Research Article

Cuestiones de Fisioterapia

Medicine

PREVALENCE AND RISK FACTORS OF PTERYGIUM AMONG OUTDOOR WORKERS ATTENDING AN OPHTHALMOLOGY OUTPATIENT DEPARTMENT: A CROSS-SECTIONAL STUDY

Dr.S.Lakshmi*

Assistant Professor, Department of Ophthalmology, Sri Lakshmi Narayana Institute of Medical Sciences & Hospital, Puducherry – 605502.

Abstract

Background: Pterygium is a common ocular surface disorder characterised by the fibrovascular proliferation of degenerated conjunctival tissue onto the cornea. Chronic exposure to ultraviolet (UV) radiation and other environmental irritants is strongly implicated in its pathogenesis, placing outdoor workers in tropical regions such as South India at heightened risk. Despite the abundant year-round sunshine of this region, occupation-specific data among outdoor workers remain limited. Objectives: To determine the prevalence of pterygium among outdoor workers attending an ophthalmology outpatient department (OPD) and to identify associated demographic and exposure-related risk factors. Methods: A hospital-based cross-sectional study was conducted among 250 outdoor workers attending the ophthalmology OPD of a tertiary care teaching hospital in South India. All participants underwent slit-lamp biomicroscopic examination for the diagnosis and grading of pterygium, and completed a structured questionnaire capturing occupational and environmental exposure. Data were analysed using descriptive statistics, the chi-square test, and the independent-samples t-test, with $p<0.05$ considered statistically significant. Results: The mean age was 45.1 (SD 15.4) years; 140 (56.0%) were male. The overall prevalence of pterygium was 24.8% (62/250; 95% confidence interval [CI] 19.4–30.2%). Among affected participants, involvement was bilateral in 23, right-eyed in 22 and left-eyed in 17; severity was graded I in 22, II in 21 and III in 19. The mean duration of outdoor work was significantly greater among those with pterygium than those without (20.4 vs 17.4 years; $t=2.00$, $p=0.046$). Gender ($p=0.21$), dust exposure ($p=0.93$), protective eyewear use ($p=0.95$), smoking ($p=0.51$), age ($p=0.93$) and daily sun-exposure category ($p=0.50$) were not significantly associated with pterygium. Conclusion: Pterygium was common in this outdoor-worker population, with cumulative duration of outdoor work emerging as the principal associated factor, consistent with chronic UV and environmental exposure. Most cases were mild-to-moderate, and laterality was fairly even. Promotion of protective measures such as sunglasses and wide-brimmed hats is warranted for long-serving outdoor workers.

Keywords: Pterygium; Ultraviolet radiation; Outdoor workers; Occupational eye disease; Prevalence; South India

Introduction

Pterygium is a common, often bilateral, degenerative and proliferative disorder of the ocular surface, characterised by a wing-shaped fibrovascular growth of bulbar conjunctival tissue that encroaches onto the cornea, typically along the horizontal palpebral fissure. Although frequently regarded as a benign cosmetic concern, pterygium can produce significant ocular morbidity, including chronic irritation, foreign-body sensation, redness, induced astigmatism, restriction of ocular motility and, in advanced cases, encroachment over the visual axis with consequent loss of vision. Its tendency to recur after surgical excision adds to the clinical and economic burden it imposes on affected individuals and health systems alike.

The global distribution of pterygium displays a striking geographical gradient, with prevalence rising markedly in populations residing closer to the equator and in regions of intense solar radiation. A systematic review and meta-analysis of geographical prevalence reported that proximity to the equator and higher ambient UV exposure are consistent ecological determinants of disease frequency [8]. Population-based surveys across Asia have reported a wide range of prevalence estimates, reflecting differences in latitude, outdoor activity and demographic composition: 10.0% in an adult Chinese population in Singapore [2], higher figures in rural and island communities of Japan [3] and Myanmar [5], and substantial burdens in Chinese rural cohorts [6,7]. Studies from Indonesia [1], Iran [4] and high-altitude Nepalese communities [9] have similarly underscored the importance of cumulative environmental exposure.

The aetiology of pterygium is multifactorial, but chronic exposure to ultraviolet (UV) radiation is the most robustly supported environmental determinant. UV-B radiation is thought to induce damage at the corneoscleral limbus, where limbal stem cells reside, triggering a cascade of altered cellular proliferation, fibrovascular ingrowth, inflammation and elastotic degeneration of the conjunctival stroma. Additional environmental contributors implicated in epidemiological studies include exposure to wind, dust, sand and other airborne irritants, as well as a chronically dry ocular surface—factors that frequently coexist in outdoor occupational settings. The peripheral light-focusing effect of incident sunlight at the nasal limbus offers a plausible explanation for the characteristic nasal predilection of the lesion.

