objects in 31.1% (87), fall in 12.5% (35), burns in 8.6% (24), road traffic accident (RTA) in 3.9% (11). Others include animal bite (1.8%, 5), human bite (2.1%, 6) and traditional healers' (2.5%, 7) (Table 1).

Table 1
 Characteristics of ocular trauma patients seen at BANRH, Asmara (N = 280)

Variable	Male (n, %)	Female (n, %)	Total (n, %)
Age group (years)			
0–16	68 (34.3)	32 (39.0)	100 (35.7)
17–29	49 (24.7)	19 (23.2)	68 (24)
30–44	48 (24.2)	18 (22.0)	66 (23.6)
45–64	22 (11.1)	12 (14.6)	34 (12.1)
65+	11 (5.6)	1 (1.2)	12 (4.3)
Mean (\pm SD)	27.3 \pm 18.0	27.8 \pm 17.7	25.4 \pm 18.6
Residence			
Urban	137 (69.2)	57 (69.5)	194 (69.3)
Rural	61 (30.8)	25 (30.5)	86 (30.7)
Time Interval from injury to presentation			
Greater than 24 hours	131 (66.2)	49 (59.8)	180 (64.3)
Less than 24 hours	67 (33.8)	33 (40.2)	100 (35.7)
* Location of injury (LOI)			
Home	42 (21.2)	47 (57.3)	89 (31.8)
Street and highway	73 (36.9)	15 (18.3)	88 (31.4)
Work	67 (33.8)	14 (17.1)	81 (28.9)
School	16 (8.1)	6 (7.3)	22 (7.8)
Cause of injury			
Blunt object	76 (38.4)	29 (35.4)	105 (37.5)
Sharp object	63 (31.8)	24 (29.3)	87 (31.1)
Fall	20 (10.1)	15 (18.3)	35 (12.5)
Burns	20 (10.1)	4 (4.9)	24 (8.6)
Road traffic accident	8 (4.0)	3 (3.7)	11 (3.9)
Others	11 (5.6)	7 (8.5)	18 (6.4)
Intent of injury			
Unintentional/ Accidental	140 (70.7)	57 (69.5)	197 (70.4)

Variable	Male (n, %)	Female (n, %)	Total (n, %)
Assault	56 (28.3)	24 (29.3)	80 (28.6)
Self-inflicted	2 (1.0)	1 (1.2)	3 (1.0)
* Work-related (WR)			
Yes	57 (28.8)	13 (15.9)	70 (25.0)
No	141 (71.2)	69 (84.1)	210 (75.0)
Total	198 (100.0)	82 (100.0)	280 (100.0)

*p < 0.05 Chi square test (WR: p = 0.023. LOI: p < 0.001)

Clinical characteristics

Medical co-morbidity was seen in 4.6% (13): hypertension (8), pregnancy (2) while diabetes mellitus, heart problem and epilepsy accounted for one each. 289 eyes of the 280 patients had ocular injuries. The right eye was involved in 46.8% (131), left eye in 50.0% (140) and both eyes in 3.2% (9).

BETTS Classification

The BETTS showed that closed globe injury was 73.2% (205) and open globe injury was 26.8% (75) (Fig. 2). In closed globe injury, 76.1% (156) was contusion while 23.9% (49) was due to lamellar laceration. In open globe injury, ruptured globe was seen in 17.3% (13) while remaining was due to laceration. Penetrating injury accounted for 56.4% of the laceration and Intraocular foreign body accounted for 32.3% (Fig. 2)

Cornea, sclera and corneo-sclera complications were the most common clinical findings (25%, n = 70) followed by adnexal and periocular laceration (17.9%, n = 50), traumatic cataract (13.2%, n = 37), sub-conjunctival hemorrhage and macular edema each accounted for 8.6% (n = 24). Devastating complications were also found that requires enucleation (0.4%, n = 1) and evisceration (1.1%, n = 3). Anterior segment injury was involved in 77.9% while posterior segment only was involved in 13.2%. Both segments were involved in 8.9%.

