CHAPTER

6

Iris and Anterior Chamber

COMPETENCY

OP6.1 DESCRIBE CLINICAL SIGNS OF INTRAOCULAR INFLAMMATION AND ENUMERATE THE FEATURES THAT DISTINGUISH GRANULOMATOUS FROM NONGRANULOMATOUS INFLAMMATION. IDENTIFY ACUTE IRIDOCYCLITIS FROM CHRONIC CONDITION

LONG ESSAYS

1. A 24-year-old woman presents with gradual onset of pain and redness in her right eye. on examination, there is ciliary congestion, corneal endothelium is studded with greasy mutton fat keratic precipitates in the inferior part. The pupil is sluggish, and the anterior chamber shows 2+ cells and 2+ flare.

A. What is the most probable diagnosis and what is its type? (2 marks)
B. Name three causes for this condition. (3 marks)
C. Explain the influence of this condition on intraocular pressure. (3 marks)
D. Name two posterior segment signs of this condition. (2 marks)

A. Most Probable Diagnosis

- Iridocyclitis (anterior uveitis)
- It is of 'granulomatous' type

B. Causes for Granulomatous Iridocyclitis

1. Tuberculosis
2. Sarcoidosis
3. Vogt–Koyanagi–Harada syndrome

C. Influence of Iridocyclitis on Intraocular Pressure

Normal IOP	Low IOP	High IOP
Iridocyclitis can be associated with normal intraocular pressure	More often, iridocyclitis causes low IOP due to ciliary shock, which recovers with the initiation of treatment	High IOP is seen in the following conditions • Trabeculitis • Annular synechiae causing the pupillary block and angle-closure • Peripheral anterior synechiae • Steroid-induced

D. Posterior Segment Signs of Iridocyclitis

1. Cystoid macular edema
2. Epiretinal membrane

2. A 44-year-old man with HIV presents with floaters and diminution of vision in his right eye. His CD4+ count is 120/mm^3.

A. Enumerate three causes for floaters. (3 marks)

B. Name three organisms that can cause posterior uveitis in a patient with HIV. (3 marks)

C. Explain the importance of knowing the CD4+ count. (3 marks)

D. Name the typical description for active ocular toxoplasmosis. (1 mark)

A. Causes of Floaters

1. Muscae voltantes (physiological)
2. Vitreous hemorrhage
3. Intermediate uveitis

B. Organisms Causing Posterior Uveitis in HIV Infected Patients

1. *Mycobacterium tuberculosis*
2. *Toxoplasma gondii*
3. Cytomegalovirus

C. Importance of knowing the CD4+ count

- The ocular manifestations are due to the infection *per se* or opportunistic infections or due to the drugs used against HIV/AIDS
- The opportunistic infections depend on the CD4+ cell count. Knowing the CD4+ count helps in expecting the organism and diagnosis

Manifestations	CD4+ cell count 0–199	CD4+ cell count 200-499	CD4+ cell count >500
Adnexal lesions	—	Blepharitis	—
Anterior segment	Ocular surface squamous neoplasia	Dry eye Kaposi sarcoma Molluscum contagiosum Herpes zoster ophthalmicus	Allergic conjunctivitis
Posterior segment	CMV retinitis Progressive outer retinal necrosis Candidal retinochoroiditis Endophthalmitis	Toxoplasmosis Intermediate uveitis Retinal vasculitis Tuberculous uveitis	HIV retinopathy Optic neuropathy

D. Typical description for active ocular toxoplasmosis

'Headlight in the fog appearance'.

3. A 24-year-old man had trauma to his right eye with a stone while using an electric motor. After two days he developed severe pain,loss of vision, and redness in the same eye

A. State the most probable diagnosis. (1 mark)
B. Explain the etiology and clinical features of this condition. (4 marks)
C. Explain the investigations and treatment of this condition. (5 marks)

A. Most Probable Diagnosis

Post-traumatic endophthalmitis.

B. Etiology and Clinical Features

Etiology

- Infective endophthalmitis
  - Bacteria (most commonly in post-operative is Staphylococcus, Strepcocci)
  - Fungi: More in vegetative injury
- Sterile endophthalmitis
  - Post-operative sterile endophthalmitis (TASS)
  - Pure copper foreign body
  - Tumor necrosis

Clinical Features

Symptoms

Pain, loss of vision.

Signs

- Lid edema
- Hazy cornea, anterior chamber reaction, hypopyon
- Edges of the wound may be swollen and gaping
- Yellow reflex in the pupil
- Exudation in the vitreous—fundus may not be visible

C. Investigations and Treatment

Investigations

- Aqueous and vitreous tap for culture and sensitivity with Gram's stain will help understand the organism
- Diagnosis is confirmed by B-scan. It shows multiple moderately echogenic opacities within the vitreous. Any associated retinal detachment may be seen

Treatment

Intravitreal Injection

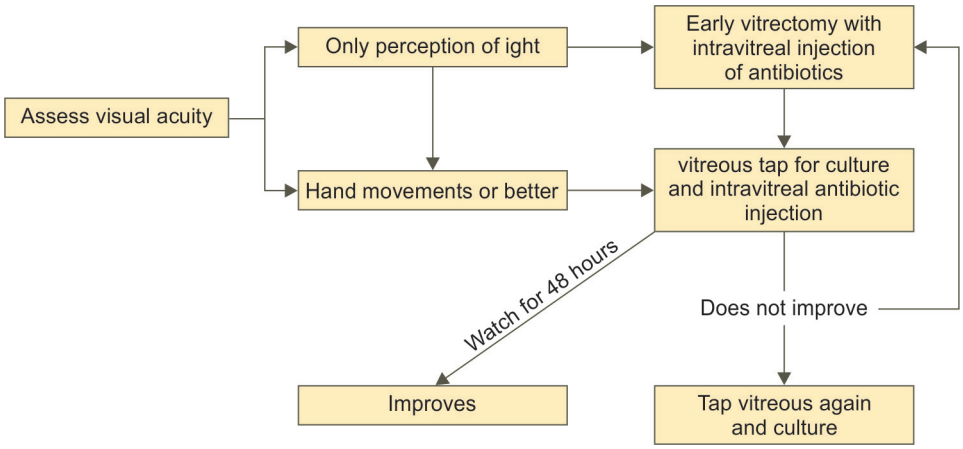
- Broad-spectrum antibiotics is given in the pars plana region (3 mm behind limbus in pseudophakic eyes, 3.5 mm behind limbus in phakic eyes)
- The usual antibiotics preferred are vancomycin (0.1 mg/0.1 ml) and ceftazidime (2.25 mg/0.1 ml)
- Other options are vancomycin + amikacin (0.4 mg/0.1 ml) and vancomycin + gentamicin (0.2 mg/0.1 ml)

