2.5 Anterior Chamber

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2.5.1 Introduction

The anterior chamber (AC) is an aqueous-filled compartment whose important bordering structures include the cornea, angle, iris, and the lens. Injuries to all neighboring tissues are discussed in their respective chapters; here we describe trauma-related pathologies involving the AC itself.

2.5.2 Evaluation

The ophthalmologist should evaluate the following variables in/of the AC:

- Depth
- Transparency (clarity)
- Presence of foreign material[1]
- Angle recession
- Abnormal tissue configuration (i.e., synechia)

The normal *depth* of the AC is 3 mm [6]; a significantly shallower or deeper AC is easily recognized by the reduced or increased distance between the cornea and the iris.

1 e.g., IOFBs (see Chap. 2.13), fibrin, lens particles; see below

Pearl

It is often easier to judge AC depth with the naked eye (rather than at the slit lamp) because this permits instant comparison with the normal fellow eye.

The AC depth may be uniformly or only partially abnormal. Lens dislocation is the most common cause, although other etiologies also occur.

Reduced clarity of the aqueous, presence of foreign material, or abnormal tissue configuration are also often recognizable with a penlight; nevertheless, the slit lamp remains the most effective diagnostic tool. The presence of white blood cells and flare are signs of anterior uveitis. Recognition of an angle recession requires a contact lens, although the UBM is an excellent alternative [7].

2.5.3 Specific Conditions

2.5.3.1 Depth

2.5.3.1.1 Shallowing of the AC

Possible causes of shallowing include:

- Leakage of the aqueous through a cornea/limbal wound[2]
- Dislocation of the lens into the AC
- Swelling of the lens
- Aqueous misdirection (malignant glaucoma; see Chap. 2.18)
- Severe intraocular hemorrhage (ECH). A combination of these etiologies is also possible

The *treatment* is determined by the underlying cause. Once aqueous loss through the wound is stopped (via spontaneous tissue tamponade or wound suturing), the AC rapidly reforms. Similarly, removal of the dislocated or swollen lens restores normal AC depth. In eyes with an ECH, treatment is

2 A scleral wound may also lead to shallowing of the AC, although this is much more rare.

much more complex (see Chap. 2.8). It is important to restore normal AC depth to prevent synechia formation.

2.5.3.1.2 Deepening of the AC

Possible causes of deepening include:

- Loss the lens (extrusion or posterior dislocation)
- Partial zonulolysis
- Presence of a posterior scleral wound [14]

Unlike a shallow AC, a deep one does not by itself represent a risk for additional complications. The AC always remains deeper in any eye if the lens has been removed.

2.5.3.1.3 Concomitant Shallowing and Deepening of the AC

The condition is caused by a complete posterior synechia, with the pupillary margin tightly adhering to the anterior lens capsule. Aqueous accumulates in the posterior chamber, pushing the iris forward in its mid-section (here the AC is shallow), and pushing the lens backward close to the iris periphery (here the AC deepens). Such an iris bombans can lead to secondary glaucoma (see Chap. 2.18).

2.5.3.2 Reduced Transparency

2.5.3.2.1 Blood (Hyphema)

This is the most commonly diagnosed pathology; the incidence varies with injury type. (Table 2.5.1). The blood usually clears spontaneously after a few days and mostly through the trabecular meshwork. The significance of hyphema lies in the secondary complications blood in the AC can cause (see below) as well as in the coexistent posterior segment injuries, which remain hidden from the examiner by the hemorrhage[3] (Table 2.5.2). In the USEIR, 53% of eyes with trauma-related hyphema showed some type of posterior pathology; in the HEIR, the rate reached 61%.

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3 The ophthalmologist may not even suspect that any posterior segment pathology is present.

