American Journal of Ophthalmology Case Reports 29 (2023) 101808

Contents lists available at ScienceDirect

American Journal of Ophthalmology Case Reports

journal homepage: www.ajocasereports.com/

Stromal peeling for deep anterior lamellar keratoplasty in a post-penetrating keratoplasty eye with hematocornea

Vincenzo Scorcia [a], Giuseppe Giannaccare [a,*], Marco Pellegrini [c,d,e], Davide Camposampiero [b], Diego Ponzin [b], Angeli Christy Yu [c,d,e], Massimo Busin [c,d,e]

[a] Department of Ophthalmology, University Magna Graecia of Catanzaro, Catanzaro, Italy
[b] The Veneto Eye Bank Foundation, Venice, Italy
[c] University of Ferrara, Department of Translational Medicine, Ferrara, Italy
[d] Ospedali Privati Forlì "Villa Igea", Department of Ophthalmology, Forlì, Italy
[e] Istituto Internazionale per la Ricerca e Formazione in Oftalmologia, Forlì, Italy

ARTICLE INFO

Keywords:
Corneal neovascularization
Deep anterior lamellar keratoplasty
Hematocornea
Penetrating keratoplasty
Stromal peeling

ABSTRACT

Purpose: To present a case of hematocornea occurring in a post-penetrating keratoplasty (PK) eye and to report the outcomes of deep anterior lamellar keratoplasty (DALK) performed by simple stromal peeling.
Observations: A 45-year-old female presented with hematocornea in the left eye that previously underwent PK 26 months prior for keratoconus. Clinical examination revealed a dense reddish-brown opacity within the PK graft which was associated with deep corneal neovascularization. Over 6 months, intracorneal hemorrhage developed a rust-colored appearance with minimal clearing. DALK was performed using the stromal peeling technique for post-PK eyes. Briefly, a dense partially organized hemorrhage was identified at the natural plane of separation, as confirmed by ex vivo histologic examination; after peeling of the deep corneal stroma and evacuation of the intracorneal hemorrhage, the residual bed appeared akin to pre-Descemet's layer–Descemet membrane–endothelium complex. One year after DALK, the graft remained clear with ECD of 1034 cells/mm^2.
Conclusions and Importance: Intracorneal hemorrhage is a rare but potentially sight-threatening complication following PK. Using the stromal peeling technique, DALK can be attempted to preserve functional endothelium in post-PK eyes. In the presence of a dense intracorneal hemorrhage, the spread of erythrocytic debris within the stroma can guide deep lamellar cleavage.

1. Introduction

Although most often attributed to long-standing traumatic hyphema associated with raised intraocular pressure, corneal blood staining has also been reported to occur in association with hemorrhagic glaucoma, central retinal vein occlusion or intraocular tumors and in rare cases of deep corneal neovascularization secondary to contact lens wear, acne rosacea and interstitial keratitis secondary to syphilis and leprosy.[1–3] While hematocornea may spontaneously resolve, patients with dense corneal staining may require corneal transplantation for visual rehabilitation.[3] We describe herein clinical presentation, surgical management, ex vivo histologic examination and postoperative outcomes of a unique case of hematocornea in a post-penetrating keratoplasty (PK) eye. In particular, the diseased stroma was exchanged by means of simple stromal peeling along a natural plane of separation without performing additional pneumatic-assisted, hydro-assisted, viscoelastic-assisted or manual deep lamellar dissection of the PK graft.

1.1. Case report

A 45-year-old female with Down's syndrome presented with blurring of vision on the left eye for 5 days. Twenty-six months prior, she underwent PK for keratoconus in the same eye which had a 2-year endothelial cell density (ECD) of 1245 cells/mm^2. Ocular and medical history were otherwise unremarkable. Slit lamp microscopy revealed a dense reddish-brown opacity within the 8 mm PK graft which was associated with deep corneal neovascularization (Fig. 1A and B). The periphery of the graft and the recipient cornea appeared otherwise clear. No hyphema was observed and intraocular pressure was within normal limits. B-scan showed no evidence of vitreoretinal abnormalities.