Given this aetiological framework, occupation is a central determinant of risk. Individuals whose livelihoods require prolonged outdoor activity—including construction workers, fishermen, farmers, traffic police personnel and gardeners—accumulate substantially greater lifetime doses of solar radiation and environmental irritants than those working indoors. Several population-based studies have identified outdoor occupation and increasing duration of sun exposure as independent risk factors for pterygium [1,2,4]. Outdoor workers therefore constitute a particularly relevant population in which to characterise the disease and its modifiable determinants.

These considerations are especially pertinent in South India, a tropical region situated at low latitude that receives abundant, intense solar radiation throughout the year. A large segment of the regional workforce is employed in outdoor and manual occupations, sustaining high cumulative UV and environmental exposure across the working lifetime. Population-based data from the Indian subcontinent, including the Andhra Pradesh Eye Disease Study [10] and the Central India Eye and Medical Study [11], have confirmed that pterygium is a prevalent condition with clear environmental associations. However, comparatively few studies have focused specifically on outdoor workers, who represent the population at greatest exposure and in whom targeted preventive interventions could yield the greatest benefit.

There remains a gap in occupation-focused evidence quantifying the burden of pterygium and clarifying which exposure variables are most strongly associated within this high-risk group attending routine ophthalmic services. Addressing this gap may inform workplace eye-protection strategies and patient counselling. The present study was therefore undertaken to estimate the prevalence of pterygium among outdoor workers attending an ophthalmology OPD at a tertiary care teaching hospital in South India, and to examine its association with demographic characteristics and occupational and environmental exposures.

Materials and Methods

Study design and setting

This was a hospital-based, observational, cross-sectional study conducted in the Department of Ophthalmology of Tertiary Care Teaching Hospital, a tertiary care teaching hospital in South India, over the study period six months.

Study population

The study population comprised outdoor workers attending the ophthalmology outpatient department during the study period. Outdoor workers were defined as individuals whose principal occupation required substantial daily work in the open air, including construction workers, fishermen, farmers, traffic police personnel and gardeners.

Inclusion and exclusion criteria

Adults aged 20–70 years engaged in outdoor occupations who attended the OPD and consented to participate were included. Individuals with a prior history of ocular surgery involving the conjunctiva or cornea (including previous pterygium excision), those with active ocular surface infection or inflammation that precluded reliable examination, and those unwilling or unable to provide informed consent were excluded.

Sample size

A total of 250 eligible outdoor workers were enrolled. The sample size was considered adequate to estimate the prevalence of pterygium in this population with acceptable precision and to permit examination of associations with demographic and exposure variables.

Clinical examination, diagnosis and grading

All participants underwent a comprehensive ophthalmic evaluation. The diagnosis of pterygium was established on slit-lamp biomicroscopy by an ophthalmologist, based on the presence of a fibrovascular triangular growth of conjunctival tissue encroaching onto the cornea. Laterality (right eye, left eye or bilateral) was documented for each affected participant. Severity was graded clinically into three grades—grade I, grade II and grade III—reflecting increasing extent of corneal encroachment and fleshiness of the lesion.

Exposure questionnaire

A structured questionnaire was administered to all participants to capture demographic details (age, sex), occupation, total duration of outdoor work (years), mean daily sun exposure (hours), and additional exposure-related variables including dust exposure, regular use of protective eyewear, and smoking status.

Statistical analysis

Data were compiled and analysed using standard statistical software. Continuous variables were summarised as mean and standard deviation (SD), and categorical variables as frequencies and percentages. The prevalence of pterygium was reported with its 95% confidence interval (CI). Associations between categorical exposure variables and pterygium status were assessed using the chi-square (χ^2) test, and differences in continuous variables between affected and unaffected participants were assessed using the independent-samples t-test. A p-value of less than 0.05 was considered statistically significant.

Results

Demographic and occupational profile

A total of 250 outdoor workers were enrolled. The mean age of participants was 45.1 (SD 15.4) years, ranging from 20 to 70 years. Males predominated, accounting for 140 (56.0%) participants, while 110 (44.0%) were female. The occupational distribution comprised 55 construction workers, 50 fishermen, 50 farmers, 49 traffic police personnel and 46 gardeners. The mean total duration of outdoor work was 18.2 (SD 10.1) years, and the mean daily sun exposure was 5.8 (SD 2.4) hours. The demographic and occupational/exposure profile of the study population is summarised in Table 1.

