

Epidemiological Profile and Pattern of Ocular Injuries in the Industrial Region of Alwar: A Retrospective Observational Study

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ABSTRACT

Background: Ocular injuries remain a major public health issue globally, often leading to permanent vision loss or impairment. The industrial region of Alwar, Rajasthan, characterized by its dense population engaged in manufacturing, mechanical, and construction work, poses a unique challenge regarding the risk of ocular trauma due to workplace hazards. Despite the high incidence of ocular injuries, data on their epidemiological pattern in this region remain scarce. This retrospective observational study aims to analyze the demographic characteristics, causes, and types of ocular injuries among patients in Alwar's industrial region.

Methods: The study was conducted at Rajiv Gandhi Government Hospital, Alwar, from December 2023 to November 2024. Data were collected from the medical records of 79 patients who presented with ocular injuries during this period. The demographic characteristics, causes, types of injuries, laterality, and time to hospital presentation were analyzed. Statistical analysis was performed using SPSS 24, with descriptive statistics and chi-square tests applied.

Results: A total of 79 patients were included in the study, with 52 males (65.82%) and 27 females (34.18%), and a mean age of 33.94 years. The most commonly affected age group was 31-40 years (25.31%). Road traffic accidents (RTA) were the leading cause of ocular injury (20.25%), followed by workplace-related injuries (35.44%). Blunt trauma (35.44%) and foreign body injuries (27.85%) were the most common types of injury. The majority of patients (32.91%) presented to the hospital within 6-24 hours of the injury. The right eye was more frequently affected (48.10%), and bilateral injuries were observed in 7.59% of cases.

Conclusion: This study highlights the significant burden of ocular trauma in the industrial region of Alwar, with road traffic accidents and workplace injuries being the predominant causes. The findings emphasize the need for improved workplace safety measures, community awareness programs, and the routine use of protective eyewear. Early medical intervention is crucial to minimize the risk of permanent visual impairment, and efforts must focus on reducing delays in hospital presentation.

KEYWORDS: Ocular injury, epidemiology, industrial region, workplace injuries, road traffic accidents, ocular trauma, Alwar, India, demographic characteristics

INTRODUCTION

Ocular trauma is a significant public health issue globally and remains one of the leading causes of monocular blindness and visual impairment [1]. The spectrum of ocular injuries ranges from minor superficial foreign bodies to severe penetrating trauma leading to permanent vision loss. According to the World Health Organization (WHO), approximately 55 million eye injuries occur annually worldwide, resulting in 1.6 million cases of blindness and 19 million cases of unilateral visual impairment [2].

Industrial and rural regions, especially in developing countries like India, face a disproportionately higher burden of ocular trauma due to poor workplace safety, limited access to protective eyewear, and delayed medical attention [3]. Injuries frequently occur among working-age males and children, with causes varying from road traffic accidents (RTAs) and workplace hazards to domestic accidents and assaults [4].

The state of Rajasthan, with its expanding industrial belts such as Alwar, presents a unique demographic for studying ocular injuries. Alwar's industrial region comprises a dense population engaged in manufacturing, mechanical, and

construction work, which potentially increases the risk of ocular trauma due to mechanical tools, flying particles, and chemical exposure [5].

Despite the high incidence, data specific to the epidemiological pattern and risk factors associated with ocular trauma in this region remain sparse. A better understanding of the demographic characteristics, causes, laterality, and types of injuries can help in identifying at-risk groups and formulating preventive strategies. This retrospective observational study was conducted to bridge this gap by analyzing the epidemiological profile and pattern of ocular injuries in patients reporting to a tertiary care hospital in the industrial region of Alwar.

MATERIALS AND METHODS

Study Design and Setting

This retrospective observational study was conducted at Rajiv Gandhi Government Hospital and Government Medical College, Alwar. The study aimed to evaluate the demographic characteristics, causes, and distribution of ocular injuries in the area. Data were collected from medical records of patients who were treated for ocular injuries between December 24, 2023, and November 2024. The study received ethical approval from the Institutional Ethics Committee of Rajiv Gandhi Government Hospital and Government Medical College, Alwar.

Study Population

A total of 79 patients were included in the study. The inclusion criteria were patients who presented with ocular injuries and were treated in the designated health facility within the study period. The exclusion criteria were:

- Patients who did not present with ocular injuries.
- Patients with incomplete medical records.

The study included 52 male and 27 female patients, with an age range from 3 to 77 years. The mean age of the patients was 33.94 years.

Demographic Data Collection

Demographic data, including age, gender, and cause of injury, were obtained from the patients' medical records. The patients were categorized into age groups as follows: 3-10 years, 11-20 years, 21-30 years, 31-40 years, 41-50 years, 51-60 years, 61-70 years, and 71-77 years.