Table 2.5.1 The incidence of hyphema (%) in various types of trauma in the USEIR database

Type of trauma	Percentage of eyes with hyphema
Contusion	14
Rupture	21
Penetrating trauma	25
Perforating trauma	6
IOFB injury	4
Overall in open globe injuries	45

Based on injuries

Table 2.5.2 The incidence of various posterior segment pathologies (%) in eyes with hyphema in the USEIR database

Pathology	Incidence if hyphema caused by contusion	Incidence if hyphema is caused by open globe trauma
Vitreous hemorrhage	40	52
Retinal break[a]	6	6
Retinal detachment	8	19
Macular hole	1	0.002
Choroidal rupture	9	5
Total no. of cases	672	2196

Based on 2878 injuries

[a]Includes any type of peripheral break, e.g., dialysis, tear, hole

2.5.3.2.1.1 Consequences[4]

- Reduced visual acuity, which may drop to LP even if no other pathology is present [12].

4 See also section 2.5.3.2.1.4.

- Difficulty recognizing coexisting anterior segment abnormalities (e.g., cyclodialysis cleft, IOFB in the angle, angle recession).
- Difficulty recognizing coexisting posterior segment abnormalities (e.g., vitreous hemorrhage, retinal detachment).
- Elevated IOP, occurring in up to a quarter of eyes (see below and Chap. 2.18).
- Corneal blood staining, which can make visualization of intraocular pathologies even more difficult. It interferes with visual rehabilitation (see Fig. 2.2.14) and its effect can last for months. The risk is especially high if the hyphema is total, blood absorption is slow, and the IOP is high. If the endothelium is dysfunctional, blood staining can occur even if the IOP is normal [1]. The dark color of a total hyphema (see below) signals a lack of oxygen in the AC, which represents a risk factor for endothelial damage.
- Formation of posterior synechiae.

2.5.3.2.1.2 Evaluation

Taking a *systemic history* is especially important since hyphema is more common and potentially much more severe in patients with sickle cell disease. In addition, it needs to be known whether the patient suffers from bleeding disorders or is on anticoagulant therapy[5]. The *slit lamp* is the best tool to identify the presence and amount of blood[6] (Table 2.5.3). Ultrasonography, the UBM, and radiological tests may have to be performed to determine whether there is coexisting damage to anterior or posterior segment structures. Laboratory tests should also be ordered if sickle cell disease is suspected (sickle cell preparation, hemoglobin electrophoresis, bleeding tests) or if systemic antifibrinolytic therapy is planned (kidney and liver functions).

5 Although it has not been proven that such therapy increases the risk [5].
6 This is usually not possible if the patient is in bed and the blood cannot settle.

Table 2.5.3 Various methods to describe the size of hyphema

Method	Comment
Millimeters	The height of the pooled blood is given; however, a "12-mm" hyphema is described as total
Percentage	0 if there is no blood in the AC and 100 if a total hyphema is seen
Clock hour	The face of the clock is used to describe the height of the meniscus of the blood at the limbus
Grade	I: <1/3
	II: 1/3–1/2
	III: 1/2 to near total
	IV: Total[a]

[a] Often referred to as eight- or black-ball hyphema [9, 11]. The dark color is caused by deoxygenization of the hemoglobin

2.5.3.2.1.3 Management

Controversial

In eyes with *open globe trauma*, the blood can be evacuated at the time of primary repair. The benefits are that additional pathologies can be visualized early and that blood-related complications may be prevented; the disadvantages are that this increases inflammation and is an unnecessary procedure if the blood would rapidly absorb on its own.[7]

2.5.3.2.1.3.1 Medical Treatment

Medical treatment consists of:

- Cycloplegics/mydriatics to reduce pain and the risk of the posterior synechia formation
- Topical corticosteroids to reduce the inflammation

7 Which is impossible to prognosticate

- Topical and/or oral[8] aminocaproic acid to reduce the risk of rebleeding [10]
- TPA, an fibrinolytic agent (10 µg injected intracamerally)
- Oral antifibrinolytic therapy (tranexamic acid 25 mg/kg 3× daily for 6 days) [13]
- Antiglaucoma treatment as necessary

Controversial

It is not known whether aspirin therapy should be discontinued; the ophthalmologist should directly consult with the patient's treating physician.

