Original Research Paper

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Opthalmology

A PROSPECTIVE STUDY TO EVALUATE THE STRUCTURAL AND FUNCTIONAL LOSS IN EYES DUE TO ROAD TRAFFIC ACCIDENTS

Rana Divya	Resident, Department of Ophthalmology, Gajra Raja Medical College, Gwalior.
Shukla Abha	Associate professor, department of ophthalmology, Gajra Raja Medical College, Gwalior.
Dubey Harshita	Resident, Department of Ophthalmology, Gajra Raja Medical College, Gwalior.
Shakya Devendra Kumar	Head of the Department of Opthalmology, Gajra Raja Medical College, Gwalior.
Kirti Chhabra*	Resident, Department of Ophthalmology, Gajra Raja Medical College, Gwalior. *Corresponding Author

ABSTRACT **Purpose** To evaluate the structural and functional loss in eye due to road traffic accidents (RTA), and secondarily to study the pattern of ocular injuries and demographic profile of ocular injuries due to RTA. **Methods** This is a prospective, observational, hospital based study, conducted on 50 patients with ocular injuries following RTA. A detailed demographic data and details of the injury was obtained. Information regarding time, location, type and mechanism of eye injury and use of protective eye wear was recorded.Complete ophthalmic examination was done and B scan, CT orbit and other investigations were done wherever required. Of these 50 patients were followed up at 1stweek, 3rd week, 2 months and 6 months. **Result** Maximum cases were seen in age group 21- 30 years (33%), more in males (82%) and two wheelers and adnexal injury was more common. At the end of 6 months, there were 14% (n=07) cases with residual functional loss. These were associated with severe impairment in visual acuity (finger count, perception of light, loss of light perception). **Conclusion** Evaluation of ocular trauma cases quantitatively would help in measuring precisely the improvement and deterioration in each case and helps to know the progress of the case and effect of treatment. So far in assessment of damage, only eye ball is considered whereas in this method damage to ocular adnexa is also calculated. In future, more studies should be conducted to check the utility of this concept.

KEYWORDS : ocular trauma, RTA, quantitative, structural and functional loss.

INTRODUCTION

Road traffic accidents (RTA) are common occurrences these days, specially in developing countries like India, due to rapid urbanisation, poor safety, lack of enforcement, distracted driving, influence of alcohol, speeding, a failure to wear seat-belts or helmets and poor road infrastructure. With the increasing number of various road transport vehicles, and the increasing number of new drivers, road traffic accidents are increasing, and causing mild to severe human injury, including injuries to the eyes. The common trauma to the eye in road traffic accidents includes injuries to eyelids, orbital wall, periorbital structures lacrimal apparatus, extra-ocular muscles, conjunctiva, cornea, sclera , uveal tissue, vitreous, choroid, optic nerve and also the entire globe of the eye may be involved.[1] Ocular trauma due to road traffic accidents (RTA) is the important causes of ophthalmological morbidity and some injuries can cause cosmetic disfigurement. Eye injuries, resulting in visual loss or impairment, cause enormous cost to the victim and his family. There is great need for more active interest in the prevention of eye injuries. Outcome of any type of ocular trauma can either in form of structural or functional loss in eye which can manifest immediately or later after sometime. Ocular adnexa is also an important part of eye, which has not been given a separate entity until Dr. B. Shukla gave another classification of ocular trauma which included ocular adnexa. Disfigurement of ocular adnexa can produce structural and functional defect in eye, which has not been discussed in many studies done on ocular trauma in past.

In this study, an effort has been made to quantify ocular trauma based on loss of structure and loss of function using the proposed model for quantification of ocular trauma by Dr. B. Shukla.[4] An attempt has been made to check the feasibility and applicability of this model to calculate the structural and functional loss in cases with ocular trauma due to RTA.

METHODS

This study was a prospective, observational, hospital based study which was conducted on 50 patients with history of ocular injuries following road traffic accident attending the out-patient department of Ophthalmology, trauma centre and casualty of Jaya Arogya hospital, Gajra Raja Medical College, Gwalior, over a period of 6 months.After obtaining institutional ethical committee permission, informed consent was taken from patients.

Selection Of Patients:

Inclusion Criteria:

- Cases of ocular injuries during the road traffic accidents.
- 1 to 70 years of age.
- Drivers, passengers or bystanders during accident.

Exclusive Criteria:

- Ocular injuries due to domestic trauma, assault or chemical injuries.
- Patients who were not willing to participate in study and those not willing for follow up. A detailed demographic data and details of the injury was obtained.

Information regarding time, location, type and mechanism of eye injury and use of protective eye wear was recorded. In examination, vision was recorded and a comprehensive anterior and posterior segment examination was done. If the patient was immoblile, bed side vision was recorded. X ray of orbit (AP and Lateral view) and computerized tomography (CT) scan (if required) was done in all suspected cases of orbital rim fractures and peri orbital trauma. Each patient was then followed up evaluated for structural loss (table 1) and functional loss (table 3,4) at 1st week; 3rd week; 2nd month; 6th month from the day of presentation. The results was analyzed and conclusions was drawn.

To classify ocular trauma BETTS classification[7] (fig.1) and Dr. B. Shukla's ocular trauma classification[2] (fig.2) ocular adnexal classification by Shukla et al (fig. 3) were used ; and for quantification of functional and structural loss in eyes proposed model of quantification of ocular trauma by Dr. B. Shukla[3] was used.