Visual acuity at presentation

At presentation, 15.7% (44) had VA of 6/6–6/7.5, 22.2% (62) have MSVI (VA < 6/18 – 3/60) and 29.3% (82) were blind (VA < 3/60) using the WHO classification (Table 2)

Table 2
VA of ocular trauma patient presenting to BANRH,
Asmara (N = 280)

VA category	Frequency	Percentage
6/6–6/7.5	44	15.7
6/9 – 6/18 (EVI)	92	32.9
6/24 – 6/48 (MVI)	47	16.8
6/60–3/60 (SVI)	15	5.4
2/60 – 1/60	33	11.8
HM	23	8.2
LP	10	3.6
NLP	16	5.7
Total	280	100.0

VA -visual acuity, HM- Hand movement, LP- Light perception, NLP- No light perception

Ocular trauma score

Probability of final visual acuity was estimated based on presenting visual acuity and clinical presentation using Ocular Trauma Score (OTS). The median OTS value was about 86. Blindness is predicted to occur in 49 eyes (17.5%) and visual impairment in 162 eyes (57.9%) by 6 months. Only 24.6% (69 / 280) of the eyes is predicted to have V/A > 6/12 by 6 months (Table 3).

Table 3
Ocular Trauma Score (OTS) of Ocular trauma patients seen at BANRH, Asmara (N = 280)

OTS	Final visual acuity category						Total
	Raw score	Category	NLP	LP/HM	CF- < 6/60	6/60 – 6/12	
0–44	1	0	4	3	0	0	7
45–65	2	4	5	8	2	1	20
66–80	3	11	20	26	12	2	71
81–91	4	1	3	1	53	9	67
92–100	5	0	1	2	55	57	115
Total		16	33	40	122	69	280

Factors associated with blindness in ocular trauma patients

Blindness (VA < 3/60) was associated with rural residence (61.6%, $p < 0.0001$), presentation greater than 24 hours post injury (35.0%, $p = 0.04$), non-use of eye protection goggles (32.4%, $p = 0.007$), open globe injury (41.3, $p = 0.018$), posterior segment involvement (43.2%, $p < 0.0001$) and hospitalization (65.4%, $p < 0.0001$) using the Chi square statistics (Table 4). Other factors like gender, age, work related injury and location of injury were not significantly associated.

Table 4
Visual acuity of patients with ocular injury and associated factors in Asmara, Eritrea

Visual acuity					
Variable	6/6–6/18 Normal n (%)	< 6/18 – 3/60 Visual imp n (%)	< 3/60 Blind n (%)	Total n (%)	p value #
Age group (years)					0.48
0–17	52 (40.3)	17 (25.4)	32 (38.1)	101 (36.1)	
18–40	50 (38.8)	31(46.3)	36 (42.9)	117 (41.8)	
41–60	20 (15.5)	14 (20.9)	11 (13.1)	45 (16.1)	
60 +	7 (5.4)	5 (7.5)	5 (6.0)	17 (6.1)	
Gender					0.43
Male	88 (44.4)	46 (23.2)	64 (32.3)	198 (100.0)	
Residence					< 0.0001
Rural	20 (23.3)	13 (15.1)	53 (61.6)	86 (100.0)	
Arrival time at hospital					0.04
Greater than 24 hours	78 (43.3)	39 (21.7)	63 (35.0)	180 (100.0)	
Eye protection before injury					0.007
No	115 (46.0)	54 (21.6)	81 (32.4)	250 (100.0)	
Location of injury					0.37
Work	30 (37.0)	20 (24.7)	31 (38.3)	81 (100.0)	
Home	47 (52.8)	20 (22.5)	22 (24.7)	89 (100.0)	
Street and highway	41 (46.6)	21 (23.9)	26 (29.5)	88 (100.0)	
School	11 (55.0)	5 (25.0)	4 (20.0)	20 (100.0)	
Unknown	0 (0.0)	1 (50.0)	1 (50.0)	2 (100.0)	
Cause of Injury					0.04
Blunt object	51 (48.6)	22 (21.0)	32 (30.5)	105 (100.0)	
Sharp object	29 (33.3)	26 (29.9)	32 (36.8)	87 (100.0)	
Fall	18 (51.4)	7 (20.0)	10 (28.6)	35 (100.0)	