* Corresponding author. University of Magna Græcia, Viale Europa, 88100, Germaneto, Catanzaro, Italy.
E-mail address: giuseppe.giannaccare@unicz.it (G. Giannaccare).

https://doi.org/10.1016/j.ajoc.2023.101808
Received 10 October 2022; Received in revised form 7 January 2023; Accepted 18 January 2023
Available online 22 January 2023

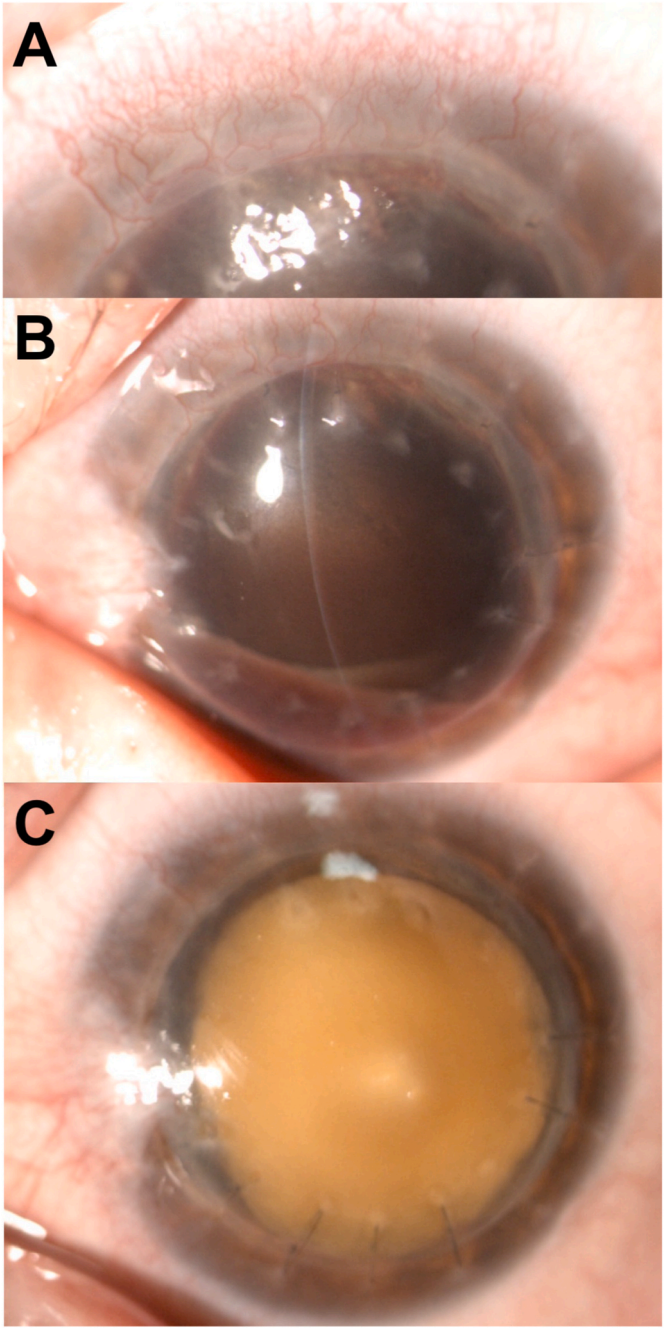

Fig. 1. Slit lamp pictures of the affected eye. At presentation, deep corneal neovascularization extending into the penetrating keratoplasty graft (A) and a dense intracorneal hemorrhage totally obscuring the visual axis (B) were observed. After six months, hematocornea developed a rust-colored appearance and minimal clearing (C).

Corneal hydrops due to advanced keratoconus was present in the fellow eye.

Over six months, the intracorneal hemorrhage developed a rust-colored appearance. However, minimal clearing at the visual axis was observed (Fig. 1C). Thus, deep anterior lamellar keratoplasty (DALK) was performed using the stromal peeling technique for post-PK eyes, as previously described.[4]

Briefly, initial partial-thickness trephination of the recipient cornea was performed outside the PK graft at the 8.25 mm zone. From the base of the trephination, lamellar dissection was performed to create a partial anterior corneal flap. While lifting the anterior corneal flap, blunt tipped Vannas scissors were used to enter and open the old PK wound until a smooth impervious natural plane of separation was identified. Similar to that observed in post-PK eyes with keratoconus, the plane appeared smooth, homogenous and translucent.[4] Using blunt-tipped Vannas scissors, which could be inserted along the identified surgical plane without any resistance, the circumference of the previous PK wound was cut, thereby severing the attachment of the PK trephination scar. The stroma of the PK graft was then simply peeled off from the underlying recipient bed. A dense partially organized hemorrhage at the identified surgical plane (Fig. 2A) was evacuated through irrigation, resulting in a clear recipient bed. An 8.25 mm donor anterior lamellar graft was sutured onto the recipient cornea. Currently, one year after DALK, the graft remained clear with ECD of 1034 cells/mm^2 (Fig. 2B). Postoperative central corneal thickness was 534 μm (Fig. 3). Histologic examination of the excised corneal button stained with hematoxylin-eosin revealed hemorrhage dispersed throughout the subepithelial space, corneal stroma and posterior surface of the graft adjacent to areas of irregular epithelial thinning, absent Bowman's layer and scarce keratocytes in the anterior stroma. The posterior surface of the graft was devoid of Descemet membrane (Fig. 2C).

