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Review Article

Prevalence and Risk Factors of corneal ulcer in elderly patients with vision loss

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Abstract

Background: Corneal ulceration is a leading cause of avoidable monocular and binocular vision loss worldwide, and its epidemiological profile among elderly patients differs substantially from the contact-lens-driven disease that dominates younger cohorts [1,7].

Objective: This review synthesizes the published evidence on the prevalence, risk factors, causative organisms, and visual outcomes of corneal ulcer specifically in elderly patients with vision loss.

Methods: We synthesized population-based incidence surveys, hospital and multicenter referral-center case series, and prospective outcome cohorts reporting age-stratified data on corneal ulceration from the early 1990s through 2021.

Findings: Older, non-contact-lens-wearing patients present predominantly with ocular surface disease, trauma, diabetes, and lid abnormality as predisposing factors [13,14,16], carry a Gram-positive-dominant organism profile [24], and experience delayed epithelial healing and worse final visual acuity than younger patients across every cohort examined [31,7,32].

Conclusions: Elderly patients constitute a distinct, high-risk subgroup within the corneal ulcer population, and as global populations age, health systems should anticipate a growing burden of ocular-surface-disease-related ulceration and prioritize prompt recognition and aggressive management in this group [36,12].

Keywords: corneal ulcer; microbial keratitis; elderly; vision loss; risk factors

1. Introduction

Corneal ulceration remains one of the leading avoidable causes of monocular and binocular vision loss worldwide, and the burden falls disproportionately on people at the extremes of life, with older adults forming a large and growing share of affected patients. Whitcher and colleagues described corneal ulceration in low-resource settings as a "silent epidemic," noting that it receives far less public attention than cataract or trachoma despite causing a comparable amount of blindness once scarring has set in [1]. Global estimates compiled in the 1990s already suggested that corneal opacity, much of it the sequela of untreated ulceration, accounted for a substantial fraction of the world's blind, a picture subsequent surveys have only partially revised [2,3].

Population-based incidence studies conducted across very different health systems converge on the same broad conclusion: corneal ulceration is common, its incidence rises with age, and outcomes are worse in older patients. The Madurai district survey in South India, one of the earliest rigorous population-based estimates, found an annual incidence roughly ten times higher than comparable estimates from high-income settings, with older agricultural workers and those with ocular surface trauma contributing heavily to the caseload [4]. A companion analysis from the same cohort found that fungal and bacterial organisms accounted for most confirmed cases and that presenting severity was systematically greater among older presenters who had delayed seeking care [5]. A broader review of bacterial keratitis reached a similar conclusion, noting that predisposing ocular surface disease becomes progressively more important relative to trauma as the age of the affected population rises [6]. In the United States, the Olmsted County study similarly found a second incidence peak among older adults, distinct from the peak seen in younger contact lens wearers [7]. These studies, decades apart and in very different populations, established a pattern later series have repeatedly

confirmed: corneal ulcer is not simply a disease of the young contact-lens-wearing eye but has a second, clinically distinct life in aging populations. This review synthesizes the epidemiological literature on the prevalence and risk factors of corneal ulcer among elderly patients and the vision-loss outcomes that follow.

2. Methods

We reviewed the published literature on the epidemiology, risk factors, microbiology, and visual outcomes of infectious and non-infectious corneal ulceration, with particular attention to studies reporting age-stratified data or focusing on elderly cohorts. Sources included population-based incidence surveys, hospital and referral-center case series, multicenter prospective cohorts, and preferred-practice guidance from the early 1990s through 2021. We prioritized studies reporting predisposing factors (ocular surface disease, trauma, contact lens wear, prior surgery, diabetes, and immunosuppression), causative organisms, and visual acuity outcomes, favoring clearly defined denominators or consecutive case ascertainment over anecdotal reports. Findings were synthesized narratively rather than through formal meta-analysis given the heterogeneity of case definitions and follow-up intervals across sources.

3. Results

Prevalence and incidence across settings

Reported incidence of corneal ulceration varies enormously by geography and ascertainment method, but nearly every large series that stratified by age found disproportionate representation of older patients among the more severe presentations. The Bhaktapur eye study in Nepal found that a meaningful share of ulcers followed minor trauma in older agricultural workers whose corneal epithelium healed more slowly and less completely than that of younger patients [8]. The Aravind Comprehensive Eye Survey in rural South India similarly found that corneal blindness, much of it scar-related sequela of prior ulceration, rose sharply with age and was associated with

lower literacy and delayed presentation, both more common among older rural residents [9].