Causes of Ocular Injury

The causes of ocular injury were classified into the following categories:

1. Road Traffic Accident (RTA): 16 patients
2. Wood Stick Injury: 4 patients
3. Fire Cracker Injury (Adolescent): 1 patient
4. Injury During Play: 1 patient
5. Injury by Animal: 1 patient
6. Burn/Head/Fire/Chemical Injury: 1 patient
7. Injury by Assault: 2 patients
8. Blast Injury: 1 patient

Data on the mechanism of injury, such as the type of accident or trauma, were recorded to determine the most common causes of ocular injuries in this population.

Data Analysis

Data were analyzed using SPSS 24. Descriptive statistics were used to summarize the demographic characteristics of the patients, including age, gender, and the distribution of ocular injuries. The causes of injury were presented as frequencies and percentages. For comparison of injuries between male and female patients, a chi-square test was used for categorical variables. The results were considered statistically significant if the p-value was less than 0.05.

RESULTS AND OBSERVATIONS;

Table 1. Age Distribution of Patients (Total: 79)

| Age Group (Years) | Number of Patients |
|-------------------|--------------------|
| 3 - 10 years | 4 |
| 11 - 20 years | 7 |
| 21 - 30 years | 18 |
| 31 - 40 years | 20 |
| 41 - 50 years | 12 |
| 51 - 60 years | 8 |
| 61 - 70 years | 6 |

| | |
|---------------|-----------|
| 71 - 77 years | 4 |
| Total | 79 |

Table 2. Demographic Distribution of Patients

| Age Group (Years) | Total Patients | Male | Female |
|-------------------|----------------|-----------|-----------|
| 3 - 10 years | 4 | 2 | 2 |
| 11 - 20 years | 7 | 4 | 3 |
| 21 - 30 years | 18 | 12 | 6 |
| 31 - 40 years | 20 | 13 | 7 |
| 41 - 50 years | 12 | 8 | 4 |
| 51 - 60 years | 8 | 5 | 3 |
| 61 - 70 years | 6 | 4 | 2 |
| 71 - 77 years | 4 | 3 | 1 |
| Total | 79 | 52 | 27 |

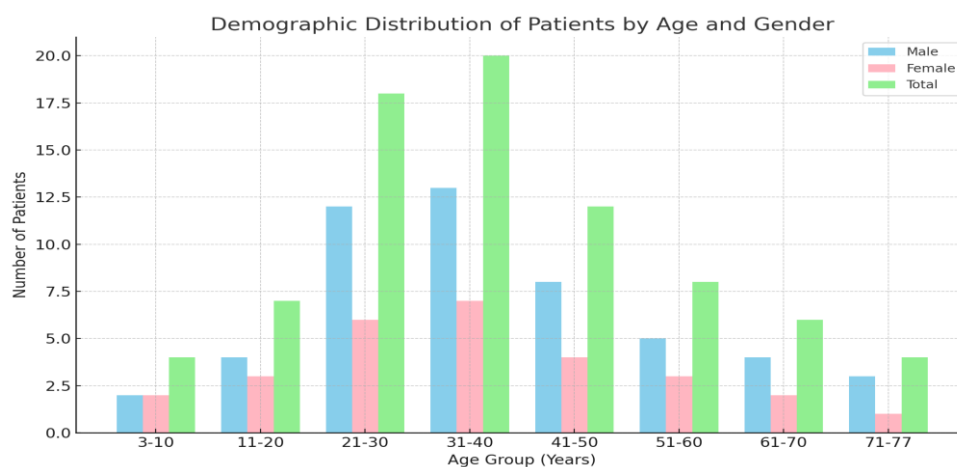


Figure 1: Demographic distribution of patients by age and gender

Table 3. Causes of Ocular Injury

| Cause of Injury | Number of Patients |
|----------------------------------|--------------------|
| Road Traffic Accident (RTA) | 16 |
| Wood Stick Injury | 4 |
| Fire Cracker Injury (Adolescent) | 1 |
| Injury During Play | 1 |
| Injury by Animal | 1 |
| Burn/Head/Fire/Chemical Injury | 1 |
| Injury by Assault | 2 |
| Blast Injury | 1 |
| Total | 79 |

Table 4: Laterality of Ocular Injury

| Eye Involved | Number of Patients | Percentage (%) |
|--------------|--------------------|----------------|
| Right Eye | 38 | 48.10% |
| Left Eye | 35 | 44.30% |
| Both Eyes | 6 | 7.59% |

