

Ophthalmic B - Scan for Ocular Trauma: A Vital Tool for Early Diagnosis in Rural Healthcare

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Abstract: Background: Ocular trauma is a major cause of preventable blindness and monocular visual impairment, with a significant burden in rural population. A comprehensive ocular assessment is crucial for early diagnosis and management. However, when media opacities hinder direct visualization, B - scan ultrasonography becomes a vital diagnostic tool. Objective: To study the ophthalmic B - scan findings in patients presenting with ocular trauma having opaque ocular media at a rural tertiary care hospital. Methods: An observational, descriptive cross - sectional study was conducted after the ethical committee approval for 9 months. A total of 20 patients with history of ocular trauma with opaque media were evaluated using ophthalmic B - Scan. Findings were analyzed based on the mode of injury, cause of trauma and diagnosis made using B - Scan. Results: Most cases were seen in the age group between 16 - 60 years with 70% occurring in males. Injury with a wooden stick was the most common cause of trauma (55%). Traumatic cataract was the most common finding found in 30% cases. Other ocular findings included vitreous hemorrhage (25%), vitreous degeneration (25%), vitreous detachment (15%), retained foreign body in vitreous (5%), retinal detachment (5%), endophthalmitis (5%) & choroidal detachment (5%). Conclusion: Ophthalmic B - Scan is a quick, non - invasive, cost effective & easily available investigation, especially valuable in a rural area used to evaluate and determine management for patients with ocular trauma who are at a higher risk of ocular morbidity and vision loss.

Keywords: Ocular trauma, B - scan ultrasonography, rural healthcare, opaque media

1. Introduction

Ocular trauma is the most prevalent ophthalmic emergency worldwide¹, with the World Health Organization (WHO) estimating that approximately 55 million people experience such injuries annually². It remains a leading yet preventable cause of blindness and monocular visual impairment.

In India, rural populations are particularly vulnerable to ocular trauma due to occupational hazards, lack of protective eyewear, and limited access to immediate medical care³. The extent of ocular involvement varies depending on the nature and mechanism of the injury, necessitating a prompt and comprehensive evaluation to determine the prognosis.

However, in cases where media opacities—such as hyphema, corneal opacity, a cataractous lens, or posterior segment pathology—obstruct visualization of intraocular structures, clinical assessment becomes challenging. In such situations, ultrasound B - scan imaging serves as an invaluable diagnostic tool. This non - invasive and cost - effective modality generates two - dimensional images of the eye⁴, allowing for an accurate assessment of posterior segment pathology even in the presence of opaque media.

Given its simplicity, affordability, and accessibility, ultrasound B - scan is particularly well - suited for use in resource - limited rural settings⁵. Its widespread application in ocular trauma cases can significantly enhance diagnostic accuracy and guide appropriate management, ultimately improving patient outcomes.

2. Materials and Methods

A retrospective observational study was conducted at a tertiary care rural hospital after obtaining the approval from the Institutional Ethics Committee from March 2023 to November 2023. Written informed consent was obtained from every participant.

The patient's age, sex, detailed history of trauma including nature, mode, site, injury time were noted. A thorough ocular examination was done and the anterior segment was evaluated using a slit lamp. The patient underwent B - scan and the findings were noted in a standard proforma.

Inclusion criteria:

All patients presenting with ocular trauma having an opaque ocular media in whom the extent of a posterior segment pathology had to be assessed

Exclusion criteria:

- 1) Patients unwilling to give written informed consent for the study
- 2) Patients presenting with active bleeding
- 3) Patients who have a ruptured globe

3. Results

A) Gender and Age wise distribution:

70% of the cases in this study were males, while 30% were females. The maximum prevalence of 25% each was seen in age groups 16 to 30 year olds and more than 61 years of age. The 31 to 45 year olds formed 20%, followed by 15% each from 0 to 10 year olds as well as 46 to 60 year olds.

