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Bleb-Related Problems After Glaucoma Filtering Surgery

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Learning Objectives: *After reading this lesson, the participant should be able to:*
1. Recall bleb-related problems that may develop after glaucoma surgery.
2. Describe the clinical characteristics of bleb-related problems that occur after glaucoma surgery.
3. Describe the treatment options for bleb-related problems after glaucoma surgery.

Since the first descriptions of trabeculectomy as a surgical treatment for glaucoma were published in the 1960s, the surgical techniques have improved, and better instruments and adjunctive pharmacologic therapy have become available. A small proportion of patients with glaucoma surgically treated with trabeculectomy will develop complications.[1,2] Many of these complications after trabeculectomy are related to the bleb, which is the intended destination for aqueous flowing from the anterior chamber through the sclerostomy.

Bleb-related complications may compromise the success rate of the trabeculectomy, interfering with intraocular pressure (IOP) control and with final visual acuity. These complications may occur early (within 3 months of surgery) or late (more than 3 months postoperatively) in the postoperative course, and they may have different effects on the IOP, causing it to be low, normal, or elevated (Table 1). Prompt and effective recognition and management of these complications are fundamental for a better prognosis with improved IOP control and visual acuity.[2]

Bleb Characteristics

Several classification systems are available for bleb description,[3] but none is in widespread use by clinicians. Filtering blebs can be described in terms of elevation, extension, wall thickness, and vascularization. A normal, healthy bleb will be elevated, diffuse, thin, and avascular. These characteristics are related to better IOP control and higher trabeculectomy success rate.[1] Any alteration of these characteristics may impact the surgical prognosis and may be considered a bleb-related complication.

Wound healing is the main variable in maintaining a healthy and functioning bleb. Increased ocular inflammation, secondary glaucoma, combined procedures, previous filtration surgery, long-term therapy with multiple topical antiglaucoma drugs, and young age may increase the wound healing response, decreasing the surgical success rate.[4] Failure to use antifibrosis drugs may decrease the likelihood of surgical success in patients who are at risk for trabeculectomy failure. Full-thickness procedures are related to thin-walled blebs,[5] and there is no difference in surgical success between the limbus- or fornix-based conjunctival flap.[6]

Leaking Blebs

Leaking blebs can be divided into two groups: early-onset and late-onset leaks. Early-onset leaks develop within 3 months after the surgery and are related to wound closure and healing; late-onset leaks can occur at any later time during the postoperative course and are related to thin-walled and avascular blebs.[2]

Adjunctive pharmacological therapy with antifibrotic agents, such as mitomycin C (MMC) and 5-fluorouracil (5-FU), is common. The reported late bleb leakage rate with perioperative MMC varies from 1.8%[7] to 10%[8]; with 5-FU, the late leakage rate reaches 7%.[9] The late leakage incidence with perioperative use of MMC and 5-FU is 3.7% and 1.4%, respectively.[10] Oozing, which also is

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Table 1. Intraocular Pressure Levels Commonly Associated With Bleb-Related Complications

Hypotony
Leaking blebs
Traumatic bleb leaks
Infected blebs
Overfiltering blebs
Normal intraocular pressure
Dysthetic blebs
Dissecting blebs
Overhanging blebs
Elevated intraocular pressure
Encapsulated blebs
Failing blebs

observed with thin-walled avascular blebs, may reach an incidence of 11.9%.[11] Other risk factors for bleb leakage and oozing include full-thickness filtration, position of the bleb, exposed bleb, argon laser suture lysis, and exposed scleral flap sutures.[1]