Loss of structure and function were graded in steps of 10% on the graph paper on either side of a central line (Fig. 4). Structural and functional loss is then calculated after every one week for at least 8 weeks. All recordings are plotted on a graph paper with one sq.mm size squares. Mostly, the maximum damage (structural or functional) is at the time of injury in case of trauma. A vertical line was drawn on a graph paper up to 10 cm from the centre of a horizontal line of 20 cm on the graph paper. Structural damage was plotted on the left side of vertical line and functional loss on the right side. The horizontal base line drawn indicated the onset of trauma. Another vertical line was drawn on

extreme right side which is divided in 8 parts of 1 cm each. Each 1 cm space represents one week. After 8 weeks, all points on the left and right side were joined and an ocular traumagram was formed. Each sq.cm area within this traumagram was counted. Each sq.cm. represents 1 trauma unit (T.U.). Many types of traumagrams were anticipated. The Ocular traumagram gives the extent of structural or functional loss in the injured eye. The enclosed area was calculated from counting 1 cm squares in the enclosed field. Structural and functional losses were added to give total loss. In bilateral cases, the same procedure was repeated in each eye and of both eyes were added to get the total loss of both eyes (Table 1-4).

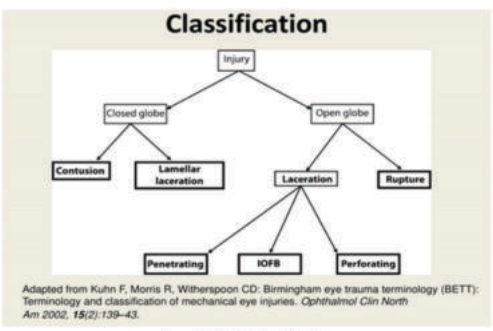


Figure 1 : BETTS classification

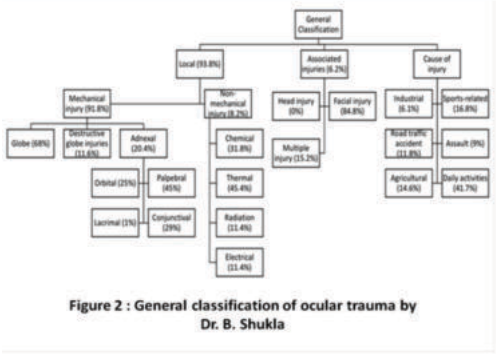


Figure 2 : General classification of ocular trauma by Dr. B. Shukla

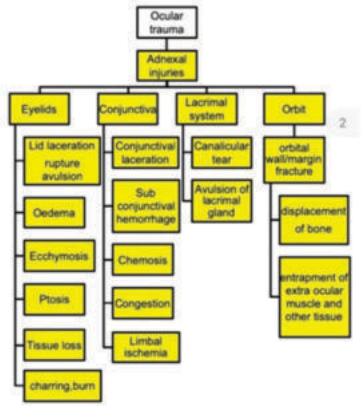


Figure 3 : Classification for ocular adnexal injuries is proposed by A Shukla et al

Table 1: Evaluation of structural loss

	MILD = 1	MOD. =2	SEVERE =3	VERY SEVERE=4
	5	10	15	20
ORBIT & EYE BALL				
CONJUNCTIVA				
CORNEA				
LIDS				
LACRIMALAPP.				
AVERAGE LOSS = TOTALLOSS / 5				

Table 2: Evaluation of structural loss

Range	Grade	Percentage
IF TOTAL IS UPTO 2O T. U. THE LOSS IS	MILD	20%
IF TOTAL IS 21- 40 T. U. THE LOSS IS	MODERATE	40%
IF TOTAL IS 41- 60 T.U. THE LOSS IS	SEVERE	60%
IF TOTAL IS 61-80 T.U. THE LOSS IS	VERY SEVERE	80%
IF TOTAL IS >80 T.U. THE LOSS IS	TOTAL	100%

Table 3 : Evaluation of functional loss

POST TRAUMA V.A.		PERCENTAGE LOSS
VA in meter	VA in feet	
6/6	20/20	0 %
6/9	20/30	10 %
6/12	20/40	20 %
6/18	20/63	30 %
6/24	20/80	40%
6/36	20/125	50 %
6/60	20/200	60 %
6/75	20/250	65 %
6/95	20/320	70 %
6/120	20/400	75 %
6/150	20/500	80 %
6/190	20/630	85 %
C.F./ H.M.	C.F./ H.M.	90 %
NO P.L.	NO P.L.	100 %

Table 4 : Evaluation of total functional loss

PARAMETERS	PERCENTAGE
VISUAL ACUITY	80 %
VISUAL FIELD	05 %
OCULAR MOTILITY	05 %
OCULAR TENSION	05 %
LACRIMAL DYSFUNCTION	05 %
TOTAL	100 %

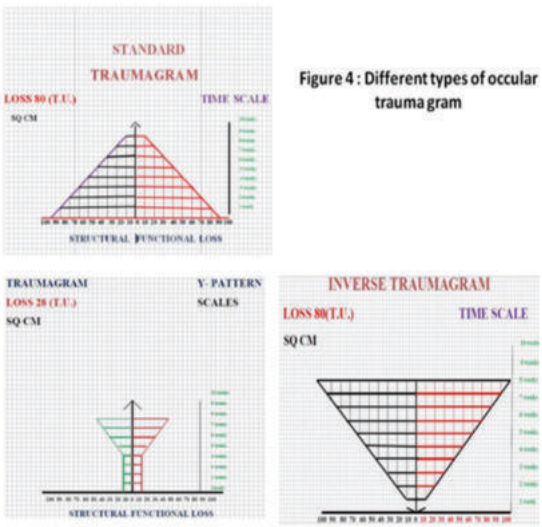


Figure 4 : Different types of occular trauma gram

RESULTS

In this study, 50 cases were followed up at weekly interval upto 2 months and then at 6th month from the day of first presentation in the hospital and structural and functional loss was evaluated at each visit. At the time of first presentation, some structural loss was present in almost all cases while functional loss was present in 24 % (n= 12) of cases. During 2nd follow up (at 3 weeks), the structural and functional loss was evaluated and there was residual structural loss in 60% (n = 30) of cases while the cases with residual functional loss remained 24 % (n = 12).

