Original Article

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Prevalence and Management of Ocular Trauma in Two Municipalities of Nepal

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ABSTRACT

Introduction: Female Community Health Volunteers (FCHVs) play a crucial role in promoting and preventing of eye health problems.

Objective: To assess the prevalence of and management of corneal abrasions using ophthalmic antimicrobials by FCHVs in urban areas of Nepal.

Methodology: This retrospective study reviews the data of ocular trauma between 2019 January and 2022 December of Nilkantha and Solududhkunda Municipalities, Nepal. The FCHVs were trained to diagnose corneal abrasions and provide a 3-day course of antimicrobials and referred unresolved cases to Eye Centres for further management. Data were analysed with IBM SPSS v.20. Chi-square and Fisher's exact tests were used. A 95% confidence interval was calculated, and significant variables were analysed through multiple logistic regression.

Result: All together 1,949 ocular trauma cases utilised the community-based eye care services provided by FCHVs. The prevalence of corneal abrasion was 87.3% (1,701), with a higher prevalence in Nilkantha (70.3%; n=1,195) than Solududhkunda (29.7%; n=506). In corneal abrasion cases, the mean age ± SD of the participants were 38.9 ± 18.1, (39.4±18.2 in Nilkantha and 37.7±17.8 in Solududhkunda municipalities). The prevalence of corneal abrasion was 47.9 % (814) in male and 52.1% (887) in female. The recovery rate of corneal abrasion was 97.4% (95% CI: 96.6–98.1; p<0.001), with consistent efficacy across location, gender, and age, but significant differences by injury type and time to FCHV visit. Patients treated within 12 to 24 hours had significantly higher odds of recovery at 15.1 (95% CI: 7.2–31.7) and 12.7 (95% CI: 5.2–30.8) compared to those treated after 24 hours.

Conclusion: The involvement of FCHVs in managing corneal abrasions proved effective in urban areas. Chloramphenicol Aplicap (1%) was found to be highly effective in treating corneal abrasions within 24 hours of ocular injury contributing to a reduction in corneal blindness in urban areas of Nepal.

Key words: Antimicrobials; corneal abrasion; female community health volunteers; management; ocular trauma; recovery.

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INTRODUCTION

Ocular trauma is a significant public health concern, especially in geographically isolated regions with limited resources for eye care services (Nikpoor et al., 2018). Corneal opacity ranks as second leading cause of blindness worldwide, highlighting the urgent need for interventions (Wang et al., 2023).

Literature highlights the connection between ocular trauma and regional disparities in health care accessibility. There is a higher prevalence of ocular injuries in remote settings with occupations such as agricultural activities (O'Brien et al., 2020; Upadhyay et al., 2001; Khatry et al., 2004). Previous studies on training community health care workers (CHW) to identify corneal abrasions showed mixed results (O'Brien et al., 2020; Bajracharya et al., 2020; Getshen et al., 2006). While some techniques have limited impact (Bajracharya et al., 2020), others demonstrate potential in reducing corneal ulcers.

Promoting FCHVs facilitates timely referrals for ocular trauma, reducing occurrences of corneal ulcers (Khatri, Mishra and Khanal, 2017; O'Brien et al., 2022; Srinivasan et al., 2022). Moreover, FCHVs also raise awareness about household risks and practices that may contribute to ocular injuries.

Nepal Eye Program, Tilganga Institute of Ophthalmology (NEP-TIO) implemented the Corneal Blindness Prevention Project, to address specific health care needs of urban communities by utilising the existing FCHV network. The novel approach introduced by the NEP-TIO since 2019 involves engaging FCHVs in management for ocular trauma. This initiative is supported by Sight Life International (now Cure Blindness Project) which seeks to provide sustainable solutions for corneal abrasions in urban areas.

Limited availability of specialised ophthalmic care and low prioritisation of eye health leads to delayed treatment, increasing the risk of significant preventable vision loss. This study investigated to assess the prevalence of and management of corneal abrasions using ophthalmic antimicrobials in two municipalities (Nilkantha and Solududhkunda) by engaging FCHVs in urban areas of Nepal.