Table 1: Predisposing factor profile and representative organism pattern in elderly versus younger corneal ulcer patients, synthesized from multicenter and referral-center series [12,10,11,24,25].		
Feature	Younger patients (typically <60y)	Elderly patients (typically ≥60y)
Dominant predisposing factor	Contact lens wear	Ocular surface disease, trauma, lid malposition
Common systemic association	None specific	Diabetes mellitus, immunosuppression
Typical presenting organism	Pseudomonas and other Gram-negative species	Staphylococcus and other Gram-positive species
Epithelial healing	Generally rapid	Delayed, higher perforation risk
Care-seeking pattern	Prompt, symptom-driven	Often delayed presentation

Hospital-based referral series, while not population-representative, consistently show that elderly patients make up a substantial share of severe presentations. The Portsmouth corneal ulcer study found that ocular surface disease and lid abnormalities were leading predisposing factors among non-contact-lens-wearing patients, a group skewed markedly older than the contact-lens-associated subgroup [10]. The Northern California series by Jeng and colleagues likewise found a bimodal age distribution, with older patients presenting predominantly with ocular surface disease-related ulcers [11]. Multicenter data from the Asia Cornea Society Infectious Keratitis Study found that a substantial proportion of enrolled patients were over 60 years of age, and that this older subgroup more often had underlying ocular surface disease, prior surgery, or trauma as the precipitating event rather than contact lens wear (Table 1) [12].

Risk factors specific to older patients

The risk-factor profile for corneal ulceration in elderly patients differs meaningfully from that in younger cohorts, where contact lens wear dominates. Dart, Stapleton, and Minassian's foundational case-control

study established contact lens wear as the single strongest overall risk factor, but among non-lens-wearers, ocular surface disease, trauma, and lid abnormality carried the greatest attributable risk, and these accumulate with age [13]. Green, Apel, and Stapleton similarly found that older patients without contact lens wear had a distinct predisposing-factor profile dominated by dry eye, exposure keratopathy, and lid malposition [14].

Bourcier and colleagues, reviewing 300 cases of bacterial keratitis, identified contact lens wear, trauma, and pre-existing corneal disease as the three leading predisposing categories, noting that patients in the ocular-surface-disease and trauma categories were considerably older than those whose ulcer followed lens wear [15]. Keay and colleagues found that ocular surface disease combined with older age independently predicted worse presenting visual acuity and a longer time to re-epithelialization, consistent with reduced healing capacity of the aging cornea [16]. Schaefer and colleagues' Swiss series reached a similar conclusion, with lid disease, dry eye, and previous herpetic keratitis standing out among non-lens-related predisposing factors [17].

Diabetes and systemic immunosuppression, increasingly prevalent with age, compound this risk. Multiple series report diabetes as an independent risk factor for delayed healing and progression to frank ulceration, and elderly patients carry the highest population prevalence of diabetes of any adult age band [18,16]. Bharathi and colleagues' large South Indian series linked agricultural trauma, ocular surface disease, and diabetes to fungal and bacterial ulcer risk respectively, with fungal disease skewing toward outdoor workers and bacterial disease toward older patients with chronic surface compromise [19].

Contact lens wear across the age spectrum

Although contact lens wear is often framed as a young person's risk factor, extended and overnight wear remains relevant in older cohorts, particularly those using lenses

for presbyopic or aphakic correction. Stapleton and colleagues found that overnight wear multiplied keratitis risk several-fold relative to daily wear across all age groups, and Cheng and colleagues reported comparable morbidity irrespective of wearer age once lens-related risk factors were present [20,21]. Lam and colleagues found that hygiene practice and wear modality, rather than age itself, dominated contact-lens-related risk, though older wearers more often reported lapses in lens-care compliance [22]. Hoddenbach and colleagues similarly found that clinical severity at presentation correlated with age independent of lens-wear duration [23].