At the end of 2nd month, the number of cases with the structural loss greatly reduced. There was residual structural loss in 12% cases while there was residual functional loss in 20 % cases only. At the end of 6 months, 92% recovered from any structural loss and only 8% of cases were left with the residual structural loss. 10% cases were still left with the residual functional loss.

Total structural loss was then assessed in terms of trauma unit loss using table 2 and graded on its basis. there were 56% (n=28) mild cases, 26% cases with moderate structural loss,12% cases with severe structural loss and cases with very severe structural loss were 6% .

Thus, in most cases of trauma there is maximum structural and functional loss at the time of injury and with the passage of time, both structural and functional losses start diminishing almost equally (table 5, fig. 6).

Table 5: Distribution Of Cases Of Ocular Trauma Due To Rta According To Age And Gender

Age Group	Male	Female	Chi square	p- value	mean age
1-10	2	1	*5.318	*0.450	32.90 ± 13.81
11-20	3	1			
21-30	17	2			
31-40	7	3			
41-50	8	1			
51-60	3	0			
61-70	1	1			
Total	41	9			

Table 6: Structural And Functional Loss At Initial Presentation And Residual Loss At Subsequent Visits:

	1st presentation		3 weeks		5 weeks		8 weeks	
	No.	%	No.	%	No.	%	No.	%
Structural loss	50 100		30 60		06 12		04	08
Functional loss	12 24		12 24		10 20		05	10

The percentage of structural and functional loss was plotted on graph for each follow up upto 2 months and a traumagram was obtained for each case. Later the trauma unit loss was calculated and grade of injury was determined according to the percentage of loss (table 7).

Figure 5 : Distribution of cases of ocular trauma due to RTA according to age and gender

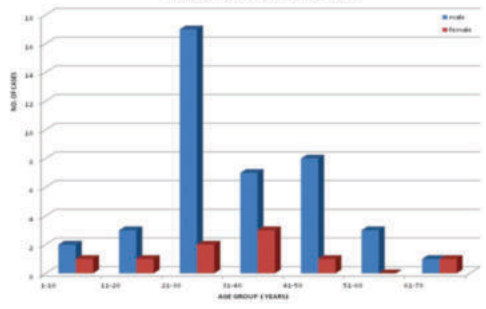


Figure 6 : Structural and functional loss in subsequent visits

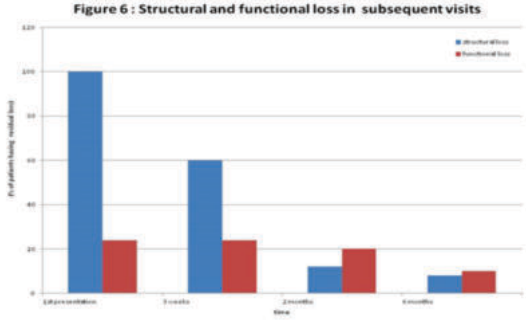


Table 7: Comparison Of Total Loss At The Time Of Initial Presentation And Subsequent Follow Ups Using Wilcoxan Paired T Test:

TOTAL LOSS	MEAN (Q3-Q1)	WILCOXAN SIGNED RANK TEST	p - VALUE
1st presentation	1.50 (1.0 - 4.0)	-6.60	0.0001
3 weeks	0.50 (0.0 -1.875)		
1st presentation	1.50 (1.0 - 4.0)	-6.10	0.0001
5 weeks	0.00 (0.00-0.125)		
1st presentation	1.50 (1.0 - 4.0)	-5.70	0.0001
8 weeks	0.00 (0.00-0.00)		

At the end of 6 months, there were 14% (n=07) cases with residual functional loss. These were associated with severe impairment in visual acuity (finger count, perception of light, loss of light perception) (table 14, fig. 12). 4% (n=02) of these cases had open globe injury, 6% (n=03)had traumatic optic neuropathy and 2% (n=01) had closed globe injury with vitreous haemorrhage and 2%(n=01) developed dacryocystitis (fig. 13).

Out of 50 cases in this study, n = 41 were males and n = 09 were females, the ratio was 4.6: 1. There was a preponderance of males in the study (table 8).The majority of cases were between 21 – 30 years followed by 30 – 40 years. In this study, the common age group was 21 – 30 years with 33% of cases followed by 31–40 years with 20% of cases (table 8). The mean age was 32.90 ± 13.81 with the youngest case of 7 years and the oldest 66 years.