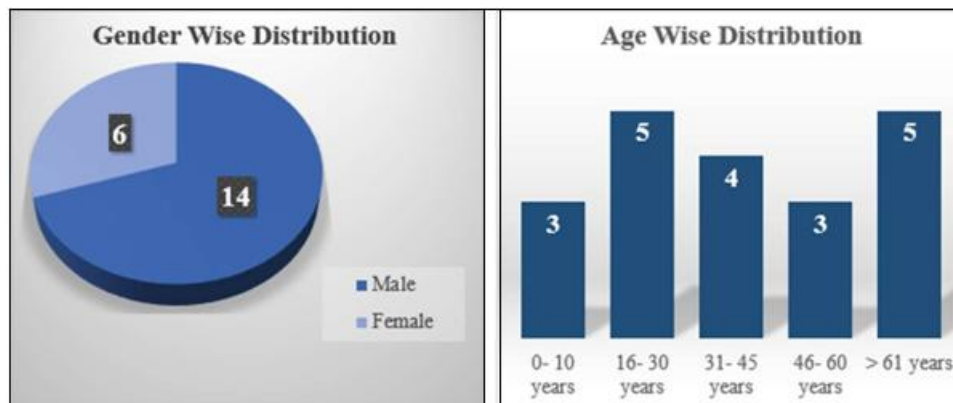


Figure 1: Gender - wise and Age - wise distribution of cases

B) Distribution according to visual acuity at presentation

No case presented with visual acuity better than 6/60. 45% of cases presented with hand movement close to face (HMCF) visual acuity. Faculty projection (PL+, PR faculty) of rays was seen in 35% of cases. 10% of cases had no perception of light while 5% of cases each had visual acuity of perception of light (PL+) and between 6/60 to finger counting 1 meter (FC 1m).

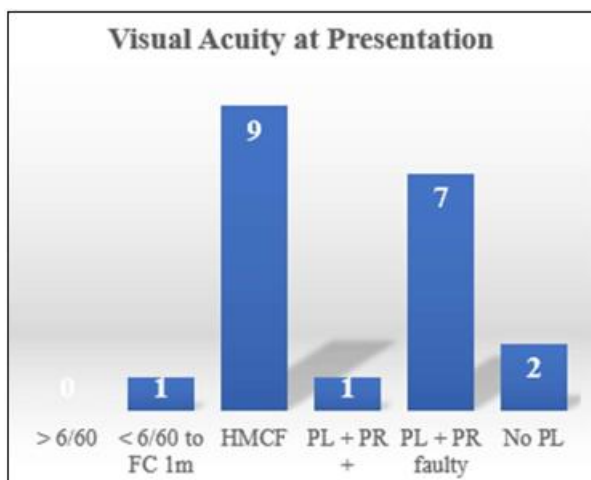


Figure 2: Visual acuity - wise distribution of cases

C) Distribution according to nature of injury

60% of cases were due to a penetrating injury, while the rest 40% could be attributed to blunt injury.

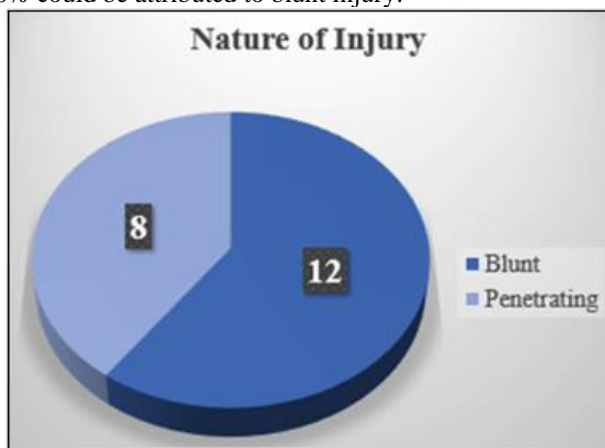


Figure 3: Nature of injury - wise distribution of cases

D) Distribution according to mode of injury

The highest prevalence of mode of injury of 55% was accidental. This was followed by assault at 20% of cases. Injury while playing and during agricultural activities was 10% of cases each. Road traffic accidents contributed to only 5% of all cases in this study.

Table 4: Mode of injury- wise distribution of cases

| Mode of Injury | No. of Patients | Percentage |
|-----------------------|-----------------|------------|
| Accidental | 11 | 55% |
| Assault | 4 | 20% |
| Play | 2 | 10% |
| Agriculture | 2 | 10% |
| Road Traffic Accident | 1 | 5% |
| Total | 20 | 100% |

E) Distribution according to cause of trauma

The highest prevalence of cause of trauma of 55% of cases was due to wooden sticks. This was followed by fist fights at 20% of cases. Injury due to metal object and due to cow's horn was 10% of cases each. Cricket ball injury contributed to 5% of all cases in this study.

