Vitrectomy using the Eckardt temporary keratoprosthesis

Supalert Prakunhungsit\textsuperscript{a,b}, Nicolas A. Yannuzzi\textsuperscript{a}, Audina M. Berrocal\textsuperscript{b,∗}

\textsuperscript{a} Bascom Palmer Eye Institute, Miami, FL, USA
\textsuperscript{b} Ophthalmology Department, Faculty of Medicine, Siriraj Hospital, Mahidol University, Thailand

\textbf{A R T I C L E   I N F O}

Keywords:
Eckardt temporary keratoprosthesis
Pediatric vitrectomy
Surgical technique
Temporary keratoprosthesis

\textbf{A B S T R A C T}

\textbf{Purpose:} to present the new vitrectomy technique through a limbus via preexisting holes in the Eckardt TKP.

\textbf{Methods:} the surgical technique performed in a case of four-year-old girl presented with a complete hyphema and vitreous hemorrhage in the left eye.

\textbf{Results:} the vitrectomy was performed via a limbal approach from the TKP without making additional sclerotomies. The vitreous hemorrhage was evacuated, the hyaloid elevated, the periphery examined with an excellent widefield view without scleral depression, an air-fluid exchange performed, and the air exchanged for silicone oil. Finally, the TKP was replaced with a permanent graft. The surgical video was presented additionally.

\textbf{Conclusion and importance:} Eckardt TKP allows for a limbal approach in aphakic or non-lens sparing vitrectomy surgery while maintaining a stable intraocular pressure, excellent peripheral and posterior access and while avoiding the need for pars plana sclerotomy placement which can be challenging in complex cases.

1. Introduction

Historically, eyes with anterior segment pathology and media opacities obscuring visualization for posterior segment surgery have been managed with open-sky vitrectomy, concurrent corneal transplantation, or endoscopic vitrectomy. Open-sky vitrectomy increases the risk of hypotony related complications such as choroidal hemorrhage, concurrent corneal grafts may be damaged during the vitrectomy surgery. The introduction of temporary keratoprosthesis (TKP) by Landers et al.\textsuperscript{1} revolutionized the approach to vitreoretinal surgery in those patients with corneal pathologies limiting posterior visualization. The indications of the use of TKP include corneal perforation, posttraumatic corneal opacities, corneal scar, and corneal edema with concurrent retinal pathologies including retinal detachment, proliferative vitreoretinopathy, endophthalmitis, and vitreous hemorrhage.\textsuperscript{1–4} The TKP has been used intraoperatively to replace the pathologic cornea, allow for proper posterior segment visualization during vitrectomy, then is replaced by a permanent graft. Using a TKP also preserves the integrity of the permanent graft. There are two main types of TKPs, one designed by Landers\textsuperscript{2} and another developed by Eckardt.\textsuperscript{5,6}

The Eckardt keratoprosthesis is composed of optically clear silicone with a hydrophilic surface in various diameters. This TKP also has a wider optical zone and shorter vertical length than the Landers. The silicone material of the prosthesis provides a sufficient elasticity allowing the instrument to blend with the peripheral corneal tissue more efficiently. The combination of temporary keratoprosthesis and pars plana vitrectomy has been reported widely in the literature.\textsuperscript{5,6} However, performing the vitrectomy through a limbal approach via pre-existing holes in the Eckardt TKP has not been previously described and is outlined in this report.

2. Surgical technique

A four-year-old girl presented with a complete hyphema and corneal opacity in the left eye. She had a history of ruptured globe one month earlier status post repair of a corneal laceration. Slit lamp examination disclosed a large corneal scar with multiple nylon sutures and corneal blood staining. The horizontal corneal diameter was measured 10 mm. wide in the left eye. There was no view posteriorly. Adjunctive B-scan ultrasonography showed vitreous hemorrhage and no retinal detachment.