Table 8: Distribution Of Cases Of Ocular Trauma Due To Rta According To The Type Of Vehicle:

2 Wheeler	45
4 Wheeler	04
Pedestrian	01

TABLE 9: Association Of Ocular Trauma Due To RTA with other injuries :

Head injury	26
Facial injury	06
Isolated ocular injury	18
Total	50

Table 10: Distribution Of Cases Of Ocular Trauma Due To Rta According To The Eye Involved:

Eye Involved	No. of patients (%)
RE	27 (54%)
LE	19(38%)
BE	04(8%)
Total	50

Table 11: Distribution Of Cases Of Ocular Trauma Due To Rta According To The Place Of Occurrence Of Accident

Place Of Accident	No. Of Cases
URBAN	27
SEMI URBAN	13
RURAL	10
TOTAL	50

The right eye was involved in n = 28 (56%) of cases and left eye in n =17(34%) and both eyes were involved in n = 5 (5%) cases (table 11, fig. 9).

Figure 7 : Distribution of cases of ocular trauma due to RTA according to the type of vehicle

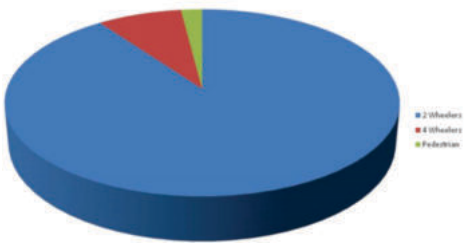


Figure 8 : Distribution of ocular trauma in association with head and facial injuries

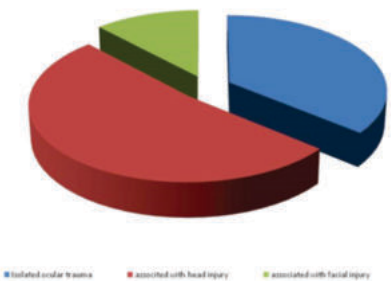
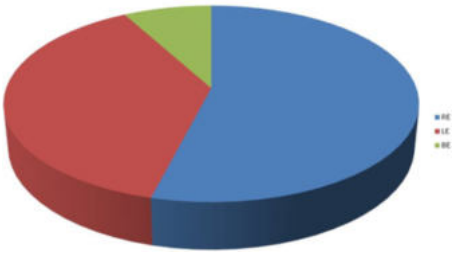


Figure 9 : Distribution of ocular trauma due to RTA according to the eye affected

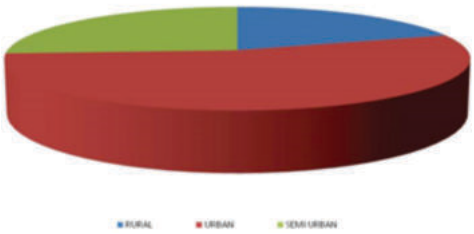


N = 45 (90%) were riding on two-wheelers and pedestrian was n = 01 (2%) and 4 wheelers were n= 04 (8%) (table 9, fig. 7). The timing of RTA was studied, and 48% trauma cases occurred at night, 20% in the evening, 32% in the morning (table13, fig 10).

Table 13: Final Visual Outcome In Cases With Ocular Trauma Due To Rta

Final BCVA	No. of patients	Percentage (%)
6/6-6/9	42	84
6/9-6/60	02	4
Finger count	01	2
PL+	02	4
PL Denied	03	6
Total	50	100

Figure 10 : Distribution of cases of ocular trauma due to RTA according to place of accident



Swelling and ecchymosis of the lids was the commonest type of ocular injury shown in n =30 (60 %) of cases, cases with laceration of lids were n=28(56%), subconjunctival haemorrhage was seen in 23(46%) cases, chemosis in n=14 (28%) cases, congestion in n=7 (14%) cases), orbital fracture was seen in 8% cases (fig.13). Traumatic iridocyclitis was found in n = 01 case with n = 04 (8%) presenting with hyphema, post traumatic endophthalmitis in n=01(2%) cases.

Figure 11 : Distribution of cases of ocular trauma due to RTA according to time of occurrence of RTA

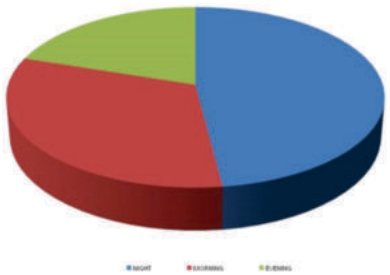


Figure 12 : Final Visual Outcome Following Ocular Trauma Due To RTA

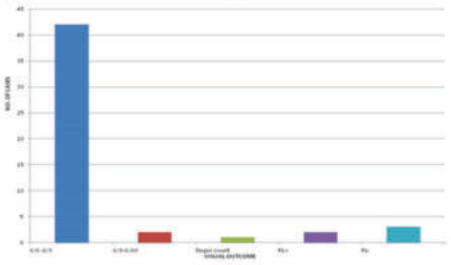
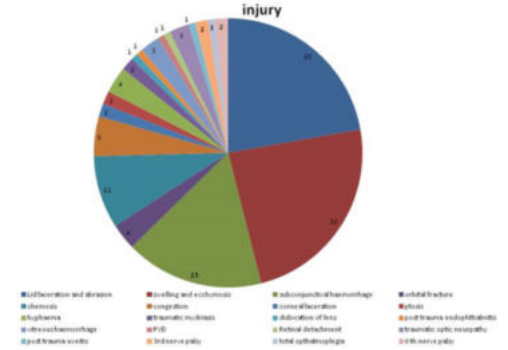


Figure 13 : Distribution of ocular trauma according to type of injury



We used Dr. B. Shukla classification (fig. 2) of ocular trauma to classify the ocular trauma cases in this study. In 90% cases adnexal injury involving lids was observed. Closed globe injuries (vitreous haemorrhage in 6%, dislocation of lens in 2% cases, PVD in 2%, retinal detachment in 2% cases) accounted for 6% (n=03) cases and open globe injuries (corneal lacerations) accounted for 4% (n = 02).