Clinically, the patient may report increased tearing, blurred vision, or both. The patient may be asymptomatic, however, with bleb leakage detected only on Seidel testing. In this test, concentrated fluorescein is placed on the bleb, which then is visualized during cobalt blue slit-lamp examination seeking dilution of the fluorescein caused by the aqueous flow. Fluorescein solutions used for applanation tonometry may not be concentrated sufficiently to visualize leaks. A higher concentration can be achieved by using 2% fluorescein solution or by applying a sterile fluorescein strip directly over the bleb after the instillation of anesthetic eye drops. This test should be performed at every postoperative examination to ensure the continued integrity of the bleb (Figure 1). Although oozing is not considered true leakage, it may precede a bleb leak.[11] In addition, hypotony may be observed in patients with bleb leakage, but it also can be a sign of overfiltration, choroidal effusion, or ciliary cleft.[1,2]

Treatment of Early-Onset Bleb Leaks

Prompt treatment of an early-onset bleb leak is recommended to prevent bleb failure, flat anterior chamber, cataract formation, corneal decompensation, synechiae, choroidal effusions, macular edema, and bleb-related infections.[1,12]

Clinical observation and topical antibiotics may be sufficient for small, early-onset bleb leaks, especially those around sutures or close to the wounds. Aqueous streaming from a bleb leak may indicate the need for additional intervention. Aqueous production suppressants such as carbonic anhydrase inhibitors or beta-blockers may help to reduce the flow through the fistula, allowing it to heal. A reduction in the dosage of corticosteroids may permit the inflammatory process to heal the leaking defect. Both of these interventions may increase the failure rate of the trabeculectomy, however.[1,13]

Tamponade therapy also is an option in these cases; torpedo patching,[13] contact lenses,[14] and use of a Simmons shell[15,16] may be used. Of the tamponade techniques, contact lenses probably are the most commonly used option when treating early postoperative bleb leaks. When using bandage contact lenses, topical antibiotics are administered, and the contact lens diameter should be big enough to cover the leaking area. Sterile hypopyon, corneal edema and infiltrates can be observed. Patching can be used for 24 to 48 hours

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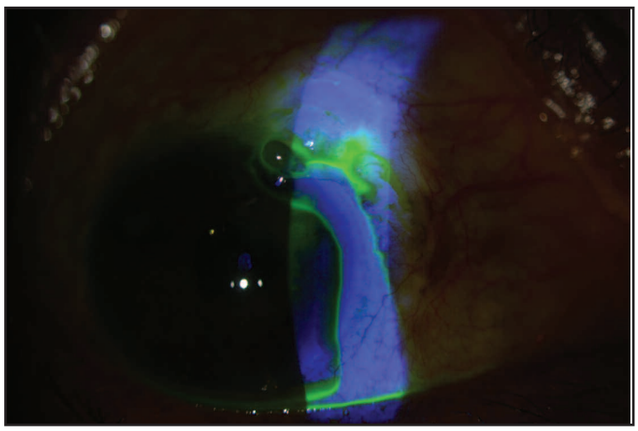

Figure 1. Positive Seidel test in a patient with a late-onset bleb leak.

with a small, folded gauze compressing the surgical site through the eyelid, but the patient should remove the patch before sleep. The Simmons shell may be effective in patients with intense leakage and a shallow chamber, when the platform is positioned directly compressing the leaking area. However, use of the Simmons shell is becoming less common because of the tendency of the shell to cause patient discomfort. Additionally, advances in treatment may have made it less necessary to compress the sclerostomy with the Simmons shell because of less-frequent flat chambers with suturing of the trabeculectomy flap, laser suture lysis, and the use of viscoelastic agents to reform the anterior chamber as a temporizing measure. All of these tamponading treatments require close follow-up because of higher risk of infection.[1,12]

The most effective procedure for early-onset bleb leakage is resuturing of the bleb, especially if the bleb is flat or if the anterior chamber is shallow. It is important to avoid iatrogenic trauma to the conjunctiva when suturing the bleb. A short 10–0 nylon, 9–0 Vicryl, or 10–0 Biosorb suture on a tapered needle is the recommended suture material.[2] The suturing procedure may be performed at the slit lamp, in the minor procedure room, or in the operating room, depending on the location of the leak and the amount of suturing required.

