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Case series
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Scleral patch with amniotic membrane for tube exposure of glaucoma drainage device in a Malaysian tertiary eye centre

Koay Jiah Bou[1,2], Shakira **Jeffrey**[1], Farrah **Ja'afar**[1], Jemaima **Che Hamzah**[2]

[1]Department of Ophthalmology, Hospital Sultanah Bahiyah, Alor Setar, Kedah, Malaysia; [2]Department of Ophthalmology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia

Abstract

Background: Glaucoma drainage device (GDD) implantation can cause serious complications such as hypotony, tube exposure, and endophthalmitis. This study illustrates the management of tube exposure.
Case series: In primary surgery, all GDD tubes were covered with a donor scleral or a pericardial flap. All cases manifested with a non-leaking conjunctival dehiscence. One eye developed exogenous endophthalmitis which resolved with antibiotic treatment. Another initially had failures with different graft materials and methods, ultimately requiring a scleral patch. A scleral patch was used to cover the exposed tube, further enclosed by a double-layered amniotic membrane using inlay and overlay grafting method. Postoperatively, instillation of autologous serum eyedrops was commenced to promote conjunctival epithelialization. All eyes epithelialized successfully to cover the scleral patch. On the other hand, another developed new conjunctival erosion and ultimately required a new GDD implantation.
Conclusion: A scleral patch graft and a double-layer amniotic membrane transplant supplemented with autologous serum eye drops may be considered in the management of GDD tube exposure.

Keywords: autologous serum eye drops, glaucoma drainage device, scleral patch, tube exposure

Correspondence: Koay Jiah Bou, Department of Ophthalmology, Hospital Sultanah Bahiyah, Km 6, Jalan Langgar, Bandar Alor Setar, 05460 Alor Setar, Kedah, Malaysia.
E-mail: jiahbou@gmail.com

Rawatan dengan graf sklera dan membran amniotik untuk tiub terdedah glaucoma drainage device di pusat mata tertiari Malaysia

Abstrak

Latar belakang: Pemasangan glaucoma drainage device (GDD) boleh menyebabkan komplikasi serius seperti hipotoni, pendedahan tiub dan jangkitan kuman di dalam mata (endophthalmitis). Pengajian ini menggambarkan pengurusan untuk pendedahan tiub.
Siri kes: Semasa pembedahan primer, tiub GDD ditutupi dengan graf sklera penderma atau pericardial flap. Dalam setiap kes, lapisan konjunktiva di atas tiub menjadi renggang tetapi tidak bocor. Satu kes mengalami komplikasi jangkitan kuman di dalam mata (endophthalmitis) dan sembuh dengan rawatan antibiotik. Satu kes lagi mula-mula gagal dibaiki dengan pelbagai cara dan bahan dan akhirnya dibaiki dengan graf sklera. Teknik ini menggunakan graf sklera untuk menutupi tiub yang terdedah, dan dua lapisan membran amniotik di atas dengan cara inlay dan overlay. Selepas pembedahan, titisan mata autologous serum dimulakan untuk menggalakkan perkembangan epitelium konjunktiva. Proses epitelialisasi lapisan konjuktiva berjaya untuk menutup graf sklera. Selain itu, satu mata lagi mengalami hakisan konjuktiva yang baru dan memerlukan pemasangan GDD baru.
Kesimpulan: Graf sklera dan dua lapisan membran amniotik dengan bekalan titisan mata autologous serum boleh dipertimbangkan dalam rawatan untuk tiub terdedah GDD.

Kata kunci: graf sklera, pendedahan tiub, titisan mata autologous serum

Introduction

Glaucoma drainage device (GDD) implantation is an effective tool in the surgical management of intractable glaucoma, especially in cases which have failed trabeculectomy or high risk is anticipated in trabeculectomy.[1,2] Tube or plate exposure is one of the serious complications of GDD implantation and requires immediate intervention due to the risk of ocular infection.[1,3] In this case series we detail the management of 3 tube exposure cases.

Case presentation

Case 1

A 30-year-old man manifested with conjunctival dehiscence overlying the GDD tube in his right eye during routine review. He was diagnosed with Vogt-Koyanagi-Harada disease as a teenager and had a long-standing history of bilateral angle-closure glaucoma secondary to chronic uveitis. He underwent cataract surgery in the right eye with bilateral band keratopathy chelation, followed by bilateral sequential GDD implantation. During the primary GDD surgery in the right eye 15 years ago, the tube was secured with a mattress suture and covered with a pericardial patch.

On examination, the conjunctival defect measured 7.5 mm in length x 3 mm in width along the tube. There was no evidence of infection. He was treated with a donor scleral patch graft to cover the exposure and a double-layer amniotic membrane transplant. Despite purse string nylon 10-0 sutures to secure the graft, the amniotic membrane dislodged after a week due to loosened sutures. Subsequently, he had an amniotic membrane grafting sutured similarly with additional simple interrupted sutures and commenced on autologous serum eye drops postoperatively.