Visual acuity				
Burn	13 (54.2)	8 (33.3)	3 (12.5)	24 (100.0)
RTA	6 (54.5)	4 (36.4)	1 (9.1)	11 (100.0)
Others	12 (66.7)	0 (0.0)	6 (33.3)	18 (100.0)
Type of injury				0.018
Open globe injury	25 (33.3)	19 (25.3)	31 (41.3)	75 (100.0)
Segment of eye involved				< 0.0001
Anterior	115 (52.8)	50 (22.9)	53 (24.3)	218 (100.0)
Posterior	5 (13.5)	16 (43.2)	16 (43.2)	37 (100.0)
Both	9 (36.0)	1 (4.0)	15 (60.0)	25 (100.0)
Hospitalization after injury				< 0.0001
Yes	11 (14.1)	16 (20.5)	51 (65.4)	78 (100.0)
Surgical repair post injury				< 0.0001
Yes	19 (26.4)	15 (20.8)	38 (52.8)	72 (100.0)
Total	129 (46.1)	67 (23.9)	84 (30.0)	280 (100.0)

The risk of blindness was 8 times higher among rural residents ($p < 0.001$ on logistic regression) and 2 times more in OGI ($p = 0.03$) (Table 5).

Table 5

Summary of binary logistic regression model describing demographic characteristics and type of injury as predictor if severe eye injury requiring medical attention (open globe), late presentation and blindness

	Adjusted OR	95% CI		p-value
Risk of V/A < 3/60				
> 24 hours presentation	1.17	0.61	2.25	0.65
Open globe injury	2.01	1.07	3.79	0.03
Rural, Residence	8.33	4.55	16.67	< 0.001
Male, Gender	1.56	0.79	3.06	0.19
Age < 25 years	0.75	0.41	1.37	0.35
Open globe injury				
Rural, Residence	1.41	0.78	2.56	0.25
Male, Gender	1.33	0.73	2.43	0.36
Age < 25 years	0.89	0.52	1.53	0.68
Late presentation (> 24 hours)				
Open globe injury	1.12	0.63	2.00	0.69
Rural, Residence	4.04	2.13	7.65	< 0.001
Male, Gender	0.77	0.44	1.35	0.37
Age < 25 years	1.58	0.94	2.65	0.09

Discussion

Ocular trauma is an uncommon event that can leave devastating effects and sometimes cause blindness.¹⁴ This study highlights the profile of patients presenting with ocular trauma to the National Referral Hospital in Asmara, Eritrea.

Males were found to have more ocular injury than females. Studies on the incidence of ocular trauma have found two important factors associated with ocular injury are age and gender especially in people under 30 years of age and the male gender.^{15,16} Ocular trauma studies done in Africa and Asia found that ocular trauma occurs in the young and more in males.^{11,17-22} Most ocular injury in males tend to occur at the street and highway and workplace. The greater tendency for men to sustain eye injury is multifactorial which includes aggressive behavior, work-related, assault-related, alcohol abuse and unwillingness to use protective devices at work.²³

The mean age of ocular trauma patients was 27.3 ± 17.9 years with no statistically significant differences in gender. Different studies on ocular injury showed that frequent occurrence of ocular injury is seen among ages 20–35 years.^{10,11,18–22,24} This age group may be more prone to ocular trauma due to being more involved in hazardous activities which could be adventurous and aggressive.^{25,26} The injury can result in huge disability adjusted life years for the young individuals as they have long life ahead of them.

The study showed ocular trauma occurred more at home among women and children, 0–17 years as well as street and highway plus work place among men [50% (n = 140/280)]. Women and children are observed to stay more at home and men more outdoors. In Addis Ababa, Ethiopia, home constituted 37% of ocular injury while workplace contributed 30.7%.¹¹ However, ocular injury in rural Nepal was 32% at home and 37% workplace.¹⁹ and was in the farm (37.2%) and at home (35.9%) in the elderly of South-Western Nigeria.¹⁰ The street was where the majority of ocular trauma occurred in New York, USA.²⁷ The differences in the different countries could be due to nature of occupation, preventive practices and whether it's rural or urban settings. There is great need to focus preventive ocular trauma strategies/ education on the home, street and highways and work place.

