4 Dystrophies and Degenerations of the Conjunctiva and Cornea

M. Vanathi, Jyoti Deswal, Navneet Sidhu, and Tanveer Alam Khan

Introduction

Dystrophies or degenerations of the ocular surface are gradual progressive deteriorations in the conjunctival or corneal tissue. Slowly and progressively, they tend to impair the function of the tissue and lead to visual problems.

Pinguecula

Pingueculae are elevated yellowish-white benign nodular lesions seen in the interpalpebral bulbar conjunctiva. These are usually bilateral and typically found adjacent to the limbus of the nasal bulbar conjunctiva.

Etiology/Risk Factors

- Ultraviolet (UV) light exposure.
- Dust exposure.
- Old age.
- Males are commonly seen to be at a higher risk.
- Smoking.

Pathogenesis

Histologically, it is an elastotic degeneration of subepithelial collagen with hyalinized connective tissue.

Symptoms

- Mostly asymptomatic.
- Ocular surface irritation.
- Foreign body sensation.
- Watering.
- Itching.

Management

- Lubrication with artificial tears.
- Topical steroid therapy can be used in patients with inflamed pinguecula (pingueculitis).

Pterygium

Pterygium is a wing-shaped fold of subconjunctival fibrovascular tissue that encroaches the superficial cornea (**Fig. 4.1**).

Predisposing Factors

Exposure to UV light, hot temperature, dust, and pollution.

Histopathology

Elastotic degeneration of stromal collagen with subepithelial fibrovascular tissue.

Clinical Features

- Usually asymptomatic, foreign body sensation, irritation, visual impairment due to astigmatism or obscuration of papillary area; diplopia due to restriction of ocular movements.

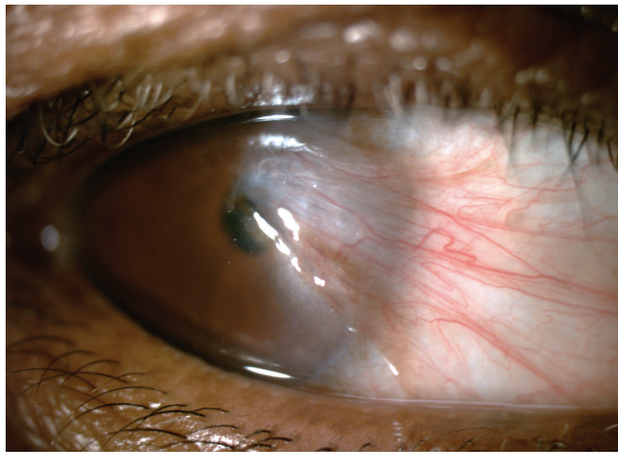


Fig. 4.1 Large, thickened (T3) pterygium. (Source: Pterygium anatomy and histology. In: Gulani A, ed. The Art of Pterygium Surgery: Mastering Techniques and Optimizing Results. 1st ed. Thieme; 2019.)

- On examination, triangular fold of the conjunctiva is seen encroaching on the superficial layers of cornea.
- Parts of pterygium: head, neck, body, and cap.
- Stocker line can be seen over the cornea just in front of the pterygium head, which is deposition of iron in corneal epithelium.
- Types of pterygium based on extent:
  - Type 1: pterygium extends less than 2 mm over the cornea.
  - Type 2: up to 4 mm of the cornea.
  - Type 3: more than 4 mm of the cornea.
- Types based on progression:
  - Progressive: vascular and fleshy with few infiltrates in front of the head of pterygium.
  - Regressive: thin, avascular, and atrophied.

Treatment

Medical Treatment

- Usually not required if asymptomatic.
- Lubricants and decongestant eye drops for irritation.
- Topical steroids for associated inflammation.

Surgical Treatment

Surgical excision.

Indications

- Cosmetic intolerance.
- Recurrent episodes of irritation and watering.
- Progressive pterygium going to encroach visual axis.
- Visual impairment due to induced astigmatism.
- Diplopia due to extensive and large pterygium.