The scleral patch was initially in place with good overlying epithelialization but dislodged after 4 months, again due loosened sutures. Hence, a second repair using a scleral patch was performed with the same method. The scleral graft survived with good epithelialization after five months and remained till date. Photographs before and after repair are shown in Figure 1.

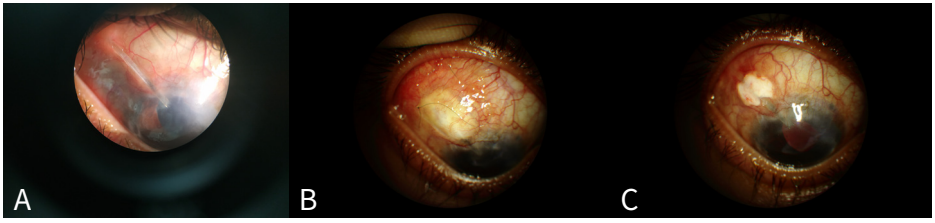

Fig. 1. Anterior segment photographs of Case 1. *(A)* Before repair. *(B)* Three days after repair. *(C)* Five months after repair.

Case 2

A 36-year-old man with bilateral advanced primary open-angle glaucoma had a conjunctival wound breakdown in the right eye 6 weeks after GDD implantation that had been covered with a pericardial patch. He underwent multiple ophthalmic surgeries previously in the right eye, including cataract surgery, trabeculectomy, and of GDD tube revision involving removal of tube ligature for underdrainage 2 weeks postoperatively. On examination, the dehiscence measured 4.5 mm in length x 3.5 mm in width, with surrounding healthy conjunctiva. An attempt to repair began with a thick conjunctival-Tenon's autograft harvested from the inferior fornix of the ipsilateral

eye that failed after 2 weeks. When he developed uncontrolled intraocular pressure in virtue of tube blockage, the GDD tube was repositioned and a tube extender was added. During the procedure, the tube was covered with a corneal patch. The graft failed 3 weeks later, following which he received a scleral patch and amniotic membrane implantation. The graft was completely enclosed by epithelium after 6 months.

Four years later, the patient had another exposed area after a failed penetrating keratoplasty for corneal decompensation. It was managed with a second donor scleral patch and a larger amniotic membrane using the same technique, supplemented with autologous serum eye drop postoperatively. Nevertheless, it also failed as the superficial layer of amniotic membrane unexpectedly broke down after 2 weeks. The tube had a new leak from the joint at the tube extender, resulting in persistent hypotony. Hence, the tube was explanted and another GDD was implanted. Postoperatively, autologous serum eye drop was commenced. Until the time of writing, patient did not experience new issues.

Case 3

After failed trabeculectomies, a 64-year-old woman with bilateral primary open-angle glaucoma underwent bilateral GDD implantation and covered with a donor scleral patch. Her right eye was complicated with exogenous endophthalmitis due to tube exposure 9 years later. She experienced sudden blurring of vision and floaters. Examination of the right eye found a conjunctival defect measuring 7 mm in length x 3.5 mm in width with anterior chamber reaction and vitritis. Clinically, she improved with antibiotic therapy and the defect was covered with a donor scleral patch and double-layered amniotic membrane graft. She did not proceed for autologous serum eye drop production due to an underlying medical condition. Epithelialization was successful after 7 months and the graft remained after 2 years. Photographs before and after repair are shown in Figure 2.

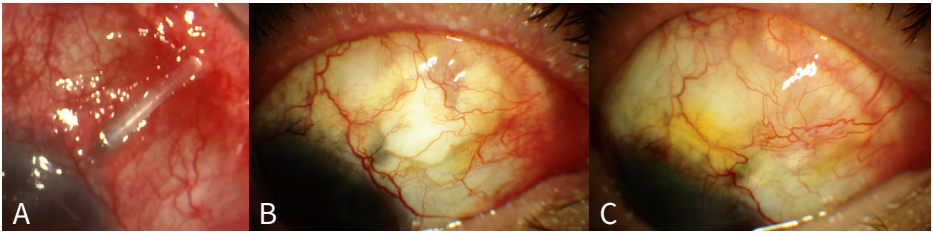

Fig. 2. Anterior segment photographs of Case 3. *(A)* Before repair. *(B)* Three months after repair. *(C)* Seven months after repair.

Discussion

Tube exposure occurs at a rate of approximately 5%,[1] mostly reported to occur 1 to 2 years after GDD implantation.[2,4] Possible risk factors for tube exposure include prior ophthalmic surgeries, neovascular glaucoma, younger age, and inflammation.[2,4-5] Thompson *et al.* suggested recurrent tube exposures occur at a higher rate at 44%, which is 7 times more common than initial exposure in their study.[6] They found Caucasian race and non-scleral patch grafts to be risk factors for earlier recurrent tube exposure. Levinson *et al.* described a lower rate of exposure in scleral patch grafts in primary surgery as compared to non-scleral patch grafts.[3]

Direct closure of tube aqueous shunt erosion carries a higher risk of re-exposure.[7,8] This was experienced in our case which required a patch graft after 2 weeks.