Subconjunctival Injection

- Combination of antibiotics with steroids is a form of adjunct therapy
- It is given for a week to maintain intraocular concentration
  - Vancomycin 25 mg/0.5 ml + ceftazidime 100 mg/0.5 ml
  - Vancomycin + cefuroxime 125 mg/0.5 ml
- Subconjunctival dexamethasone (4 mg/ml) is given to decrease the inflammation under the cover of antibiotics

Topical Antibiotics

- Vancomycin 50 mg/ml or cefazoline (50 mg/ml) + amikacin (20 mg/ml) or tobramycin (15 mg%)
- Topical steroids like prednisolone and dexamethasone are frequently instilled
- Supportive therapy in the form of cycloplegics and antiglaucoma medications has to be started
- A study-endophthalmitis vitrectomy study (EVS) outlines the treatment protocol for postoperative endophthalmitis



SHORT ESSAYS

1. Give the SUN classification of uveitis. (5 marks)

SUN Classification of Uveitis

1. **Anterior uveitis**
   - i. Iritis (iris inflammation)
   - ii. Anterior cyclitis (ciliary body inflammation)
   - iii. Iridocyclitis
2. **Intermediate uveitis**
   - i. Pars planitis
   - ii. Posterior cyclitis
   - iii. Hyalitis
3. **Posterior uveitis**
   - i. Choroiditis (focal or diffuse)
   - ii. Retinitis

iii. Retinochoroiditis
iv. Chorioretinitis
v. Retinal vasculitis
vi. Neuroretinitis

4. **Pan uveitis**
   i. Inflammation in the anterior chamber, vitreous, and retina/choroid

2. Explain the formation of keratic precipitates (KPs). Explain the classification based on appearance. (2+3 marks)

Formation of KPs

- In iridocyclitis, the corneal endothelium becomes sticky
- There are inflammatory cells in the aqueous that keep floating with the convection currents of the aqueous. They stick to the lower part of the cornea and are termed 'keratic precipitates'

Classification of KPs

Fine KPs (small, non-pigmented)	They are associated with acute nongranulomatous inflammation
Large, mutton fat, greasy KPs	They are associated with granulomatous inflammation
Pigmented, crenated KPs	They are a sign of chronic or healed anterior uveitis
Diffuse, stellate KPs	Occurrence of KPs above the horizontal midline Viral uveitis, Fuch's heterochromic iridocyclitis

3. Classify uveitis based on etiology. (5 marks)

Etiological Classifcation of Uveitis

1. **Infective uveitis**
   - It can be due to exogenous (entry of organism from the environment), secondary (spread from other ocular structures), or endogenous (through blood from distant sources)
     i. *Bacteria:* Mycobacteria, *Brucella*, *Treponemes*, streptococci, staphylococci
     ii. *Viruses:* Herpes simplex and zoster, cytomegalovirus, human immunodeficiency virus
     iii. *Parasites: Toxoplasma*, *Toxocara*, onchocerciasis
     iv. *Fungi: Candida*, *Aspergillus*, cryptococci
2. **Allergic uveitis**
   i. Microbial allergy
   ii. HLA associated: B27: ankylosing spondylosis, Reiter's; B5: Behcet's, DR4 and DW15: VKH syndrome
   iii. Autoimmune: Associated with Still's disease, rheumatoid arthritis, Wegener's granulomatosis
3. **Toxic uveitis**
   i. Endotoxins: Uveitis associated with acute pneumococcal or gonococcal conjunctivitis, keratomycosis
   ii. Endocular toxins: Uveitis associated with long-standing retinal detachment, tumors (masquerade syndromes), and phacotoxic uveitis
   iii. Exogenous toxins: Drugs, chemical irritants

4. **Traumatic uveitis**
   - It is due to:
     i. Mechanical injury
     ii. Entry of foreign body or organism
     iii. Blood
     iv. Sympathetic ophthalmia in the other eye
5. **Uveitis associated with noninfective systemic diseases**
   - Polyarteritis nodosa, SLE, diabetes, gout, etc.
6. **Idiopathic uveitis**
   - Pars planitis, Fuch's heterochromic iridocyclitis, other nonspecific idiopathic uveitis

4. Describe the anterior segment signs of iridocyclitis. (5 marks)

Cornea

- Circum corneal congestion or ciliary congestion is congestion of the anterior ciliary vessels
- Ciliary tenderness is elicited by gentle pressure over the ciliary region
- Keratic precipitates (Fine KP, mutton fat KPs)
- Band shaped keratopathy (late stages)

Iris

- Muddy iris
- Koeppe nodules: Nodules at pupillary border
- Busacca nodules: Nodules on the iris surface
- Berlin nodules: Nodule in angle
- Festooned pupil: The pupil is irregular due to patchy posterior synechiae at various positions. It is discovered on pupillary dilatation
- Ectropion pupillae: eversion of the iris surface leading to the visibility of the posterior surface of the iris. It happens due to the contraction of fibrinous exudate on the anterior surface of the iris
- Seclusio pupillae formation of posterior synechiae in an annular fashion that blocks the outflow of aqueous from the posterior chamber to anterior chamber
- Occlusion pupillae: Blocking of the pupil by exudates

Anterior Chamber

- Cells
  - A sign of activity, are seen as particles in the aqueous
  - It is graded as follows:

Grade	Cells in field
0	<1
0.5+	1–5
1+	6–15
2+	16–25
3+	26–50
4+	>50

- Flare
  - A measure of turbidity of the aqueous
  - Its grading is shown below

Grade	Description
0	None
1+	Faint
2+	Moderate (iris and lens details clear)
3+	Marked (iris and lens details lazy)
4+	Intense (fibrin or plastic aqueos)

- Plasmoid aqueous
  - Turbid aqueous when the protein concentration of aqueous is as high as plasma
- Hypopyon
  - It is formed due to collection of exudates in the anterior chamber
- Depth of the anterior chamber varies with the clinical situation

Seclusio pupillae	Shallow at the periphery, deep at center
Occlusio pupillae	Diffusely shallow
Peripheral anterior synechiae	Irregularly shallow

- Lens
  - Pigments on the anterior lens capsule
  - Posterior synechiae
  - An exudative membrane on the lens capsule
  - Complicated cataract

5. Compare and contrast granulomatous and nongranulomatous uveitis with examples. (5 marks)

Or

Explain the pathological classification of uveitis. (5 marks)

Feature	Nongranulomatous uveitis (plastic)	Granulomatous uveitis
Cause	Due to toxins, antigen, and antibody reactions. (Types II and III)	Usually due to invasion of an organism or due to type IV hypersensitivity
Pathology	Polymorphonuclear cells, lymphocytes	Giant cells, epithelioid cells, macrophages
Onset	Acute	The usually slow, indolent course
Clinical course	Short	Chronic, remissions exacerbations
Grade of inflammation	High	Low
Keratic precipitates	Many, small	Less, large mutton fat KPs
Aqueous cells and flare	Marked, numerous cells, fibrinous exudates commonly seen	Less, a few cells
Iris nodules	Absent	Present

Contd.