Recurrence

Recurrence rate is around 40% after surgical excision. To prevent recurrence, any of the following measures can be taken:

- Surgical excision with free conjunctival limbal autograft.
- Surgical excision with amniotic membrane transplantation.
- Application of mitomycin C (0.02%) at bedtime before putting graft.
- Lamellar keratectomy and lamellar keratoplasty may be needed in deeply infiltrated pterygium.

Corneal Dystrophies

Epithelial Corneal Dystrophies

Epithelial corneal dystrophies are a subset of noninflammatory disorders of the cornea affecting corneal epithelium bilaterally.

Types of Epithelial and Subepithelial Dystrophies

- Epithelial basement membrane dystrophy.
- Meesmann epithelial corneal dystrophy.
- Lisch epithelial corneal dystrophy.
- Gelatinous drop-like corneal dystrophy.
- Subepithelial mucinous corneal dystrophy.
- Epithelial recurrent erosion dystrophies.

Diagnosis

Clinical history: history of onset of symptoms, progression, and associated features is very important. Obtaining a family history is very important since most of these are inherited disorders. Genetic testing in such a case will be helpful.

Symptoms

- Diminution of vision.
- Pain due to recurrent corneal erosions.
- Corneal opacities.

Signs

- Recurrent corneal erosions.
- Epithelial deposits.
- Corneal edema may be present rarely.

Investigations

- Anterior segment optical coherence tomography (AS-OCT) to look for depth of involvement.
- Corneal topography.

Management

- Phototherapeutic keratectomy (PTK).
- Anterior lamellar keratoplasty/deep automated lamellar therapeutic keratoplasty (ALTK or DALK).
- Penetrating keratoplasty.

Corneal Stromal Dystrophies

Corneal stromal dystrophies are a subset of noninflammatory disorders of the cornea affecting the corneal stroma bilaterally. They can be divided into epithelial-stromal TGFβ1 dystrophies or stromal dystrophies.

Epithelial-Stromal TGFβ1 Dystrophies

- Reis–Bücklers corneal dystrophy (**Fig. 4.2**).
- Thiel–Behnke corneal dystrophy (**Fig. 4.3**).
- Lattice corneal dystrophy (**Fig. 4.4**):
  - Lattice corneal dystrophy type 1.
  - Lattice corneal dystrophy variants (III, IIIA, I/IIIA, and IV).
- Granular corneal dystrophy (**Figs. 4.5 and 4.6**):
  - Granular corneal dystrophy type 1.
  - Granular corneal dystrophy type 2.

Stromal Dystrophies

- Macular corneal dystrophy (**Fig. 4.7**).
- Schnyder corneal dystrophy.
- Congenital corneal stromal dystrophy.
- Fleck corneal dystrophy.
- Posterior amorphous corneal dystrophy.
- Pre-Descemet corneal dystrophy.

Diagnosis

Clinical history: history of onset of symptoms, progression, and associated features is very important. Obtaining a family history is very important since most of these are inherited disorders. Genetic testing in such a case will be helpful.

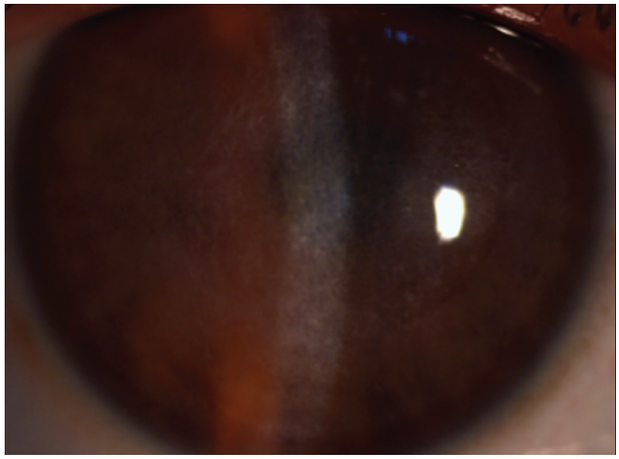


Fig. 4.2 Reis–Bücklers corneal dystrophy relapse, 3 years after treatment with phototherapeutic keratectomy. (Source: Corneal dystrophies. In: Levin A, Zanolli M, Capasso J, eds. Wills Eye Handbook of Ocular Genetics. 1st ed. Thieme; 2017.)