Traumatic optic neuropathy was seen in n =03 (6 %) cases with isolated 3rd nerve palsy was in 4% cases, isolated 6th nerve palsy in 4 % cases and total ophthalmoplegia was seen in n= 01 (2%) cases(fig. 13).

Out of 50 cases of ocular trauma, 52% (n=26) cases were associated with head injury,12 % with facial injury (table 10, fig. 8).

12% cases developed permanent severe visual impairment. (fig. 12) In this study, out of 50 cases, n = 5 (10%) cases were with injury to globe and most of the other injuries (n = 45) were ocular adnexal injuries rather than penetration of the globe. Of the globe injuries, n= 48 (96%) were closed globe injuries including injury to periorbital structure and conjunctiva and n = 02 (4%) were open globe injuries.

DISCUSSION

Several efforts have been made to quantify qualitative data of ocular trauma, earlier by Dr. B. Shukla[2], Kuhn et al[7] (fig.1,2). An effort had been made by Shukla et al[3], to quantify ocular trauma based on loss of structure and loss of function (table 1,2,3). In the present study, we have tried to check the applicability and feasibility of this model to calculate the structural and functional loss. This procedure is easy to understand and apply but at the same time, it is a time taking and lengthy procedure.

There are certain limitations of the present study. Firstly, the sample size is 50 patients which is very small, so there is need to do further studies with larger sample size. Secondly, this is a hospital based observational study, so are chances of selection bias. Thirdly, in the present study we have included the cases of ocular trauma due to RTA which further adds to the selection bias. Future studies should be done with larger sample size including variety of ocular trauma cases.

In this study, 50 cases were followed up at weekly interval upto 2 months and then at 6th month from the day of first presentation in the hospital and structural and fuctional loss was evaluated at each visit.

At the time of first presentation, some structural loss was present in almost all cases while functional loss was present in 24 % (n= 12) of cases (table 5). During 2nd follow up (at 3 weeks), the structural and functional loss was evaluated and there was residual structural loss in 60% (n = 30) of cases while the cases with residual functional loss remained 24 % (n = 12) as there was decrease in functional loss in some patients while there was increase or appearance of newly diagnosed functional loss in some patients. At the end of 2nd month, the number of cases with the structural loss greatly reduced. There was residual structural loss in 12% cases while there was residual functional loss in 20% cases only. At the end of 6 months, 92% recovered from any structural loss and only 8% of cases were left with the residual structural loss. But functional loss was not much reduced. 10% cases were still left with the residual functional loss.

Thus, in most cases of trauma there is maximum structural and functional loss at the time of injury and with passage of time, both structural and functional loss start diminishing .The percentage of structural and functional loss was plotted on graph for each follow up

upto 2 months and a traumagram was obtained for each case. Later the trauma unit loss was calculated and grade of injury was determined according to the percentage of loss.

When comparison of total loss at the time of presentation and subsequent follow ups was done using Wilcoxan paired t test (table 6) , p value came out to be <0.05(0.0001), therefore, significant .It implies that there is decrease in structural and functional loss with time in most of the cases of ocular trauma.

At the end of 6 months, there were 14% (n=07) cases with residual functional loss. These were associated with severe impairment in visual acuity (finger count, perception of light, loss of light perception). 4%(n=02) of these cases had open globe injury, 6 % (n=03)had traumatic optic neuropathy and 2% (n=01) had closed globe injury with vitreous haemorrhage and 2%(n=01) developed dacryocystitis.

As per the study done by Alam et al;[14] out of 119 RTAs with ocular injuries, 22 (18.48%) had no PL at reporting due to due to ocular nerve injury and all of them failed to recover even after treatment.

In a study done by Kavitha et al;[20] 2 patients, who previously had no perception of light with traumatic optic neuropathy, showed no improvement in visual outcome.

In a study done by Gahlot et al;[10] poor visual outcome was there in 8.20 cases(n=10) cases- 4 cases due to closed globe injury and 6cases due to open globe injury.,

According to a study done by Maurya et al;[5] 29.70% eyes had good visual outcome and 30.69% eyes had visual impairment. Here, visual outcome was directly proportional to the number of orbital walls fractured which is not the case with the present study.

There were 8% (n=04) cases with residual structural loss . N= 01 case was having total ophthlmoplegia, n=02 with corneal scarring, and n=01 with post traumatic defect in lacrimal apparatus (fig. 13).

In the present study, globe perforation was seen in 4%(n=02) cases. Karanth et al[19] ; reported corneal tear in 4.5% cases, Alam et al[14] ; 5.04% cases, Puzari et al[16]; 3.33% patients were reported with corneal perforation similar to the present study. Maurya et al[5]; reported 13.86%, Dubey et al[18]; reported 2.77 % cases, El Shtewi et al[1]; reported 46.7% cases with corneal perforation. Many of these cases must have reported corneal scarring later. Namala et al;[8] corneal Opacity in 33% cases. Muralidhar et al[15]; reported 40% cases with extraocular muscle involvement but did not tell how many patients had residual extra ocular muscle paralysis.

Cosmetic disfigurement in patients after ocular trauma becomes a social stigma and many patients can not afford to get a cosmetic correction done. Also, the loss of vision following ocular trauma can cause enormous cost to the victim and his family. Therefore strict implementation safety measures must be ensured while driving/riding. Out of 50 cases in this study, n = 41 were males and n = 09 were females, the ratio was 4.6: 1. There was a preponderance of males in the study, which is in concordance with Namala et al;[24] in Rajanagaram where they found the male to female ratio of 4.5 : 1.