Feature	Nongranulomatous uveitis (plastic)	Granulomatous uveitis
Posterior synechiae	Thin and tenuous	Thick and broad-based
Posterior segment involvement	Not commonly involved	Commonly involved
Examples	Viral, HLA B27 associated uveitis, Behcet syndrome, JRA	Tuberculosis, VKH, sympathetic ophthalmia, sarcoidosis Tuberculosis can cause both granulomatous and nongranulomatous types of uveitis

6. Explain the clinical features and management of intermediate uveitis.

(5 marks)

Intermediate Uveitis

- An insidious, chronic, relapsing inflammation primarily of the vitreous
- They tend to be bilateral and more in females
- Its subset, pars planitis is the term used for idiopathic inflammation
- Intermediate uveitis can be associated with multiple sclerosis (HLA DR15), Lyme's disease, and sarcoidosis. An idiopathic variant is more commonly seen in children and tends to be aggressive
- IU associated with systemic disorders occurs in the third and fourth decades

Clinical Features

Symptoms

- The most common presenting complaint is unilateral or bilateral floaters associated with diminished vision
- Metamorphopsia

Signs

- On examination, the eye may show signs of anterior uveitis, especially in those with systemic associations
- Vitreous cells and haze, more so in the anterior part, are pathognomonic for IU
- Vitreous may also be studded with exudates, called 'snowballs' appearance
- The peripheral retinal examination is mandatory in these cases, which reveal snow banking, i.e. whitish-gray exudative membrane is seen circumferentially; more so inferiorly
- Neovascularization may develop on the snowbanks
- Perivascular sheathing and periphlebitis can also be seen
- Cystoid macular edema can also be present in many cases as a result of inflammation

Management

Investigations

- FFA helps to detect peripheral neovascularization
- OCT helps to detect cystoid macular edema
- Following a thorough ophthalmic examination, systemic associations of IU as mentioned before have to rule out

Treatment

- 80% of cases resolve spontaneously, hence may not require treatment
- In severe non-resolving conditions, steroids are given in the form of subTenon injections or oral administration
- If associated with multiple sclerosis, interferon-beta may be of help
- In presence of neovascularization in the peripheral retina, laser photocoagulation is indicated
- Vitrectomy: It is indicated when there is no response to steroids, vitreous opacities significantly decreasing vision, unresolving cystoid macular edema, vitreous hemorrhage, tractional retinal detachment, and epiretinal membrane
- Accompanying endo-LASER can be done if associated neovascularization is present

7. Explain the clinical features of posterior uveitis. (5 marks)

Posterior Uveitis

- Inflammation of the choroid and/or retina
- It can be infectious or noninfectious

Clinical Features

Symptoms

- The patient usually presents with visual symptoms predominantly associated with floaters
- There is no pain or redness of the eye as such
- In cases of peripheral lesions, no symptoms may be reported and hence tend to be accidentally found on routine examination
- The other symptoms are metamorphopsia (distorted images), macropsia (due to increase in distance between photoreceptors), micropsia (due to crowding of photoreceptors), photopsia (sensation of flashes of light), and positive scotoma

Signs

- One may find a few KPs and the anterior segment is usually quiet
- Fundus examination may reveal vitreous cells and flare
- Vitritis is more commonly seen with retinitis lesions
- Fundus examination shows retinitis/choroiditis/retinal vasculitis/a combination of these in the form of focal, multifocal, or diffuse lesions.
  - The retinitis patch looks yellowish bright spot with fuzzy margins, obscuring the blood vessels
  - Choroiditis is seen as pale yellow subretinal lesion with normal overlying blood vessels
  - Retinal vasculitis is seen sheathing of veins or arteries or both. There may be associated hemorrhages or capillary occlusion
- After resolution, either due to therapy or remission
  - Retinitis lesion becomes atrophic, thinned out and translucent
  - Choroiditis lesion heal by pigmentation. The vessels which run through that segment appear thin and sclerotic. Sclera may be visible below and may simulate a coloboma
- In cases of severe posterior uveitis, complications like complicated cataracts, choroidal neovascularization, secondary glaucoma, and rhegmatogenous retinal detachment can occur

- Some of the important patterns of posterior uveitis are listed below:

Congenital toxoplasmosis	Usually bilateral punched out lesions simulating macular coloboma
Acquired toxoplasmosis	Headlight in the fog appearance: intense vitreous haze with creamy yellow retinitis patch Arising from the edge an old healed lesion
CMV retinitis	A brush-fire pattern of full-thickness retinal necrosis with hemorrhages and exudation
Tuberculosis	Choroid tubercles (yellowish subretinal lesions of varying size) usually associated with meningitis, tubercular conglomerate granuloma (solitary) Serpiginous-like choroiditis: centrifugal spread of choroiditis with healing seen in the other end
Sarcoidosis	Choroidal and retinal granulomas, periphlebitis retinae: sheathing around veins resembling 'candle wax drippings
Toxocariasis	Chronic endophthalmitis: Presents with leukocoria due to marked vitreous clouding, in children of the age of 2–10 years, poor prognosis Posterior pole granuloma: A yellow-white, round, solitary, raised nodule, mild inflammatory response, about 1–2 disc diameter in size, located either at the macula or in the centrocaecal area, in children of age 5–15 years, presents with decreased vision Peripheral granuloma: Can have vitreous bands and develop retinal detachment

8. Describe the etiology, clinical features, and management of sympathetic ophthalmia. (1+2+2 marks)

Or

A 56-year-old woman presents with left-sided ocular pain and redness. Granulomatous panuveitis is diagnosed in the left eye. She gives a history of penetrating injury and loss of vision in the right eye. State the diagnosis. Explain the signs and management of this condition. (1+2+2 marks)

Sympathetic Ophthalmia

A bilateral serious, chronic granulomatous, panuveitis due to sensitization to choroidal antigen due to either injury or surgery in the fellow eye.