Table 5: Cause of trauma - wise distribution of cases

| Cause of Trauma | No. of Patients | Percentage |
|-----------------|-----------------|------------|
| Wooden Stick | 11 | 55% |
| Fist | 4 | 20% |
| Metal Object | 2 | 10% |
| Cow's Horn | 2 | 10% |
| Cricket Ball | 1 | 5% |
| Total | 20 | 100% |

F) Distribution according to factors causing opaque media

Factors causing opaque media could be divided according to the ocular structure affected.

- **Cornea:** 75% of cases affected the cornea in this study. Of them, 46.66% corneal cases were due to corneal opacity followed by 26.66% due to corneal tear, 20% due to corneal edema and 6.66% due to presence of anterior staphyloma.
- **Lens:** 50% of cases affected the lens in this study. Of them, 80% lead to cataract formation and remaining 20% cases presented with a subluxated lens.
- **Iris:** 20% of cases involved the iris in this study. All of them resulted in iridiodialysis.
- **Anterior chamber:** Hyphema was seen in 5% of the total cases in this study.

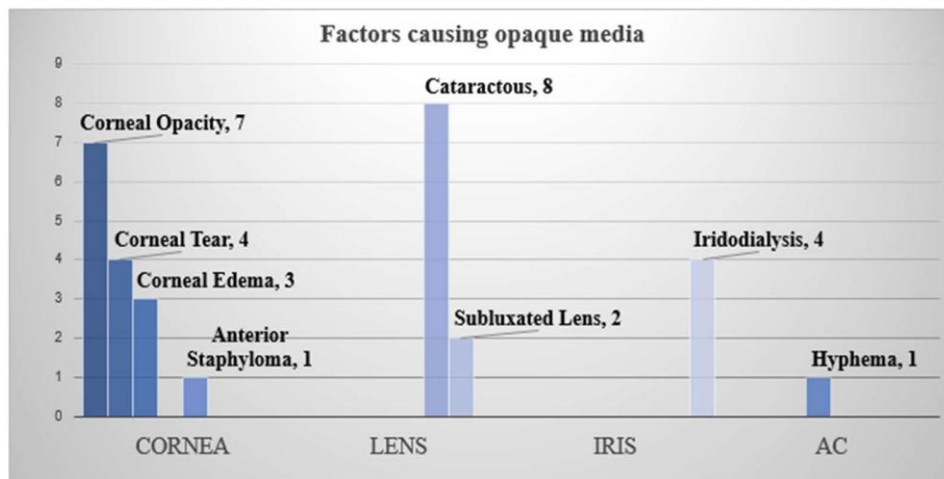


Figure 6: Factors causing opaque media - wise distribution of cases

G) Distribution according to diagnosis established using B - Scan findings

25% of cases showed a normal B - Scan. Rest of the cases can be divided according to the ocular structure affected and diagnosis established using B - Scan.

- **Chorio - retinal:** 15% of cases affected the chorio - retina in this study. Of them, 5% of cases were due to choroidal detachment followed by 5% due to retinal detachment and 5% due to posterior staphyloma.
- **Vitreous:** 90% of cases involved the vitreous cavity in

this study. Of them, 30% had posterior vitreous detachment, followed by 25% of cases each of vitreous hemorrhage and vitreous degeneration. Remaining 5% of cases each were diagnosed with foreign body in vitreous cavity and vitreous exudates suggestive of endophthalmitis.

- **Lens:** 40% of cases involved the lens in this study. Traumatic cataract was present in 25% of cases and subluxation of lens in 15% cases.

| Ocular structure | B- Scan Finding | No. of cases N=20 | Percentage |
|------------------|-------------------------------|----------------------|------------|
| None | Normal | 5 | 25% |
| Chorio- retinal | Choroidal Detachment | 1 | 5% |
| | Retinal detachment | 1 | 5% |
| | Posterior Staphyloma | 1 | 5% |
| Vitreous | Vitreous haemorrhage | 5 | 25% |
| | Vitreous degeneration | 5 | 25% |
| | Posterior vitreous detachment | 6 | 30% |
| | Vitreous exudates | 1 | 5% |
| | Foreign body in vitreous | 1 | 5% |
| Lens | Displaced lens | 3 | 15% |
| | Traumatic cataract | 5 | 25% |

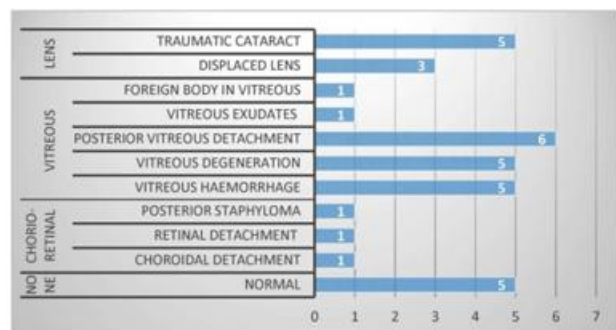


Figure 7: B - Scan diagnosis - wise distribution of cases

4. Discussion

1) Gender: (Figure No.1)