Treatment for Late-Onset Bleb Leaks

Management of a late-onset leaking bleb includes conservative treatment with medications; autologous blood injection; laser therapy (argon, Holmium, or Nd:YAG); cyanoacrylate or fibrin glue; or surgical revision.

Conservative treatment with antibiotics and aqueous suppressants with clinical observation is appropriate in most cases. Nevertheless, because late leakage is related to thin and avascular conjunctiva, the success rate of conservative treatment is low, and leakage often recurs.[17]

Autologous blood injection is performed using a peri- or intrableb technique to induce thickening of the bleb wall. Peribleb injection is considered safer, but the mechanism is not clearly understood. It is hypothesized that an accumulation of plasma proteins and inflammatory cells on the surrounding conjunctiva diffuses to the leaking bleb, inducing healing.[18–22] The success rate of autologous blood injection in the management of overfiltering and leaking blebs has been reported to be from 28% to 58.3%.[18,20] Complications related to intrableb blood injection include recurrent leak, IOP spikes, reflux of blood into the anterior chamber, intraocular inflammation, and endophthalmitis. Increased IOP after this procedure may improve visual acuity in chronic hypotony or hypotony maculopathy.[17,20] Wise[21] hypothesized that in the intrableb technique, fibrin and erythrocytes first obstruct fluid flow through the overfiltering bleb, and then the whole blood provides cells capable of fibroblastic transformation to replace inactivated Tenon's capsule cells. Multiple injections can be done, but surgical treatment may be considered as leakage recurs.[2,17]

Autologous blood injection can be performed easily at the slit lamp, or in the operating room on selected cases (e.g., uncooperative individuals). In the office, after instillation of topical antibiotic and anesthetic, a lid speculum is inserted and 0.1 to 0.3 mL of blood is injected into the bleb. To reach the intrableb space, a 30-gauge needle mounted on a syringe containing autologous venous blood is introduced into the subconjunctival space 5 to 10 mm away from the bleb, gently advancing toward it, until the needle tip is present within the bleb. Blood is injected slowly and continuously until the necessary amount of blood has been instilled in the bleb. At the conclusion of the procedure, additional topical antibiotic is administered and a Seidel test is performed.[20] Viscoelastic can be injected into the anterior chamber first via a paracentesis to prevent hyphema, but usually this is not necessary. Blood also can be injected around the bleb only, or added to an intrableb injection.[2]

A thin, avascular filtering bleb with friable conjunctiva is more likely to fail autologous blood injection treatment, and surgical revision should be considered. Surgical management includes excision of the ischemic bleb. To recover the bleb area, different techniques may apply: free conjunctival autograft from the same or the fellow eye; rotating or sliding conjunctival flap; amniotic membrane transplantation; or advancement of the conjunctiva with a conjunctival relaxing incision in the fornix.[23–26] The choice of which of these surgical techniques to use depends on the size of the excised bleb. Budenz and colleagues[23] reported a persistent bleb leak rate of 8% after conjunctival advancement. This procedure also may increase the failure rate of the preexisting trabeculectomy. In the same study, 50% of patients required medical therapy and 8% needed reoperation for increased IOP.

We most commonly perform conjunctival advancement for small bleb excisions (<3 to 4 mm posterior to the limbus); for larger bleb excisions we prefer autologous conjunctival patch grafts. Free conjunctival graft obtained from the inferior area of the same eye is the preferred technique.[2,17]

Alternative Treatments for Late-Onset Bleb Leaks

Cyanoacrylate and fibrinogen glue are the most commonly used adhesives for repairing late-onset bleb leaks.