2.5.3.2.1.3.2 Complementary Treatment[9]

- No bedrest necessary
- No hospitalization necessary
- No patching necessary

2.5.3.2.1.3.3 Surgical Treatment

Mechanical evacuation of the blood is indicated in either of these two scenarios:[10]

- Spontaenous blood absorption is too slow to allow treatment of a retinal pathology.
- The IOP cannot be medically controlled and corneal blood staining threatens. Surgery is 20 times more likely to be necessary if there is rebleeding [3]. Several surgical techniques are available. The selection is partially based on whether the blood has clotted and partially on surgeon preference.

8 Must not be used by persons having liver or renal disease; side effects are common and include diarrhea and postural hypotension.

9 These recommendations should be reversed if the patient is a noncompliant child or has sickle cell disease or a rebleeding.

10 The intervention is more pressing if the patient has sickle cell disease.

- The initial step is the preparation of a *paracentesis*. To be efficient, and reduce the risk of intra- and postoperative complications, the paracentesis must satisfy several criteria (Fig. 2.5.1a,b). The working paracentesis should be on the temporal side to increase convenience and minimize interference from the patient's nose.
- When the blood is *liquid*, simple irrigation is sufficient. The washout can be accomplished via a single paracentesis or via two.
  - If a *single* paracentesis is used, the irrigation cannula must be relatively small (23 g suffices) to fit the channel *and* to allow fluid[11] to egress (Fig. 2.5.1c). While the cannula is in the AC, it must be angled by the surgeon so as to minimize the risk to the endothelium and to the lens in a phakic eye. The surgeon can use both hands to hold the syringe (5 or 10 ml), and press the lower corneal wound lip down to gape the wound.
  - If *two* paracenteses are used, a larger cannula may be selected; the second paracentesis should be made on the opposite side of the eye where fewer manipulations are required. The surgeon uses a spatula to depress the wound lip here to gape it for easier fluid egress.
- When the blood is *clotted*, it must be evacuated using the vitrectomy probe or a fine forceps. Especially if the vitrectomy probe is used, an AC maintainer (Fig. 2.5.2) must be placed first to avoid collapse of the AC. Extreme caution is needed to prevent injuring the endothelium, lens, or the iris[12]; viscoelastics should *not* be used until the blood has been removed.
- A fairly thorough evacuation of the blood is recommended, but not all circulating red blood cells need to be removed.
- If a rebleeding is detected, it can be halted with viscoelastics and then the source cauterized if vitrectomy instrumentation is available.
- Whether air or viscoelastics needs to be left in the AC at the conclusion of surgery depends on the specifics of the case. The main goal is to

11 A mixture of blood and BSS, used for irrigation.
12 This can cause severe intraoperative bleeding.

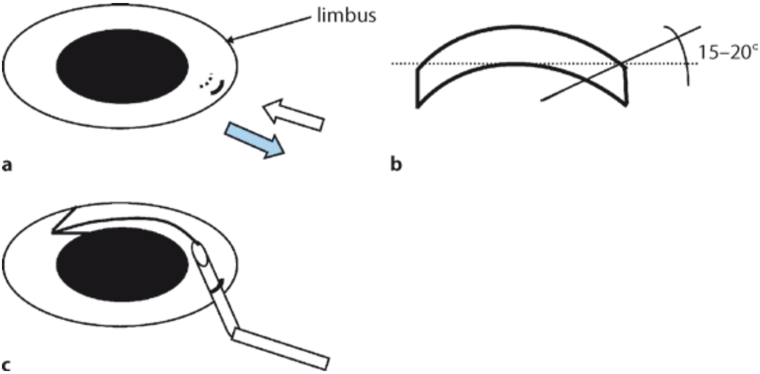

Fig. 2.5.1 The technique of paracentesis and AC irrigation. **a** The eye is held firmly with forceps (not shown here); ideally, the conjunctiva is grasped at a convenient location on the *same* side as the paracentesis: this allows the eye to be held against (*blue arrow*) the force of the MVR (*white arrow*). The MVR blade should be placed slightly central from the limbus to avoid pushing stem cells into the AC and to reduce the risk of synechia formation. The *solid line* shows the slice in the epithelium, the *dotted line* in the endothelium. The channel created by the blade is obviously a slit, yet it allows simultaneous fluid transport in both directions if the irrigation cannula is correctly used.[1] **b** The angle of blade direction is also important: too shallow a path leaves a large scar, limits maneuverability of the instruments introduced through the channel, and causes image distorsion[2] by compressing the cornea; too deep a path also limits instrument maneuverability and makes it less likely that the paracentesis will be self-sealing. An angle of 15–20° allows easy manipulations in the AC while alleviating the need for suturing. **c** The cannula must be kept parallel to the iris (reduce the injury risk both the endothelium the lens in the phakic eye), and its tip is kept over the iris at all times. The jet stream is not too forceful and is roughly parellel with the plane of the iris; the angle is irrigated with a gentle stream. As long as blood flows out from the AC freely, there is little need to modify the cannula's position. If the blood is sticky in certain places, this can usually be "uprooted" with a directly aimed jet stream

