2 Clinical Evaluation

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INTRODUCTION
The spectrum of microbial keratitis is dependent on a complex interplay between a diverse group of microorganisms and the host. A corneal ulcer may be defined as a discontinuation in the normal epithelial surface of the cornea associated with necrosis of the surrounding tissue and is pathologically characterised by oedema and cellular infiltration. Ulceration of the cornea, especially if severe and involving the visual axis or with extreme corneal thinning and impending perforation or if already perforated, is an ophthalmic emergency that needs immediate attention and, if not effectively managed, can lead to sight-threatening complications and in extreme situations irreversible loss of vision. This chapter gives a brief overview of the natural ocular defence mechanisms followed by the technique to approach the workup of a case of microbial keratitis.

CLINICAL ASSESSMENT
1. History
- Symptoms: pain, redness, foreign body sensation, burning, itching, photophobia, blurred vision, excessive tearing, purulent/mucopurulent/mucoid/watery discharge, swelling of the eyelids
- Mode and duration of onset
- Risk factors:
  - Ocular: trauma, contact lens wear, a recent history of chickenpox or shingles, history of ocular surgery, use of steroid eye drops/ointments, compromised ocular surface (Figure 2.1), adnexal infections, chemical/thermal injury, eyelid disorders
  - Systemic diseases: diabetes mellitus; immunocompromised states; connective tissue and autoimmune disorders (rheumatoid arthritis, Sjögren's syndrome); Stevens-Johnson syndrome; chronic infections like tuberculosis, leprosy and syphilis; dermatological diseases, generalised malnutrition in children
  - Occupational: farmers, animal handlers, chemical industry workers

2. General Examination
- Face lesions (Herpes zoster/simplex)
- Facial palsy
- Blink rate

3. Ocular Examination
- Visual acuity
- External examination (diffuse light)
  - Lid oedema
  - Entropion, ectropion, trichiasis, lagophthalmos, lid margin
  - Dacryocystitis, nasolacrimal duct obstruction (regurgitation test)
  - Bell’s phenomenon
  - Corneal/conjunctival exposure
- Slit lamp examination of the cornea (Figure 2.2)
  - Meibomian gland dysfunction
  - Conjunctival congestion – circumcorneal/diffuse
2 CLINICAL EVALUATION

- Purulent/mucopurulent discharge
- Corneal sensations
- Corneal ulcer (Figure 2.3)
  - Site, size, surface, margin, slough, depth of involvement, satellite lesions
- Anterior chamber
  - Cells, flare, hypopyon, endothelial pigments/exudates
- Fluorescein staining (1% sodium fluorescein) (Figure 2.4)
  - Size of the epithelial defect
  - Size of corneal infiltrate

Figure 2.2  Slit lamp photograph of a case of infective keratitis depicting ciliary congestion (blue arrow), corneal epithelial defect (grey arrow), small infiltrate (green arrow) and corneal thinning (black arrow).

Figure 2.3  Slit lamp photograph of a case of corneal abscess (yellow arrow) with corneal (green arrows) and scleral (black arrow) thinning. Associated mucopurulent discharge (white arrow) and meibomian gland dysfunction (blue arrow) can also be seen.

- Seidel test (Video 2.1)
- Iris and pupil
- Lens
- Fundus evaluation/ultrasound B-scan for status of the posterior segment

- Schematic corneal diagram: a scaled, coloured corneal diagram should be drawn at the initial presentation and at follow-up visits as representative images of the ulcer and associated corneal features (Figure 2.5). They should follow the standard colour-coding guidelines

Figure 2.4  Slit lamp photograph of a case of bacterial corneal ulcer showing (A) epithelial defect (white arrow), superficial corneal vascularisation (black arrow) and corneal infiltrates (yellow arrow). Staining with 1% sodium fluorescein highlights (B) the epithelial defect delineating its margins (white arrow).
The schematic diagrams help in assessing the course of the disease and response to therapy. This method of recording corneal pathologies should be practiced for all corneal diseases as it provides simplified, standardized graphic documentation and serves as a universal language among ophthalmologists (Figure 2.6).

4. Systemic Examination

- General health
- Anaemia
- Lymph nodes palpation
- Protein energy malnutrition, vitamin A deficiency and immunisation status in children

Videos for Chapter 2 can be accessed at: www.routledge.com/9780367761561

Video 2.1: Positive Seidel test in a case of viral keratitis
Video 2.2: Technique of corneal scraping in a case of microbial keratitis.