Predisposing Factors and Etiology

1. Injury in the ciliary region
2. Penetrating injury/vitreoretinal surgery
3. Incarcerated ciliary body/lens capsule or iris
4. Can occur in any age group
   - It is thought to be due to a T cell-mediated response driven against sensitized uveal antigens (Fig. 6.1.1)
   - Viral infection may be initiating factor
   - The eye which is traumatized is called the exciting eye
   - The other eye is called the sensitizing eye

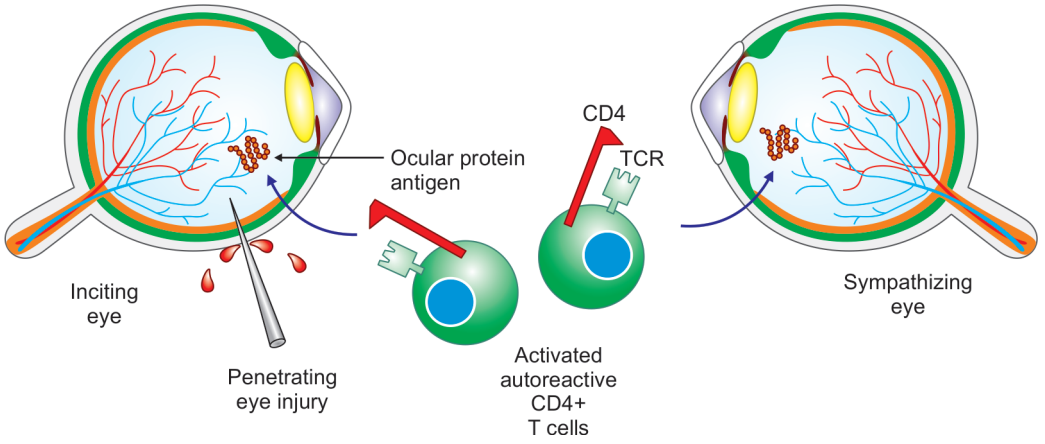


Fig. 6.1.1: Pathogenesis of sympathetic ophthalmia

Clinical Features

Prodromal Stage

- When the sympathetic ophthalmia begins, there is a return of ciliary congestion, tenderness, and lacrimation in the shrunken eye
- In the sympathizing eye, the first symptom to begin is photophobia and defective near vision as a result of the weakness of accommodation
- A careful examination may reveal ciliary tenderness, KPs, vitreous cells, and flare
- Fundus examination reveals Dalen–Fuch nodules (yellow subretinal lesions)

Established Stage

- Full-fledged granulomatous uveitis features may be seen: Iridocyclitis, peripheral retinal exudation, Dalen–Fuch nodules, and papillitis
- It tends to be chronic and may last many months
- Inflammation may be severe enough to cause complications like phthisis

Prophylaxis

- Meticulous repair of any penetrating injury to take care of the uveal tissue not to be incarcerated in the wound
- Uncontrolled uveitis in the severely damaged eye for more than 2 weeks should be enucleated

Treatment

- Early recognition of signs of inflammation and starting steroid therapy in the form of intravenous methylprednisolone 1000 mg followed by oral prednisolone 1 mg/kg and topical steroids and cycloplegics
- After the eye quietens down, a maintenance dose of 15–20 mg is administered for many months and the eye has to be monitored
- Enucleation of the exciting blind eye is proposed by some but must be done before the initiation of inflammation

9. Explain various complications of uveitis. (5 marks)

Complications of uveitis can be due to inflammation per se and due to the treatment of uveitis.

Complications due to Inflammation

1. **Cornea**
   - Band keratopathy: It usually occurs in chronic inflammation
2. **Angle**
   - Peripheral anterior synechiae form between the peripheral iris and the cornea that bridge the angle and cause a block of aqueous outflow
3. **IOP**
   - Hypotony and hypotonous maculopathy occur as a result of ciliary shock and ciliary shutdown
   - Raised intraocular pressure can occur as a result of trabeculitis and scarring of the trabecular meshwork
4. **Iris**
   - Posterior synechiae form between the lens and posterior surface of the iris
   - Iris bombe forms due to annular synechia that causes forward displacement of the peripheral iris causing secondary angle-closure glaucoma
5. **Lens**
   - Complicated cataract, usually seen as posterior subcapsular cataract with bread-crumb appearance
   - Poor dilatation during cataract surgery occurs due to thinning of the iris and formation of posterior synechiae
   - Cyclitic or retrolental membrane forms due to the organization of exudates behind the lens
6. **Retina**
   - Cystoid macular edema is the most common retinal complication associated with uveitis. It is a frequent cause of diminished vision
   - Epiretinal membrane
   - Retinal detachment (exudative)
   - Subretinal fibrosis
7. **Phthisis bulbi**
   - Occurs as a result of chronic inflammation leading to ciliary body shut down leading to low IOP and complete loss of vision

Complications due to Treatment

1. **Steroids**
   - Steroid-induced glaucoma
   - Steroid-induced cataract

10. Describe the etiology, clinical features, and management of Pan ophthalmitis. (5 marks)

Pan ophthalmitis

Inflammation of all the coats of the eyeball along with orbital tissues.

Etiology

- Exogenous entry of organisms can follow penetrating injury or postoperatively. The usual organisms implicated are gram-positive cocci
- Endogenous infection is seen in severely immunocompromised individuals with indwelling catheters and prostheses

Clinical Features

Symptoms

- Severe eye pain
- Complete loss of vision

Signs

- On examination, visual acuity is negative to the perception of light
- The lids are edematous, the eyeball is proptosed and extraocular movements are restricted due to orbital edema
- Conjunctival chemosis and congestion are present
- The cornea is usually sloughing off with an anterior chamber full of purulent material
- Fundus cannot be visualized. Intraocular pressure is raised

Management

- Evisceration is the treatment of choice. Supportive systemic antibiotics and anti-inflammatory drugs are given
- Evisceration is the removal of the entire contents of the eyeball leaving behind the sclera
- Evisceration can be done in two methods: Simple and frill evisceration
- In the former, the whole sclera is left behind

SHORT ANSWERS

1. Explain the clinical features of plastic iridocyclitis. (3 marks)

Plastic Iridocyclitis

- Another name for nongranulomatous iridocyclitis
- It is usually acute and is associated with intense inflammation

Clinical Features

Symptoms

- Patients present with acute onset of redness, periocular pain, and photophobia
- Visual acuity depends on the severity of the inflammation

Signs

- The eye is congested, with dilated ciliary vessels. Ciliary tenderness is usually present
- The cornea shows fine, nonpigmented KPs in the inferior aspect of the cornea. Corneal edema may be present
- In the anterior chamber, there is a reaction in the form of cells and flare. In non-granulomatous uveitis, the reaction tends to be intense with 'plasmoid aqueous'. The protein content of the aqueous may be as that of plasma
- The iris is muddy and engorged. The pupil is usually miotic
- Hypopyon is usually present

2. Explain the terms **(3 marks)**

A. Occlusio pupillae

B. Seclusio pupillae

C. Iris Bombe

A. Occlusio Pupillae

Occlusion of the pupillary aperture due to exudates.

