Surgical Technique

'*Stop-and-Slide*' technique for trocar insertion during lens-sparing vitrectomy for retinopathy of prematurity

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The modern-day trocar cannula systems meant for adult eyes pose a challenge in infant's eyes with stage 4 retinopathy of prematurity (ROP) undergoing lens-sparing vitrectomy. This is primarily owing to the length of the trocar, globular lens, smaller axial length, and anteriorly displaced retina. We describe an inexpensive modification of the technique of trocar insertion in such cases wherein the trocar is inserted partially till the cannula impinges the sclera and thereon, the cannula slides over the trocar into the vitreous cavity. This obviates the need for complete insertion of the trocar into the vitreous cavity and hence limits the chances of inadvertent injury to the crystalline lens or the anteriorly lifted retina. We have experience in using this technique in 52 eyes of 44 infants over the past 2 years with no episode of iatrogenic lens touch or retinal break during trocar insertion.

Key words: Cannula, lens-sparing vitrectomy, retinopathy of prematurity, ROP, stage 4 ROP, trocar

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Tractional retinal detachment (TRD) related to retinopathy of prematurity (ROP) is a surgical challenge. Despite the success of laser photocoagulation, 5–10% of eyes, especially those with aggressive posterior ROP and disease in zone 1, progress to TRD requiring surgical management.[1-3] Lens-sparing vitrectomy (LSV) using Micro Incision Vitrectomy System (MIVS) has gained wide acceptance with success rates between 82–97% in advanced ROP.[4-6] The smaller gauge of instruments has several potential advantages while gaining access to the fibrovascular tissue in these small eyes. Higher cut rates, smaller internal diameters, port placement close to the tip, and controlled vacuum of cutters allow superior cutting efficiency and lesser vitreoretinal traction even when working close to the surface of the retina.

Keeping in mind the plethora of possible advantages of MIVS for ROP, the main challenge remains the placement of the cannulas. The trocar cannula systems for MIVS available today are designed for adult eyes. The infants' eyes are vastly different in anatomy from the adult counterparts. First, the pars plana is poorly developed and the entry has to be much anterior through the pars plicata. Second, the lens is more globular and occupies a larger proportion of the eyeball. Both these reasons along with the shorter axial length and anteriorly pulled up retina lead to a reduced working space and higher chances of iatrogenic lenticular and retinal injury.[7,8] Shorter instruments have been developed by Alcon (Alcon Laboratories Inc., Fort Worth, Texas, USA) and Dutch Ophthalmic Research Center (DORC, Zuidland, The Netherlands) keeping these eyes in mind. However, the Alcon instruments require a direct scleral cut down without the use of trocar cannula, hence taking away the advantages of a closed vitrectomy system. The DORC instruments have trocar cannulas with 25% shorter length but the same is available only in 27 gauge. Previous attempts have been made by researchers to shorten the length of currently available 25-gauge trocar cannula systems with the use of spacers.[9,10] However, they have their limitations and require extra instrumentation, hence adding to the surgical cost and time. To overcome these problems, we describe a simple '*stop-and-slide*' technique for trocar insertion with standard instrumentation in these eyes to prevent inadvertent injury to both the crystalline lens and the lifted retina.

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Examination under anesthesia is done before starting the procedure to look for the extent of detachment behind the crystalline lens and to identify safe areas for trocar insertion. The child is draped with aseptic precautions. A localized conjunctival peritomy is done in the area of the intended sclerotomies [Video 1]. Alternatively, transconjunctival

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placement can also be done as per surgeon comfort. We use the valved 25-gauge trocar cannula system from Alcon (Alcon Laboratories Inc., Fort Worth, Texas, USA). Entry into the eye is planned 1-1.5 mm behind the limbus. Insertion of the full length of the trocar into the eye has the danger of hitting the lifted retina beneath [Fig. 1a]. In this technique, the trocar is inserted into the eye till the tip of the cannula just penetrates the sclera (gives way). [Fig. 1b]. At this point, the surgeon stops and holds the cannula from its body with a forcep [Fig. 1c]. The cannula is then slid over the trocar into the vitreous cavity and the trocar is retracted out [Fig. 1d]. The same technique is employed for the other two ports. A standard LSV is then performed clearing the surgical planes of vitreous from ridge to lens, ridge to ridge, ridge to disc, ridge to periphery, and circumferentially along the ridge. A partial fluid air exchange is done. At the end of the case, the cannulas are simply pulled out and the sclerostomies are sutured with 7-0 vicryl sutures. The conjunctiva is sutured back over the sclerotomies. We have performed LSV in 52 eyes with this technique over two years.

