British Microbiology Research Journal
17(2): 1-5, 2016, Article no.BMRJ.28289
ISSN: 2231-0886, NLM ID: 101608140

SCIENCEDOMAIN *international*
www.sciencedomain.org

Recurrent Glaucoma Drainage Device Erosion Associated with Occult Infection with Biofilm-producing Organisms

Imran Masood[1,2*], Peter Shah[2,3,4,5], Michael Benjamin[6], Adonis El Salloukh[1] and Freda Sii[2,3]

[1]Birmingham and Midland Eye Centre, Sandwell and West Birmingham Hospitals NHS Trust, Birmingham, UK.
[2]Birmingham Institute for Glaucoma Research, Institute of Translational Medicine, Birmingham, UK.
[3]University Hospitals Birmingham NHS Foundation Trust, Birmingham, UK.
[4]University College London, Moorfields Eye Hospital NHS Foundation Trust and UCL Institute of Ophthalmology, London, UK.
[5]University of Wolverhampton, Wolverhampton, UK.
[6]The Royal Wolverhampton NHS Trust, Wolverhampton, UK.

Authors' contributions

This work was carried out in collaboration between all authors. Author IM designed the study and performed the repair surgeries on the patient. Author MB wrote the first draft of the manuscript. Authors MB and AES managed the literature searches. Authors IM, PS and FS were involved in editing and proof-reading. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BMRJ/2016/28289
Editor(s):
(1) Laleh Naraghi, Plant Disease Research Department, Iranian Research Institute of Plant Protection, Tehran, Iran.
(2) Hung-Jen Liu, Distinguished Professor, Institute of Molecular Biology, National Chung Hsing University, Taiwan.
Reviewers:
(1) Italo Giuffre, Catholic University of Roma, Rome, Italy.
(2) Robert Feldman, University of Texas Health Science Center Houston, USA.
(3) Dominika Wróbel-Dudzińska, Medical University, Lublin, Poland.
Complete Peer review History: http://www.sciencedomain.org/review-history/16408

Case Report

Received 13th July 2016
Accepted 9th September 2016
Published 1st October 2016

ABSTRACT

Aim: We report the first case of recurrent erosion of a glaucoma drainage device (GDD) associated with chronic infection with biofilm-producing bacterial organisms.
Presentation of Case: A 68-year-old Caucasian female was referred to a tertiary glaucoma service with uncontrolled left inflammatory glaucoma and cataract in association with Fuchs

**Corresponding author: E-mail: imranmasood777@gmail.com;*

Heterochromic Iridocyclitis. Combined glaucoma drainage device (GDD) implantation and phacoemulsification cataract surgery was performed. Fourteen months post-operatively, the patient presented with recurrent GDD erosion requiring multiple ocular surface repairs over the next 12 months. The device was finally explanted and sent for microbiological analysis after all surgical strategies to control the refractory erosions were unsuccessful.

Discussion: Cultures of the GDD were positive for *Streptococcus parasanguis* and *Rothia dentocarisoa*; organisms commonly found in the oral flora. *S. parasanguis* is known to form biofilm and is a common cause of late prosthetic valve endocarditis. Both organisms were sensitive to chloramphenicol, and the patient responded to topical chloramphenicol therapy with good final vision and intraocular pressure control.

Conclusion: Mechanical factors are often used to explain GDD erosion. This case demonstrates that in recurrent GDD erosion, occult chronic infection, particularly with biofilm-producing organisms, should be considered in the differential diagnosis. Surgical repair of the erosion may have a low chance of success in occult or chronic infection and definitive GDD explantation may be required. With the current trend towards earlier and more frequent GDD implantation in glaucoma, it is likely that this problem will increase in prevalence.

Keywords: Biofilm; complications; erosion; glaucoma drainage device; infection.

ABBREVIATIONS

GDD : Glaucoma Drainage Device.
IOP : Intraocular Pressure.

1. INTRODUCTION

Glaucoma is the commonest cause of irreversible blindness in the world. The main risk factor for this sight threatening optic neuropathy is raised intra-ocular pressure (IOP). Intraocular pressure can be controlled with topical medication but failing this, these patients require surgery to divert the aqueous humour externally from the anterior chamber into the sub-Tenon's space surrounding the globe.

Glaucoma drainage devices (GDDs), as shown in Fig. 1, are made of smooth, tumbled-polished, silicone. They are being increasingly used in external glaucoma filtration surgery [1,2]. However, GDDs are associated with long-term complications, including erosion and extrusion of the device through the conjunctival tissue. Extrusion has traditionally been assumed to occur in association with local mechanical factors, such as device movement or local ocular surface problems. Although chronic low-grade infection may be a factor in GDD erosion, there is little data to support this hypothesis, with a lack of published microbiological data in this area [1-5].

We describe a case of recurrent GDD erosion requiring explantation. The device was sent for microbiological analysis and culture. Two organisms commonly found in flora of the mouth and implicated in prosthetic valve endocarditis were isolated.