B. Seclusion Pupillae

Occlusion of the aqueous outflow through the pupil due to formation of annular or ring synechiae circumferentially.

C. Iris Bombe

- When annular synechiae forms, the aqueous cannot escape through the pupil.
- As a result, it builds up in the posterior chamber and pushes the peripheral iris towards the angle.
- This causes bulging of the peripheral iris forward to cause 'iris bombe' (Fig. 6.1.2)

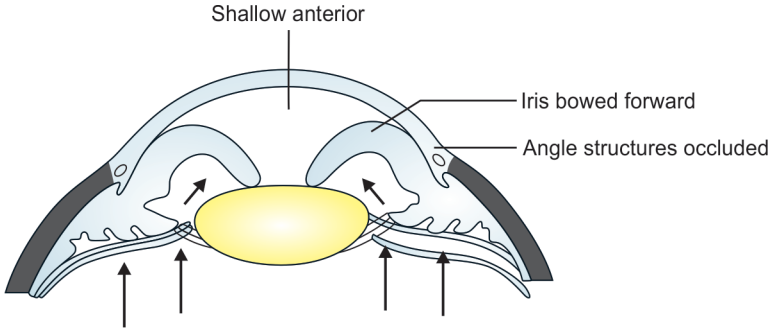


Fig. 6.1.2: Iris bombe

3. Explain the pupillary changes that can occur in uveitis. **(3 marks)**

- The pupil becomes small and the reaction becomes sluggish in acute iritis
- Iris nodules
  - It may be studded with an inflammatory nodule at the border (Koeppe's nodules) or the collarette (Busacca's nodules) as seen in granulomatous inflammation.
  - The Koeppe's nodules form posterior synechiae
- The pupil may be irregular due to patchy posterior synechiae at various positions (Festooned pupil, Fig. 6.1.3)
  - It is discovered after instilling mydriatics.
  - The adhered part of the iris does not dilate whereas the free iris moves behind
- Ectropion pupillae
  - Eversion of the iris surface leading to the visibility of the posterior surface of the iris
  - It happens due to the contraction of fibrinous exudate on the anterior surface of the iris

Fig. 6.1.3: Festooned pupil

4. Justify the reason for keratic precipitates being present in the inferior half of the cornea. Name one condition where this rule is not followed. (2+1 marks)

KPs are seen on the inferior half of the cornea

- Keratic precipitates are a sign of uveitis. In uveitis, the endothelium of the cornea becomes sticky
- As a result, polymorphonuclear cells that are released into the aqueous get attached to the endothelium
- The anterior of the eye is relatively cooler than the posterior due to exposure to air and evaporation of the tear film. As a result convection currents are set up in the aqueous. The aqueous that is closer to the cornea, sinks and the aqueous that is near the iris rises (Fig. 6.1.4)
- During this process, the keratic precipitates settle down in the form of an 'Artl's triangle'

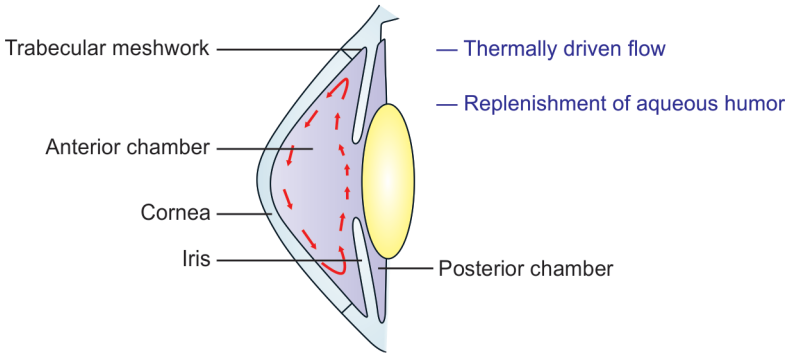


Fig. 6.1.4: Convection currents

Condition in which this Rule is not Followed

Stellate diffuse KPs are characteristically seen in herpetic iridocyclitis and Fuch's heterochromic cyclitis

5. Compare and contrast atrophic bulbi and phthisis bulbi. (3 marks)

- Atrophic bulbi is the initial stage of phthisis bulbi
- Phthisis bulbi is also known as atrophic bulbi with disorganization.

Similarities	Differences
• Both have no visual acuity • The lens is cataractous • The retina is atrophic and detached • The eye is smaller than usual and IOP is low	• Phthisis bulbi is a shapeless eye and does not have a structure, whereas atrophic bubli still maintains the original eyeball shape • Phthisis bulbi is associated with calcifications in all parts of the eye evident on CT scan or B scan. There is bone metaplasia evident in RPE • The cornea becomes sclera-like and the sclera becomes markedly thickened in phthisis bulbi. The parts of the eyeball cannot be differentiated from one another

6. Enumerate three indications of evisceration. (3 marks)

1. Expulsive choroidal hemorrhage
2. Panophthalmitis
3. Bleeding anterior staphyloma

COMPETENCY

OP6.2 IDENTIFY AND DISTINGUISH ACUTE IRIDOCYCLITIS FROM CHRONIC IRIDOCYCLITIS

SHORT ESSAY

1. Differentiate between acute and chronic iridocyclitis. (5 marks)

Differentiating Features

Parameter	Acute Iridocyclitis	Chronic Iridocyclitis
Symptoms	• Acute onset of pain, brow ache, and hazy vision • Lasts for about 6 weeks to 3 months	• Chronic indolent course, with acute exacerbations • Diminished vision is a more common presentation • Duration >3 months
Signs	• Ciliary congestion and tenderness • Corneal edema • Fresh KPs • Anterior chamber cells and flare, • Exudative membrane, hypopyon may or may not be there	• No congestion • Old crenated KPs • Anterior chamber flare is more in comparison with cells • Presence of posterior synechiae • A complicated cataract may be present • Peripheral anterior synechiae and glaucoma may be present
Complications	• Hypertensive uveitis • Ciliary shock and hypotony • Disc edema and hypotonus maculopathy • Choroidal detachment	• Complicated cataract • Annular synechiae and pupillary block glaucoma • Retinal detachment due to contraction of fibrovascular membrane • Neovascular glaucoma • Phthisis bulbi • Band-shaped keratopathy
Pathology	• Usually nongranulomatous response	• May be granulomatous or nongranulomatous
Examples	• Idiopathic anterior uveitis • Traumatic uveitis • Bacterial endophthalmitis • HLA B27 associated iridocyclitis	• Cyclitis • Intermediate uveitis • Sympathetic ophthalmia • VKH syndrome • Tuberculous uveitis • Syphilitic uveitis • Stills disease or juvenile idiopathic arthritis-associated uveitis

SHORT ANSWERS

1. Define (1 mark each)

A. Acute uveitis
B. Chronic uveitis
C. Recurrence of uveitis

A. Acute Uveitis

Onset is sudden and duration of symptoms and signs of uveitis last not more than 3 months.