[1] i.e., the cannula is gently pushing down on the lower lip of the corneal wound to gape the wound, as described in the text and Fig. 2.5.2.

[2] This is also true for manipulating any instrument inside the AC whether the paracentesis was performed for blood washout or any other purpose.

have the AC reformatted and the IOP restored. If viscoelastics are left behind, the IOP may rise significantly, and prophylactic antiglaucoma treatment with close follow-up is necessary. Air takes longer to absorb from the AC than from the vitreous cavity.

Pearl

If viscoelastics must be left in the AC, use a cohesive, not a dispersive, one (see below). This tends to reduce the risk and length of IOP elevation.

2.5.3.2.1.4 Complications

Complications include:

- Recurrent bleeding. The incidence is between 3 and 26% [13]. The complication rate following a rebleeding is much higher than after the initial hemorrhage. Risk factors include sickle cell disease, being on systemic anticoagulant therapy, and larger initial bleeding.
- Corneal blood staining. This pathology is best recognized with the slit lamp, using high magnification and a narrow beam to find yellowish-brownish discoloration of the posterior cornea. Even though the condition has been reported at low IOP [1], the most important risk factor is a persistently elevated IOP. Patients with elevated IOP must be closely monitored, and surgical intervention should be early if signs of corneal staining appear. If staining has occurred and posterior segment surgery is indicated, TKP vitrectomy (see Chap. 2.15) or endoscopy (see Chap. 2.19) can be performed.
- Glaucoma. Since this is a rather common complication[13] (the incidence is up to 14% with the initial and 25–67% with recurring hemorrhage [13]), gonioscopy should be performed a few weeks after the hemorrhage has disappeared to lower the risk of rebleeding. Chapter 2.18 provides the details of treating eyes with elevated IOP in eyes with hyphema.

13 Elevated IOP in an eye with hyphema is not necessarily the consequence of the hemorrhage; the two may be independent pathologies caused by the same trauma.

2.5.3.2.2 Fibrin, Fibrinous Membranes, and Inflammatory Debris

While small amounts of *fibrin* do not require intervention, larger amounts or fully developed membranes should lead to the consideration of intervention. If surgery is not otherwise planned, 25 μg TPA may be injected intracamerally [4]. If surgery is performed,[14] surgical removal is another viable option.

The membrane is very elastic; it can usually easily be extracted with aspiration (through a paracentesis using a cannula or the vitrectomy probe; see above). If it is possible to completely occlude the cannula's port with the membrane, there is no need for an AC maintainer. To prevent AC collapse, however, it is safer to insert one first.

Alternatively, a fine intravitreal forceps is utilized. The membrane is grasped and gently pulled, then patiently held under traction until it detaches.

Pearl

Cohesion of a *fibrinous membrane* is stronger than its adhesion to the tissues it covers. Under the proper amount of tension, the membrane will break from the tissue, and allow the surgeon to remove it in a single piece.

A thorough irrigation of the AC is also needed to remove the *inflammatory debris* from the angle. Irrigation may have to be repeated throughout surgery, especially in children and in eyes with endophthalmitis.

2.5.3.2.3 Lens

Lens particles floating in the AC represent a serious secondary glaucoma risk as well as an obstacle to visualizing the deeper structures of the eye. Removal of the lens particles is rather urgent. The technique depends primarily on whether vitreous prolapse is present or threatens (see Chap. 2.18).