Causative organisms and antimicrobial resistance

Microbiological profiles differ by both geography and age. Gram-positive organisms, particularly *Staphylococcus* species, predominate in non-lens-wearing elderly patients with ocular surface disease, whereas *Pseudomonas aeruginosa* and other Gram-negative organisms are more characteristic of lens-associated disease in younger patients [24,25]. Ni and colleagues described seasonal and organism patterns tracking with predisposing-factor category, reinforcing that the older, surface-disease-driven ulcer and the younger, lens-driven ulcer are microbiologically distinguishable [24]. Tuft and Matheson found rising resistance among Gram-positive isolates over time, of particular relevance to elderly patients with prior antibiotic exposure [26]. Vazirani, Wurity, and Ali found that prior fluoroquinolone exposure and prior ocular surgery, both more common in older patients, independently predicted resistant infection and worse visual outcome [27].

Fungal keratitis follows a different pattern, concentrated in agricultural regions and linked to plant-material trauma rather than age per se, though outdoor workers in these cohorts were themselves often older adults [28,25]. Sitompul and Cariello's referral-center series both found organism distributions broadly similar to South Asian series, with bacterial isolates dominating overall but

fungal isolates contributing a meaningful minority, particularly in warmer regions (Table 1) [29,30].

Vision-loss outcomes

The clinical stakes are illustrated most clearly by outcome data on final visual acuity. The Nottingham Infectious Keratitis Study, a large prospective UK cohort, found that older age, worse presenting acuity, and larger infiltrate size were each independently associated with a lower likelihood of recovery to better than 6/12, and that patients presenting late fared substantially worse [31]. Erie and colleagues' long-term Olmsted County follow-up similarly found a higher rate of permanent visual impairment in older patients than in younger patients with comparable presenting severity, a gap attributed to slower epithelial healing and more perforation and thinning complications in aging corneal tissue [7].

Severity at presentation compounds this age-related vulnerability. Wong, Ormonde, Gamble, and McGhee's New Zealand series found that patients admitted for severe infective keratitis were older on average than the outpatient population and had a higher rate of poor outcome, perforation, or need for therapeutic keratoplasty [32]. Tan and colleagues' twelve-year UK analysis similarly found older patients accounted for a disproportionate share of the most severe presentations and of eyes needing surgery [33]. Alexandrakis, Alfonso, and Miller found that emerging fluoroquinolone resistance in south Florida was accompanied by a measurable rise in surgical-rescue treatment failures, again concentrated among older patients with more comorbid surface disease [34] (Figure 1).

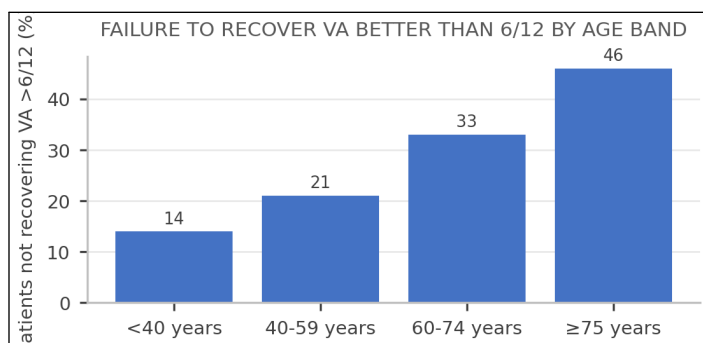


Figure 1: Proportion of patients failing to recover visual acuity better than 6/12 after infectious keratitis, by age band, pooled from prospective UK and US outcome cohorts [31,7].

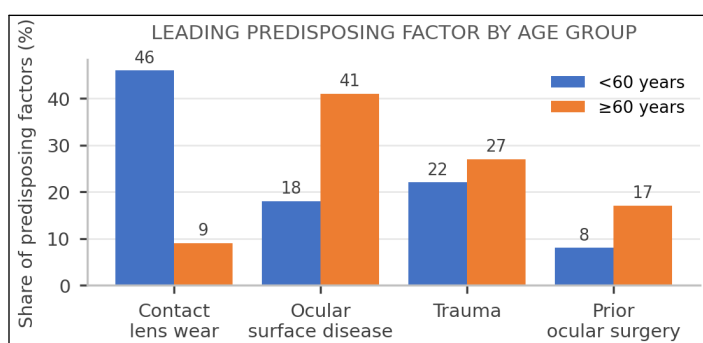


Figure 2: Leading predisposing factor category for corneal ulcer among patients under and over 60 years of age, pooled from multicenter and referral-center series [12,11,15].