Table 1. Demographic and occupational/exposure profile of the study population (N=250)

Characteristic	Value
Mean age, years (SD)	45.1 (15.4)
Age range, years	20–70
Male, n (%)	140 (56.0)
Female, n (%)	110 (44.0)
Construction worker, n	55
Fisherman, n	50
Farmer, n	50
Traffic police, n	49
Gardener, n	46
Mean duration of outdoor work, years (SD)	18.2 (10.1)
Mean daily sun exposure, hours (SD)	5.8 (2.4)

Prevalence, laterality and severity of pterygium

Pterygium was identified in 62 of the 250 participants, yielding an overall prevalence of 24.8% (95% CI 19.4–30.2%). Among the 62 affected participants, involvement was bilateral in 23, confined to the right eye in 22 and to the left eye in 17, indicating a fairly even distribution of laterality. With respect to severity, 22 participants had grade I disease, 21 had grade II and 19 had grade III, indicating that the majority of cases were mild-to-moderate. The distribution of pterygium severity grades among affected participants is shown in Figure 1, and the prevalence, laterality and grade are detailed in Table 2.

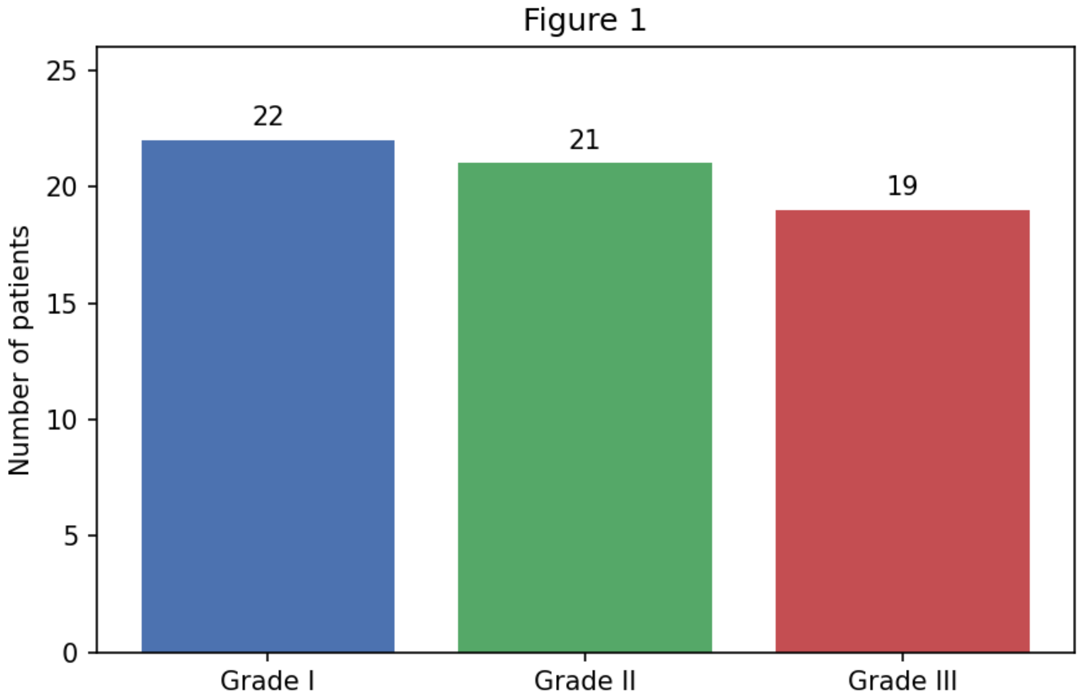

Figure 1. Distribution of pterygium severity grades among the 62 affected participants.

Table 2. Prevalence, laterality and severity grade of pterygium

Parameter	n	% (of affected, n=62)
Pterygium present (of N=250)	62	24.8 (95% CI 19.4–30.2)
Bilateral	23	37.1
Right eye only	22	35.5
Left eye only	17	27.4
Grade I	22	35.5
Grade II	21	33.9
Grade III	19	30.6

Factors associated with pterygium

The mean duration of outdoor work was significantly greater among participants with pterygium than among those without (20.4 vs 17.4 years; t=2.00, p=0.046). This was the only variable significantly associated with the presence of pterygium and represents the key finding of the study. The comparison of mean duration of outdoor work by pterygium status is illustrated in Figure 2.