14 The presence of fibrin alone is almost never an indication by itself.

2.5.3.2.4 Vitreous

If vitreous is present in the AC, two factors determine whether removal is indicated:

- Presence of a corneal wound, which gives convenient access for the vitrectomy probe to be introduced to trim the vitreous. It is especially important not to leave vitreous fibrils to remain attached to the inside of the wound:[15] this is a source of traction and thus a risk factor for retinal detachment.
- The presence and type of secondary complications.
- A luxated lens requires surgery even in a contused eye.
- If the lens is subluxated but there is no corneal touch by the lens or vitreous, intervention is not necessary (see Chap. 2.7).

Recognition of the vitreous in the AC is not necessarily easy;[16] an indirect sign is a deformed pupil that cannot be explained by other reasons. Intraoperative diagnostic tools include air and TA (see below).

Regarding surgical technique:

- An infusion (typically, an AC maintainer) is almost always necessary. As always, the AC maintainer is placed in such a way that its tip it is unable to injure the lens (Fig. 2.5.2). The infusion is opened as the first and removed as the last of the maneuvers.
- A paracentesis is made on the *temporal* side, even if this does not coincide with the surgeon's better (dominant) hand. The vitrectomy probe must be held in the proper plane, and the nose of the patient must not interfere (see above).
- Vitreous that is clearly visible is removed.
- The vitrectomy probe should be held as deep in the AC as possible, and its port should be facing the surgeon to avoid injury to the lens or to the iris.

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15 Irrespective of whether the incarceration occurred as the wound spontaneously closed or it is the result of the surgeon's actions.

16 Pigment dispersion on the vitreous surface is a giveaway.

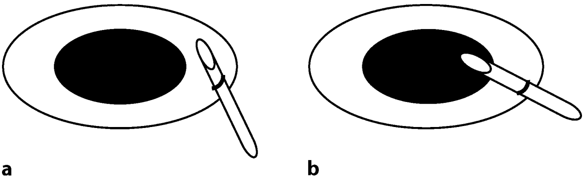

Fig. 2.5.2 The correct and incorrect placement of an AC maintainer in a phakic eye. **a** The correct placement of the cannula has its tip over the iris. Even if the cannula is pushed/pulled during surgery, its tip is unable to injure the lens. **b** The incorrectly placed cannula's tip is over the lens. Should any inadvertent force[1] be applied on the cannula,[2] the lens capsule can easily be breached

[1] e.g., the surgeon's hand, the assistant's instrument, the nurse's manipulation of the drape.

[2] The cannula does not have to be displaced to injure the lens: a downward push of its tip (i.e., elevation of its distal end around the fulcrum represented by the paracentesis wound) is sufficient.

- The cutting should be turned on continually to avoid traction of the peripheral retina via the pulling on the prolapsed vitreous.
- A small amount of TA is injected, which clearly shows any remaining vitreous. Injecting too much of the drug creates a "snowfall" phenomen and extends the surgical time.
- The iris is a great vehicle for demonstrating whether vitreous is still left. If the iris shows undulating movement as the vitrectomy probe is cutting at at area distant from the iris, it shows that vitreous remains adherent to the iris.

In a phakic eye, it is usually impossible to completely remove the vitreous; however, if only a thin layer is left, and it has lost its bridges to the cornea and is severed from the intravitreal vitreous, the risk of tractional retinal detachment is extremely low.

2.5.3.2.5 Air

Occasionally, air is introduced into the AC during the injury or injected during an intraocular injection. An air bubble actually forming inside the eye raises the possibility of infection by gas producing bacteria [2], a potentially leathal infection. Air is usually introduced by the surgeon to:

- Prevent the formation of anterior synechiae or iris prolapse into a wound (although an effective tool and devoid of the risk of IOP elevation, the air reabsorbs in only a few hours[17] or days)
- Determine the presence of certain foreign materials

Pearl

Air is the supreme tool to show the presence of vitreous or viscoelastics in the AC. Under normal circumstances, the air bubble takes on a regular dome shape. If vitreous or viscoelastic is present, the air bubble is deformed.

