

Infectious Keratitis: A Neglected Environmental Work Hazard

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Abstract

Infectious keratitis (infectious corneal ulceration) is the fifth leading cause of preventable blindness globally. However, it continues to be a neglected health problem, and is rarely considered to be an environmental work hazard. This is surprising since 20 % to 92 % of infectious keratitis, especially in Asia, is reported to occur following ocular trauma in workers engaged in agricultural chores or other forms of outdoor manual labour. Reported traumatising agents include mud and dust particles and plant material (leaves, tree branches, paddy grain), cow's tail, sticks, stones and iron particles. Any form of corneal damage is a potential threat to vision, and unilateral or bilateral corneal blindness resulting from infectious keratitis is a devastating economic and psychological occurrence for any individual. Individuals with unilateral or bilateral corneal opacity arising from infectious keratitis have been found to suffer from disturbances in vision-specific mobility (general function), psychosocial vision and visual symptoms, resulting in a poorer vision-related quality of life than normal individuals. Treatment of infectious keratitis may take several days, hence cost of treatment may be prohibitive. Since prompt prophylactic treatment of corneal abrasions with antibacterial and antifungal ointment has been shown to prevent occurrence of infectious keratitis, committed grassroots workers and a fairly extensive rural health network are needed to make this a reality. Campaigns (either official or by word of mouth) are needed to make the general public aware of this condition and its possible prevention.

Keywords: infectious keratitis; ocular trauma; prevention; vision-specific quality of life

Key Points

1. Infectious keratitis has been estimated to affect millions of individuals in China and other Asian countries; however, it is rarely considered to be an environmental work hazard.
2. A high proportion of infectious keratitis (exceeding 50% in many countries in Asia and Africa) occurs following ocular trauma in agricultural workers or outdoor labourers.
3. Unilateral or bilateral corneal blindness resulting from infectious keratitis causes disturbances in vision-specific mobility and other parameters, leading to impaired vision-related quality of life in affected individuals; moreover, the ability to do certain forms of work is affected.
4. Since the cost of treatment may be prohibitive, greater efforts should be made to prevent the occurrence of the condition. Public health campaigns will help to raise awareness of the disabling effects of the condition, and how it can be prevented by timely action.

5. Prompt prophylactic administration of antimicrobial ointment to individuals sustaining corneal abrasions has been shown to prevent subsequent onset of infectious keratitis; however, this line of action needs to be followed regularly, and on a large scale, in settings where infectious keratitis is prominent.

Introduction

Keratitis refers to an inflammation of the cornea (the anterior, projecting, transparent part of the external coat of the eye). When this is caused by microbes (bacteria, fungi, parasites) or viruses, it is collectively referred to as infectious keratitis or microbial keratitis [1]; the term 'ulcerative keratitis' is also used, since there is a defect of the corneal epithelium, with inflammation of the underlying corneal stroma. The presentation is acute, with patients often in significant pain and distress; indeed, infectious keratitis is a medical emergency, for which aggressive treatment should be rapidly started to halt the disease process and limit the extent of corneal scarring and loss of vision [2].

Prevalence of infectious keratitis

Infectious keratitis is reported to be the fifth leading cause of blindness overall, causing 3.5% (36 million) of all blind individuals up to 2015 [3]. While the real burden of the disease worldwide is difficult to ascertain, poor rural and agricultural populations are likely to be disproportionately affected, especially in developing countries in Asia, where infectious keratitis is a public health threat due to limited access to health care, poor health indices and a higher proportion of workers in farming and agriculture [3-5]. In one study in the Hubei region of China, it was calculated that 8.4712 million individuals suffered from sequelae of, or current, infectious keratitis [6]. Another study on patients from different regions of China estimated that 2.47 million individuals suffered from infectious keratitis (including sequelae and active keratopathy), of whom 1.04 million were blind in at least one eye [7]. Even in a country like the United States, where the prevalence of infectious keratitis is comparatively lower, this disease is estimated to annually necessitate about 1 million visits to health professionals and 58 000 to emergency departments, resulting in direct health expenditure of about 175 million dollars [8, 9].

Infectious keratitis and occupational health

So, how is infectious keratitis relevant to occupational health? It is relevant since individuals in agricultural and outdoor occupations are at high risk of developing infectious keratitis following trauma to the eye/cornea sustained during the course of their work [10]. In a study on 200 patients with infectious keratitis in southern India, 35.5% of patients were agriculturalists and 31% were outdoor workers; 83% of the agriculturalists and 65% of the outdoor workers gave a history of trauma to the eye [11]. In a more recent prospective, observational cohort study in southern India on 252 patients with severe infectious keratitis seen over a 13 month period, corneal trauma was sustained in 181 (72%) immediately prior to the onset of the ulcer; the source of trauma was vegetative matter in 82 (46%) of 180 and 159 (63%) of 251 participants were agricultural workers [12]. A detailed review of the literature has shown that the proportion of patients with infectious keratitis reporting antecedent ocular trauma as a predisposing factor is very high in Africa, India, other parts of Asia and Brazil [13] (Table).

