Ocular Examination: FRONT TO BACK
Cornea Pathology
Examination Tools

• Visual Acuity
• Gross evaluation
• Slit Lamp examination
  – Various illuminations
  – Various magnifications
  – Dyes
    • Na FL
    • Rose bengal
    • Lissamine green
Diffuse Illumination /Parallelepiped

• Find problem areas (low mag)
• Then can increase mag and illumination
Optic Section Thru Cornea

- Depth
Retroillumination

- Bounce light off retina and allow it to come back thru cornea
Examination Tools

- Keratometer
  - Mire quality
  - Very small area
    - About 3 mm/11-12mm

- Rigid gas perm lens
  - Gives smooth front refractive surface

- Scrapings & cultures

- Visante
• **Anesthesiometer**
  – Measures corneal sensitivity
  – Teased cotton swab applicator

• **Pachymetry**
  – Ultrasound
  – Measures corneal thickness

• **Topography**

• **Specular microscopy**
  – Endothelium

• **Confocal microscopy**
  – See living cells within cornea
  – See hyphae of fungus
  – Close up of acanthomoeba

• **Photography**

• **Videography**

A close-up confocal microscopy image of AK.
Cornea

- Transparent
- Avascular
- Refractive surface
- 11.5 mm approximate diameter
- 0.5-0.6 mm center thickness
- 0.6-0.8 peripheral thickness
- Borders the sclera at the limbus
What can be seen?

- Nerve
- Shagreen
- Vogt’s Limbal Girdle
- Arcus
- Posterior Embryotoxin
- Depositions
  - Iron
  - Calcium
  - Drugs
- Dystrophies
  - Inherited

Degenerations

What can go wrong?

- Foreign body
- Abrasion
- Superficial Punctate Keratitis (SPK)
- Edema
- Neovascularization
- Infiltrates
- Ulcers
- Opacities
- Keratic Precipitate (KP)
- Guttata
- Endothelial folds
- Ectasia
Corneal Pathology Symptoms

- None
  - Find on “wellness” examination
- Pain
  - Superficial
  - Proparacaine relieves
- Photophobia
- Tearing
- Reduced acuity
- Fluctuating vision
- Unstable refraction
- Blurry vision upon wakening
- Eye pain upon waking
- Irritation
- Red eye(s)
- See “white” spot on eye
- Contact lens intolerance
- Rub eyes
- Blink too much
• Nerve

• Shagreen
  – Corneal degeneration
• Vogt’s Limbal Girdle
  – Corneal degeneration
• Arcus
  – Corneal degeneration
• Posterior Embryotoxin
  – Prominent Schwalbe’s line

– Anterior segment dysgenesis
  • Axenfeld’s anomaly
  • Reiger’s syndrome
  • Peter’s anomaly
    – Glaucoma concern- get in glaucoma course
• Hudson-Stahli line
  – Deep epithelium
  – Lower 1/3 of cornea
  – Iron deposition
    • Use cobalt blue filter
  – Aging

• Stocker’s line
  – Iron deposition
  – Leading edge of pterygium
• Fleischer’s line (ring)
  – Iron deposition
  – Base of cone in keratoconus

• Ferry’s line
  – Iron deposit associated with filtering bleb
• Band keratopathy
  – Subepithelial whitish depositions (calcium) in the interpalpebral zone

• Medication toxicity
• Foreign body

• Abrasion
  – Epithelium missing
Recurrent Erosions

- Unilateral
- Wakes patient up
- Sandy, irritated eye upon wakening
- Look for cause
  - Rosacea, old trauma (fingernail in eye)
Superficial Punctate Keratitis (SPK)

- Sign, not diagnosis
- Disruption of epithelial layer

CCLRU Punctate staining types
Location, Location, Location

- Diffuse
  - Toxic
  - Contact lens over wear
- Central
  - Adenovirus
- Upper 1/3
  - SLK
  - Vernal
  - Inclusive conjunctivitis
  - Trachoma
- Lower
  - Staph blepharitis
  - Lagophthalmos
  - Entropion
  - Acne rosacea
- Linear streak
  - FB
- Negative staining
  - Dystrophy/degeneration
  - Keratoconus
• Negative Staining
- Edema
  - Epithelial/subepithelial
  - Stromal
  - Bullous keratopathy
    - Hydrops
  - Striae
  - Microcystic
• Neovascularization
  – Response to lack of oxygen
    • Encroachment
      – Does not cross limbal band
    • Superficial
    • Deep
    • Ghost
    • Pannus
  – Big ???
    • Etiology?
• Epithelial Infiltrates
  – Accumulation of WBC within superficial cornea
  – Response to inflammation and/or infection

Viral- superficial, will stain with NaFl.
• Staph hypersensitivity reaction
  – Sterile
• Infected ulcer