2. Discussion

Frank intracorneal hemorrhage is a rare but potentially sight-threatening complication following PK. Typically, corneal neovascularization impairs vision through lipid deposition, stromal edema or scarring secondary to immunologic rejection.[5] In this case, however, direct bleeding from deep corneal neovascularization within the stroma of the PK graft resulted in a significant intracorneal hemorrhage that completely obscured the visual axis. Although spontaneous clearing has been reported to occur, the dense intracorneal hemorrhage in this case persisted with minimal clearing and necessitated graft exchange for visual rehabilitation.[2] Moreover, delayed suture removal especially in keratoconus patients with tendency for eye rubbing must be avoided even in seemingly quiescent corneas to reduce the risk of corneal neovascularization. Close follow-up would be ideal for patients who develop clinically relevant deep corneal neovessels, which may possibly recur.

More than just an unusual occurrence, the management of this case also highlights the surgical anatomy of grafted corneas and related considerations in lamellar keratoplasty.

First, when a dense opacity precludes specular microscopy, clinical assessment of endothelial status based on the presence of epithelial defects, bullae, microcysts or stromal edema can inform surgical decision-making. As in this case with no of evidence of endothelial dysfunction, DALK is ideally preferred over a repeat PK to selectively replace the diseased stroma while leaving the functional endothelium of the old PK graft intact. Unlike PK, DALK obviates the introduction of new endothelium, which is the primary stimulus for immunologic rejection and subsequent graft failure.[4,6]

Second, the identification of a natural plane of separation that posteriorly delimits the infiltration of blood from a spontaneous intracorneal hemorrhage provides additional evidence and clinical relevance to the distinct lamellar cleavage plane that can be exploited during stromal peeling.[4] In this case, the intracorneal hemorrhage was found to diffusely infiltrate the stroma and collect over a clear homogenous impervious layer. Upon removal of the erythrocytic debris, the residual bed appeared akin to the pre-Descemet's layer–Descemet membrane–endothelium observed in type-1 bubble formation.[7] Should a similar dense hemorrhage occur in naïve corneas, the spread of erythrocytic material within the corneal stroma can be used to guide the depth of layer-by-layer manual dissection.

Third, aside from the presence of blood dissecting between the deep stroma and pre-Descemet's layer, the weakened interlamellar attachment in post-PK grafts facilitate lamellar dissection through stromal peeling.[4,8] Similar to what is seen in DALK for recurrent corneal ectasia after PK, stromal peeling along a natural surgical plane of separation can

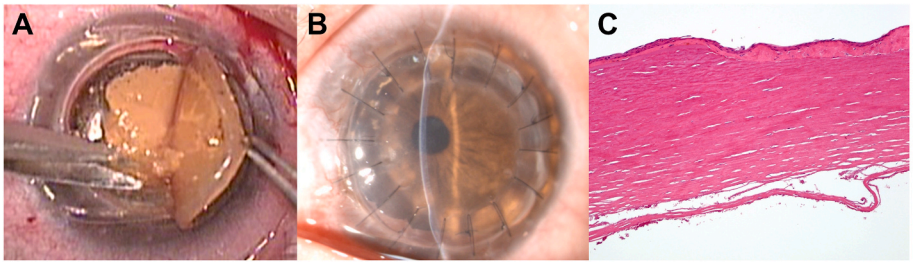

Fig. 2. Additional images of the affected eye. A. Intraoperative photo depicting partially organized intracorneal hemorrhage at the plane of lamellar cleavage.
B. Hematoxylin-eosin stained section (200x) of the excised corneal button reveals hemorrhage dispersed throughout the subepithelial space, corneal stroma and posterior surface of the graft adjacent to areas of irregular epithelial thinning, absent Bowman's layer and scarce keratocytes in the anterior stroma. The posterior surface of the graft is devoid of Descemet membrane. C. Slit lamp photo 6 months after stromal exchange.