METHODOLOGY

This study was a retrospective review of four years of data from 2019 January to 2022 December. It focused on residents of Nilkantha Municipality (Dhading district) and Solududhkunda Municipality (Solukhumbu district) of Nepal. The study sites were selected because the Corneal Blindness Prevention Program had been previously implemented by the Outreach Department of the Tilganga Institute of Ophthalmology.

The FCHVs were assigned the role of primary eye care providers at the community level, allowing for early detection and referral of patients with corneal abrasions. They received two days of basic cornea care training and refresher sessions were conducted biannually. The FCHVs used fluorescein tests to identify corneal abrasions with the help of cobalt blue illumination torch was used in the field setting, and if diagnosed, administered antimicrobials to prevent infections and complications. Diagnosed

cases were treated with 1% chloramphenicol ointment in single-dose applicaps for three days. Patients who did not show improvement after three days of treatment, or who developed signs of corneal ulceration, were referred to surgical or community eye centres for further management. These eye centres are staffed by trained ophthalmic assistants who are clinically qualified to manage and treat corneal ulcer cases.

To monitor and support FCHVs, a field supervisor was assigned to each municipality. They visited the homes of FCHVs and conducted monthly meetings at the health centre each month. Supervisors reviewed the logbook to check the details of ocular injuries, including the corneal abrasions and referral cases. They also submitted monthly reports to the outreach department of NEP-TIO.

Data entry, coding, and decoding were conducted in Microsoft Excel Sheet, and the cleaned data were transferred to IBM SPSS Statistics for Windows, version 20 (IBM Corp., Armonk, N.Y., USA) for analysis. Chi-square test was used to assess the association of categorical variables, and Fisher exact test was conducted when expected cell counts less than five. Ninety five percent confidence interval was calculated using the 1000 bootstrapping method. All statistically significant variables from the bivariate analysis were included in a multiple logistic regression using the enter method. The ethical approval was granted by the Tilganga Institute of Ophthalmology-Institutional Review Committee (TIO-IRC) (Reference number: 12/2023; dated: 21.09.2023).

RESULT

Of the 1949 enrolled ocular trauma patients, 72.0% (1404) were from Nilkantha Municipality, and 28.0% (545) were from Solududhkunda Municipality. Among these patients, 1701 (87.3%) had abrasions and were included in the variable-wise detailed data analysis (Table 1).

The study population was predominantly female, with a male-to-female ratio of approximately 0.92:1. The age distribution was skewed towards the working-age population, with 79% of participants aged 19-64 years. A smaller proportion, 16%, were under 18 years, and only 6% were 65 years or older. The majority of ocular traumas were caused by vegetation, accounting for 71% of cases. Insect/animal injuries were responsible for 22%, while other causes like metal pieces, sand, or dust particles contributed to the remaining 8%. Most injuries were treated within 12 hours, representing 68% of cases. This disparity might be attributed to the higher prevalence of agricultural work in hilly regions compared to mountainous areas, increasing exposure to potential eye injuries.

The overall prevalence of corneal abrasion was 87.3% (n = 1,701). The prevalence of corneal abrasions in Nilkantha accounting for 85.1% (n = 1,195) whereas was 92.8% (n = 506) in Solududhkunda. It indicated that the proportion of abrasion cases having trauma were visited in Solududhkunda in compared to Nilkantha ($p < 0.001$). The mean age ± SD of participants with corneal abrasions was 38.9 ± 18.1 years overall, with 39.4 ± 18.2 years in Nilkantha and 37.7 ± 17.8 years in Solududhkunda. The ages of patients with abrasions in both

municipalities were statistically similar (p = 0.08). The overall gender ratio (M: F) was 1.1:1, with a ratio of 1.03:1 in Nilkantha and 1.23:1 in Solududhkunda, indicating a slight predominance of males, which was also not statistically significant (p = 0.101).

The recovery rates for corneal abrasions treated with antibiotics by FCHVs showed high efficacy (Table 2). Out of the 1,701 patients diagnosed with corneal abrasions, 97.4% (n = 1,657; 95% CI: 96.6 - 98.1) recovered, highlighting the effectiveness of Chloramphenicol Aplicap in managing these cases (p <0.001). This high overall recovery rate highlights the success of community-based eye care interventions in treating corneal abrasions.