Cyanoacrylate is an artificial polymer that forms a plug on the leaking area.[27] Unfortunately, due to its rigid, and thus, irritating, characteristics, soft contact lenses are mandatory, and corneal abrasion, conjunctival holes, injection, and inflammation are common findings. Bleb failure is common after cyanoacrylate use. Fibrinogen glue may be a better option than cyanoacrylate because it can be applied directly to the leaking area or injected subconjunctivally around the bleb; however, its characteristics and success rate are similar to those of autologous blood injection.[28–30]

Laser application with holmium, argon, or Nd:YAG laser is another possible treatment. It is theorized that the thermal injury to the conjunctiva induces inflammation, which will improve bleb healing. However, the use of laser therapy has been limited because of its disappointing success rate and iatrogenic leakage.[1,2,31]

Amniotic membrane transplantation may be considered as an alternative to conjunctival advancement or transplantation.[23,26] However, Budenz and colleagues[23] reported that this procedure had a much lower success rate than did conjunctival advancement.

Traumatic Bleb Leaks

Although in some cases minimal trauma can produce bleb rupture,[32,33] most traumatic bleb leaks are associated with significant blunt trauma. A ruptured bleb following significant trauma invariably is large and accompanied by other ocular problems. Like any ruptured globe, the bleb leak should be closed emergently, and a comprehensive surgical plan for management of associated ocular injuries or problems usually is required.[2]

Bleb-Related Endophthalmitis

After glaucoma filtration surgery, ocular infection may affect the subconjunctival space, the anterior segment, and the posterior segment. The infectious process usually spreads in the same sequence, starting with bleb purulence and mild ocular inflammation. A hypopyon may form, increase, and develop into a vitreous infection process (Figure 2). If the infection process is limited to the bleb, it is considered a blebitis,[2] although the intrableb space may be considered an externalization of the anterior chamber, and any infection of the bleb should be observed and treated with extreme caution.[1,12,34–37]

Early-onset bleb-related infection is related to perioperative bacterial inoculation, and its incidence is approximately 0.09%, similar to that of other intraocular surgeries.[35,36] The incidence of delayed-onset bleb-related infection, with or without antifibrotic agents, varies from 0.4% to 17.9% and is related to transconjunctival bacterial migration.[35,38] The reported risk factors include late-onset bleb leak, antifibrotic agent application, a prior episode of blebitis, diabetes mellitus, inferior limbal trabeculectomy, male gender, nasolacrimal duct obstruction, laser suture lysis, bleb needling, young patient age, ocular surface disease, and contact lens use.[12,38,39] Common clinical symptoms include ocular pain, redness, foreign-body sensation, blurred vision, and tearing,

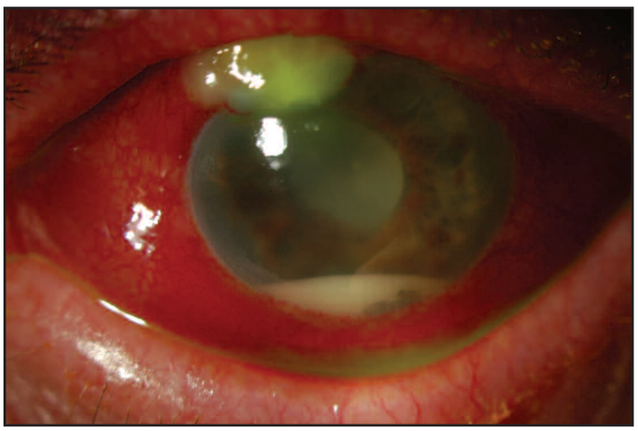

Figure 2. Late-onset blebitis and bleb-related endophthalmitis. The bleb is filled with purulent fluid, the conjunctiva is markedly hyperemic, and there is a hypopyon in the anterior chamber.

usually with a sudden onset.[1,12,35] A positive vitreous culture has been reported in more than 90% of patients with bleb-related endophthalmitis.[2] Streptococcal species are the bacteria most commonly isolated, followed by gram-negative organisms, *Haemophilus influenzae*, and *Staphylococcus* spp. Other reported organisms include *Moraxella* spp., *Enterococcus faecalis*, and *Propionobacterium acnes*.[34,35]

