2.1 Conjunctiva

Ferenc Kuhn

2.1.1 Introduction

The conjunctiva's role is neither visual nor structural, but it does offer protection against chemical agents and FBs with low momentum. It is highly vascularized and therefore its wounds heal rapidly.

2.1.2 Evaluation

The procedure for evaluation is as follows:

- The bulbar conjunctiva is easy to examine with the naked eye, a penlight, or, preferably, the slit lamp.
- The lower fornix is examined by pulling the lid down and having the patient look up. This also allows inspection of the lower palpebral conjunctiva.
- The upper (tarsal) palpebral conjunctiva is more difficult to visualize and requires patient cooperation throughout the entire process.
  - Explain to the patient, especially if it is a child, that no pain will be experienced but that the lack of cooperation may cause discomfort and loss of a few eyelashes.
  - Throughout the process, repeatedly remind the patient to keep looking down with both eyes *open* and that looking up is counterproductive.
  - A long, narrow, rigid object (e.g., instrument handle, match stick, glass rod, or even the finger of an experienced examiner) is necessary (Figs. 2.1.1).


a


b


c

Fig. 2.1.1 Eversion of the upper eyelid. **a** The upper lid is grabbed by the eyelashes; the patient is asked to keep the eye open and look down. **b** The lid is gently pulled downward, a rigid tool (e.g., Desmarres retractor) is used to push down on the upper edge of the tarsus; the lid is then turned upwards until the tarsus "flips," revealing the tarsal conjunctiva. **c** The everted tarsus can easily be held in this position for inspection and intervention unless the patient looks up or wants to close the eye

- The superior fornix is much more difficult to bring into view; it requires double eversion of the lid using a Desmarres lid retractor[1] (see Fig. 3.1.2) and a light source to that can be directed so as to illuminate this hard-to-access area.
- Vital stains can also be used, but their significance is less important for conjunctival than for corneal trauma (see Chap. 2.2).

2.1.3 Specific Injuries

2.1.3.1 Erosion

Loss of the conjunctival epithelium is much less painful than that of the cornea, and healing is fast. When de-epithelization occurs in the context of a chemical injury and is accompanied by ischemia, the condition is extremely serious and requires immediate treatment (see Chaps. 1.10, 3.1). Stains can be useful in showing the defect in the epithelium (Table 2.2.3).

If there is pain associated with an erosion, antibiotic ointment can be applied as a lubricant.

1 Once the lid is everted, the Desmarres everter is inserted between the lid and the globe. The maneuver is not easy, requires close patient cooperation, and access to this narrow space is still limited and difficult.

2.1.3.2 Chemosis

Conjunctival edema is a pathology that may accompany virtually any type of eye trauma. While itself insignificant, it may point toward severe conditions such as chemical injury, endophthalmitis, orbital hemorrhage, or carotid–cavernous fistula. The severity of the underlying pathology and the degree of chemosis are not necessarily proportional.

There is no specific treatment: the causative condition must be addressed. Corticosteroids may help reduce the edema.

2.1.3.3 Emphysema

Intra- or subconjunctival air can originate from external sources such as a ruptured pressurized air hose. More commonly, however, the source is a paranasal sinus in the presence of an orbital fracture [3]. Blowing the nose exacerbates the emphysema and should strongly be discouraged until the etiology is treated (see Chap. 1.9).

Removal of the air is not necessary; once the resupply is cut off, the air quickly absorbs.

2.1.3.4 Hemorrhage

Being a richly vascularized tissue that quickly responds to virtually any noxa by dilatation of the blood vessels, intra- and subconjunctival hemorrhages commonly occur in trauma (Fig. 2.1.2). The etiology and significance varies and includes:

- Spontaneous ("idiopathic")
- Systemic conditions (e.g., physical strain;[2] hypertension [1]; amyloidosis)
- Minor trauma such as (inadvertent) rubbing of the eye
- Major injury

2 Especially in the context of a Valsalva maneuver (see Chapter 3.3).

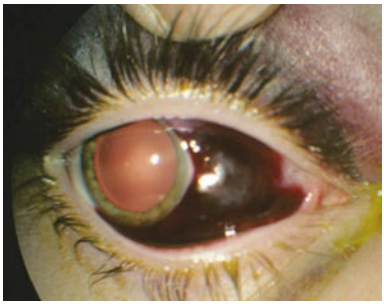

Fig. 2.1.2 Thick subconjunctival hemorrhage. The patient sustained a fist injury. The appearance of the blood raises suspicion that a scleral rupture may also have occurred, especially because the IOP is 7 mmHg; however, the lid hemorrhage is a telling sign that at least some of the force was blocked by the orbital bones. The visual acuity is good, there is excellent red reflex, and the subconjunctival hemorrhage itself affects a limited area. All of these indications point to a closed globe injury. In this case a detailed fundus examination is possible to conduct and will determine whether an occult rupture is present

The significance of the condition lies not in the presence of blood, which absorbs spontaneously and without adverse consequences.[3] The real danger is a thick layer of blood concealing an underlying wound (occult scleral rupture; see Chaps. 2.3, 2.12).

The condition itself does not require treatment.

2.1.3.5 Foreign Body

Superficial objects are usually easy to recognize and remove.[4] Virtually any tool can be used, including the tip of finger or the edge of a preferably wet-

3 Even if the conspicuous discoloration, which can persist for weeks and change color with time, may be disturbing to some people.