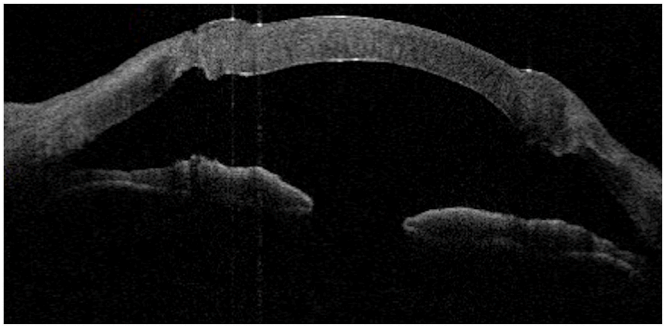

Fig. 3. Postoperative anterior segment optical coherence tomography one year after stromal exchange.

be performed in this case due to the absence of adherence between the deep stroma of the PK graft and the underlying corneal bed.[4] Through histologic analysis of corneas in which stromal peeling was attempted but mandated conversion to PK, our group has previously demonstrated that stromal peeling occurred along a natural plane, which was lined by a single row of keratocytes separating a thin layer of pre-DM stroma from the overlying anterior stroma.[8] The pre-DM stroma is continuously linked to the host tissue facilitating lamellar cleavage at the plane of separation without exposing the intraocular contents. These post-operative alterations in the stromal microarchitecture allow deep lamellar cleavage without the need for pneumatic-assisted, hydro--assisted, viscoelastic-assisted or manual deep lamellar dissection of the PK graft.[4,8,9] Reports of spontaneous Descemet membrane detachment occurring years after PK likewise support our observations.[10,11]

3. Conclusions

In conclusion, intracorneal hemorrhage represents a rare cause of severe visual loss after PK. Using the stromal peeling technique, DALK can be attempted to preserve functional endothelium in post-PK eyes. In the presence of a dense intracorneal hemorrhage, the spread of erythrocytic debris within the stroma can guide deep lamellar cleavage.

Funding

No funding or grant support.

Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Patient consent

The patient's legal guardian consented to publication of the case in writing.

Declaration of competing interest

The authors have no relevant financial or non-financial interests to disclose.

Acknowledgements

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajoc.2023.101808.

References

1. Brodrick JD. Corneal blood staining after hyphaema. *Br J Ophthalmol*. 1972;56(8):589–593.
2. McDonnell PJ, Green WR, Stevens RE, et al. Blood staining of the cornea. Light microscopic and ultrastructural features. *Ophthalmology*. 1985;92(12):1668–1674.
3. Donnenfield ED, Ingraham H, Perry HD, et al. Contact lens-related deep stromal haemorrhage. *Ophthalmology*. 1991;98:1793–1796.
4. Bovone C, Nahum Y, Scorcia V, et al. Stromal peeling for deep anterior lamellar keratoplasty in post-penetrating keratoplasty eyes. *Br J Ophthalmol*. 2022;106(3):336–340.
5. Pellegrini M, Scorcia V, Giannaccare G, et al. Corneal neovascularisation following deep anterior lamellar keratoplasty for corneal ectasia: incidence, timing and risk factors. *Br J Ophthalmol*. 2022;106(10):1363–1367.
6. Scorcia V, Beltz J, Busin M. Small-bubble deep anterior lamellar keratoplasty technique. *JAMA Ophthalmol*. 2014;132:1369–1371.
7. Dua HS, Faraj LA, Said DG, et al. Human corneal anatomy redefined: a novel pre-Descemet's layer (Dua's layer). *Ophthalmology*. 2013;120(9):1778–1785.
8. Yu AC, Mattioli L, Busin M. Optimizing outcomes for keratoplasty in ectatic corneal disease. *Curr Opin Ophthalmol*. 2020;31:268–275.
9. Busin M, Bovone C, Scorcia V, et al. Ultrastructural alterations of grafted corneal buttons: the anatomic basis for stromal peeling along a natural plane of separation. *Am J Ophthalmol*. 2021;231:144–153.
10. Gorski M, Shih C, Savoie B, et al. Spontaneous Descemet membrane detachment 20 years after penetrating keratoplasty for keratoconus. *Cornea*. 2016;35:1023–1025.
11. Lifshitz T, Oshry T, Rosenthal G. Retrocorneal membrane after penetrating keratoplasty. *Ophthalmic Surg Laser*. 2001;32:159–161.