Ocular trauma was commonly caused by blunt objects (37.5%) followed by sharp objects (31.1%, metallic and wooden) and then fall (12.5%). The blunt objects injury was mainly caused by sticks, thrown stones and less frequently fist fights and injuries during sports. Stick was the main cause of eye injury in Nigeria,¹⁰ Tanzania²¹ and in Ethiopia.^{11,24} Blunt objects was the cause of ocular trauma in other studies.^{27–29} However, sharp objects were found to be of higher incidence in ocular trauma studies done in Ethiopia, Egypt and Singapore.^{17,20,30} It was noted that children in the city usually play with stones and throw stones at each other. There is negligible civil disturbance in Eritrea which reduce the risk of sharp objects.

Work related injuries occurred in 25% of participants. The common occupations involved were farmers, metal workers (hammering, grinding, and welding) and wood workers. Eighty nine percent of workers involved in work-related injury did not wear protective devices while working. This may be due to negligence on their part and unwillingness to wear protective devices as some workers become more confident that they cannot have injuries to the eyes because they are now 'expert'. In Malaysia³¹ and Ethiopia,¹¹ none of the participants wore protective devices during the eye injury, while in Southern India, 97.8% did not wear any eye protection at the time of injury.³²

Accidental injuries (70.4%) occurred more than assault injuries (28.6 %). In Malaysia, 92% of ocular injuries were accidental and 7.7 % from assault.³¹ Though most accidents are preventable, unintentional accidents occur as a result of ignorance, haste, negligence, carelessness and lack of knowledge. Laterality in ocular injuries also tends to vary in different studies. the right eye was involved in 46.8% of patients while left eye was involved in 50% of the patients in this study. Similar findings occurred in Uttarakhand where left eye occurred more than right eye.⁷ It is possible that right handedness may contribute to this. Bilateral injury was seen in 3.2%. This is similar to injuries in Egypt (4.1%)²⁰ and

Malaysia (10.3%),³¹ where ocular trauma plays a minor role in bilateral blindness compared to its major role in unilateral blindness.

Post traumatic blindness was associated with rural residence ($p < 0.0001$), presentation greater than 24 hours post injury ($p = 0.04$), non-use of eye protection goggles ($p = 0.007$), open globe injury ($p = 0.018$), posterior segment involvement ($p < 0.0001$) and hospitalization ($p < 0.0001$) in univariate analysis. However, in logistic regression analysis, only rural residency and OGI were associated with blindness. This may be because people with ocular trauma living in rural areas may present late, and those with open globe injury may have involvement of the posterior segment and vital structures that may compromise vision. In Ethiopia,¹¹ rural residence was associated with blindness post ocular trauma. Poor vision post eye injury was associated to male gender and advancing age in India³² and to increasing age and OGI in Nepal.¹⁹

Strength and Limitation

The main strength of our study is its novelty the first of its kind in Eritrea. The study was also undertaken in the only national referral eye hospital in the country and may thus give a fairly good account of the profile of patient with ocular trauma.

Nonetheless, the study has some limitations. The short study period may not reflect the actual profile of cases for the whole year. Also, the study was a hospital-based study, the study subjects were not representative of the population at risk. This makes it difficult to determine the prevalence of ocular injury accurately. The study covered patients only from the eye hospital and hence, patients who had eye injuries along with other life-threatening injuries may have been missed. Though the study setting was only the government hospital, there are no private eye clinics in Asmara which makes the data more complete. The minor injuries from urban and rural areas may not have presented to hospital further missing more information.

Conclusion And Recommendations

Ocular injuries are still a common and preventable cause of monocular blindness in Eritrea. Efforts to prevent ocular injuries should particularly be directed toward improving established domestic habits and occupational safety especially among farmers and artisans using metal and wood. An appropriately designed preventive health education campaigns should also be made to the public. Improved access to comprehensive eye care, especially in the rural areas, is essential.

Declarations

Conflict of Interest

The authors have no conflict of interest to declare on this study.

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Authors' contributions

DM, HM, AI, RR conceived of the study, participated in the design, performed clinical examinations. OAI performed the statistical analysis, participated in the design and reviewed/edited the manuscript. All authors read and approved the final manuscript.

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Supporting Documents

The dataset supporting the conclusions of this article are available from the corresponding author on reasonable request.