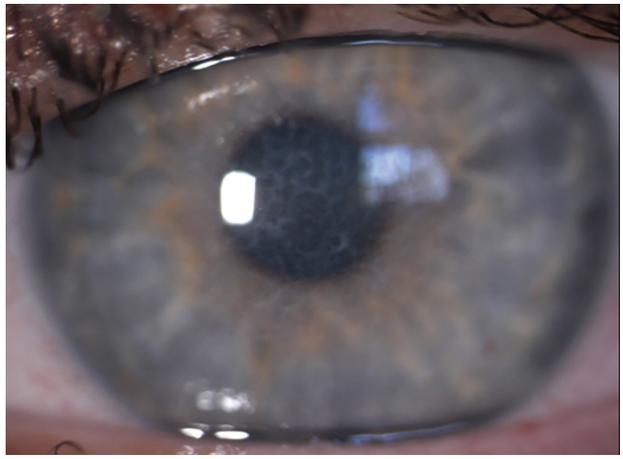


Fig. 4.3 Thiel–Behnke corneal dystrophy showing honeycomb central opacity affecting Bowman's layer. (Source: Corneal dystrophies. In: Levin A, Zanolli M, Capasso J, eds. Wills Eye Handbook of Ocular Genetics. 1st ed. Thieme; 2017.)

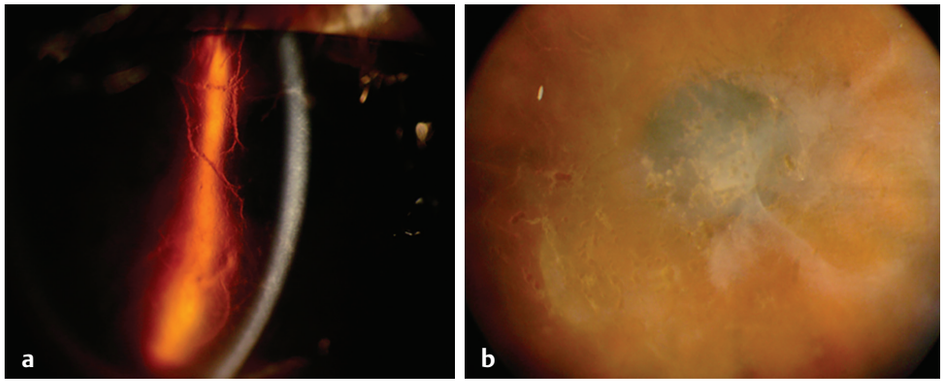


Fig. 4.4 **(a)** Lattice corneal dystrophy type 1 in a young patient. **(b)** Lattice corneal dystrophy type 1 in an older patient with progression of the condition. Note diffuse opacities associated with erosions. (Source: Corneal dystrophies. In: Levin A, Zanolli M, Capasso J, eds. Wills Eye Handbook of Ocular Genetics. 1st ed. Thieme; 2017.)

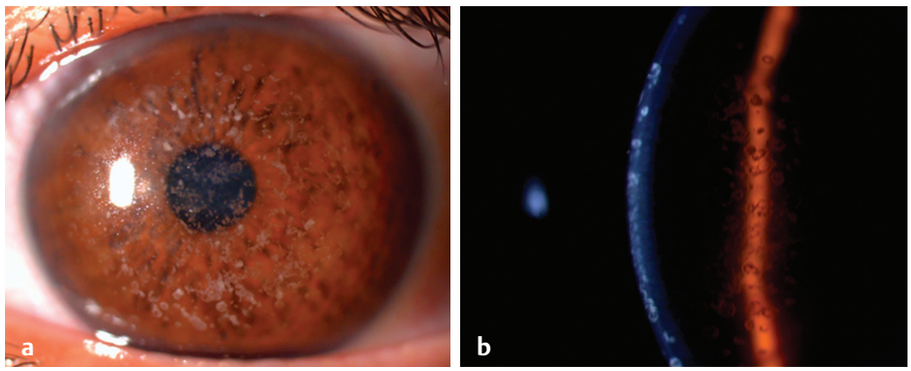


Fig. 4.5 (a) Granular corneal dystrophy type 1. **(b)** Note opacities in the anterior stroma. (Source: Corneal dystrophies. In: Levin A, Zanolli M, Capasso J, eds. Wills Eye Handbook of Ocular Genetics. 1st ed. Thieme; 2017.)