An alternate strategy to repair with a lamellar corneal patch graft, further covered with an autologous conjunctival graft or oral buccal mucous membrane, has been described.[9] Rootman *et al.* reported a successful rate of 83% in lamellar corneal patch grafts with buccal membrane.[10] This method is not performed in our centre due to poor accessibility to the graft materials.

Scleral patch and amniotic membrane transplant

Ainsworth *et al.* successfully managed tube exposure using a scleral patch with an additional double-layered amniotic membrane graft.[8] Similarly, it has been suggested that scleral grafts protect against recurrence.[6] Case 1 had an initial dislodgement of the amniotic membrane and a sequential dislodgement of the scleral patch. This was possibly due to loosened sutures, which were performed by an inexperienced trainee during the primary repair. Hence, during second revision, the patch graft was more firmly secured. On the other hand, Case 2 had previously undergone procedures with different graft materials, followed by a scleral graft coupled with amniotic membrane that lasted for 4 years. It was postulated that Case 2 had a relatively tight orbit or an anteriorly located globe. In virtue of the anatomical limitations, the first GDD plate was placed more anteriorly, 6 mm from the limbus, leading to more frictions against the upper eyelid.

In our centre, counjuctival autografts and corneal grafts have been previously performed but scleral grafts have become the method of choice in recent years. During the procedure, a donor scleral graft is harvested and soaked in gentamicin solution. After preparation, it is used to cover the exposed tube and then anchored to the host sclera.

Subsequently, the scleral patch is enclosed by a complex of a fresh double layer of amniotic membrane and host conjunctiva, shown in Figure 3. As the amniotic membrane has 2 surfaces, *i.e.*, an epithelial side and a stromal side, its orientation is important to act as a scaffold for conjunctival epithelial growth. Identification of the surfaces is based on the texture and appearance. The epithelial side appears shiny while the stromal side is sticky.

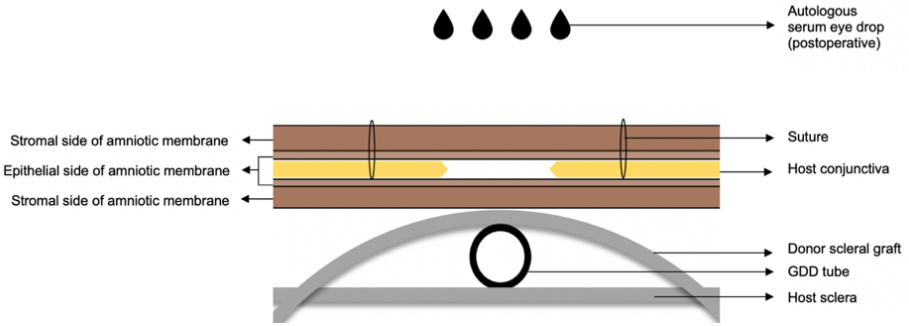

Fig. 3. Schematic diagram of an amniotic membrane inlay and overlay grafting.

In this amniotic membrane inlay and overlay grafting, the first membrane is inserted beneath a host conjunctival defect, while a larger second membrane overlies all grafts. The epithelial side of the first amniotic membrane faces up while the second faces down to meet the host conjunctiva (Fig. 3). This is also known as the sandwich method. On the other hand, the stromal face of the first amniotic membrane faces down toward the scleral patch, whereas the second faces up. A non-absorbable suture secured the superficial layers, including amniotic membrane and conjunctiva, using the purse string method.

Autologous serum eye drops

Autologous serum eye drops are produced from donor blood and are ultra-filtrated for serum. They are then individually packed into small vials for each use. All are kept in the freezer for longer preservation. As autologous serum eye drops are packed with growth factors, they are known to promote growth of epithelial cells.

Autologous serum eye drops have been described as a substitute for natural tears in ocular surface disorders. They require a full or partial blood donation of a patient who is in good health. Its content varies from one person to another but generally contains a variety of epitheliotrophic factors, including growth factors that are beneficial in healing.[11] It is useful for ocular surface reconstruction after graft surgery. Patients with graft failure after a penetrating keratoplasty improved significantly with undiluted autologous serum eye drops.[12] It has been reported that an amniotic membrane graft alone could be sufficient for re-epithelialisation.[8] In the authors' opinion, autologous serum eye drops should complement the surgery whenever possible to promote epithelial regrowth.

Conclusion

Complications of GDD tube exteriorisation are potentially blinding if not treated promptly. A scleral patch graft and a double-layered amniotic membrane transplant supplemented with autologous serum eye drops is a promising method for the management of GDD tube exposure.

Declarations

Informed consent

The patients have provided the informed consent for the publication of the data and images.

Competing interests

None

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None

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None

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