Types of traumatising agents and consequences of ocular trauma

Trauma to the eye can cause ulceration of the corneal epithelium; once the epithelium is breached, the corneal stroma and deeper part of the cornea are prone to become secondarily infected by bacteria and fungi and, to a lesser extent, by *Acanthamoeba* or other protozoa.

The principal traumatising agents reported are mud and dust particles and plant material (leaves, tree branches, paddy grain); other traumatising agents include cow's tail, sticks, stones, fingers, insects, oil and iron particles [11]. It is unclear whether certain occupations predispose to specific types of keratitis, for example, agricultural work to fungal keratitis; interestingly, fungal keratitis was reported to occur frequently in onion harvesters in Taiwan [14].

Infectious keratitis and disturbed vision-related quality of life

Infectious keratitis has a serious impact on the quality of life (QOL) of an affected individual. In a recent population-based study in a rural North Indian population, Raj et al. (2023) [15] reported that there were 65 cases of infectious keratitis (14.9% of study population of 435 patients with corneal disease). When three subscales of Indian Vision-Function (IND-VFQ-33) questionnaire, namely, vision-specific mobility (general function), psychosocial impact and visual symptoms were used, these participants had significantly higher VR-QoL scores, and hence poorer VR-QoL, across all three domains of vision function (scores of 28 vs 22, 7.5 vs 5 and 15.5 vs 9, respectively; $p < 0.0001$) when compared with healthy controls [15]. The authors concluded that VR-QoL is significantly impaired in patients with CO resulting from infectious keratitis, both in bilateral and unilateral cases. The most common activity affected in individuals with corneal disease was difficulty in recognizing people from a distance (66.7%). Other important activities restricted due to poor vision were close work, such as seeing fallen objects in food (31.9%) and ascertaining the level of liquids in the container (40.2%). The psychosocial impact was greatest for fear of losing residual vision (59.8%) and a feeling of fear when going out at night (49.4%). Visual symptoms related to corneal disease were greater for feeling dazzled in bright light (34.3%) and bright light hurting the eyes (32.2%) [15].

Measures to prevent infectious keratitis during work

Chidambaram et al. (2018) [12] concluded that severe infectious keratitis occurred predominantly in agriculturalists post-corneal trauma and often had poor outcomes; they suggested that provision of community-based eyecare might allow earlier treatment and improve outcomes. If posttraumatic infectious keratitis is initiated following a breach in the corneal epithelium, then, theoretically speaking, application of antimicrobials to the abraded cornea soon after trauma should diminish the occurrence of infectious keratitis. Two studies at the village level, one in Bhutan [16], and the other in Burma [17] have validated this hypothesis. In Bhutan, application of 1% chloramphenicol ointment soon after trauma-induced corneal abrasion was detected effectively prevented onset of bacterial keratitis [16]. Similarly, in Burma, when 1% chloramphenicol-clotrimazole ointment was applied to the corneal abrasion soon after the trauma, fungal keratitis was effectively prevented [17]. To maintain relevance, this concept needs to be widely promoted and implemented. However, several aspects need to be fulfilled to ensure success. Individuals at risk of sustaining ocular trauma during work should be educated and motivated enough to seek proper treatment immediately following trauma. There needs to be village-level workers (voluntary or otherwise) available to whom the affected worker can go after ocular trauma, and these village-level workers should be taught to recognise such abrasions and to give the appropriate drops or ointment. There should be an adequate supply of the antimicrobial medication. The help of traditional healers in these defined populations may need to be sought to widen the reach of the village-level workers. Provision of protective glasses in agricultural workers and manual labourers may reduce the risk of ocular trauma, preventing corneal infection [18].

Table

Proportions of infectious keratitis cases in different regions of the world where trauma is reported as an important predisposing factor.

Region	No. of studies	No. of infectious keratitis	Proportion(%) of infectious keratitis with trauma as a predisposing factor	
			Mean	Range
Africa	8	1992	60.6	43.3 to 78.5
Asia (only India)	15	18338	67.2	32.4 to 92.1
Asia (excluding India)	13	6198	51.7	20.0 to 90.0
Brazil	2	664	52.3	49.3 to 55.6

Adapted from Hoffman et al. (2021) [13].

Supplementary Data

Not applicable to this article as no new data were created or analyzed in this article.

Conflicts of Interest

There are no conflicts of interest to report.

Data Availability Status

Data sharing is not applicable to this article since no new data were created or analyzed in this article.

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