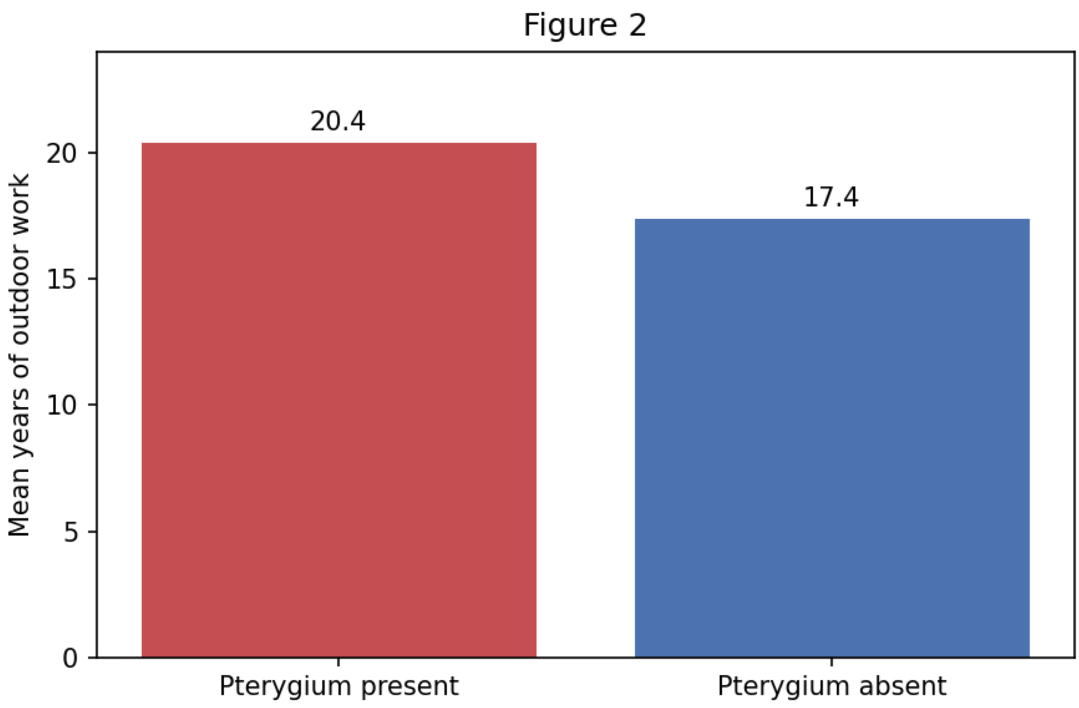

Figure 2. Comparison of mean duration of outdoor work (years) between participants with and without pterygium.

None of the other examined variables showed a statistically significant association with pterygium. Although the prevalence appeared numerically higher among females (29.1%) than males (21.4%), this difference was not statistically significant (χ^2=1.55, p=0.21). Likewise, dust exposure (p=0.93), regular use of protective eyewear (p=0.95), smoking (p=0.51), age (p=0.93) and daily sun-exposure category (p=0.50) were not significantly associated with the presence of pterygium. The factors examined are summarised in Table 3.

Table 3. Factors associated with pterygium

Factor	Comparison	Test statistic	p-value	Significance
Duration of outdoor work	20.4 vs 17.4 years (present vs absent)	t=2.00	0.046	Significant
Gender	Female 29.1% vs male 21.4%	χ^2=1.55	0.21	Not significant
Dust exposure	—	—	0.93	Not significant
Protective eyewear use	—	—	0.95	Not significant
Smoking	—	—	0.51	Not significant
Age	—	—	0.93	Not significant
Daily sun-exposure category	—	—	0.50	Not significant

Discussion

In this hospital-based cross-sectional study of 250 outdoor workers attending an ophthalmology OPD in South India, pterygium was a common finding, with an overall prevalence of 24.8% (95% CI 19.4–30.2%). The key determinant identified was the cumulative duration of outdoor work, which was significantly greater among affected participants (20.4 vs 17.4 years; p=0.046). This finding is biologically coherent and aligns with the prevailing understanding that pterygium is fundamentally a disease of chronic, cumulative environmental and ultraviolet exposure rather than of any single acute insult.