Consent for publication

Not applicable.

Ethics approval and consent to participate

Ethical approval for the study and clinical protocols used was obtained from Eritrean Ministry of Health (MOH) research ethical committee. Informed written consent was obtained from all participants. During the study, strict adherence to approved clinical protocols was observed.

Author details

¹ Orotta College of Medicine and Health Sciences (OCMHS). P.O. Box 8566, Asmara, Eritrea.

Tel: +291 765 6970.

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Figures

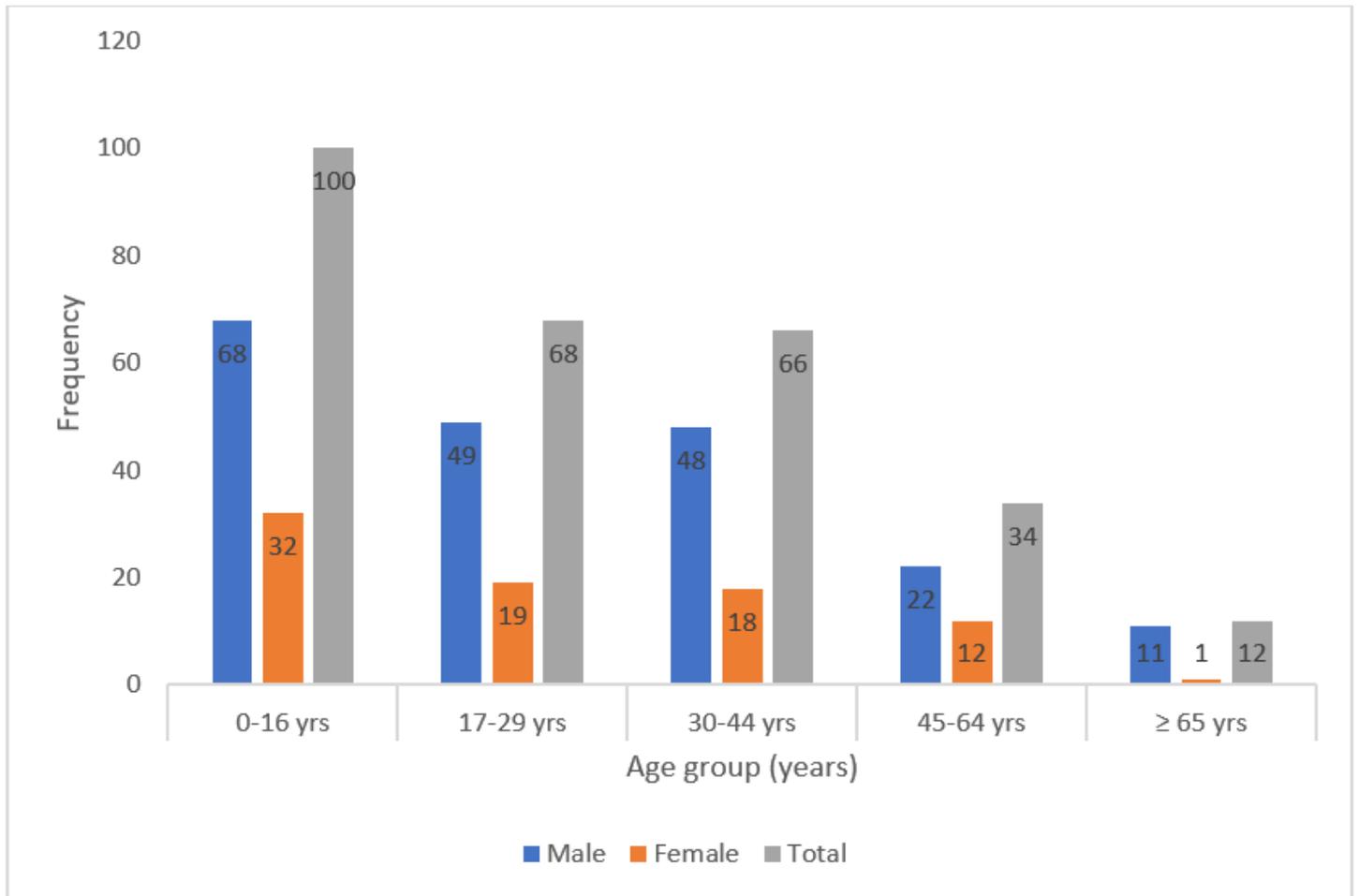


Figure 1

The Age and Gender Distribution of Ocular Trauma Patients seen at Berhan Ayni National Referral Hospital (BANRH), Asmara