In a study by El Shtewi et al;[1] out of 248 cases, 186 (75%) patients were male and 62 (25%) were female. In a study by Dawson et al;[6] the male to female ratio was 3: 1. In a study be Puzari et al;[16] in 60 cases, male (76.66%) preponderance was seen (M:F=3:1).

In the present study, the common age group was 21 – 30 years with 33% of cases followed by 31–40 years with 20% of cases. The mean age was 32.90 ± 13.81 with the youngest case of 7 years and the oldest 67 years. In a study by Gahlot et al;[10] in Pune found mean age as 30.57 years**.** In a study by M El Shtewiet al;[1] at Tripoli, Libya, the mean age was 32.5 years. In a study by Gahlot et al;[10] age group of 21-30 yrs represented the largest group, i.e., 45.90%. The mean age was 30.57 years ± 10.53 (S.D.). In a study by Muralidhar et al;[15] out of 40 cases, most of the patients who sustained injuries were between 41 to 50 years (40%, 16/40), followed by second decade (30%, 12/40) which is not the case with the findings in present study. Males have been found to be commonly involved in RTA as males often drive vehicles and arthus are more exposed to highway traffic accidents as compared to females and younger males (21- 30 years) are more likely to drive in risk and with lesser use of safety measures.

In the present study, the right eye was involved in n =28 (56%) of cases and left eye in n =17(34%) and both eyes were involved in n = 5 (5%) cases. These findings is consistent with the findings of following studies:

Muralidhar et al; [15] right eye injury was more frequent (60%, 24 patients) than left eye (40%, 16 patients). One patient had bilateral eye injury. El Shtewi et al;[1] right eye was injured in 116 (42%) patients and the left eye in 104 (37.7%). Both eyes were affected in 28 (20.3%) patients. Kuhn et al;[7] involvement of right eye was seen in 60 % of cases and that of left eye in 33.33% cases and both eyes in 6.67% cases. Dawson et al; [6] the right eye was involved in n = 45 (60 %) of cases and left eye in n = 25 (33.33 %) and both eyes were involved in n = 5 (6.67 %). Puzari et al;[16] the right eye involvement was in 55% cases as compared to left eye in 35% with bilateral involvement in 10% cases.

Maurya et al; [5] there was predominance of left eye involvement (56.58%) which is not in concordance with our study.

In the present study, n= 45 (90%) were riding on two-wheelers and pedestrian was n = 01 (2%) and 4 wheelers were n= 04 (8%) which is inconsistent with the study done by Panagiotidis et al;[17] where they found that 86.56% cases were injured following car accidents while 11.95% cases occurred due to motorcycle accidents. In a study by Dubey et al;[18] ocular injuries due to vehicular accidents involving two wheelers had the maximum incidence (72.2%). . According to Dawson et al;[6] N = 65 (86.67 %) were riding on two-wheelers and rest were on 3 wheelers and 4 wheelers. Kumaraswamy et al;[11] with similar observations found 85.4 % of cases with ocular injuries were 2-wheeler riders. According to a similar study done by Namala et al[8]; most of the cases with ocular trauma were two wheeler riders (67%). Two wheelers are more common in our country because of easy affordability. Riders do not follow proper traffic rules and don't wear helmets and don't put on seat belts while travelling on the highway as there is a paucity of traffic controllers on these roads. Also in the developing countries like ours, the road infrastructure is poor and there is no maintenance which contributes to a major part of RTA.

In the present study, the timing of RTA was also studied. 48% trauma cases occurred at night, 20% in the evening(combined 34 cases), 32% in the morning. Similar findings were seen by Dubey et al;[18] out of the 144 cases- (30.6%) cases took place at day time and (69.4%) at night .In a study done by Muarya et al[5]; majority of the victims sustained injury in the afternoon between 12.00 -17.59 hrs (29.47%) and in evening between 18.00-23.59 hrs (27.33%). Dawson et al; 46.67 % trauma cases occurred in the morning, 33.33 % in the evening, and 20 % occurred at night which is not in concordance with our findings. Accidents are more likely to take place in night time because of drunken driving and poor visibility and awakefullness is less in night.

In the present study, maximum cases (54%) belonged to the urban background, 26 % from semi- urban setup and 20% from rural background, which is not consistent with the study done by Maurya et al,[191] where the maximum number of victims belonged to rural background (42.10%) followed by semi urban (31.58%) and urban (26.32%) background.

Due to increase in number of vehicles, there is rise in vehicular traffic in urban area, and also there is immigration of population from rural to semi- urban and urban areas, therefore road traffic accidents are more in people with urban background.

In the present study, in 94% cases, adnexal injury involving lids, conjunctiva and orbit was observed. Lids were involved in 90 % (n = 45) cases and swelling and ecchymosis of lids in n= 30 (60%) laceration/ abrasion of lids in n=28 (56%). Involvement of conjunctiva was seen in n= 44 (88%) cases (subconjunctival haemorrhage in n =23 (46%) cases, chemosis in n=14 (28%) cases, congestion in n=7 (14%) cases), orbital fracture was seen in 8% cases (fig. 13). Alam J et al;[14] reported periorbital oedema with ecchymosis as the commonest findings in ocular injuries. Maurya et al;[5] the commonest type of ocular injury was ecchymosis (77.23% eyes) followed by eyelid & periocular laceration (67.33% eyes).In a similar study by Dawson et al;[5] ecchymosis of the lids was the commonest type of ocular injury shown in n = 53 (58.67 %) of cases. In a study by Karanth et al;[19] eyelid