B. Chronic Uveitis

Insidious onset, duration of disease lasting for more than 3 months.

C. Recurrent Uveitis

Repeated attacks of uveitis separated by periods of inactivity of more than 3 months without treatment.

2. Enumerate three causes for chronic uveitis. (3 marks)

1. Fuch's heterochromic cyclitis
2. JIA associated uveitis
3. Syphilitic uveitis

3. Describe three signs of chronic uveitis. (3 marks)

Signs of Chronic Uveitis

1. **Visual acuity**
   - Maybe subnormal owing to sequelae of uveitis
2. **Cornea**
   - Old crenated KPs
   - Band keratopathy
3. **Anterior chamber**
   - Flare is more common than cells and is out of proportion to cells
   - Depth may be uneven due to the formation of anterior synechiae
4. **Iris**
   - Areas of iris atrophy may be present
5. **Lens**
   - Complicated cataract
   - Pigments on the lens
6. **Retina**
   - Subretinal fibrosis
   - An epiretinal membrane may be present
   - Chronic macular edema

COMPETENCY

OP6.3 ENUMERATE SYSTEMIC CONDITIONS THAT CAN PRESENT AS IRIDOCYCLITIS AND DESCRIBE THEIR OCULAR MANIFESTATIONS

SHORT ESSAYS

1. A 36-year-old man with back pain and stiffness presented with recurrent episodes of iridocyclitis. On further investigating, an X-ray of the lumbar spine shows a "bamboo-spine" appearance.

A. Which systemic condition is being described here and what is the HLA type expected? (2 marks)

B. Enumerate other two systemic manifestations of the same HLA type with ocular manifestations. (1 marks)

C. Annotate the management of this condition. 2 marks)

A. The Systemic Condition Described Here is

- Ankylosing spondylosis
- It is associated with HLA B27

B. Other Conditions Associated with HLA B27

1. Reiter's disease
2. Psoriatic arthritis

C. Management

- Uveitis associated with HLA B27 is usually unilateral, acute, and anterior
- It is treated with topical steroids and cycloplegics
- The cycloplegics have to be continued for three weeks after control of inflammation to decrease recurrence
- In case of recurrent disease, systemic NSAIDs and monoclonal antibodies should be used

2. Enumerate four systemic conditions that are associated with anterior uveitis. Describe the features of Heerfordt syndrome. (4+1 marks)

Systemic Conditions That are Associated with Anterior Uveitis

1. Ankylosing spondylosis
2. Reiter's disease
3. Inflammatory bowel disease
4. Tubulointerstitial nephritis

Heerfordt's Syndrome

- It is also known as uveoparotid fever and is characterized by bilateral granulomatous panuveitis + painful enlargement of parotid glands + cranial nerve palsies + skin rashes + fever
- It is seen as an acute manifestation of Sarcoidosis

3. Name the systemic autoimmune disorder in which the eye develops a recurrent "cold hypopyon"? Describe other ocular manifestations of that disease. (1+4 marks)

Systemic Autoimmune Disorder is

- Cold hypopyon is seen characteristically in Behcet's syndrome
- It is characterized by recurrent episodes of anterior uveitis with hypopyon with minimal signs of inflammation like cells and flare. So, it is described as a 'cold hypopyon'

Ocular manifestations of Behcet's Syndrome

- Behcet's disease is an idiopathic multisystem disorder characterized by obliterative arteritis affecting vessels of all sizes
- The uveitis is typically bilateral and anterior. Iridocyclitis is recurrent and associated with hypopyon
- There is minimal inflammation in the form of cells and flare
- Posterior uveitis is characterized by vitritis, periphlebitis retinae, and retinitis that can present as white creamy exudates. It can also cause panuveitis

4. Describe the manifestations of tuberculosis in the eye. (5 marks)

- Ocular manifestations of tuberculosis are due to hematogenous spread of the organism or due to a hypersensitivity triggered by tubercular protein.
- It has varied manifestations from the ocular surface to the retina

Lid	• Lupus pernio, cold abscess (rare)
Conjunctiva	• Granuloma can occur in the conjunctiva • Phlyctenular conjunctivitis is a type IV hypersensitivity reaction to tubercular protein and is commonly seen in children. As a result, there is a formation of a pinkish nodule with feeding blood vessels. They respond well to topical steroids
Sclera	• Scleritis can occur as a hypersensitivity reaction • A scleral ulcer is an infectious process
Cornea	• Interstitial keratitis is a result of a hypersensitivity reaction
Uvea	• Anterior uveitis: It is usually granulomatous with mutton-fat KPs and iris nodules • Intermediate uveitis is characterized by vitritis and snow banking • Choroid tubercles, granuloma, serpiginous-like choroiditis are posterior segment manifestations of TB • Choroid tubercles are subretinal lesions of smaller dimensions usually seen in the posterior pole. They are seen in association with military tuberculosis and CNS tuberculosis
Retina	• Infectious retinitis • Eales' disease is a hypersensitivity reaction characterized by recurrent vitreous hemorrhages and perivenous exudates (retinal vasculitis)
Optic nerve	• Papilledema due to arachnoiditis and noncommunicating hydrocephalus

5. Annotate the ocular manifestations caused by this organism. (5 marks)

Or

Enumerate the manifestations of syphilis in the eye. (5 marks)

- Syphilis has many forms of ocular presentation and thus is known as the great masquerader"