Among all the variables examined, the type of injury and the duration of treatment were found to have a statistically significant impact on recovery outcomes (p <0.001). Abrasions caused by vegetation showed the highest recovery rate of 98.2% (95% CI: 97.3 - 98.9), followed closely by insect/animal-related injuries at 97.5% (95% CI: 95.9 - 98.9). In contrast, injuries from other causes, such as metal pieces, dust, sand, mud, nails, or pieces of stones, had a statistically lower recovery rate of 89.9% (95% CI: 84.5 - 94.6). These findings suggest that the type of corneal injury may necessitate distinct treatment approaches or more intense interventions.

Patients who received treatment within 12 hours of injury had the highest recovery rate of 98.4% (95% CI: 97.6 - 99.0), while those treated between 12 and 24 hours had a slightly lower recovery rate of 98.1% (95% CI: 96.8 - 99.1). However, patients treated after 24 hours experienced a significantly reduced recovery rate of 80.5% (95% CI:72.0 - 89.0). These findings indicate the significance of receiving immediate medical care for corneal abrasions to achieve optimal recovery outcomes.

According to the results of the bivariate analysis, there was no statistical significance between recovery rates and demographic factors such as gender (p=0.228), location (p=0.172) and age group (p=0.875), indicating recovery rates were similar across these groups. This suggests that recovery rates for corneal abrasion did not differ significantly by gender, age, or location, suggesting consistent treatment outcomes across all demographic groups.

The factors that showed statistical significance in the bivariate analysis were included in a multiple logistic regression to quantify their effect on recovery outcomes (Table 3). The logistic regression model was statistically significant, as indicated by the omnibus test ($\chi^2 = 64.27$, df = 4, p <0.001), suggesting that the predictors collectively explain a significant portion of the variability in the dependent variable. In addition, the Hosmer and Lemeshow test demonstrated a good model fit ($\chi^2 = 1.668$, df = 3, p = 0.644), indicating strong alignment between observed and predicted values.

The correlation matrix showed moderate relationships among the predictors, with all correlation coefficients below 0.6, confirming no evidence of multicollinearity. This suggests that the predictors are adequately independent, which strengthens the reliability of their relationships with the dependent variable.

The analysis showed that the odds of recovery from vegetation-related injuries were 6.4 times higher (95% CI: 3.0 - 13.7) than those from other types of injuries. Similarly, insect or animal-related injuries had 4.0 times greater odds of recovery (95% CI: 1.6 - 10.0). In terms

of treatment duration, the odds of recovery were 15.2 times greater (95% CI: 7.3 - 31.8) for patients treated within 12 hours, and 12.8 times greater (95% CI: 5.3 - 30.9) for those treated within 12 to 24 hours, compared to those treated after 24 hours.

Table 1: Demographic characteristics of corneal abrasion cases, n (%).

Variables		Number (Percent)
Total		1701 (100)
Gender	Male	814 (47.9)
	Female	887 (52.1)
Age group (years)	Up to 18	265 (15.6)
	19 to 64	1341 (78.8)
	65 and above	95 (5.6)
Cause of trauma	Vegetation	1205 (70.8)
	Insect/Animal	367 (21.6)
	Others (metal pieces, sand, dust particles)	129 (7.6)
Duration of trauma (hours)	Within 12	1157 (68.0)
	>12 to 24	462 (27.2)
	>24	82 (4.8)
Location	Nilkantha	1195 (70.3)
	Solududhkunda	506 (29.7)

Table 2: Recovery rates for corneal abrasions by demographic and injury variables.

Variables		Total Number	Recovered Number	Recovered Percent (95% CI)	p-value
Total		1701	1657	97.4 (96.6 - 98.1)	<0.001
Gender	Male	814	789	96.9 (95.7 - 98)	0.228
	Female	887	868	97.9 (96.8 - 98.8)	
Age group (years)	Up to 18	265	259	97.7 (95.8 to 99.2)	0.875
	19 to 65	1341	1306	97.4 (96.5 to 98.2)	
	>65	95	92	96.8 (92.6 to 100.0)	
Type of injury	Vegetation	1205	1183	98.2 (97.3 - 98.9)	<0.001
	Insect/Animal	367	358	97.5 (95.9 - 98.9)	
	Others (metal pieces, sand, dust particles)	129	116	89.9 (84.5 – 94.6)	
Duration of treatment (hours)	Within 12	1157	1138	98.4 (97.6 – 99.0)	<0.001
	>12 to 24	462	453	98.1 (96.8 - 99.1)	
	>24	82	66	80.5 (72.0 – 89.0)	
Location	Nilkantha	1195	1160	97.1 (96.0 – 98.0)	0.172
	Solududhkunda	506	497	98.2 (97.0 - 99.2)	

CI: Confidence interval.