Treatment includes broad-spectrum topical antibiotics (vancomycin and ceftazidime) in patients without vitreous involvement. If the vitreous is infected, immediate hospitalization, vitreous biopsy, and intravitreal antibiotics are required. Intravitreal vancomycin 1.0 mg/0.1 mL and ceftazidime 2.25 mg/0.1 mL, or amikacin 0.4/0.1 mL, are recommended. Use of topical or intravitreal corticosteroids is controversial, but intravitreal dexamethasone 0.4 mg/0.1 mL should be considered. The role of periocular or systemic antibiotics is not well established.[1] After intravitreal therapy, topical antibiotics should be administered. Repeated evaluation is recommended within 24 hours. If clinical deterioration is observed, treatments should be reconsidered according to the results of the vitreous culture.[35,36,40]

Recurrence of infection is uncommon, and long-term antibiotic prophylaxis is not necessary. Partial or total failure of the filtration surgery is a common consequence of a bleb-related infection.[1,35]

Overfiltering Blebs

Overfiltering blebs are a common cause of ocular hypotony without evidence of bleb leak, especially with the application of perioperative antifibrotic agents. Ocular hypotony also may be related to bleb leaks, choroidal detachment, retinal detachment, intraocular inflammation, and cyclodialysis cleft, or aqueous suppressant therapy.[1] Anterior chamber shallowing, hypotony maculopathy, choroidal effusion, and cataract formation may be observed with ocular hypotony due to overfiltrating bleb. Funduscopic examination or ocular ultrasonography should be performed on these patients.[2]

Clinical observation is an option, especially in the early postoperative period, when improvement is more likely to

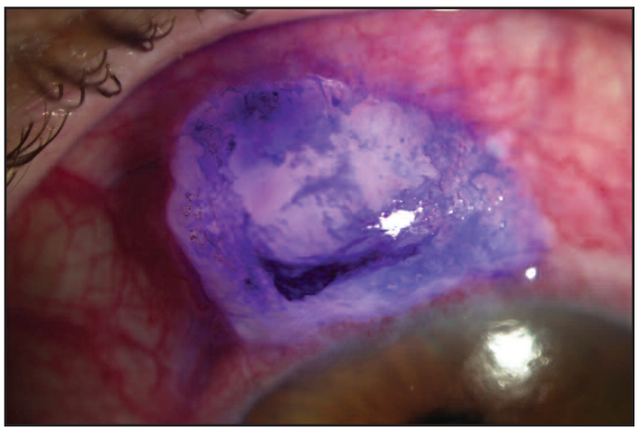

Figure 3. High-domed, dysthetic bleb treated with argon laser to lower the profile of the bleb. The bleb is pretreated with methylene blue applied with a marking pen, to provide a chromophore for absorption of laser energy and shrinkage of the bleb.

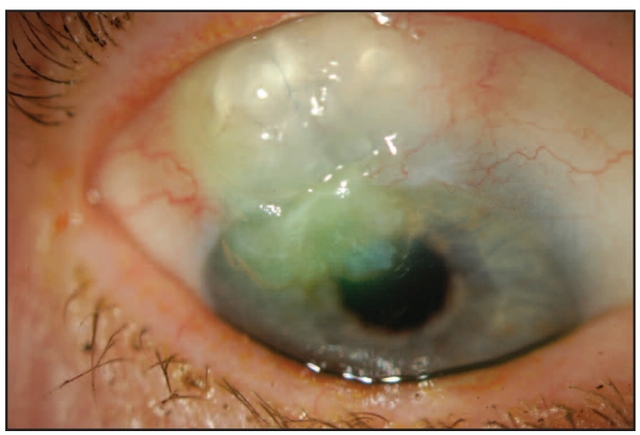

Figure 4. Dissecting, overhanging blebs extending onto the cornea.

occur. Viscoelastics may be used to reform the anterior chamber in some patients, which is mandatory if cornea lens touch is observed. Argon laser photocoagulation, autologous blood injection, compressive patching, and compression suture may be considered if overfiltration persists. Definitive treatment may be achieved with suturing of the scleral flap or bleb revision.[2] Intraoperatively, if scleral melt is observed in the area of the scleral flap or sclerostomy, a patch graft with preserved sclera or pericardium may be required.