Stages of Syphilis and Ocular Manifestations

Primary	• Chancres in eyelid and conjunctiva (rare)
Secondary	• Interstitial keratitis (with ghost vessels – salmon patch) • Scleritis • Cataract • Acute non granulomatous iritis (may be as a part of Jarisch–Herxheimer reaction) • Chronic granulomatous uveitis • Acute syphilitic placoid posterior chorioretinitis (ASPCC) • Optic neuritis, papilledema
Latent	• None
Tertiary	• Iris roseola (dilated blood vessels in the iris due to microembolism of vessels due to organisms) • Gumma of the uveal tract • Argyll Robertson pupil
Congenital syphilis	• Hutchison's triad: Interstitial keratitis + Hutchison's teeth + sensorineural deafness • Developmental cataract

6. Describe the clinical features of congenital and acquired ocular toxoplasmosis. (5 marks)

- Ocular toxoplasmosis is caused by *Toxoplasma gondii*
- It can be congenital or acquired

Congenital Toxoplasmosis

- Congenital toxoplasmosis is acquired by the fetus when the expectant mother suffers an episode of toxoplasmosis which may not be very apparent clinically
- When the infection happens in the first trimester, the fetus usually does not survive
- Congenital toxoplasmosis is characterized by convulsions, calcifications, and choroiditis
- The choroiditis is typically at the macula owing to the pattern of the ocular blood supply in the fetus. When discovered, the lesions are usually healed, bilateral, and appear as punched-out lesions with pigmentation. The children usually present with nystagmus and decreased central vision

Acquired Toxoplasmosis

- It may be due to *de novo* acquisition of infection due to consumption of undercooked meat or reactivation of old scars where the worms remain as bradyzoites
- They are usually seen in moderately immunosuppressed conditions
- Commonly, a retinitis lesion is seen to begin from the edge of old scars (recurrent infection). The parasites replicate and cause an intense vitreous reaction
- The lesion is yellowish raised plaque and appears as a "headlight in the fog". In extreme immunocompromise, vitritis may be less

7. Enumerate four opportunistic infections that cause posterior uveitis in immuno-compromised individuals. Discuss the clinical features of CMV retinitis. (2+3 marks)

Opportunistic Infections That Cause Posterior Uveitis

1. Toxoplasmosis
2. CMV retinitis
3. Posteriori uveitis caused by tuberculosis
4. Candidal endophthalmitis

CMV Retinitis

- Most frequent opportunistic infection in immunocompromised individuals
- Incidence has decreased after the initiation of HAART
- Most commonly seen when CD4+ counts <50/mm^3

Symptoms

- The patients present with floaters and diminution of vision depending on the amount of retinal involvement
- Many-a-times, they can be asymptomatic when the lesions are in the extreme periphery and not associated with significant vitritis

Signs

- The anterior segment is usually quiet
- A careful fundus examination of both eyes by mydriasis is necessary

Clinical Forms

1. **Fulminant form:** Brush-fire pattern, seen as hemorrhagic vasculitis and necrosis of retina along the major arterial arcade. This is a more fulminant variant and has more impact on visual acuity
2. **Granular form or indolent form:** Seen as granular lesions in the periphery. Sometimes, there is severe perivascular exudation leading to a 'frosted branch' angiitis-like appearance

SHORT ANSWERS

1. Describe the features of Vogt–Koyanagi–Harada syndrome. (3 marks)

- Vogt–Koyanagi–Harada syndrome is an idiopathic multisystem disorder
- Associated with HLA DR4 and DW15
- Ocular + cutaneous + CNS manifestations
- The disease occurs in many phases

Prodromal Phase

- Flu-like symptoms: fever, headache
- Tinnitus, hearing loss

Uveitic Phase

- Bilateral anterior granulomatous uveitis characterized by the formation of iris nodules and posterior synechiae
- Posterior uveitis with multifocal chorioretinitis lesions with bilateral exudative detachment
- Increased choroidal thickness

Chronic Recurrent Phase

- Chronic unteated posterior uveitis
- Depigmentation of the RPE (sunset glow fundus)
- Depigmentation of the limbus (Siguara sign)

Cutaneous Phase

- Alopecia, poliosis and vitiligo.

2. Describe the posterior segment manifestations of tuberculous uveitis. (3 marks)

- Tuberculosis can affect both the anterior and posterior segments
- The posterior segment manifestations of tuberculosis include

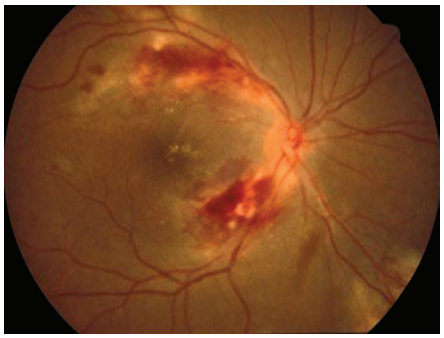
1. **Choroid tubercles**
   - These are usually multiple, subretinal, yellow flat lesions that are dispersed in the post-equatorial region and are associated with meningeal tuberculosis and disseminated tuberculosis
   - They are 1/6th to half the disc diameter size
2. **Solitary granuloma/choroidal granuloma**
   - Occurs as a focal lesion in any part of the retina. It appears yellow and well-demarcated and a size of more than 2 disc diameters
3. **Multifocal choroiditis**
   - Can also be seen in tuberculosis

4. **Serpiginous-like choroiditis**
   - There is centripetally advancing choroiditis that affects the posterior pole mainly
   - The lagging edge shows features of healing in the form of pigmentation
   - If not treated, there is diffuse chorioretinal atrophy

3. Summarize the treatment of CMV retinitis.

Or

A 32-year-old man with HIV presents with blurred vision. His CD4 count is 4/mm³. Fundus shows the following features. (3 marks)



Summarize the Treatment of this Condition

Treatment of CMV Retinitis

- In the pre-HAART era, the only treatment was lifelong antivirals. But the quality of life has improved significantly after the introduction of HAART
- Prompt initiation of HAART is quintessential for treating CMV retinitis
- Antivirals that are recommended are ganciclovir (first line), valganciclovir, foscarnet, and cidofovir; and they are continued till there is a doubling of CD4+ counts or if CD4+ counts cross 100/mm³ and maintained for 6 months

Drug	Induction dose	Maintenance dose
Injection ganciclovir	5 mg/kg twice daily intravenous for 3 weeks	5 mg/kg once daily IV
Oral valganciclovir	900 mg twice daily for 3 weeks	9000 mg once daily
Oral foscarnet	90 mg/kg BD for 14 days	90–120 mg/kg OD

- Other options include intravitreal injections and vitreal implants that release ganciclovir into the vitreous. They are helpful in unilateral cases
- The systemic side effects of these drugs include myelosuppression, renal dysfunction