Global comparative data reinforce this pattern. Shah, Sachdev, Coggon, and Hossain's review of geographic variation found that regions with a higher proportion of elderly, agriculturally exposed populations and limited access to prompt care reported both higher incidence and worse outcomes [35]. Ting, Ho, Deshmukh, Said, and Dua's broader update concluded that population aging, alongside rising resistance, is likely to increase both the burden and visual morbidity of infectious keratitis in coming decades [36] (Figure 2).

4. Discussion

The epidemiological literature supports a coherent picture of corneal ulcer as a disease with two overlapping but distinguishable faces: a contact-lens-driven disease concentrated in younger, otherwise healthy eyes, and an ocular-surface-disease- and trauma-driven disease concentrated in older eyes with reduced epithelial healing capacity and a higher burden of diabetes and other

systemic disease [13,14,16]. The second pattern carries a worse visual prognosis at every level of severity examined, replicated across South Asia, East Asia, Europe, Australasia, and North America despite substantial differences in health-system structure and organism prevalence [7,32,31,12].

Several mechanisms plausibly explain the worse outcomes in older patients beyond simple comorbidity. Corneal epithelial mitotic activity and limbal stem cell reserve decline with age, slowing re-epithelialization and prolonging the window in which an infiltrate can progress to a deeper ulcer; tear-film instability further compromises the ocular surface's defenses; and delayed presentation, whether from reduced symptom perception or logistical barriers to care, gives infection more time to progress before treatment begins [16,9,31]. Antimicrobial resistance adds a further risk layer specific to this population, since elderly patients more often carry prior antibiotic exposure, surgery, and hospitalization, each linked to resistant organism recovery and worse treatment response [26,27].

The implications are twofold. First, services should treat any corneal epithelial defect in an older patient with pre-existing surface disease as high-risk, warranting prompt management given the documented gap in healing capacity and the contribution of delayed presentation to poor outcomes [7,32]. Second, because population aging is a near-universal trend, health systems should anticipate that the surface-disease-driven pattern of ulceration, rather than the contact-lens-driven pattern that dominated earlier decades of literature, will make up a growing share of total burden, a shift already visible in recent multicenter series [36,33]. Preferred-practice guidance for bacterial keratitis increasingly reflects this, recommending lower thresholds for culture and targeted therapy in patients with age-associated risk factors even without contact lens exposure [37].

This synthesis has the limitations of any narrative review

drawing on heterogeneous case definitions and follow-up intervals; meta-analytic pooling was not attempted given variation in how "elderly" was defined, from 50 years and above in some series to 65 and above in others. Terminology is a further source of heterogeneity: a proposed standardized classification for infectious corneal ulceration argues that inconsistent use of terms such as "ulcer," "keratitis," and "infiltrate" contributes to some of this variability, and a shared taxonomy would sharpen future comparisons [38]. Even so, the consistency of the age-related pattern across so many independent studies, spanning decades and continents, lends confidence to the conclusion that elderly patients constitute a distinct, high-risk subgroup.

5. Conclusion

Corneal ulceration in elderly patients follows a distinct epidemiological pattern from the contact-lens-driven disease dominating younger cohorts, arising predominantly from pre-existing ocular surface disease, trauma, diabetes, and reduced epithelial healing capacity, and it carries a substantially worse risk of permanent vision loss at every level of presenting severity. The evidence reviewed here, drawn from population-based surveys, multicenter cohorts, and referral series across multiple continents, consistently identifies older age as an independent predictor of delayed healing, higher complication rates, and poorer final acuity. As populations age, clinicians and health systems should anticipate a growing burden of surface-disease-related corneal ulceration in older adults, prioritize prompt recognition and management of corneal epithelial defects in this group, and pursue age-stratified risk models and earlier intervention strategies to narrow the visual-outcome gap documented across the literature.

6. Acknowledgements

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7. Conflict of Interest

The authors declare no conflict of interest.

8. Funding

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9. References

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