Dysthetic and Dissecting Blebs

Filtering blebs usually are asymptomatic, but in some cases, patients may report foreign body sensation, tear bubbles, discomfort, and irritation. These symptoms usually are related to large blebs or blebs that extend to the area between the upper and lower lids.[41] In this situation, dellen formation, punctate keratopathy, induced astigmatism, visual field alterations, and monocular diplopia may be observed.[1,2]

For dysthetic blebs, several techniques may be employed, depending on the particular observed problem.[1] Techniques available to the clinician include autologous blood injection, compression sutures, focal cryotherapy, argon laser shrinkage of bleb with a chromophore such as methylene blue (Figure 3),[41] holmium or Nd:YAG laser,[42] or trichloroacetic acid.[1] Surgical bleb revision may be required in some cases.

In dissecting blebs, conjunctiva may extend onto the cornea, and aqueous humor may dissect between the corneal epithelium and stroma, leading to hydration of the underlying corneal stroma and consequent astigmatism (Figure 4). The resulting bleb on the corneal surface, which may be called an *overhanging bleb*, may cause irritation, tear film disturbances, and blurred vision. Bleb leakage may be observed.[1,2,41] In extreme cases, the bleb may extend to the visual axis, causing decreased visual acuity.

Dissecting blebs may be treated with autologous blood injection and compression sutures, or other techniques. The definitive treatment is partial bleb excision, in which the part of the bleb overlying the cornea is dissected and the bleb is resutured at the limbus.[41] Outcomes after partial bleb excision are good, with a low rate of recurrence of the dissecting bleb.

Encapsulated Blebs

An encapsulated bleb (Figure 5) is an elevated, well-circumscribed, dome-shaped bleb, usually associated with elevated IOP. It develops in response to increased healing activity with the development of a dense connective tissue bleb wall, fibrous connective tissue, and proliferating fibroblasts in the area of the bleb.[43] Bleb encapsulation usually occurs between the third and fourth week postoperatively and is a common cause of failure in the early postoperative period.[1,2,43]

The incidence of bleb encapsulation has been reported to vary from 3% to 29%, but most series have reported an incidence of 10% to 16%. Several risk factors have been described, including previous surgery involving the conjunctiva; long-term use of topical ocular medications (e.g., timolol, pilocarpine); transfer of glove powder during the procedure, young age; and male gender. Intra- or perioperative antifibrotic agent application may prevent bleb encapsulation.[1,2] Clinically, IOP elevation is the most common clinical finding, but bleb elevation may interfere with upper eyelid function, causing dellen, punctate keratitis, astigmatism, and, in some cases, an eyelid mass.[1]

Treatment of Encapsulated Blebs

As time passes, encapsulated blebs may grow thinner and avascular, improving spontaneously. Depending on the severity of glaucomatous damage and the IOP level, however, treatment may be required. Treatment may include antiglaucoma topical medication, topical corticosteroids, digital massage, needling with antifibrotic agents, or capsule excision and surgical revision.[1,44]

Conservative treatment is the most common and most effective initial approach.[1,2,43] Aqueous suppressants for IOP control and topical corticosteroids to inhibit surgical site fibrosis are effective in 90% of cases.[43,45] Digital massage—

transient, constant pressure applied to the globe, 180 degrees away from the bleb, to increase the aqueous flow through the fistula and bleb wall—is effective in 70% to 90% of patients.[1,2] IOP will rebound to premassage levels within 1 to 2 hours after digital massage, but there may be a long-term benefit as well. The short-term effect of digital massage may be assessed in clinic, and the patient's ability to perform this technique correctly should be assessed at clinic visits. Patients can perform digital massage daily at home, because complications are rare.[2,32]