4. Describe the management of tuberculous uveitis. (3 marks)

Management of Tuberculous Uveitis

Investigations

- In presence of features of tuberculous uveitis and a history suggestive of exposure to a patient with active tuberculosis, the following tests help to support the diagnosis of tuberculous uveitis
  - Positive tuberculin test (>10 mm induration) or positive interferon-gamma release assay
  - Chest X-ray suggestive of active or healed tuberculous lesions
  - Intraocular fluid (aqueous) PCR for tuberculous DNA
- IGRA or interferon-gamma release assay (commonly known as quantiferon) is a quantitative assay for measuring the amount of gamma interform released by the patient's WBC in response to exposure to tubercular proteins and peptides. It cannot differentiate between latent infection and active infection
- Other possible sites of tuberculosis should be investigated by relevant imaging techniques like MRI brain, CT chest, MRI spine, abdominal and pelvic ultrasound

Treatment

Topical

- Steroids (in anterior uveitis)
- Cycloplegics
- Periocular steroids in intermediate and posterior uveitis

Systemic

- ATT for 6 months followed by isoniazid and rifampicin for another 6 months
- Systemic steroids are indicated in cases with severe inflammation

5. Enlist the clinical features of syphilitic uveitis. (3 marks)

Treponemes can affect all the coats of the eyeball.

Anterior Uveitis

- Characterized by the formation of iris roseola (dilated vessels) caused by treponemes-causing emboli of the microvasculature of the iris
- Acute nongranulomatous iritis (may be as a part of Jarisch–Herxheimer reaction)
- Chronic granulomatous uveitis is characterized by mutton fat KPs and iris nodules

Intermediate uveitis

Seen as dense vitritis.

Posterior uveitis

- Deep chorioretinitis may be focal/solitary or multifocal or diffuse. It is seen as a yellow gray subretinal lesion with surrounding shallow retinal detachment and vitrits
- Acute syphilitic placoid posterior chorioretinitis (ASPPC) with typical leopard skin pigmentation of the RPE seen during fluorescein angiography
- Necrotizing retinitis (mimics acute retinal necrosis)

Panuveitis

Inflammation of all parts of uvea

COMPETENCY

OP6.4 DESCRIBE AND DISTINGUISH HYPHEMA AND HYPOPYON

SHORT ESSAYS

1. Define hyphema. Enumerate four causes for the same. (1+4 marks)

Definition of Hyphema

Blood in the anterior chamber

Causes

1. Blunt ocular trauma
2. Hemophilia
3. UGH syndrome due to ACIOL implantation
4. Fuch's heterochromic iritis

2. Explain the clinical features of hyphema. (5 marks)

Clinical Features of Hyphema

Symptoms

- Usually hyphema follows blunt trauma

- Blurred vision
- Ocular pain
- Photophobia

Signs

- There is blood in the anterior chamber and depending on its severity, it is graded as follows
  1. Microscopic hyphema: The absence of gross collection of blood, RBCs are seen floating in the aqueous
  2. Grade 1: <1/3 of the anterior chamber filled with blood
  3. Grade 2: 1/3–1/2 of the anterior chamber filled with blood
  4. Grade 3: 1/2 to a near-total anterior chamber filled with blood
  5. Grade 4: total hyphaema or 8-ball hyphema
- IOP is usually raised
- Other features of trauma like mydriasis, subluxation of the lens, sphincter tears, and iridodialysis may be seen

SHORT ANSWERS

1. Explain the management of hyphema. (3 marks)

- The patient is advised bed rest in a propped-up position so that the cells settle down and vision clears
- Topical steroids and cycloplegics are given to decrease intraocular inflammation
- Antiglaucoma medications are given to decrease intraocular pressure as hyphema is usually associated with raised IOP. Drugs like beta-blockers, alpha agonists, carbonic anhydrase inhibitors are useful. Cholinergic and prostaglandins should not be used
- Antifibrinolytics like e-amino caproic acid and tranexamic acid can be given to prevent rebleed
- Surgical treatment is required only if IOP is very high or the hyphema does not dissolve even after 7 days. The clot is evacuated by paracentesis

2. Enumerate three causes of hypopyon. (3 marks)

1. Corneal ulcer
2. Iridocyclitis
3. Endophthalmitis

3. Define a pseudohypopyon. Differentiate it from a true hypopyon. (3 marks)

Pseudohypopyon

A noninflammatory collection of cells in the anterior chamber that resembles a hypopyon.

Differentiation from True Hypopyon

- The most common cause of a pseudohypopyon is intraocular malignancies like retinoblastoma, intraocular lymphoma, and leukemias. It may also follow an intravitreal injection of triamcinolone
- It is more convex in configuration cf hypopyon. It may not be associated with corcumcorneal congestion, anterior chamber reaction, and flare
- Also, it persists despite the use of topical steroids and does not regress

4. Differentiate between hypopyon seen in bacterial and fungal keratitis. (3 marks)

- Hypopyon is a feature of both bacterial and fungal keratitis
- Hypopyon occurs more commonly in fungal keratitis than bacterial keratitis
- However, in fungal keratitis, the hypopyon is not sterile as the fungal hyphae penetrate the cornea
- Also, its size is out of proportion to the size of the ulcer in fungal keratitis and is relatively immobile

COMPETENCY

OP6.5 DESCRIBE AND DISCUSS THE ANGLE OF THE ANTERIOR CHAMBER AND ITS CLINICAL CORRELATES

LONG ESSAYS

1. A. Define the angle of the anterior chamber. (1 mark)
B. Explain the measurement of the angle of the anterior chamber. (3 marks)
C. Describe the formation of aqueous. (3 marks)
D. Describe the outflow of aqueous. (3 marks)

A. Angle of the Anterior Chamber

- The space between the peripheral part of the cornea and the base of the iris
- It is the site of aqueous drainage

B. Measurement of the Angle of the Anterior Chamber

- The depth of the anterior chamber can be measured by gonioscopy
- It is measured based on the structures seen on gonioscopy

Grade 0	No angle structures visible	Closed	0°
Grade I	Schwalbe's line	High chance of angle-closure-very narrow-angle	10°
Grade II	Schwalbe's line, trabecular meshwork	Angle-closure possible-narrow-angle	20°
Grade III	Schwalbe's line, trabecular meshwork, scleral spur	Open-angle-no chance of angle-closure	20–35°
Grade IV	Schwalbe's line, trabecular meshwork, scleral spur, ciliary body band	Wide-open angle-no chance of angle-closure	35–45°

C. Formation of Aqueous

- It is secreted from the pars plicata of the ciliary body