Table 3: Multiple logistic regression of statistically significant variables.

Variables	p-value	Odds Ratio (95% CI)
Injury (Other)	**Reference**	
Vegetation	<0.001	6.4 (3.0 to 13.7)
Insect/Animal	0.003	4.0 (1.6 to 10.0)
Duration (>24 hours)	**Reference**	
Within 12	<0.001	15.2 (7.3 to 31.8)
>12 to 24	<0.001	12.8 (5.3 to 30.9)

DISCUSSION

Ocular trauma remains a significant public health concern, particularly in resource-limited settings, where disparities in health care access and awareness often hinder effective management and impact outcomes (Khatry et al., 2004; Upadhyay et al., 2001; Nikpoor et al., 2018). While previous research on community-based ocular trauma management has primarily focused on rural settings and the role of community health volunteers (CHVs) in prevention (Getshen et al., 2006; O'Brien et al., 2022), this study aimed to evaluate the effectiveness of FCHVs in managing corneal abrasions in an urban Nepalese context.

The findings of this study demonstrate the efficacy of this community-based intervention. The predominance of vegetation-related injuries (70.8%), aligning with O'Brien et al., (2020), underscores the need for targeted interventions in agricultural settings. Crucially, timely FCHV intervention significantly influenced recovery. Patients treated within 12 hours exhibited a 98.4% recovery rate (95% CI: 97.6–99), while those treated within 12-24 hours showed similar outcomes at 98.1% (95% CI: 96.8–99.1). However, recovery significantly decreased to 80.5% (95% CI: 72–89) for delayed treatment beyond 24 hours, emphasising the critical role of prompt FCHV intervention in preventing complications and improving outcomes, as previously observed by Khatry et al., (2004).

The study further demonstrates the effectiveness of equipping FCHVs with Chloramphenicol Aplicap for direct management of corneal abrasions within the community. This approach significantly reduced treatment delays associated with referrals to community eye care centres (CECs), leading to a high recovery rate of 97.4% (95% CI: 96.6–98.1). This finding aligns with previous research demonstrating the efficacy of Chloramphenicol Aplicap in preventing corneal ulceration following trauma (Algarni et al., 2022; O'Brien et al., 2020; Upadhyay et al., 2001). Moreover, the consistent efficacy across different injury types and demographic groups highlights the suitability of this intervention for diverse patient populations.

This community-based model offers several advantages. By reducing the need for patients to travel to CECs, it minimises transportation and accommodation costs for both patients and the health care system (Khatry et al., 2004; Panday et al., 2017). This not only improves

access to care, especially for those with limited socioeconomic resources, but also alleviates the burden on CECs, allowing for more efficient resource allocation (Panday et al., 2017). While studies by Vaughan et al., (2015) and Panday et al., (2017) have demonstrated the economic benefits of CHW involvement in other health domains, further research is needed to conduct a cost-benefit analysis specifically for FCHV-led ocular care in this context.

Notably, the study found no significant difference in recovery rates between the hilly and mountainous regions or across demographic factors like gender and age. This suggests that the FCHV model has the potential for broad scalability and applicability across diverse geographic and demographic groups within Nepal, aligning with the findings of Nikpoor et al., (2018). Future research could further explore the model's effectiveness in the Terai region to assess its applicability across different ecological contexts.

CONCLUSION

In conclusion, this study provides valuable evidence for the effectiveness of FCHVs in managing corneal abrasions through timely administration of Chloramphenicol Aplicap. The high recovery rates, particularly with early intervention, demonstrate the significant potential of this community-based approach to improve access to quality eye care, reduce the burden on health care systems, and ultimately enhance visual health outcomes in Nepal.

Since this is retrospective study, the limitations of the study might not be generalisable for all municipalities of Nepal. For greater impact, a large-scale study will be recommended including the information of occupation.

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