Bacterial
• Ulcer
  Fungal

Confocal microscopy hyphae
• Acanthamoeba
Summary of corneal ulcers

**Differential Diagnosis: Sterile Versus Infected Corneal Ulcer**

<table>
<thead>
<tr>
<th></th>
<th>STERILE</th>
<th>INFECTED</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size</strong></td>
<td>Small</td>
<td>Large</td>
</tr>
<tr>
<td><strong>Number</strong></td>
<td>Single Lesion</td>
<td>Multiple or confluent</td>
</tr>
<tr>
<td><strong>Sensation</strong></td>
<td>Mild Pain</td>
<td>Pain</td>
</tr>
<tr>
<td><strong>Discharge</strong></td>
<td>No discharge</td>
<td>Discharge</td>
</tr>
<tr>
<td><strong>Epithelium</strong></td>
<td>Intact</td>
<td>Staining</td>
</tr>
<tr>
<td><strong>Elevation</strong></td>
<td>Elevated</td>
<td>Flat or excavated</td>
</tr>
<tr>
<td><strong>Anterior Chamber</strong></td>
<td>Quiet</td>
<td>Reaction</td>
</tr>
<tr>
<td><strong>VA</strong></td>
<td>Unchanged</td>
<td>Decreased</td>
</tr>
<tr>
<td><strong>Onset</strong></td>
<td>Longer term</td>
<td>Acute</td>
</tr>
<tr>
<td><strong>Injection</strong></td>
<td>Mild</td>
<td>Significant</td>
</tr>
</tbody>
</table>

- NaFl leaks into stroma
- Superficial staining of infiltrate
Dentritic Ulcer

- Herpes simplex keratitis
  - Epithelial disease
  - Desensitized cornea
• Geographic lesion
• Interstitial disease
  – Stromal involvement
Neurotrophic keratopathy

- Lots of nerves within cornea
- Fed by CN 5 (sensory)
- Without them, cornea very sick and dies
• Dellen
  – Thinning of cornea due to dehydration

• Pterygium
  – Conjunctival overgrowth
• Limbal follicles

• Herbert’s pits
  – Late stage trachoma
  • Earlier limbal follicles
• Endothelial pigment
• Guttata

Figure 1: Corneal endothelial photograph taken with Konan CellChek.
• Endothelial Folds

• Vogt’s striae
• Keratic Precipitates (KP)
  – Inflammatory deposition on back of endothelium

- Mutton Fat
- Retro Illumination
- Stellate
- Fine
— Corneal Ectasia
— Bulging
— Keratoconus
— Collagen disorder
• Opacities
  – Anything that makes cornea “not clear” or opaque
  – Why (etiologic)
    • Developmental
    • Trauma
      – Scars
        » “War Wounds”
    • Infection
    • Degenerations/dystrophies
  – Types (from least to most dense)
    • Nebula
    • Macula
    • Leukoma
• Nebular

• Macular

• Leukoma
Surgical Scarring

• Radial Keratotomy (RK)

• LASIK
  – The Flap NEVER heals
# Summary

## TABLE 1: Differentiating Between Dystrophy and Degeneration

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>DYSTROPHY</th>
<th>DEGENERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corneal location</td>
<td>Central</td>
<td>Peripheral</td>
</tr>
<tr>
<td>Laterality</td>
<td>Bilateral</td>
<td>Often unilateral</td>
</tr>
<tr>
<td>Symmetry</td>
<td>Symmetric</td>
<td>Asymmetric</td>
</tr>
<tr>
<td>Vascularization</td>
<td>None (Group of non-inflammatory disease)</td>
<td>Common</td>
</tr>
<tr>
<td>Family History</td>
<td>Inherited</td>
<td>Aging process</td>
</tr>
<tr>
<td>Onset age</td>
<td>Often 10 or less</td>
<td>Often 40 or more</td>
</tr>
<tr>
<td></td>
<td>Approx. 20 specifically named corneal dystrophies</td>
<td>Involutional = seen with age</td>
</tr>
</tbody>
</table>
- What does it look like?

- Where is it located?
Corneal Dystrophy VS Corneal Degeneration

• Corneal dystrophy
  – Over 20
    • Fuchs' dystrophy
    • Keratoconus
    • Lattice dystrophy
    • Macular dystrophy
    • Map-dot-fingerprint dystrophy (AKA Cogan’s, Epithelial Basement Membrane, or Microcystic Corneal Dystrophy)
  – Inherited non-inflammatory diseases that affect both eyes
• Fuch’s dystrophy
  – later-onset dystrophy that affects women more than men
  – Corneal guttata
    • Endothelial dystrophy
  – Corneal haze
• Keratoconus
  – Corneal Ectasis
  – Inherited
    • Late teens to early 20’s
• **Lattice dystrophy**
  – Autosomal dominant
  – Most common stromal dystrophy
• Macular dystrophy
  – Autosomal recessive
  – Stromal
• Map-Dot-Fingerprint
  – Epithelial basement membrane