The decision was made to proceed with surgery. The cornea was trephined, and the opaque cornea was then removed from the anterior chamber in an open-sky fashion. Next, eight interrupted 10–0 nylon sutures were passed through the corneal limbus to secure the Eckardt TKP (Dutch ophthalmic research center, D.O.R.C., Zuidland, the Netherlands). To accomplish the vitrectomy procedure, we developed a novel surgical technique using Eckardt TKP (Video 1). The 25G trocars and infusion line were placed through the preexisting holes in the Eckardt TKP between the passed sutures. Next the 25G vitrectomy was...
performed using the holes in the TKP without making additional sclerotomies (Fig. 1). Trocars were not used for vitrector and light-pipe entry sites since the TKP holes themselves remained unobstructed and securely sealed with the support from underneath host cornea. Then, the hemorrhage was evacuated from the posterior pole, the hyaloid elevated (Fig. 2), the periphery examined with an excellent widefield view without scleral depression (Fig. 3), an air fluid exchange performed (Fig. 4), and the air exchanged for silicone oil. Finally, the TKP was replaced with a permanent graft without potential postoperative complications such as host corneal damage or wound leakage (see Video, Supplemental Digital Content, which demonstrates the vitrectomy surgical technique).

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajoc.2020.100709

3. Discussion

Sclerotomy placement through the Eckardt TKP permits adequate surgical maneuverability but avoids several pitfalls of pars plana sclerotomy in selected pediatric vitreoretinal procedures. Intended pars plana sclerotomy placement may risk inadvertent retinal penetration or hemorrhage in pediatric eyes with proliferative vitreoretinopathy, an underdeveloped pars plana as observed in persistent fetal vasculature or familial exudative vitreoretinopathy, and posttraumatic cases with aberrant anatomy after initial surgical repair. Insertion through the TKP is also easier in soft eyes after open sky surgery in comparison to pars plana placement through thick, elastic pediatric sclera. During the case, the various instruments could also be moved into different openings in the TKP to allow for easier ergonomics and access to different locations in the peripheral retina. These holes still maintained a tight seal and during the vitrectomy there was no significant leakage from the TKP or unexpected hypotony or posterior instability. Finally, there are no sclerotomies to be at concern or require suturing with this approach as the TKP is removed prior to placement of the final graft.

Although the view was maintained during air fluid exchange in this case, the TKP view under air may be limited by fogging which can be managed temporarily with viscoelastic. This approach is also not appropriate in cases where the crystalline lens can be preserved.

In conclusion, the Eckardt TKP allows for a limbal approach in aphakic or non-lens sparing vitrectomy surgery while maintaining a stable intraocular pressure, excellent peripheral and posterior access and while avoiding the need for pars plana sclerotomy placement which can be challenging in complex cases.
Patient consent

Written consent to publish this case has not been obtained. This report does not contain any personal identifying information.

Funding

The Funding is an unrestricted grant from Research to Prevent Blindness.

Authorship

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

Acknowledgements

Catherin Negron.

Declaration of competing interest

The following authors have no financial disclosures: SP, NY, and AB.

References

1. Landers MB, Foulks GN, Landers DM, et al. Temporary keratoprosthesis for use during pars plana vitrectomy. Am J Ophthalmol. 1981;91(5):615-9.
2. Fallah MR, Golabdar MR, Rahimi F, et al. Indications for temporary keratoprosthesis, anatomical and visual outcomes. Iran J Ophthalmol. 2012 Jul 1;24(3):39.
3. Helsen S, Ni Dhubhghall S, Zakaria N, et al. Eckardt keratoprosthesis for tectonic repair of a large corneal perforation. Cornea. 2016 Aug 1;35(8):1147-1149.
4. Nowomiejska K, Haszcz D, Forlini C, et al. Wide-field landers temporary keratoprosthesis in severe ocular trauma: functional and anatomical results after one year. J Ophthalmol. 2015:2015.
5. Eckardt C. A new temporary keratoprosthesis for pars plana vitrectomy. Retina. 1987;7:34-37.