In our study we found ocular injuries were higher in males 70% (14) compared to females 30% (6). This was in line with studies done by Wagh V. et al where 88%, Maiya AS. et al where 82% and Shazlee MK et al. where 68% males showed a higher incidence of trauma.3, 4, 6

Age:

In our study both more than 61 year old and 16 - 30 year old groups showed equal incidence of 25% (5) each, accounting for 50% of all cases. Maiya AS. et al found maximum cases in 21 - 40 - year - old group, similar to our study. In the Wagh V. et al study 31 - 40 - year - old group, while in Misra S. et al the 0 - 10 - year - old group was most common.3, 6, 7 This difference of higher incidence in >61 year olds may be as we have included both newly inflicted trauma and past history of trauma cases in our study.

2) Visual Acuity at presentation: (Figure No.2)

50% patients perceived at least HMCF and only 1% had no

PL in our study which differs from the Misra S. et al study where 91% patients had visual acuity ranging from <6/60 to HMCF and 6.66% were PL negative.7

3) Mode of injury: (Figure No.4)

The comparison between our study, Misra S. et al7 study and Gupta A. et al8 study findings are compared below:

| Mode of Injury | Our Study | Misra S. et al Study | Gupta A et al study |
|-----------------------|-----------|----------------------|---------------------|
| Accidental | 55% | - | 16% |
| Assault | 20% | - | 26% |
| Play | 10% | 36% | - |
| Agriculture | 10% | 43% | 30% |
| Road Traffic Accident | 5% | 3% | 4% |
| Domestic | | 16% | 24% |
| Total | 100% | 100% | 100% |

Figure 8: Comparative table between our study and other studies for mode of injury

4) Cause of trauma: (Figure No.5)

The comparison between our study, **Misra S. et al**7 study and **Wagh V. et al**3 study findings are compared below:

| Mode of Injury | Our Study | Misra S. et al Study | Gupta A et al study |
|----------------|-----------|----------------------|---------------------|
| Wooden Stick | 55% | 55% | 6.5% |
| Fist | 20% | - | - |
| Metal Object | 10% | 16% | 6.5% |
| Cow's Horn | 10% | 3% | 1.5% |
| Cricket Ball | 5% | - | 1.5% |
| Fall | - | - | 67% |
| Others | - | 29% | 17% |
| Total | 100% | 100% | 100% |

Figure 9: Comparative table between our study and other studies for cause of trauma

5) Diagnosis based on B - Scan findings: (Figure No.7)

The comparison between our study, **Gupta A. et al**8 study, **Sujatha G. et al**9 and **Nanda R. et al**10 study findings are compared below:

| Diagnosis based on B-Scan Findings | Our Study | Gupta A. et al study | Sujatha G. et al study | Nanda R. et al study |
|---|-----------|----------------------|------------------------|----------------------|
| Traumatic cataract | 20.0% | 23% | - | - |
| Vitreous hemorrhage | 13.4% | 23% | 26.5% | 25.5% |
| Vitreous degeneration | 16.6% | 3% | | |
| Vitreous detachment | 10.0% | 13% | | |
| Displaced Lens | 3.3% | 4% | 0.5% | - |
| Retained foreign body in vitreous | 3.3% | - | - | - |
| Vitreous hemorrhage+ Retinal detachment | 3.4% | - | 8.0% | 8% |
| Retinal detachment | - | 23% | 7% | 7% |
| Choroidal detachment | 3.4% | 1.5% | 1% | - |
| Posterior staphyloma | 3.4% | - | 1% | - |
| Endophthalmitis | 3.4% | - | 1% | - |
| Misc | - | 9.5% | - | 8.5% |
| Normal | 16.6% | - | 54.5% | 51% |
| Total | 100% | 100% | 100% | 100% |

Figure 10: Comparative table between our study and other studies for B - Scan findings

5. Conclusion

Ophthalmic B - Scan is a quick, non - invasive, cost effective & easily available investigation invaluable for evaluation of ocular trauma with opaque media. It's therefore of utmost importance to learn how to perform and interpret Ultrasound B - scan in a tertiary center where trauma cases are common especially in a rural setting.

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