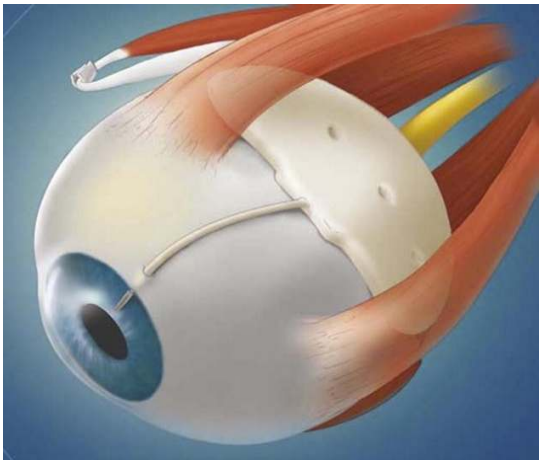

Fig. 1. A Baerveldt glaucoma drainage device *in situ* connected to the anterior chamber

2. PRESENTATION OF CASE

A 68-year-old Caucasian female was referred to a tertiary glaucoma service with a diagnosis of uncontrolled inflammatory glaucoma and cataract in association with Fuchs Heterochromic Iridocyclitis in the left eye. Best-corrected visual acuity at presentation was 6/12 in the left eye and 6/6 in the right eye. The IOP in the left eye was 24 mmHg on a combination of a topical prostaglandin analogue, beta-blocker and carbonic anhydrase inhibitor. The IOP in the normal right eye was 15 mmHg on no medical

therapy. Optic nerve vertical cup to disc ratios were 0.8 in the left eye and 0.4 in the right eye.

Combined GDD implantation with a Baerveldt 350 and phacoemulsification cataract surgery was performed. This particular implant is made from smooth, tumble-polished, pliable silicone plate material. The plate area is 350mm^2 and has 4 fenestrations to allow for ingrowth of fibrous tissue to limit the height of the drainage bleb, thus reducing the incidence of ocular motility disorders. The Baerveldt 350 GDD was selected to give the optimum chance of long-term IOP control [6] in the presence of chronic inflammatory eye disease. The GDD was placed in the supero-temporal quadrant of the sub-Tenon's space and the tube was covered with a donor lamellar scleral graft. At the end of surgery, subconjunctival injection of cefuroxime and betamethasone was given in the inferior fornix.

Post-operative treatment included topical dexamethasone 0.1% 6 times a day and topical chloramphenicol 0.5% 4 times a day. The initial post-operative course was uncomplicated with a visual acuity of 6/9 and IOP of 20 mmHg off glaucoma medication. At 3 months post-operatively, the IOP was well-controlled at 18 mmHg off glaucoma medication, with minimal anterior segment inflammation. The vision was stable at 6/9. However at 4 months post surgery, an increase in anterior chamber inflammation was noted and a tapering short course of topical steroid was initiated, with rapid reduction in anterior chamber activity. Over the next 10 months there were several further episodes of anterior chamber inflammation, each of which partially resolved with short courses of topical steroid therapy.

Fourteen months after the original GDD surgery the patient experienced supero-temporal ocular pain and was noted to have a small area of tube erosion in the supero-temporal quadrant (Fig. 2). The defect was repaired with a patch graft of tutoplast (processed pericardium).

At seventeen months after initial GDD surgery the eye was again painful and examination revealed evidence of recurrent erosion at the previous site. Further surgical repair was performed with a donor lamellar corneal graft. Three further episodes of GDD erosion occurred at the same site over the next 10 months (between 17 and 27 months post initial surgery); each time requiring reconstructive surgery to cover the defect. Throughout this complicated course, there was no evidence of other significant local or systemic factors associated with recurrent erosion. Specifically, there were no signs of ocular surface disease, local tissue shortage, nutritional deficiencies or systemic vasculitis.

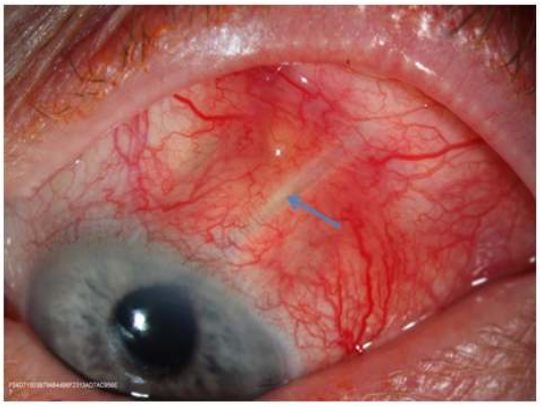

Fig. 2. The tube is eroding through the conjunctiva just to the centre of the tube with surrounding conjunctival injection

At 27 months post initial GDD surgery, the patient presented with a painful left eye and loss of vision. The IOP was 2mmHg and the anterior chamber was flat with corneal oedema and a visual acuity of hand motions. There was a significant leak of aqueous from the conjunctival defect over the GDD. Due to the risk of potentially blinding infectious endophthalmitis in association with the refractory GDD erosion, the GDD was explanted and the filtration area closed with donor scleral patch grafting and conjunctival flap mobilisation. The explanted GDD was sent for microbiological examination. Topical chloramphenicol 0.5% drops were commenced post-operatively and the area rapidly healed with preservation of vision and good IOP control. Topical chloramphenicol was continued for 3 months after GDD removal. Three years following GDD explantation, the vision was stable at 6/9 with IOP well-controlled at 14 mmHg on 3 glaucoma medications. Humphrey visual field analysis of the left eye showed stable visual function with moderate reduction of sensitivity.

