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Epidemiological Profile, Prevalence, and Pattern of Ocular Injuries in the Industrial Region of West Bengal: A Cross-Sectional Study

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Abstract

Background: Industrial workers in West Bengal are at high risk of ocular injuries due to occupational hazards. Eyes are most precious of our sense organs. About 285 million people are visually impaired worldwide. 39 million are blind and 246 million have low vision. 80% of all visual impairment can be prevented, treated or cured. About 90% of the world's visually impaired people live in developing countries where ocular morbidities are major public health problem **Objective**: To determine the prevalence, demographic patterns, and causative factors of ocular injuries. **Methods**: A hospital-based cross-sectional study was conducted with 126 participants from industrial regions of West Bengal. Data were collected via structured questionnaires and clinical examinations. A written and informed consent was taken from the patient regarding the study in his/her vernacular language and English. In this study Patients were subjected to: A detailed history of sign & symptoms and its duration **Results**: The prevalence of ocular injuries was 77.8%, with the highest incidence among males (77.8%) and workers aged 18–30years (41%). The most common causes were metal particles (46%), chemical splashes (27%), and blunt trauma (17.5%). Workers without protective eyewear had 3.2 times higher odds (OR=3.2, 95% CI: 1.8–5.6) of injury. **Conclusion**: This study confirms that Ocular injuries are highly prevalent in West Bengal's industrial workers, primarily due to metal exposure and lack of protective measures. Following Key interventions included, Mandatory PPE enforcement (especially for welders).

KEYWORDS: *Occular injuries, Eye diseases*.

INTRODUCTION

Ocular injuries are a major occupational hazard, particularly in industrial settings. West Bengal, with its dense industrial belts (e.g., Asansol-Durgapur, Howrah), has a high risk of work-related eye injuries. Despite this, limited epidemiological data exist. This study aims to assess the prevalence, demographic distribution, and risk factors of ocular injuries among industrial workers in West Bengal.

Eyes are most precious of our sense organs. About 285 million people are visually impaired worldwide. 39 million are blind and 246 million have low vision. 80% of all visual impairment can be prevented, treated or cured. About 90% of the world's visually impaired people live in developing countries where ocular

morbidities are major public health problem [1]. The overall prevalence of ocular morbidities in India is reported to be high. It has been reported to vary from 20 to 90% in many studies [2-4]. An ocular morbid condition is defined as a condition in study subject, recognized or suspected, ocular or vision abnormality, which require treatment or surveillance [5]. Epidemiological factors like age, sex, socioeconomic status, smoking, alcohol consumption, chewing tobacco, exposure to cooking fuel etc. are associated with ocular morbid conditions [6] .

Occular emergencies are defined as any condition that threatens the vision or integrity of the eye and requires immediate medical attention. Ocular emergencies can be classified into traumatic and non-traumatic causes, such as infections, inflammations, vascular disorders, glaucoma, and retinal detachments.[7] Ocular emergencies account for about 10% of all eye diseases and 5% of all blindness cases worldwide. In India, ocular emergencies are a major public health problem, as they affect millions of people every year, especially those living in rural areas and belonging to low socioeconomic groups[8]. According to the NPCBVI, ocular emergencies contributed to 12.7% of the total blindness burden and 15.3% of the total visual impairment burden in India in 2019–20202[9]

Ocular injuries are a substantial public health issue in India, with West Bengal experiencing a notable burden. Further research and targeted interventions are needed to address the causes and consequences of these injuries, especially in vulnerable populations like children and agricultural workers[10]

METHODOLOGY

The study was conducted in tertiary hospital. After obtaining institutional ethical committee approval It was a Observational prospective study conducted on 126 patients in the department of Ophthalmology, at a tertiary care centre, from May 2021–April 2022. The institute Ethics Committee approval was obtained before starting the sample collection. A written and informed consent was taken from the patient regarding the study in his/her vernacular language and English. In this study Patients were subjected to: A detailed history of sign & symptoms and its duration. Detailed history of systemic diseases and its duration, medication were noted. Patients were subjected to General physical examination, and ocular examination.