Removal of an air bubble is rarely necessary, but if deemed so, simple irrigation is sufficient. The eye (patient's head) should be turned so that the paracentesis is at the highest point of the eye. The BSS is injected when the tip of the cannula is *distal* from the wound so that the fluid can esaily push the air bubble outward. If multiple small air bubbles need to be removed, this is best done by injecting *more* air first so that the many small bubbles coalesce into a single large one, which is then easily irrigated out.

2.5.3.3 Viscoelastic Use

Viscoelastics have two distinct features: they can coat and maintain space. As an additional feature, they are also excellent in stopping a hemorrhage[18]:

- *Coating*. This attribute is utilized when the endothelium must be protected during manipulations of the lens or condensation of fluid on the IOL's or capsule's surface must be fought in an air-filled eye. In general,

17 The air bubble's presence is especially short-term if it was introduced during general anesthesia using nitrogen-dioxide.

18 Working as a tamponading agent.

viscoelastics of low viscosity (e.g., Viscoat[19]) are used for this purpose (dispersive viscoelastic).

- *Space tactics*. Viscoelastic materials are incompressible and hard to dislodge. If they are placed underneath a corneal wound, for instance, they tend to stay there and prevent the iris from adhering to the wound; they are also able to counter silicone oil prolapse into the AC irrespective of whether the eye is aphakic, pseudophakic, or phakic.[20] These cohesive or viscous viscoelastics (e.g., Healon[21]) have a much wider use in ocular traumatology, including pre- and even subretinal applications (see Chap. 2.9).
- When a cohesive viscoelastic is injected, it is especially crucial to use a low force[22] to avoid increased resistance ("backfiring") by the material.
- Before injection, a plan must be designed to make viscoelastic use efficient.
- Viscoelastics are not intended to push tissue back into the eye. The material is to be used after the prolapsed tissue has been repositioned (see Chap. 2.4). The viscoelastic should be injected through a paracentesis, not through the original wound.
- When a space is to be created/filled, injection should be started at the most distal point and advanced backwards (i.e., as the surgeon is slowly withdrawing the cannula).
- If the viscoelastic is used for breaking a synechia, it must be kept in mind that the material works indiscriminately: where the tissue breaks is not necessarily where the surgeon wanted it to break.

As mentioned above, viscoelastics are occasionally left in the AC to prevent silicone oil prolapse or synechia formation. The risk of IOP elevation is higher with *less* viscous materials, and they are also more difficult to re-

19 Alcon, Fort Worth, Texas.

20 Prophylactic filling of the AC with a cohesive viscoelastic should be considered in every eye undergoing silicone oil implantation.

21 Advanced Medical Optics, Santa Ana, Calif.

22 Think about a bulldozer instead of a hammer.

move during surgery. Just as when injecting the viscoelastic, the key during viscoelastic removal is to start distally and limit the force with which the BSS is applied.

2.5.3.4 Silicone Oil

- If silicone oil prolapses into the AC in an eye with an intact iris diaphragm, the prolapsed oil eventually breaks off from the large intravitreal bubble, and a single intracameral droplet is formed. This droplet cannot be forced back into the vitreous cavity.
- If the droplet is relative small, does not interfere with the patient's vision, and is mobile,[23] it can be left in situ.
- If the intracameral droplet does need to be removed, two paracenteses are prepared: one for the injection of a viscoelastic and one to drain the silicone oil. Injection of the viscoelastic requires a special technique (see above).
- The surgeon must make sure during the exchange that the silicone oil is in constant contact with the drainage paracentesis; otherwise, the droplet gets "lost," floating to the highest point of the AC. Reestablishing contact between the oil droplet and the paracentesis is not always easy. Inserting a spatula into the AC during drainage in such cases is very helpful. It can press the lower wound lip downwards but also reach into the inside of the silicone oil droplet. If this is achieved, the oil can be completely drained along the spatula even if the droplet itself is not in the immediate vicinity of the paracentesis. The viscoelastic must be left in the AC to prevent further silicone oil prolapse.
- If the silicone oil emulsifies (Fig. 2.5.3), removal becomes more difficult. If possible, the intravitreal oil must be removed first; otherwise, it provides an endless resupply of droplets. The technique of removal does not differ significantly from that described above, but it takes a lot

23 i.e., it does not press against the endothelium continually at the same site.

