Techniques of Bleb Repair

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Filtering bleb-related complications have increased manifold after use of anti metabolites for filtering surgery. Their diagnosis and management is of utmost importance in view of their potentially sight threatening implications. Though there are many conservative treatment modalities like pressure bandage, bandage contact lens, autologous serum & laser treatment etc that can be tried in early small leaks, a large leak with shallow anterior chamber or hypotonous maculopathy warrants surgical repair of the bleb. Various techniques of bleb repair like conjunctival advancement or graft, scleral or pericardium patch and amniotic membrane graft are described that can be tried according to the nature of the leak, surrounding healthy tissue or presence of fistula or suture tract. The results of bleb repair as reported by various studies are encouraging so we can conclude that proper intervention at the proper time can help in preventing vision-threatening complications.

Abstract

Introduction
With the advent of use of anti metabolites like mitomycin-C and 5-fluorouracil in filtering surgery, although there is an increase in the life of the filtering bleb, bleb-associated complications have also increased manifold. These complications can also be seen without their use; like in congenital glaucoma and high myopia as the conjunctiva covering the bleb is relatively thin and friable and becomes more cystic when it comes in contact with aqueous humor. There can be early onset (within days) or late onset bleb related complications. As the potential complications from bleb can vary from astigmatism, cosmetic appearance, dellen formation, superficial punctuate keratopathy, foreign body sensation to far more dreaded complications like bleb related endophthalmitis, serous choroidal detachment, persistent hypotonous maculopathy, blebitis and perforation, the diagnosis, management and if needed repair of filtering bleb is important for an ophthalmologist as to treat it at the right point.

Many conservative management modalities can be tried initially. The convenience of these methods lies in the ease of doing these procedures without the aid of microscope and non-invasive nature.

a. Aqueous suppressants: Anti-glaucoma medications like carbonic anhydrase inhibitors or beta blockers can be given to reduce aqueous humor production that helps in reducing aqueous flow from the leak.

b. Pressure Bandage: Pressure bandage provides tamponade to the ocular surface reducing aqueous leak.

c. Simmon’s shell: Ruderman et al used Simmon’s tamponade shell to treat five patients with leaking filtering blebs and had success in four of the cases.

d. Bandage Contact Lens: Large soft bandage contact lens of 14 mm diameter can be successfully used for 2-3 weeks in cases of bleb leak.

e. Autologous Serum: Matsuo et al demonstrated successful resolution of late-onset bleb leak using topical application of autologous serum four times in a day for 12 weeks.

f. Trichloroacetic acid: Gehring et al showed effectiveness of topical trichloroacetic acid in cases of bleb leak.

g. Laser treatment: Henis et al demonstrated successful resolution of bleb leak by use of argon laser on fluorescein stained conjunctival bleb.

h. Compression Sutures: Haynes and Alward used transconjunctival compression sutures with autologous blood injection for treating leaking trabeculectomy blebs causing post-filtration hypotonous maculopathy.

i. Cyanoacrylate glue: Haslinda et al demonstrated use of cyanoacrylate tissue adhesive glue used topically to resolve bleb leak. The only complication reported with this method is corneal abrasion as reported by Zaltra and Weilder in three of their cases.

If the complications are sight threatening or the patient is not responding to conservative management, definitive surgical management has to be considered. Even if the anterior chamber is maintained with normal intraocular pressure, definitive treatment of oozing bleb is needed as it can act as a source for microbes to gain access inside and cause endophthalmitis. The aim of treatment should be to eliminate bleb leak or its impending perforation while preserving the patency of bleb and maintaining target intra-ocular pressure. In this article, a concise review of the various management modalities of bleb repair and their clinical outcomes is presented.

Diagnosing alteration in bleb morphology & function
The Indiana bleb appearance grading scale-provides us the guidelines to assess the filtering bleb post trabeculectomy. A functioning bleb is avascular, cystic, moderately elevated, non-leaking, thin-walled and covered with the upper eyelid, with no pain to the patient. Any bleb has to be graded post-operatively and noted down in the patient’s case sheet as bleb metamorphosis takes place within weeks of its formation. An over-filtering or leaking bleb has to be differentiated from early post-operative hypotony with Seidel’s test. Also it is important to differentiate sweating of bleb from a leaking bleb. Sweating of bleb is a transconjunctival oozing of aqueous from the bleb that can present as pearls coming from the bleb site during Seidel’s test. The site of bleb leak is usually the thinnest and most avascular area of the bleb.
The most elevated area of the bleb can also be an area of leakage as the risk of trauma by frequent blinking is high. Any overhanging bleb resulting in astigmatism or dellen formation, a thin overhanging bleb over the cornea that can potentially rupture or a leaking bleb not responding to conservative management modalities is an indication for surgical bleb repair. If the leak confirmed on Seidel’s test is leading to hypotony and flat or shallow anterior chamber, the surgical management should be undertaken promptly. In cases where a leak is found during routine examination and there are no signs of inflammation and the anterior chamber is formed, conservative management options can be used.

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Many surgical modalities are employed depending upon the condition of filtering bleb. Because of the friable nature of conjunctiva of the bleb, fresh conjunctiva from the adjacent site or from distant site may be required. In some cases, because of a thin friable or necrosed partial thickness scleral flap, additional reinforcing tissue to give strength to the underlying structures is needed. The decision of employing the technique depends on the bleb, the ocular surface, surgeon’s choice and careful assessment of the consequences of repair as it may not function as well in the post operative period. The surface area of the bleb and health of the surrounding tissue are important considerations for deciding the technique to be used for repair. In the subsequent discussion, the salient features of the commonly used surgical techniques for bleb repair are presented.