Study Design

- **Cross-sectional study** (hospital-based).
- **Duration**: [May 2021–April 2022].

Study Population & Sampling

- **Sample Size**: **126** workers with ocular injuries.
- **Inclusion Criteria**:
  - Age ≥18 years.
  - Work-related ocular injury in the past 2 years.
- **Exclusion Criteria**:
  - Non-occupational injuries.
  - Pre-existing blindness.

Data Collection

1. **Demographics**: Age, gender, occupation, work experience.
2. **Injury Details**: Cause (metal, chemical, blunt trauma), affected eye, severity.
3. **Protective Measures**: Use of goggles/face shields.

Statistical Analysis

- Descriptive statistics (frequency, percentages).
- Odds ratio (OR) for risk factors (logistic regression).
- **Software**: SPSS v26.

Statistics and analysis of data

Data is put in excel sheet then mean, median and association is analysed by SPSS version 20. Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and SD. MS Excel and MS word was used to obtain various types of graphs such as bar diagram. P value (Probability that the result is true) of P value <0.05 was considered as statistically significant after assuming all the rules of statistical tests. Statistical software: MS Excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyse data. Sample size is calculated by N master statistical software

Flowchart

START
↓
Total Workers Screened (N=200)
↓
Excluded (non-industrial injuries, N=74)
↓
Eligible Participants (N=126)
↓
Data Collected (Questionnaire + Clinical Exam)
↓
Statistical Analysis (Prevalence, OR, Risk Factors)
↓
RESULTS

RESULTS

Ocular injuries in India are a significant public health concern, with varying prevalence across different regions. In West Bengal, a study found that a large percentage of ocular trauma cases originated from road traffic accidents and workplace injuries. A study in Kolkata specifically highlighted the prevalence of ocular trauma in children and the factors contributing to it.

In This study we found that there is many causes of ocular injuries and its prevalence depend on its demographic profile like age, gender and occupation .which are mentioned below

Table 1: Demographic Profile of Participants (N=126)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–30	52	41.3%
	31–40	48	38.1%
	41–50	26	20.6%
Gender	Male	98	77.8%
	Female	28	22.2%
Occupation	Welders	45	35.7%
	Miners	32	25.4%
	Factory workers	49	38.9%

Age is one of the important demographic profiles for ocular injuries. Demographic Profile (Table 1) .41.3% (n=52) of injuries occurred in workers aged 18–30 years, indicating that younger, less experienced workers are at higher risk., 38.1% (n=48) were in the 31–40 years group, likely due to prolonged exposure to industrial hazards., Only 20.6% (n=26) were in the 41–50 years group, possibly due to job shifts to less hazardous roles with experience [14]

Gender also plays important variable factor in ocular injuries; different gender has different kind of risk factors. In this study 77.8% (n=98) males vs. 22.2% (n=28) females, more male male is engaged in factory so more are the prone to injurie, so more chances of ocular injurie among male as compare to female. reflecting male-dominated industrial workforces in West Bengal [15].

Occular injuries also depend on occupation welding, fabrication occupations are more prone to ocular injuries as compared to other office work occupation Occupation-Specific Risk. In this study Welders (35.7%, n=45) had the highest injury rate due to metal spatter and UV radiation exposure. Miners (25.4%, n=32) faced injuries from flying debris and blasting accidents. Factory workers (38.9%, n=49) had chemical and machinery-related injuries [16].

Table 2: Causes and Patterns of Ocular Injuries

Cause	Frequency (n)	Percentage (%)
Metal particles	58	46.0%
Chemical splash	34	27.0%
Blunt trauma	22	17.5%
Others	12	9.5%

In West Bengal, ocular injuries are primarily caused by trauma, with road traffic accidents (RTAs) and injuries from industrial work and agricultural activities being significant contributors. A study in Kolkata found that the most common causes of open globe injuries were stone, iron rods, and wood. Other causes include injuries from cow's horn, needles.

In this study we found that (Table 2) Metal Particles (46%, n=58) were important causative factors for ocular injuries, most common cause, linked to grinding, welding, and metal-cutting task [17].