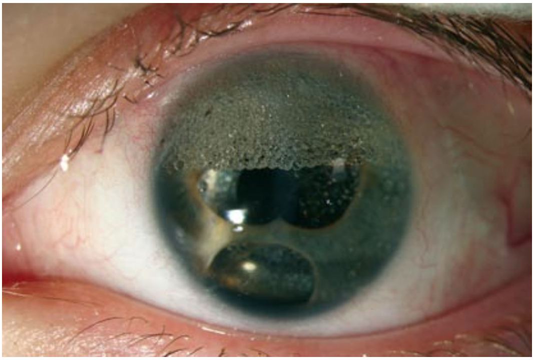

Fig. 2.5.3 Emulsified silicone oil in the AC. The inferior iridectomy is open; the eye is pseudophakic, yet the emulsified silicone oil fills at least 40% of the AC superiorly. Silicone oil bubbles are also seen through the iridectomy to adhere to the posterior capsule (See the text for more details.)

longer to "chase out" all the droplets.[24] The viscoelastic may be removed since no silicone oil resupply is possible.

2.5.3.5 Synechia

An *anterior* synechia is formed when the iris is caught in a corneal/limbal wound or adheres to an area with endothelial damage. A *posterior* synechia is diagnosed when the iris is attached to the lens. The condition is made worse when secondary scarring develops, which may grow into the angle and interfere with aqueous outflow.

Whether surgical intervention is indicated depends on the consequences of the condition; duration of the synechia is another factor to consider.

24 In fact, it is virtually impossible to leave the eye completely bubble-free. It takes many months for all the bubbles to clear through the trabecular meshwork; the IOP must be followed closely.

Cave

A blunt tool is best suited to break acute synechiae, but the blunt instrument can cause major tissue damage if used to deal with a chronic synechia.

Table 2.5.4 shows the recommended treatment modalities for synechiae of various types.

Table 2.5.4 Management of various types of synechiae

Synechia	Comment
Acute anterior	The iris should be freed from the wound before suturing the wound. Freeing is best done with a blunt spatula introduced into the AC through a paracentesis that is both at a distance[1] from the incarceration and at a convenient location. The spatula is used to gently sweep the iris away from wound, pulling it back into the AC. If there is a tendency of iris reprolapse, viscoelastic can be injected from the paracentesis site, leaving a viscoelastic "bolus" underneath the wound
Acute posterior	Dilating (constricting in the rare case of a wide pupil) the pupil with a drug such as intracameral synephrin usually suffices; surgical breaking of the synechia rarely becomes necessary. If mechanical breakage is needed, again the spatula is the optimal tool. Viscoelastic should *not* be used: since it would be injected under the iris, its effects would be blocked from the surgeon's view
Chronic anterior	Intervention solely for the purpose of breaking the synechia is necessary only if the IOP is elevated.[2] Synechiolysis often becomes part of a complex anterior segment reconstruction (Fig. 2.5.3). The tissue to be freed is usually vascularized and a strong scar present; blunt dissection is not an option any more because tissue tearing and severe bleeding threaten. Proper diathermization and prophylactic injection of viscoelastics are recommended first. The tissue is cut with a sharp instrument; there is no need to fully remove it from the cornea to avoid ripping off Descemet's membrane. Careful freeing of the angle is a more important, albeit difficult and somewhat dangerous, part of the procedure; it should be attempted only if the IOP is high and cannot be controlled medically

Table 2.5.4 *(continued)* Management of various types of synechiae

Synechia	Comment
Chronic posterior	Indicated only if the synechia prevents aqueous traffic between the two chambers[3] and laser iridectomy has not been effective. A spatula can be used to very carefully break the connection between the lens capsule and the iris. The risk of breaching the lens capsule is rather high, and this must be understood by the patient before the procedure is undertaken. If the spatula cannot be introduced for the lack of space between the two tissues at the pupillary margin, a peripheral iridectomy can be performed superiorly and the spatula introduced through the iridectomy. This has the additional advantage of being able to break the synechia 360° in a single sweep. Strong anti-inflammatory treatment must be used postoperatively to prevent synechia recurrence, and the pupil must be kept mobile[4]

[1] Typically at 90–180° from the wound if it is limbal; if the wound is more toward the central cornea, the primary factor in determining the paracentesis location is convenience for the surgeon.