Table 5: Type of Injury

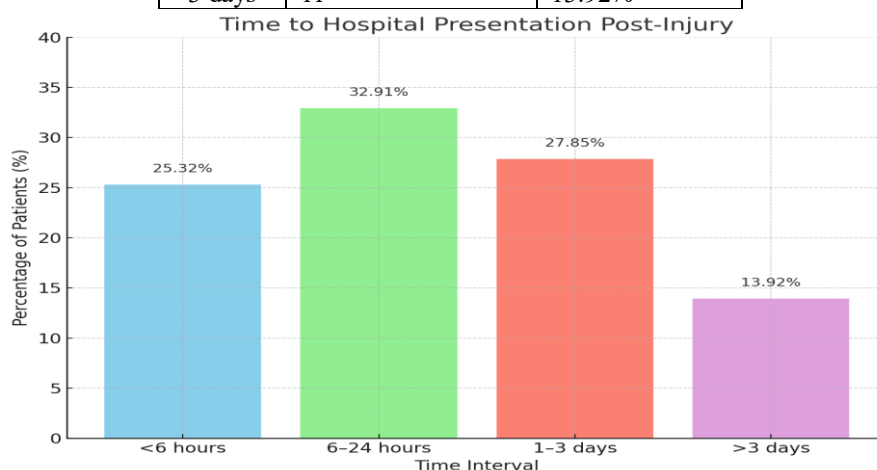
| Type of Injury | Number of Patients | Percentage (%) |
|---------------------|--------------------|----------------|
| Blunt Trauma | 28 | 35.44% |
| Penetrating Injury | 18 | 22.78% |
| Chemical Injury | 4 | 5.06% |
| Foreign Body | 22 | 27.85% |
| Others/Unclassified | 7 | 8.86% |

Table 6: Place of Injury Occurrence

| Place of Injury | Number of Patients | Percentage (%) |
|-------------------|--------------------|----------------|
| Road | 18 | 22.78% |
| Home | 15 | 18.99% |
| Workplace/Factory | 28 | 35.44% |
| School/Playground | 10 | 12.66% |
| Others | 8 | 10.13% |

Table 7: Time to Hospital Presentation Post-Injury

| Time Interval | Number of Patients | Percentage (%) |
|---------------|--------------------|----------------|
| <6 hours | 20 | 25.32% |
| 6–24 hours | 26 | 32.91% |
| 1–3 days | 22 | 27.85% |
| >3 days | 11 | 13.92% |

**Figure 2: Time to Hospital Presentation Post Injury**

DISCUSSION

The present study provides valuable insight into the demographic characteristics, causes, and patterns of ocular injuries in the industrial region of Alwar. The findings are consistent with prior reports suggesting that ocular trauma is predominantly a male-associated injury, with 65.82% (52 out of 79) of patients being male. This gender disparity has been reported in numerous studies and is often attributed to the greater outdoor and industrial exposure of males, particularly in manual labor-intensive jobs [6,7].

The age group most commonly affected was 31–40 years, accounting for 25.31% of the cases. This trend mirrors other studies, which have highlighted the vulnerability of the working-age population to ocular trauma [8]. The involvement of the productive age group has significant socioeconomic implications, especially in developing regions where workplace safety regulations may be inadequate [9].

Road traffic accidents (RTAs) were the leading cause of ocular injuries in our study, responsible for 20.25% of cases. This finding is in line with studies conducted in urban Indian settings, where increasing vehicular density and inadequate road safety measures contribute to higher injury rates [10]. Workplace-related injuries, particularly in factories, were the most frequent location-specific cause (35.44%). This emphasizes the urgent need for stricter enforcement of industrial safety protocols and the routine use of protective eyewear [11].

Foreign body injuries and blunt trauma were the most prevalent types of injury, affecting 27.85% and 35.44% of patients, respectively. These results are comparable to findings from rural and semi-urban studies, where flying particles, small projectiles, and physical altercations are common sources of trauma [12,13].

Interestingly, 25.32% of patients presented to the hospital within 6 hours of the injury, while 13.92% delayed seeking care for more than three days. Delayed presentation is a critical factor associated with poor visual outcomes, and this

pattern of delay has also been documented in studies from central and western India [14]. Limited awareness, transportation issues, and initial preference for traditional or local remedies may contribute to such delays [15]. Regarding laterality, injuries were almost equally distributed between right (48.1%) and left (44.3%) eyes, with 7.59% of patients having bilateral involvement. Bilateral ocular trauma, though rare, poses a significant burden on visual function and rehabilitation efforts [16].

The small proportion of chemical injuries (5.06%) and firecracker-related injuries (1.26%) seen in our study may be seasonal and underreported, particularly during festive periods or due to the underestimation of minor burns and irritations that do not reach hospital settings [17].

Our findings underscore the need for community-level awareness campaigns, promotion of protective equipment, and the establishment of ocular trauma registries. Timely intervention and rehabilitation services must be strengthened, especially for industrial workers who remain highly vulnerable.

CONCLUSION

The findings of this retrospective observational study highlight the significant burden of ocular injuries in the industrial region of Alwar, with a predominance of male patients in the working-age group. Road traffic accidents and workplace-related injuries were the leading causes of ocular trauma, emphasizing the urgent need for targeted preventive strategies, especially in industrial settings. The study also underlines the importance of timely medical intervention, as delayed hospital presentation is associated with poor visual outcomes. The data further suggest a need for increased awareness about ocular safety, particularly in high-risk environments like factories and roadways, along with the routine use of protective eyewear. Community education and stronger enforcement of safety regulations could play pivotal roles in reducing the incidence of ocular injuries. The establishment of ocular trauma registries, coupled with improved access to timely medical care, will be essential in mitigating the long-term impact of these injuries on public health. Future studies with larger sample sizes and a more detailed analysis of long-term visual outcomes would help in refining preventive measures and improving patient care strategies.

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