4 If superglue is the object, it generally does not stick to a wet surface. If it did stick, it is impossible to remove nonsurgically but the glue patch will spontaneously detach in a few days. Whether surgical removal is indicated depends on how rough its surface is and how much complaint it causes.

ted, clean napkin. The FBs embedded deeper require some type of a sharp instrument and often topical anesthesia as well.

Pearl

Anesthetizing a small area of the conjunctiva is best done not with drops but a moisturized cotton-tipped applicator held over the area for a minute.

- If the FB is lodged in the upper fornix, recognition may be delayed[5] and removal difficult. The most common object to be involved is the wing of an insect.
- Sharp objects on the upper tarsal conjunctiva cause the most pain since they scratch the cornea with each blink; their removal brings tremendous relief to the patient.
- The FB may be subconjunctival and thus harder to find. If it is inert and does not cause symptoms, it can be left in situ. Spontaneously FB delivery can also occur with time.

2.1.3.6 Wound

Regardless of the type of agent, the conjunctival wound is always a laceration.[6] The conjunctiva is elastic and mobile and therefore very resistant to trauma from blunt objects [6]. The wound has important management implications related to the entire globe (Chap. 2.11), and it may warn the ophthalmologist of an underlying pathology such as a clear wound with or without the presence of an IOFB (see Fig. 2.13.1).

- Small conjunctival wounds need not be closed. Cleansing, disinfection, and short-term antibiotic treatment suffice.

5 The symptoms may not present early; even a granuloma may develop before the patient seeks medical help.

6 I.e., even if the eye sustained a rupture, the conjunctiva itself is not ruptured but torn due a shearing force.

- Larger wounds require closure. Suturing of the conjunctiva is easy, but *proper* suturing requires recognition of certain characteristics that are unique to the conjunctiva. This is especially important if the wound is at or near the limbus.
- In most cases, the conjunctiva remains attached to the underlying Tenon' capsule and the two are treated as if being a single layer.
- The conjunctiva is anchored at the limbus and to a much lesser degree over the extraocular muscles, but the tissue is extremely mobile everywhere else.[7]
- The conjunctiva does not offer resistance against manipulation or needle introduction.[8] Advancing the tissue edge to where it needs to be and threading it with the needle are easily accomplished.
- In elderly patients, the conjunctiva is often thin and very fragile. Extreme caution must be exercised to avoid tearing it, which makes closure increasingly all the more difficult.

Pearl

If the conjunctival dissection is done with a blunt instrument, it is the tissue itself that determines where the cleavage plane of the dissection occurs; if a sharp instrument is used, the surgeon determines the cleavage plane. Blunt dissection is convenient if no subconjunctival scarring is present; in eyes that have undergone previous surgery, such as vitrectomy or especially scleral buckling, sharp dissection may be advantageous to avoid scleral or muscle injury.

- Because the tissue is so mobile, care must be taken to avoid overtightening the knot: if the knot is made too tight,[9] it will fold the conjunctiva

7 Except in areas of previous injury or surgery where scar tissue has formed.
8 Except in areas of previous injury or surgery where scar tissue has formed.
9 One method to prevent overtightening is to make the initial throw a triple one and leave it relatively loosely tightened to avoid tissue flip; the second and third, single throws are made tight (see Chapter 2.2 for further details on knot preparation) to lock the knot.

over. Although this does not interfere with the success of the "watertightness" of wound, it does result in a change of the overall configuration of the conjunctiva. The surface will never be even and smooth: a small prominence will remain there unless this "bump" is later excised.

- Thin (9 or 8/0) absorbable sutures[10] are sufficient; *vicryl* is the most widely used material today.
- It makes clinical sense to use numerous sutures: the relatively loose, absorbable sutures may fall out prematurely or get accidentally removed by the patient who rubs his eye. Extra sutures are especially beneficial if the wound is at the limbus; this is the area most important to properly cover (see above).
- Prior to closure, the sclera must be thoroughly inspected (see Chaps. 2.11, 2.12).

Cave

The scleral wound may be located at a significant distance from the conjunctival tear.

- Other methods are also available to close the conjunctival wound: a bipolar diathermy probe or fibrin glue [7].

Pearl

The conjunctiva is able to properly heal even if left unsutured. If torn at the limbus in a phakic eye's rupture and the patient goes untreated for a few days, the conjunctiva spontaneously reattaches at the limbus. The conjunctival scar is not conspicuous, and the disappearance of the crystalline lens (found neither inside the eye nor subconjunctivally) appears as a mystery to the unsuspecting ophthalmologist.

10 e.g., chromic or plain gut, vicryl.

2.1.3.7 Ischemia and Necrosis

This is the most significant pathology of the conjunctiva: a stoppage in the perilimbal blood flow eliminates the major nutrient supply to the cornea [5]. Immediate rinsing is crucial in the management [2]. (See Chap. 3.1 for a complete list of to-do's.)

Recent data give new support to the old clinical observation that subconjunctival injection of the patient's own blood has therapeutic benefit [4].

DO:

- learn the unique characteristics of conjunctival behavior to aid in properly closing its wounds
- irrigate the ocular surface immediately after a chemical injury

DON'T:

- fail to open the conjunctiva with thick hemorrhage if presence of an occult rupture cannot otherwise be excluded

Summary

Most conjunctival injuries are not significant, and only those that are caused by a chemical agent have long-term consequences. It is critical to determine whether a scleral rupture is present underneath a subconjunctival hemorrhage.

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