ecchymosis was seen in 51% of patients making it the most common ocular presentation. These findings are in concordance with our study. Puzari et al;[16] found that out of 60 cases, subconjunctival haemorrhage was the most common ocular injury (83.33%) followed by lid oedema and ecchymosis (78.33%). Dubey et al;[18] among 144 cases studied, subconjunctival hemorrhage (87.5%) was maximum followed by lid edema and ecchymosis (75%) and lid laceration (19.4%). Muralidhar et al;[15] most common form of injury was subconjunctival hemorrhage constituting 70% (28/40), followed by ecchymosis constituting 50% (20/40). Maurya et al;[5] most common ocular part involved was eyelid / periocular skin (85.15% eyes) followed by conjunctiva (82.18% eyes), and orbit in 51.49% eyes. Dubey et al;[18] among 144 cases, subconjunctival hemorrhage (87.5%) was maximum followed by lid edema and ecchymosis (75%) and lid laceration (19.4%). Dawson et al;[6] reported ecchymosis of the lids as the commonest type of ocular injury present in n = 53 (70.67 %) of cases. Alam J et al;[14] have reported periorbital oedema with ecchymosis as the commonest findings in ocular injuries. Murlidhar et al;[15] have reported sub-conjunctival haemorrhage followed by ecchymosis as the commonest findings in ocular trauma cases.

In the present study, orbital fracture was reported in 8 %(n=04) cases. Gahlot et al[10]; reported orbital fracture in 17.21% cases, Namala et al[8]; 6% cases, Karanth et al[19]; in 1.8%, Maurya et al; in 50.53%.and Kumarsamy et al; found orbital fractures in 22.22% of study subjects. While in study of Shtewi et al ; only 1.1% of victims presented with orbital fracture.

In present study, we also classified ocular trauma using BETTS[22] classification of ocular trauma (as it was being used in previous similar studies) and classified ocular injuries into closed and open globe injuries. In the present study, there were 96% (n=48) cases of closed globe injuries including injuries to periorbital structures and 4% (n=02) cases belonged to the category of open globe injury. Dawson et al;[6] n = 50 globe injuries n = 45 (90 %) were closed globe injuries and n = 5 (10 %) were open globe injuries. Dubey et al;[18] 95.8 % patient had closed globe injury and 4.2 % had open globe injury which are consistent with the present study. Mishra et al;[12] in their study found 86.4 % of cases with closed globe injuries and 13.6 % with open globe injuries. Karanth et al;[19] reported that 91% suffered closed globe injury whereas 9% had open globe injury.Namala et al;[8]reported that the percentage of closed globe injuries was 87% than open globe injuries with 13%. Vasu et al;[13] in their study found that 38.10% were open globe injuries while 61.90% were closed globe injuries. According to Puzari et al;[16] 93.33 % patient had closed globe injury and 6.66 % had open globe injury.In a study by Gahlot et al;[10] injuries involving periorbital tissue were present only in 32.79% of cases and intraocular injuries(closed and open globe) accounted for 67.27% and the integrity of the globe was breeched in 10 cases(8.19%). According to a study by Dawson et al;[6] lids and adnexa were involved only in 33.33 % of cases and intraocular injuries (closed or open globe accounted for 66.67 %).

In 94% cases, adnexal injury involving lids, conjunctiva and orbit was observed.

In the present study, globe injuries including vitreous haemorrhage in 6% ,dislocation of lens in 2% cases, PVD in 2%, retinal detachment in 2% cases accounted for 6% (n=03) cases, post traumatic uveitis in 2% (n=01) and corneal lacerations , traumatic iridocyclitis was found in n = 01(2%) case, n = 04 (8%) cases presented with hyphema, post traumatic endophthalmitis seen in (n=01) 2% cases, accounted for 10 % (n = 05) cases (fig. 13).

In the present study, traumatic mydriasis was seen in 4%(n=02) cases (fig. 13). Dubet et al[18]; reported 7.6% patients, Karanth et al;[19] found 8% cases with traumatic mydriasis.

In the present study, cranial nerve involvement was seen in 14 % cases, isolated 3rd nerve palsy was in 4% (n=02) cases, isolated 6th nerve palsy in 4 % (n=02) cases and total ophthalmoplegia was seen in 2%(n= 01) cases and optic nerve injury in 6 %(n=03) cases (fig. 13). In a study by Dawson et al;[6] optic nerve injury was seen in 14.67 % cases, and by Alam et al;[14] 18.48% patients with optic nerve injury. These findings were not consistent with the present study. Muralidhar et al;[15] found optic neuropathy in 2.5% cases, Maurya et al;[5] found traumatic optic neuropathy in 5.94% cases, and Gahlot et al;[10] in 4% cases. According to Patil et al;[20] 3.9% cases were with traumatic optic neuropathy. Kumarswamy et al;[11] found cranial nerve involvement in 17.36% cases. Puzari et al;[16] reported 1.66% cases with 3rd cranial nerve palsy.

Out of 50 cases of ocular trauma, 52% (n=26) cases were associated with head injury,12 % with facial injury (table 10, fig. 8). Dawson et al;[6] reported 13.33 % cases with associated facial injuries. Alam et al[14]; reported 7.56% cases with facial injury. Namalla et al;[8] the head injury cases associated with ocular injury are 70% and remaining 34% head injury is not associated with ocular injury.