When conservative treatment fails, needling and surgical revision, both with the administration of subconjunctival antifibrotic agents, should be considered. The bleb needling success rate varies from 70% to 90% in properly selected cases, although 93% of patients will need glaucoma medications.[2,45]

Needling can be performed easily at the slit lamp, using topical anesthesia or subconjunctival lidocaine injection. Topical apraclonidine 0.5% or phenylephrine 2.5% improves visualization and minimizes bleeding after vasoconstriction. Balanced salt solution may be injected into the subconjunctival space adjacent to the bleb to separate the conjunctiva from the sclera and bleb wall, which may minimize the chance of trauma to the conjunctiva. Injection of balanced salt solution, however, may reduce visualization of the aqueous flow and elevation of the conjunctiva around the encapsulated bleb during the procedure. For good visualization during the procedure, an eyelid speculum and patient collaboration with maintaining steady downward gaze are important. A 25- to 27-gauge needle or a Ziegler-type needle knife is introduced under the conjunctiva, 5 to 10 mm away from the bleb. With side-to-side movements, the fibrous wall around the bleb is incised, and the conjunctiva around the encapsulated area is elevated with the aqueous flow.

After the bleb needling procedure, topical antibiotics are administered and the Seidel test is performed. Subconjunctival 5-FU (5 mg in 0.1 mL) may be administered, depending on the clinician's preferences. Complications from bleb needling include hypotony, shallow anterior chamber, subconjunctival hemorrhage, hyphema, iatrogenic conjunctival perforation, and choroidal detachment.[1,2,46]

Surgical revision for bleb encapsulation consists of a limbal-based conjunctival flap approach under retrobulbar or general anesthesia. A conjunctival incision is located 1 to 2 mm posterior to the superior margin of the encapsulated bleb. The conjunctiva is separated from the underlying fibrous tissue with blunt scissor dissection. The pseudocyst is isolated and excised from the sclera, and the conjunctival flap is closed with a running suture. Adjunctive subconjunctival injection of 5-FU (5 mg) should be considered. Topical or subconjunctival antibiotics and corticosteroids are administered after surgical revision.[2]

Alternative Treatments for Encapsulated Blebs

Transconjunctival application of Nd:YAG laser pulses for revision of late-failing filtration blebs have an initial success rate of 80%, but long-term success has not been determined. An Abraham peripheral iridotomy lens is placed directly over the bleb. The laser is aimed through the translucent portion of the bleb onto the fibrous wall with laser parameters of 2.0 to 7.0 mJ, single pulse mode. Conjunctival buttonhole and leakage are the common complications.[2,47]

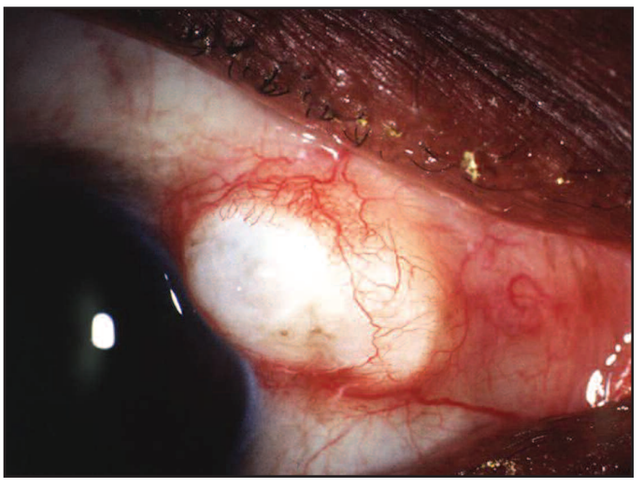

Figure 5. Encapsulated bleb, with localized, elevated bleb and surrounding hyperemia.

Figure 6. In a bleb that has failed to function, the conjunctiva is immobile and tightly adherent to the underlying episcleral and scleral tissue.