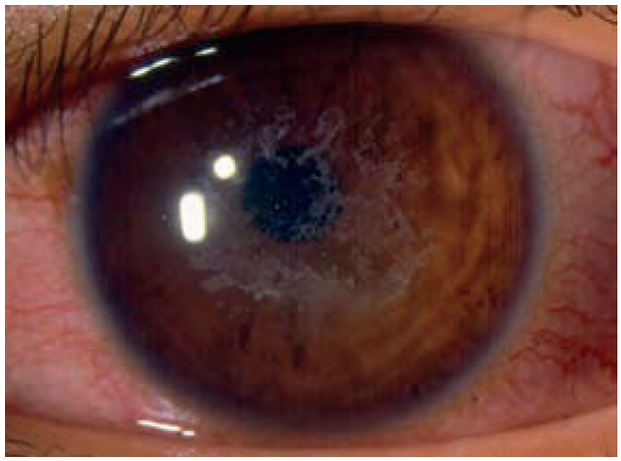


Fig. 4.6 Granular corneal dystrophy. (Source: Management. In: Agarwal A, Jacob S, eds. Color Atlas of Ophthalmology: The Quick-Reference Manual for Diagnosis and Treatment. 2nd ed. Thieme; 2009.)

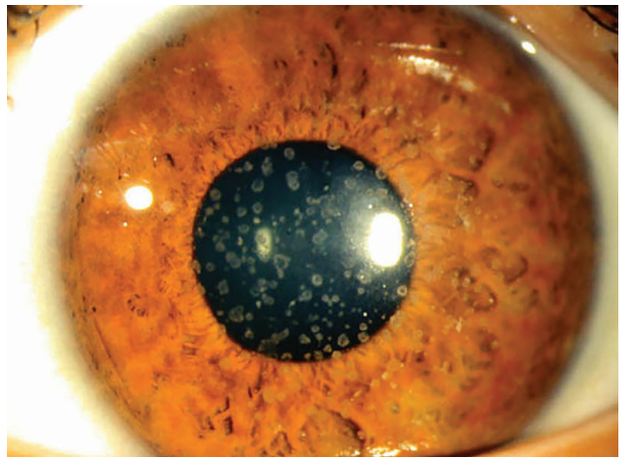


Fig. 4.7 Macular corneal dystrophy showing diffuse stromal opacities. (Source: Corneal dystrophies. In: Levin A, Zanolli M, Capasso J, eds. Wills Eye Handbook of Ocular Genetics. 1st ed. Thieme; 2017.)

Symptoms

- Diminution of vision,
- Pain due to recurrent corneal erosions,
- Corneal opacities,

Signs

- Recurrent corneal erosions,
- Corneal stromal deposits,
- Corneal edema may be present rarely,

Investigations

- Anterior segment OCT to look for depth of involvement.
- Corneal topography.

Management

- PTK.
- Anterior lamellar keratoplasty (ALTK or DALK).
- Penetrating keratoplasty.

Endothelial Corneal Dystrophies

Corneal stromal dystrophies are a subset of noninflammatory disorders of the cornea affecting the corneal endothelium bilaterally.

Major endothelial corneal dystrophies are

- Fuchs endothelial corneal dystrophy.
- Posterior polymorphous corneal dystrophy.
- Congenital hereditary endothelial dystrophy.

Symptoms

- Diminution of vision.
- Glare.
- Foreign body sensation.

Signs

- Endothelial guttae.
- Stromal haze.
- Corneal edema.
- Descemet membrane folds.

Investigations

- Anterior segment OCT to look for depth of involvement.
- Corneal topography.
- Central corneal thickness.
- Confocal microscopy.