1. Conjunctival Advancement
This method of bleb repair has been practiced widely in small to medium sized blebs. Tannebaum et al reviewed the clinical outcome of 49 patients who underwent bleb repair with conjunctival advancement method and found successful clinical outcome in all except three of the patients that required additional bleb repair surgery and four that had uncontrolled IOP requiring additional glaucoma surgery. In this method, peritomy is done on both the sides of conjunctiva extending it by 1-2 clock hours from the bleb. The site is inspected for any scleral fistula, buttonhole or suture tract. Dissection of bleb from the healthy conjunctiva is done. A relaxing incision is given posteriorly to facilitate the advancement of conjunctiva and avoid tension. The limitation of the area that can be covered with conjunctival pedical flap is the major drawback of this technique. Also, the titration of applied sutures has to be done so as to avoid too tight flaps or buttonholing. Evaluation of underlying scleral flap should be an integral part of bleb revision, particularly in those cases where there is persistent hypotony in the absence of frank leak. The original bleb is preserved in cases where there is no necrosis of the sclera flap and there is a functioning bleb.

2. Conjunctival graft
When there is a large, avascular and thin bleb that has a high risk of perforation or a persistent hypotony/ hypotonous maculopathy post trabeculectomy, conjunctival autograft from the inferior fornix with or without Tenon’s layer can be taken and after denudation of the thinned out avascular flap, the conjunctiva can be sutured with 8-0 vicryl sutures at the place. Also this can be used in cases where there is scarring in the conjunctiva where construction of pedicle flap is difficult. Anterior chamber paracentesis is done and a visco-elastic is put to avoid collapse of the chamber during surgery. Denudation of avascular & thin-walled bleb tissue is done. The amount of conjunctiva to be taken for the flap should be 1-2 mm more than the area of the flap as there can be shrinkage of the conjunctiva post operatively. It is advisable to mark the area where the graft has to be put with gentian violet. Continuous or interrupted 8-0 vicryl sutures are put to hold the conjunctival graft in place. After the graft is secured, anterior chamber wash is done with Balanced Salt solution and titration of the bleb is done to avoid scar tissue formation, as it can ultimately lead to bleb failure. Antibiotic steroid eye drops are given in the postoperative treatment regimen. As the graft is very friable initially, make sure that the eye is protected by accidental trauma or rubbing. Schnyder et al evaluated the clinical outcome of bleb repair in 16 patients and showed resolution of the indication of bleb repair in most of the patients, though they also noted need for anti glaucoma medications in a few patients in the post operative period.

3. Pericardial graft
In some patients in whom trabeculectomy surgery with anti-mitotics has been done, the partial thickness scleral flap becomes friable and necrotic with uveal show at the place of thinnest sclera. This type of scleral flap requires support in the form of external tissue. Also, the presence of scleral fistula causing persistent hypotony with hypotonous maculopathy needs the support of reinforcing material. In these cases, human pericardial graft over the area of scleral thinning or absence can be used and secured with a 10-0 monofilament nylon suture. Melo et al used pericardial graft in 19 patients during bleb excision and conjunctival advancement and found 83 % qualitative success rate in their study.

4. Amniotic membrane
Amniotic membranes promote epithelialization with anti-fibrotic effects and can be used to promote healing in bleb repair. Amniotic membrane transplantation seems to be a good option for repair of bleb to prevent further destruction of already compromised ocular surface. It can be sutured or glued over the surface of the bleb using tissue adhesive. Lan-Hsing Chuang et al used it in exuberant bleb with conjunctival advancement and showed encouraging results in 10 month follow up period.

5. Sclera
Donor sclera or reversed scleral flap from the surrounding healthy sclera can be used as the reinforcing material in cases of friable necrosed partial
thickness scleral flaps. The donor sclera can be used as such or made into half thickness by a crescent blade and is sutured at the place of friable scleral tissue. Sharma et al described a technique of partial thickness newly constructed scleral flap in the vicinity of the necrosed sclera, which can be upturned and sutured at the place by a 10-0 monofilament nylon suture. Authors have reported gradual increase of IOP with gradual resolution of signs of hypotony and gain in vision.

6. Autologous free Tenon’s graft
   Kawai et al\(^2\) described the use of free Tenon’s graft in cases of post-trabeculectomy severe hypotony due to a scleral defect. The avascular bleb conjunctiva and melted sclera were excised. Autologous Tenon’s graft was separated from the underlying sclera of appropriate size and sutured to the sclera with 10-0 nylon sutures. A layer of amniotic membrane graft was applied over the exposed sclera. At three months post-operative period, vascularization of the graft and stabilization of IOP with resolution of symptoms was seen.

It has been seen that the bleb formed after surgical repair is thicker and vascularization is more. Intraocular Pressure can be slightly more in the initial post-operative period. The vascularization starts from the edges of the graft and initially the graft is paler at the centre. Post operative visits should include assessment of the suture tracts, position of graft, Seidel’s test, vascularization and IOP measurement. The patient should be seen once a week for at least three weeks to assess the bleb morphology and graft uptake. The success of bleb repair is evaluated by resolution of the indication for which it is done, with maintenance of intra ocular pressure in the absence of glaucoma surgery. There may be a need for starting antiglaucoma medications after surgery as there can be rise in intra-ocular pressure.\(^15\) There can be post-operative retraction and would dehisence in autologous conjunctival graft repair. In view of predictable and good results of bleb repair and potential sight threatening complications of the leaking or overfiltering bleb, it is advisable to proceed with surgical management within the appropriate time.

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