The prevalence observed in the present study is consistent with, and toward the higher end of, the spectrum reported in Asian and Indian epidemiological literature. The Tanjong Pagar survey of an adult Chinese population in Singapore reported a prevalence of 10.0% [2], while the Tehran Eye Study documented intermediate figures in an Iranian urban population [4]. Higher burdens have been described in equatorial and island or rural settings, including Indonesia [1], the Kumejima Study in southwestern Japan [3], the Meiktila Eye Study in central Myanmar [5], and rural Chinese cohorts in Shandong [6] and among the Bai population of Yunnan [7]. The comparatively high prevalence in our cohort is unsurprising, given that the study population was deliberately restricted to outdoor workers—an inherently high-exposure group—in a low-latitude tropical region with intense year-round insolation. This selection contrasts with general population-based surveys that include large proportions of indoor-working and less-exposed individuals, and it likely accounts for the elevated estimate relative to mixed-population studies.

Within India, the Andhra Pradesh Eye Disease Study provided a population-based assessment of pterygium prevalence and risk factors in a South Indian state [10], and the Central India Eye and Medical Study documented a substantial burden among a rural agrarian population [11]. Both studies identified outdoor activity and related environmental exposures as important correlates, reinforcing the external validity of our central observation. The systematic review and meta-analysis by Liu and colleagues synthesised global data and confirmed that geographical and exposure-related variables—particularly proximity to the equator and outdoor exposure—are the dominant drivers of prevalence [8]. Our finding that the duration of outdoor work, a direct proxy for lifetime cumulative exposure, distinguished affected from unaffected workers integrates neatly within this body of evidence.

The mechanistic basis for this association centres on chronic ultraviolet radiation. UV-B radiation reaching the limbus is hypothesised to damage limbal stem cells, disrupt the normal corneolimbal barrier and provoke aberrant fibrovascular proliferation, accompanied by inflammation, angiogenesis and elastotic degeneration of the subepithelial conjunctival stroma. The longer an individual works outdoors, the greater the integrated lifetime UV dose delivered to the ocular surface, providing a plausible explanation for why duration of outdoor work—rather than any single point-in-time exposure measure—emerged as the discriminating variable. Co-existing environmental irritants common to outdoor work, including wind, dust and a desiccated ocular surface, may act synergistically with UV radiation; chronic ocular surface dryness and irritation have themselves been linked to outdoor environmental exposure in related population work [13].

Notably, several individual exposure variables were not significantly associated with pterygium in this sample, including gender (p=0.21), dust exposure (p=0.93), use of protective eyewear (p=0.95), smoking (p=0.51), age (p=0.93) and daily sun-exposure category (p=0.50). The numerically higher prevalence among females (29.1% vs 21.4%) did not reach statistical significance. Several interpretations are plausible.

First, the study population was relatively homogeneous in being uniformly high-exposure outdoor workers, which compresses the contrast between sub-groups and reduces the statistical power to detect differences in any single exposure measure. Second, cross-sectional measures such as daily sun-exposure hours or current eyewear use may poorly capture lifetime cumulative exposure, which is better represented by total duration of outdoor work. Third, self-reported behaviours such as eyewear use and smoking are subject to misclassification. The convergence of risk onto cumulative duration, rather than instantaneous exposure indices, is consistent with the chronic, dose-dependent natural history of the disease and echoes findings from larger surveys [1,2,4]. Reviews of major Asian eye studies, including the Singapore Malay Eye Study, have similarly highlighted environmental and ageing-related ocular surface changes within broader population health contexts [12].

The clinical and public-health implications are practical. Because cumulative outdoor exposure is the principal driver, preventive strategies should emphasise reducing lifetime UV dose to the ocular surface. UV-blocking sunglasses and wide-brimmed hats are simple, affordable interventions that can meaningfully attenuate ocular UV exposure and should be actively promoted among outdoor workers, particularly those with long service. Workplace health programmes, occupational eye-protection policies and patient counselling at the point of care represent feasible avenues for implementation. Most cases in our cohort were mild-to-moderate (grade I in 22 and grade II in 21 of 62), and laterality was fairly even, suggesting that earlier identification and protective counselling could limit progression to advanced, vision-threatening or surgically demanding disease in this working population.

Conclusion

Pterygium was common among outdoor workers attending an ophthalmology OPD in South India, with a prevalence of 24.8%. The cumulative duration of outdoor work was the principal factor associated with the presence of pterygium, consistent with chronic ultraviolet and environmental exposure, whereas other individual exposure variables were not independently significant in this high-exposure sample. Most cases were mild-to-moderate, and laterality was fairly even. These findings support the active promotion of protective measures, particularly UV-blocking sunglasses and wide-brimmed hats, among long-serving outdoor workers, and underline the value of occupational eye-protection programmes and patient counselling in sunny tropical settings.

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