Management

Medical Management

- Topical hypertonic saline drops (5%) and ointment (6%).
- Lubricants.
- Antiglaucoma medications.

Surgical Management

- Posterior lamellar keratoplasty (Descemet stripping automated endothelial keratoplasty [DSAEK] or Descemet membrane endothelial keratoplasty [DMEK]).
- Penetrating keratoplasty.

Corneal Degenerations

Spheroidal Degeneration

- Spheroidal degeneration is a noninflammatory degenerative condition of the cornea characterized by the presence of yellowish-brown nodules in the cornea and/or the conjunctiva. It is commonly seen in areas with extremes of temperature and low humidity.
- The deposition is seen in Bowman's membrane, subepithelium, and corneal stroma.
- Other names: Labrador keratopathy, fisherman's keratopathy, climatic droplet keratopathy, actinic keratopathy, Bietti's band-shaped nodular dystrophy.
- More common in males and areas with greater exposure to UV radiation.

Classification

It can be classified as

- Type 1 or primary: not associated with other ocular pathologies.
- Type 2 or secondary: associated with ocular inflammation or corneal pathology.
- Type 3 or tertiary: associated with conjunctival lesions and mostly associated with pinguecula.

Clinical classification was given by Johnson and Ghosh:

- Grade I: lesions involving the interpalpebral cornea but not the central cornea.
- Grade II: lesions involving the central cornea but not affecting the visual acuity.
- Grade III-:lesions involving the central cornea associated with decreased visual acuity.
- Grade IV: elevated lesions.

Clinical Features

- Type 1: occurs in older patients:
  - Confined to interpalpebral aperture.
  - Multiple, small, droplet-like subepithelial deposits seen.
  - Yellow to gold in color.
- Type 2: diffuse haze involving the lower two-thirds of the cornea:
  - Small spherules present beneath the epithelium, within Bowman's layer and/or anterior stroma.
- Type 3: multiple clusters of golden subepithelial spherules of variable size that progress over the surface of cornea:
  - Associated with pinguecula.
  - Scarring and vascularization may be present.

Histopathology

- Deposition of hyaline-like material below the epithelium, within Bowman's layer and in corneal stroma.
- Disruption of Bowman's layer with thinning of epithelium.

Pathogenesis

- Chronic inflammation occurs because of exposure to UV radiation and harsh environmental conditions.
- Abnormal protein deposition occurs due to chronic inflammation.
- Elevated levels of matrix metalloproteinase-2 (MMP-2) and MMP-9.
- Decreased levels of tissue inhibitor of metalloproteinase-1.

Treatment

- Superficial keratectomy.
- Penetrating keratoplasty.

Band-Shaped Keratopathy

- Band-shaped keratopathy is defined as a band-like deposition of calcium salts in the subepithelium and

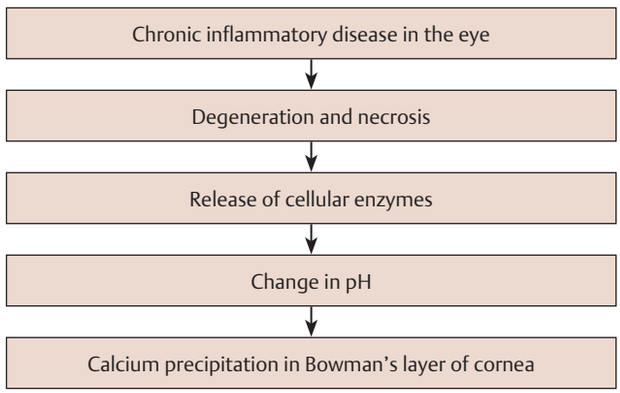
Bowman's membrane in the interpalpebral zone of the cornea. It was described by Dixon in 1848.
- It can be primary or secondary.