Streptococcus parasanguis and *Rothia dentocariosa* were isolated from the Baerveldt GDD. Both organisms were sensitive to

chloramphenicol, cefuroxime, penicillin, erythromycin, clindamycin and vancomycin.

3. DISCUSSION

Glaucoma drainage devices are being increasingly used in the management of refractory glaucoma. Recurrent erosion of a GDD is a significant surgical challenge and this case demonstrates that low-grade chronic infection may be a pathogenic factor. Both organisms isolated from direct culture of the GDD in this case are found in the oral cavity. *S. parasanguis* and *R. dentocariosa* are part of the spectrum of flora associated with dental caries [7,8]. *S. parasanguis* is known to form biofilm and is a common cause of late prosthetic valve endocarditis [7]. It is difficult to be sure of the exact sequence of events in this case. Colonisation of the GDD with biofilm-producing organisms could have occurred at any time post initial surgery, and may have occurred at the time of the initial GDD erosion. This is particularly true when recurrent courses of potent topical steroids have been used to treat intermittent uveitis, with attendant risk of compromising local ocular surface defence mechanisms.

Chronic infection and recurrent erosions associated with a GDD colonised by these organisms may be difficult to treat as the biofilm protects these organisms from the effects of antibiotics [7,9]. As in prosthetic valve endocarditis where removal of the valve is indicated [10], the management of this case required explantation of the colonised GDD.

Pre-operative assessment of dental hygiene and immune status may reduce the risk of intra- and post-operative implant colonisation by oral flora and subsequent chronic infection. A high index of suspicion of low-grade infection is required in cases of recurrent GDD erosion.

4. CONCLUSION

To our knowledge, this is the first reported case of recurrent erosion of a GDD associated with chronic infection with a biofilm-producing bacteria. In cases of recurrent erosion, infective causes, particularly by biofilm-producing organisms, should be considered in the differential diagnosis. Surgical repair may have a low chance of success in occult and chronic infection and definitive GDD explantation may be required. With the current trend to earlier and more frequent GDD implantation in glaucoma, it is likely that this problem will increase in prevalence. Whilst our observation of occult colonisation of the GDD with biofilm-producing organisms does not prove causality in GDD erosion, this possibility should be borne in mind when managing such challenging cases.

CONSENT

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Minckler D, Vedula SS, Li T, Mathew M, Ayyala R, Francis B. Aqueous shunts for glaucoma. Cochrane Database of Systematic Reviews. 2006;2. Art. No.: CD004918.
   DOI: 10.1002/14651858.CD004918.pub2
2. Muir KW, Lim A, Stinnett S, Kuo A, Tseng H, Walsh MM. Risk factors for exposure of glaucoma drainage devices: A retrospective observational study. BMJ Open. 2014;4(5):e004560.
3. Nguyen QH, Budenz DL, Parrish II RK. Complications of Baerveldt glaucoma drainage implants. Arch Ophthalmol. 1998; 116:571-5.
4. Sarkisian Jr SR. Tube shunt complications and their prevention. Curr Opin Ophthalmol. 2009;20:126-30.
5. Hall S, Barton K. Corneal complications of glaucoma surgery. Curr Opin Ophthalmol. 2009;20(2):131-6.
6. Christakis PG, Kalenak JW, Zurakowski D, Tsai JC, Kammer JA, Harasymowycz PJ, Ahmed II. The Ahmed versus Baerveldt study: One-year treatment outcomes. Ophthalmology. 2011;118(11):2180-9.
7. Froeliger EH, Fives-Taylor P. *Streptococcus parasanguis* fimbria-associated adhesin fap1 is required for biofilm formation. Infect Immun. 2001;69: 2512-9.

8. Ruhl S, Eldt A, Melzi H, Reischi U, Cisar JO. Probing of microbial communities for coadhesion partners. Appl Environ Microbiol. 2014;80(21):6583-90.

9. Jhajharia K, Parolia A, Shetty KV, Mehtq LK. Biofilm in endodontics: A review. J Int Soc Prev Community Dent. 2015;5(1):1-5.

10. Head SJ, Mokhles MM, Bogers JJC, Kappetein AP. Surgery in current therapy for infective endocarditis. Vasc Health Risk Manag. 2011;7:255-63.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/16408