[2] Cosmesis may be another indication if the synechia is large; the patient must understand the risks of the procedure before the surgeon consents to the patient's wish.

[3] i.e., an iris bombans is present

[4] i.e., short-acting dilatation is to be used, not atropin; a wide pupil may have to be constricted even though this risks increasing the inflammation

2.5.3.6 Comprehensive Anterior Segment Reconstruction

Several structures of the AC and adjacent tissues may be damaged during the injury, and posttraumatic scarring may make the condition worse. The scar tissue can destroy the cornea and the angle, elevate the IOP, and seriously impede vision (Fig. 2.5.4). Reconstruction of such eyes requires a surgeon skilled in both anterior and posterior segment techniques, ranging from PK to vitrectomy. Chapters 2.1–2.15 and 2.18–2.20 describe various elements of the intervention, which must also be carefully planned.[25]

25 The reconstruction is typically done as a late procedure, the details of which are beyond the scope of this book.

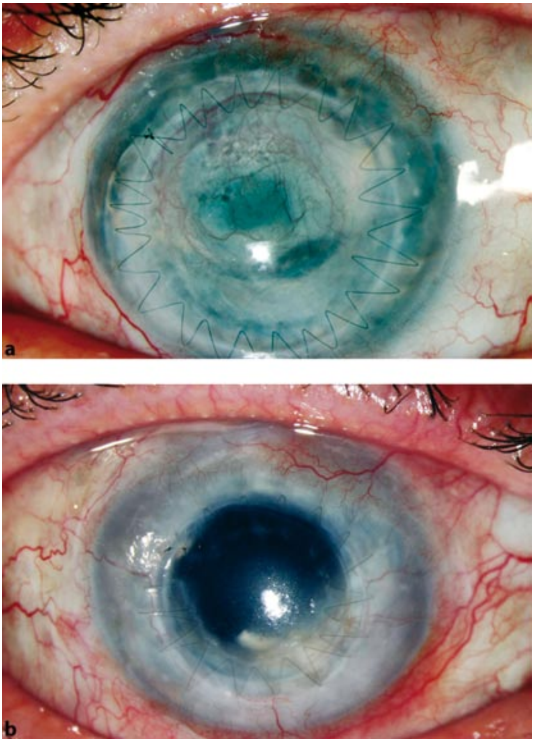

Fig. 2.5.4 Comprehensive anterior segment reconstruction. The patient had bilateral injuries several years ago; multiple surgeries (repeat PK, lens removal, IOL implantation, repeat vitrectomies) have been performed, but visual acuity is LP in both eyes and the IOP is under 8 mmHg. The two eyes look virtually identical. **a** Preoperative image of the right eye. The graft is clear but the peripheral cornea has multiple layers of new vessels. There is a large, vascularized retrocorneal membrane. The iris is barely visible; even its color is difficult to determine. **b** Postoperative image of the left eye. Most of the corneal vessels have been closed. The retrocorneal membrane has been removed. The angle has been freed. The IOL has been respositioned. The vitreous cavity has been lavaged. Visual acuity improved to 20/160, the IOP is 16 mmHg

2.5.3.7 Angle Recession

A condition that often leads to glaucoma, angle recession is discussed in Chap. 2.18.

DO:

- determine whether sickle cell disease has played a role in hyphema development
- prevent corneal blood staining by aggressively bringing the IOP down and by removing the intracameral blood early if staining threatens
- learn the basics of viscoelastic properties and use to maximize their benefits and reduce the risks of their use

DON'T:

- start hyphema removal before planning all aspects of surgery including timing, instrumentation, and wound preparation
- forget that damage to other intraocular structures are very common in eyes with hyphema
- leave vitreous incarcerated into a corneal wound

Summary

The AC has a wide variety of pathologies; in addition to knowing how to deal with each, the surgeon should also learn some basic rules such as space and tissue tactics. Of the major pathologies, hemorrhage has the greatest importance.

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