Causes of Band-Shaped Keratopathy

- Local factors:
  - Chronic uveitis.
  - Chronic ocular surface inflammation.
  - Vogt–Koyanagi–Harada disease.
  - Chemical burns.
  - Phthisis bulbi.
  - Corneal graft rejection.
  - Long-term topical medications.
  - Severe dry eye.
  - Spheroidal keratopathy.
  - Intraocular silicon oil.
- Systemic factors:
  - Hypercalcemia.
  - Hypophosphatasia.
  - Sarcoidosis.
  - Renal failure.
- Familial band-shaped keratopathy.(**Flowchart 4.1**)

Clinical Features

The patient is usually asymptomatic in early cases. However, involvement of the visual axis leads to a reduced visual acuity and glare. There can be painful recurrent corneal erosions and corneal ulcers (**Fig. 4.8**).



Flowchart 4.1 Pathogenesis of band-shaped keratopathy formation.

Pathogenesis

Deposition of calcium salts is seen in Bowman's membrane in the exposed interpalpebral area. Precipitation of calcium occurs because of changes in tear osmolality, elevation of pH due to increased corneal metabolism, or increased tear film calcium or phosphate.

Treatment

Treatment is indicated in cases with reduced vision, significant glare or irritation, and foreign body sensation.

The aim of treatment is to remove the calcium deposits, restore vision, and achieve a smooth ocular surface.
- Chelation with topical ethylenediaminetetraacetic acid.
- Transepithelial PTK.
- Mechanical debridement with amniotic membrane transplantation.

Bullous Keratopathy

Bullous keratopathy is the development of irreversible corneal edema caused by endothelial decompensation. It is characterized by the formation of bullae, hence the name bullous keratopathy. Pseudophakic bullous keratopathy is seen in 1% to 2% of cataract surgeries.

Causes

- Preoperative factors:
  - Fuchs endothelial corneal dystrophy.
  - Iridocorneal endothelial syndrome.
  - Glaucoma and angle closure attacks.

  } Low endothelial counts
  - Anterior uveitis.
  - Microcornea.
  - Herpetic endotheliitis.

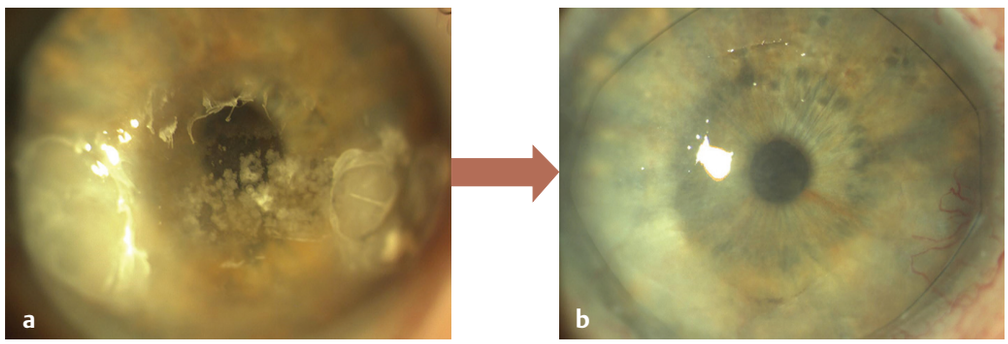


Fig. 4.8 (a, b) Band-shaped keratopathy: diffuse. (Source: Band-shaped keratopathy. In: Gulani A, ed. The Art of Pterygium Surgery: Mastering Techniques and Optimizing Results. 1st ed. Thieme; 2019.)

- Intraoperative factors (damage endothelial cells):
  - Excessive phaco power.
  - Toxicity from irrigating fluids.
  - Trauma from instruments.
  - Vitreous prolapsed.
- Postoperative factors:
  - Inflammation.
  - High intraocular pressure.
  - Shallow or flat anterior chamber.
  - Iris touch.
  - Subluxated intraocular lens.
  - Anterior chamber intraocular lens.

Risk Factors

- Advanced age.
- Previous intraocular surgery.
- Shallow anterior chamber.
- Ocular trauma.
- Systemic conditions (uncontrolled diabetes).