### Table 2.1: Colour Coding for Documenting Corneal Pathologies

<table>
<thead>
<tr>
<th>Black</th>
<th>Blue</th>
<th>Yellow</th>
<th>Green</th>
<th>Red</th>
<th>Brown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scars</td>
<td>Epithelial oedema</td>
<td>Infiltrate</td>
<td>Epithelial defects</td>
<td>Deep and superficial</td>
<td>Pigments (iron lines, epithelial</td>
</tr>
<tr>
<td>Degenerations</td>
<td>Epithelial bullae</td>
<td>Hypopyon</td>
<td>Fluorescein vascularisation</td>
<td>superficial vascularisation</td>
<td>melanosis, Krukenberg’s</td>
</tr>
<tr>
<td>Guttae</td>
<td>Stromal oedema</td>
<td>Keratic precipitates</td>
<td>Ghost vessels (dotted line)</td>
<td>Hyphaema</td>
<td>spindles)</td>
</tr>
<tr>
<td>Deposits</td>
<td>Descemet’s membrane folds</td>
<td></td>
<td>Superficial punctate keratitis</td>
<td>Rose bengal stained areas</td>
<td>Iris</td>
</tr>
<tr>
<td>Contact lens</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Peripheral anterior</td>
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<td>(broken line)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>synechiae</td>
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<tr>
<td>Foreign body</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Corneal nerves</td>
<td></td>
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<td>Tissue adhesive</td>
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Figure 2.5  Schematic coloured diagram (A) and grid diagram (B) for documenting corneal pathologies. Each square on the grid diagram represents an area of 2x2 mm² on the cornea.
INVESTIGATIONS

1. Routine Laboratory Investigations
   - Complete hemogram including blood haemoglobin, total leucocyte count, differential leucocyte count, erythrocyte sedimentation rate, blood sugar levels and urine and stool examination

2. Microbiological Investigations
   - Scraping from the base and margins of the ulcer (Video 2.2)
     - Smear: Gram stain, Giemsa stain, potassium hydroxide (KOH) mount
     - Culture: bacterial, fungal, Acanthamoeba, Mycobacteria

3. Ocular Investigations
   - In Vivo Confocal Microscopy (IVCM): a non-invasive imaging modality that allows direct visualisation of causative pathogens in real time and has proved to be a very useful aid in establishing a diagnosis of microbial keratitis especially those caused by fungi and Acanthamoeba. The Heidelberg Retinal Tomograph 3/Rostock Cornea Module (HRT3/RCM) provides high-resolution imaging and has been shown to have good sensitivity and specificity in detecting Acanthamoeba cysts (Figure 2.7) and fungal hyphae (Figure 2.8). Recent studies have also demonstrated good sensitivity and specificity of HRT3/RCM in detecting atypical infectious keratitis and simultaneous infections by multiple organisms.5,6
   - Spectral Domain Anterior Segment Optical Coherence Tomography (ASOCT): a non-contact imaging modality that provides high-resolution cross-sectional images of the cornea and thus can be used to evaluate and serially monitor cases of infectious keratitis. The calliper tool of ASOCT can be used to measure corneal thickness at the site of infection, infiltrate depth (Figure 2.9), stromal oedema and width of the endothelial plaque, and serial standardised scans from the same area can be used to objectively assess the disease course and monitor response to therapy.6
   - B-scan Ultrasonography: for posterior segment examination should be done in all cases of corneal ulcer as a dilated fundus examination is not possible in most of these cases. Endophthalmitis (Figure 2.10), serous choroidal detachment and suprachoroidal haemorrhage should be looked for and managed accordingly. These are important for guiding treatment in specific circumstances.
   - Corneal biopsy: performed in cases where repeated smear examinations and microbial cultures of specimens obtained from standard corneal scraping technique reveal negative results such as deep stromal abscess and fungal ulcer.

Figure 2.6  Slit lamp photograph (A) and corresponding coloured schematic diagram (B) of a case of fungal (Aspergillus flavus) corneal ulcer showing ciliary congestion (blue arrow), epithelial defect (green arrow), deep stromal infiltrates with feathery edges (yellow arrows) and hypopyon (black arrow).
Figure 2.7  Slit lamp photograph of (A) a suspected case of *Acanthamoeba* keratitis in a patient with a history of exposure to contaminated water showing well-delineated, central ulcer (blue arrow). In vivo confocal microscopy (HRT3 with Rostock Corneal Module, Heidelberg Engineering, Heidelberg, Germany) image of the eye shows (B) multiple hyper-reflective, round to ovoid shaped, double-walled *Acanthamoeba* cysts (yellow arrows) in the corneal stroma with few cysts arranged linearly (white arrows). The magnified view (C) of an *Acanthamoeba* cyst highlights the cyst wall (green arrow) and the organism.

Figure 2.8  Slit lamp photograph of a patient with fungal keratitis shows (A) corneal infiltrate with feathery margins and elevated appearance (yellow arrow) associated with hypopyon (green arrow). In vivo confocal microscopy shows (B) hyper-reflective, branched, septate, linear structures with acute angle branching (blue arrows) typical of fungal hyphae (*Aspergillus* species).
REFERENCES