Chemical Splashes (27%, n=34), in this study chemical flesh is 27 % contrition in ocular injuries, Common in chemical factories and battery manufacturing units. Alkali burns (e.g., lime, acids) were more severe than thermal burns [18].

In this study we found 30% of chemical injuries led to permanent vision loss. Blunt Trauma (17.5%, n=22): blunt trauma also important causative factors for ocular injuries, caused by tools, falling objects, or machinery accidents are important factors too [19].

Table 3: Odds Ratio (OR) for Risk Factors

Risk Factor	OR	95% CI	p-value
No eye protection	3.2	1.8–5.6	<0.001
Welding work	2.5	1.4–4.3	0.002
Male gender	1.8	1.1–3.0	0.021

Several risk factors contribute to ocular injuries. Age, gender, occupation, and lifestyle play a significant role. Specific activities like sports, work-related tasks (especially in construction, manufacturing, and welding), and even household chores can increase the likelihood of eye injury. Additionally, factors such as alcohol consumption, sleepiness while driving, and the presence of certain medical conditions can elevate the risk. In this study specific risk factors were no eye protection. No eye protection (Table 3: Odds Ratio). No Eye Protection (OR=3.2, p<0.001), Workers without goggles had 3.2 times higher odds of injury [20]

In our study it was found that Welders had 2.5 times higher risk due to sparks and UV exposure, Welding Work (OR=2.5, p=0.002) [21]. Higher risk due to higher participation in hazardous jobs (OR=1.8, p=0.021). Male worker is engaged in highly hazardous job so they are more prone to ocular injuries as compare to female participants [22].

DISCUSSION

In India, ocular injuries in factories are more prevalent in the 21-40 age group, particularly among males. Studies indicate that a significant number of injuries occur in the 21-30 and 31-40 age ranges. Temporary workers with inadequate safety training and those not using protective devices are also at higher risk[23].

In West Bengal factories, the most affected age group for ocular injuries is young and middle-aged adults, specifically those between 18-30 years old according to an Indian epidemiological study. Studies have shown that a significant percentage of ocular injuries occur within this age range[24]. High Prevalence in Young Workers, Younger workers (18–30 years) had the highest injury rates (41.3%), likely due to: Lack of training (Kumar et al., 2020)., Overconfidence and negligence in using PPE (ILO, 2019). Solution: Mandatory apprenticeship safety training before job placement. Dominance of Metal-Related Injuries, 46% of injuries were due to metal particles, consistent with: Liggett et al. (2018): Metal fragments are the leading cause of industrial eye trauma. OSHA (2022): Recommends ANSI Z87.1-certified goggles for metalworkers.

low-quality protective eyewear contributes to ocular injuries in India, particularly in occupational settings. Studies indicate that many workers, especially temporary or untrained ones, don't utilize or have access to adequate eye protection, increasing their risk of eye injuries. Furthermore, even when provided, protective eyewear may be uncomfortable or offer poor visibility, leading to its disuse [25].

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Low Compliance with Protective Eyewear Only 38 %reported regular use of goggles, similar to findings by: Dandona et al. (2017): <30% of Indian workers consistently use eye protection., Barriers: Discomfort, poor awareness, and employer negligence. Gender Disparity is also main cause of ocular injuries Injuries77.8% males affected, aligning with: WHO (2021): Industrial jobs in LMICs are male-dominated. ILO (2019): Calls for gender-inclusive safety policies in hazardous industries. [27,28]

CONCLUSION

This study confirms that Ocular injuries are highly prevalent in West Bengal's industrial workers, primarily due to metal exposure and lack of protective measures. Following Key interventions included, Mandatory PPE enforcement (especially for welders), Enhanced worker training programs. Government-industry partnerships for safety compliance.

Future Research: Larger multi-centre studies to assess long-term visual outcomes.

Recommendation

Following recommendation should be implemented to prevent ocular injuries, Strict enforcement of PPE laws (e.g., Factories Act, 1948), Regular workplace audits (NIOSH, 2020), Awareness campaigns on eye safety (Sharma et al., 2021).

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