Bleb Failure

Bleb failure causes inadequate IOP control due to obstruction of aqueous flow. The failure may be caused by extraocular, scleral, or intraocular factors. Early bleb failure is observed within the first postoperative month and may be related to internal sclerostomy obstruction (e.g., blood clot, iris, vitreous, or Descemet's membrane) or episcleral fibrosis. This situation can be reversed with effective therapy targeted to the cause of bleb failure.[1]

Late bleb failure usually is related to subconjunctival and scleral fibrosis. The risk of late failure is increased in African-American patients, young adults, and children. Other risk factors include postoperative subconjunctival hemorrhage, the presence of reactive sutures, secondary glaucoma, aphakia, previous ocular surgery with conjunctival manipulation, and

preexisting ocular inflammation.[1,2] Clinically, the overlying conjunctiva is immobile when assessed at the slit lamp with a moistened cotton-tipped applicator.

Failing blebs are characterized by reduced bleb height, increased bleb wall thickness, vascularization of the bleb, loss of conjunctival microcysts, and elevated IOP (Figure 6). In a failed bleb, the conjunctiva may be flat and tightly adherent to the underlying scleral and episcleral tissue. In these cases, a second filtering procedure or a glaucoma drainage implant should be considered due to the poor prognosis of conservative treatment, needling, or surgical revision.[2]

Summary

Bleb-related problems may occur after glaucoma filtration surgery, but prompt recognition and treatment can avoid further complications and preserve bleb function. Meticulous surgical technique and vigilance for early clinical signs may help to reduce the incidence and morbidity of bleb-related complications after glaucoma filtration surgery.

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1. The most important parameters used to describe a bleb are
   - **A.** pigmentation, extension, wall thickness, and vascularization
   - **B.** elevation, extension, wall thickness, and vascularization
   - **C.** elevation, extension, shape, and vascularization
   - **D.** elevation, pigmentation, wall thickness, and vascularization

2. A healthy filtering bleb is
   - **A.** flat, diffuse, thin, and avascular
   - **B.** elevated, diffuse, thin, and avascular
   - **C.** elevated, diffuse, thick, and avascular
   - **D.** elevated, diffuse, and thin-walled

3. Treatment of early-onset bleb leak may prevent
   - **A.** bleb failure
   - **B.** endophthalmitis
   - **C.** macular edema
   - **D.** all of the above complications

4. All of the following are treatment options for bleb leakage, *except*
   - **A.** clinical observation and topical antibiotics
   - **B.** autologous blood injection
   - **C.** antifibrotic agents
   - **D.** surgical revision

5. Which one of the following complications is less commonly associated with dissecting blebs?
   - **A.** Astigmatism
   - **B.** Bleb failure
   - **C.** Monocular diplopia
   - **D.** Blurred vision

6. Definitive treatment for dissecting blebs usually is provided with
   - **A.** autologous blood injection
   - **B.** argon laser
   - **C.** surgical revision
   - **D.** tissue glue

7. Risk factors associated with bleb-related infections include all of the following, *except*
   - **A.** young patient age
   - **B.** previous uveitis
   - **C.** bleb leakage
   - **D.** nasolacrimal duct obstruction

8. Common clinical findings in bleb-related infections include
   - **A.** ocular pain, bombé iris, blurred vision, and tearing
   - **B.** ocular pain, redness, foreign body sensation, and hypotony maculopathy
   - **C.** ocular pain, redness, shallow chamber, blurred vision, and tearing
   - **D.** ocular pain, redness, foreign body sensation, blurred vision, and tearing

9. Treatment for blebitis in patients without vitreous involvement includes
   - **A.** topical antibiotics
   - **B.** intravitreal corticosteroid injection
   - **C.** intrableb antibiotic injection
   - **D.** surgical drainage of the bleb

10. Failing blebs are characterized by
    - **A.** reduced bleb height
    - **B.** vascularization of the bleb
    - **C.** elevated intraocular pressure
    - **D.** all of the above