In the present study, PVD and retinal detachment were seen 4% (n=02) cases, post traumatic endophthalmitis in 2%(n=01) cases, and post traumatic uveitis in 2% (n=01) cases (fig. 13). Maurya et al[5]; retinal detachment in 15.84% cases, Namala et al[8] ; reported in 16% cases, PVD in 5% cases, post traumatic endophthalmitis in 3% and post traumatic uveitis in 3% (fig. 13).

In the present study, lens dislocation was seen in 2% cases (fig. 13). In a study, Muralidhar et al; [15] reported 2.5% cases, Puzari et al;[16] reported 1.66%, Patil et al;[20] reported 1.05% with dislocation of lens which was similar to the present study. Gahlot et al;[10] reported 0.82 % cases, Maurya et al;[5] reported 15.84%, El Shtewi et al;[1] reported 7.6 % cases with lens dislocation.

In the present study, vitreous haemorrhage was reported in 6%(n=03) patients.

According to Maurya et al[5]; 24.75 % cases, Puzari et al[16]; 1.66% cases , and Namala et al[8]; 8% cases were seen with vitreous haemorrhage.

In the present study; hyphaema was reported in 8% cases (fig. 13) . In a study done by Namala et al; [8] done in Rajanagaram, A.P.; found 7.7 % cases with hyphaema which is concordance with the present study. In a similar study by Muralidhar et al ; reported hyphaema in 10% cases. Kumarasamy et al;[11] reported hyphaema in 4.16 %. Gahlot et al;[10] reported hyphaema in 2.46 % cases, Karanth et al;[19] in 3.8% cases.

In the present study, globe perforaton was seen in 4%(n=02) cases. Karanth et al;[19] reported corneal tear in 4.5% cases, Alam et al;[14] 5.04% cases, Puzari et al;[16] 3.33% patients were reported with corneal perforation similar to the present study. Maurya et al;[5] reported 13.86%, Dubey et al;[18] 2.77 % cases, El Shtewi et al;[1] 46.7% cases with cornaela perforation (fig.13).

In the present study, visual acuity was not affected in 84% of cases. Visual acuity improved in one case with vitreous haemorrhage from finger count 1 feet to 6/60, in one case with complete hyphaema from finger count 3 feet to 6/9 and in one case with corneal laceration from no perception to light to finger count 2 ft, 4% of cases had visual acuity of 6/9 - 6/60. Visual outcome was poor (<6/60) in 12% of cases, out of which 6% had no light perception (table 14, fig. 12). In a study done by Namala et al;[8] the visual outcome - 71% had good visual outcome and 11% had significant vision loss that is less than 6/60 vision. According to Dawson et al;[6] visual acuity outcome was good up to 6 / 18 in 90.67 % of cases, fair in 8.0 % cases and poor in one case. El Shtewi et al;[1] in their study reported post treatment 61.22 % of their cases had a visual acuity of 6 / 6 – 6 / 18 (good visual acuity), 19.59 % had visual acuity of 6 / 24 – 6 / 60 (fair visual acuity), 15.94 % had a visual acuity of < 6 / 60 (poor visual acuity) and 3.28 % had no light perception. Panagiotidis D et al;[17] reported 29.5 % of all cases seen had a poor visual outcome. The anatomical placement of eyeball is protected by bony socket and periorbital structures. The low degree impact injuries in RTA usually affect these structures probably could be a reason for low number of globe injuries in our study and other studies.

CONCLUSION

RTA is one of the most important and preventable causes of ocular trauma. With the increasing urbanization, increase in new and young drivers, there is rise in vehicular traffic with simultaneous increase in road traffic accidents in general, specially in economically active age group. Also, due to higher number of males involved in outdoor activities, RTA related ocular trauma is more common in the men. Due to preponderance act of motor vehicle driving, because of easy affordability specially in developing countries like India ,ocular trauma is more common in two wheeler riders.Due to low visibility at night and non-lit roads and poor infrastructure of roads, RTA related ocular injuries are more common at night. In most of the cases of the ocular trauma , there is maximum structural and functional loss at the

time of injury and with the passage of time both start diminishing. but in some cases there is residual structural and functional loss. The cases with structural loss resulted in cosmetic disfigurement.There are certain trauma related prognostic factors which are corneal scarring following open globe injury, fixed eye or squint following cranial nerve palsies, damage to lacrimal apparatus following full thickness lid laceration , delayed reporting to the hospital for appropriate intervention.There are certain prognostic factors for poor visual outcome; globe rupture, posterior segment trauma, intra ocular haemorrhage, optic neuropathy related to orbital fracture, delayed presentation.

The cases with residual functional loss were mostly associated with severe visual impairment due to globe rupture, orbital fracture, and severe posterior segment injury like lens dislocation, optic nerve injury.

Therefore, public health education regarding use of seat belt, helmets and other safety measures while driving should be encouraged. Also early reporting and appropriate intervention may reduce the vision threatening complications in RTA related ocular trauma.

Also, the evaluation of the ocular trauma cases quantitatively would help in measuring precisely the improvement and the deterioration in each case and helps to see the progress of a case and the effect of any treatment.It would also help in evaluating the loss quantitatively in ocular injuries in medicolegal cases which may help in deciding the amount of compensation and punishment in a case of ocular trauma which is very vague at present. So far in assessment of damage only eye ball is considered whereas in this method damage to ocular adnexa is also calculated. In future, more studies should be conducted to check the utility of this concept.Ocular trauma can present in variety of ways and it is in itself a vast field which needs more trials to better understand management.Therefore, emphasis should be made on the changing perspectives of the ocular trauma and look at ocular trauma as an evolving subspeciality.

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