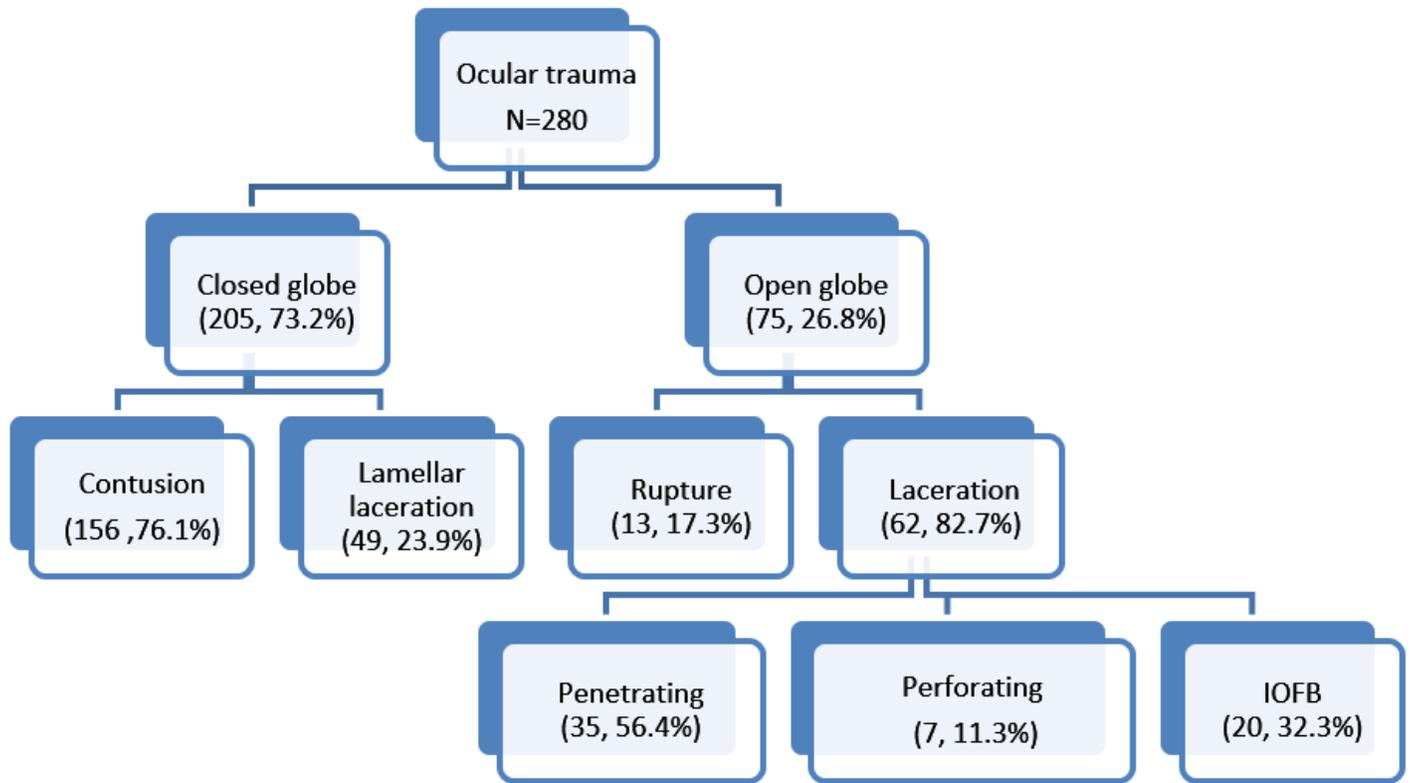


Figure 2

BETTS classification of Ocular trauma patients seen at BANRH, Asmara

Supplementary Files

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- [QuestionnaireforoculartraumaofpatientsattendingBerhanAyniNationalReferralHospital1.pdf](#)