Clinical Features

- Symptoms:
  - Diminution of vision.
  - Pain, when associated with epithelial defects.
  - Watering.
  - Foreign body sensation.
  - Photophobia.
- Signs:
  - Epithelial bullae which may get ruptured leading to epithelial defects
  - Diffuse Corneal edema
  - Descemet's membrane folds
  - Scarring may be present

Diagnosis

- Slit-lamp examination:
  - Diffuse corneal edema.
  - Epithelial bullae and defects.
  - Stromal haze and scar.
  - Descemet's membrane folds.
  - Corneal neovascularization.
  - Presence and location of intraocular lens.
  - Size of pupil and any irregularities.
  - Presence of vitreous in anterior chamber.
  - Iris transillumination defects.
- Investigations:
  - Central corneal thickness.
  - AS-OCT.
  - Specular microscopy.

Management

- Medical management:
  - Hypertonic saline drops (5%) and ointment (6%).
  - Lubricating drops.
  - Antiglaucoma drugs.
  - Injection of cultured cells with ROCK inhibitors (Rho-kinase inhibitors) into the anterior chamber.
- PTK to relieve pain by removing the epithelial bullae.
- Amniotic membrane transplantation to promote re-epithelization.
- DSAEK or DMEK.
- Penetrating keratoplasty preferred in presence of scarring.

Prevention

- Use of low phaco power.
- Dispersive viscoelastic to coat and protect the endothelium (soft shell and ultrasoft shell techniques).

Differential Diagnosis

- Posterior polymorphous corneal dystrophy.
- Congenital hereditary endothelial dystrophy.
- Herpetic stromal keratitis.
- Herpetic endotheliitis.
- Recurrent cornea erosion syndrome.

Salzmann's Nodular Degeneration

Salzmann's nodular degeneration is a noninflammatory degenerative condition leading to the formation of fibrous outgrowth resulting in nodules over cornea, commonly involving midperipheral to peripheral areas.

Etiology

Idiopathic or can be associated with inflammation, trauma, and surgery.

Risk Factors

Dry eye, chronic blepharitis, phlyctenular keratoconjunctivitis, pterygium, vernal keratoconjunctivitis, and long-term contact lens wear.

Epidemiology

- Commonly seen in fifth decade.
- Bilateral.
- Female preponderance.

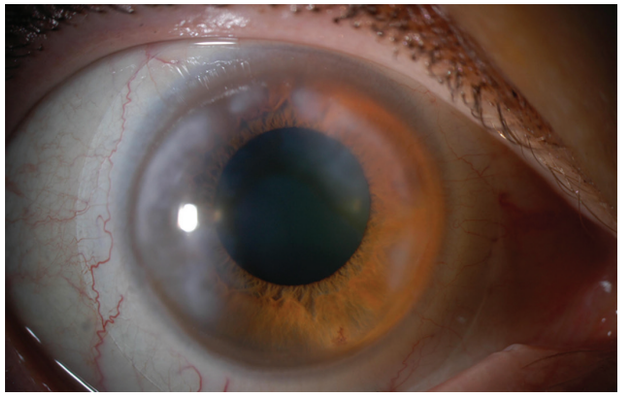


Fig. 4.9 Corneal elevations in Salzmann's nodular degeneration. (Source: Introduction. In: Gulani A, ed. The Art of Pterygium Surgery: Mastering Techniques and Optimizing Results. 1st ed. Thieme; 2019.)

Clinical Feature

Bluish white–gray nodules, usually round or conical, often found in the superonasal quadrant, followed by the superotemporal, typically discrete from one another but may fuse with nearby nodule (**Fig. 4.9**).

The nodules stain negative with fluorescein stain.

Other findings: decreased tear break-up time and reduced tear meniscus height.

Investigations

- Slit-lamp exam.
- Ultrasound biomicroscopy.
- In vivo confocal microscopy.
- AS-OCT.
- Corneal topography and tomography.

Treatment

- Lubricating eye drops.
- Anti-inflammatory eye drops.
- Surgical treatment (in refractory cases): manual excision, PTK with or without the use of topical mitomycin C, and lamellar or penetrating keratoplasty.

Complications

- Blepharospasm.
- Secondary recurrent corneal erosions.
- Flattening of the cornea, leading to astigmatism.

Suggested Readings

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