Discussion

We describe a simple modification to the routinely employed technique of trocar insertion for pediatric eyes undergoing LSV for ROP-related tractional retinal detachment. The average thickness of the sclera 1 mm from the limbus is around 0.5 mm.[11] The total length of the trocar cannula system is 9.6 mm with the part of the cannula going inside the eye being 4 mm in length.[12] The axial length of the eye in premature infants ranges from an average of 12.6 mm at 25 weeks postconceptional age (PCA) to 16.2 mm at 37 weeks PCA.[13] By stopping mid-way during the insertion of the trocar and sliding in the cannula, we ensure that we have penetrated the eye coats while preventing any injury to the underlying lifted retina. Of the 52 eyes of 44 infants operated by us using this technique, 10 eyes had stage 4A ROP and 42 had stage 4B. None of the cases had any incident of iatrogenic lens touch or retinal break during the insertion of the trocar cannula system. There was no failure of insertion or incident of serous choroidal during the surgery.

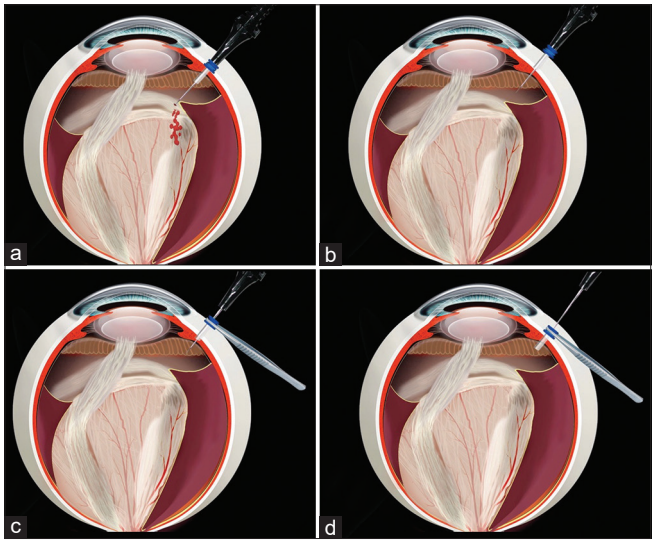

Figure 1: Animation stills describing the stop-and-slide technique for trocar insertion in eyes with retinopathy of prematurity undergoing lens sparing vitrectomy. (a) Complete insertion of the trocar into the vitreous cavity as in adults runs the risk of iatrogenic retinal injury in infants' eyes. (b) A simple modification wherein the surgeon stops once the trocar is partially inserted and the cannula impinges on the sclera. (c) The body of the cannula is held with a forcep and the cannula is slid into the vitreous cavity over the trocar. (d) The trocar is then removed with the cannula placed in situ

The need for special modifications in the technique for accessing the vitreous cavity in infants has been felt previously also. An ab interno incision was described to release anterior retinal traction before direct insertion of instruments through the sclerotomies without the use of cannulas.[14] Though commonly applied, this approach takes away the advantages of closed system vitrectomy provided by the valved trocar cannula systems. The incision maneuver with the help of a microvitreoretinal blade also runs a significant risk of damage to the posterior lens capsule or the retina. To facilitate the use of trocar cannula system in such situations, Babu *et al*.[9] described the use of a trimmed 42-silicon band inserted over the trocar cannula to act as a spacer and thereby reducing the effective length of the 25 gauge cannula. However, an inherent drawback of this method is the blunting of the trocar while piercing through the silicon band for insertion over the cannula. To overcome this, Wong *et al*.[10] suggested the use of 270-silicone Watzke sleeve inserted twice over the trocar cannula as a spacer. This was again a time-consuming procedure, requiring special instrumentation and preparation. The basic problem with the use of trocar cannula system in pediatric eyes lies with the length of the sharp trocar going into the eye. The techniques described previously by using different materials as spacers, reduce the effective length of both the trocar and the cannula. This increases the chances of inadvertent sub-retinal/suprachoroidal migration of the cannula during the surgery, a complication encountered by the authors themselves.[9]

Our technique is relatively easy to put into use. It requires no new material or instrumentation. It is a simple modification of the step every vitreoretinal surgeon is accustomed to. Hence, it has a short learning curve. Despite these potential advantages, not all stage 4 ROP cases may be suitable to approach with this technique. Cases with anterior retinal tractional folds in close proximity to the crystalline lens and extensive anterior fibrosis may still require a primary lensectomy through a more anterior limbal approach. A good pre-operative examination under anesthesia by the surgeon to identify the safe quadrants remains paramount to prevent any iatrogenic retinal injury.

Conclusion

To conclude, in our experience, the 'stop-and-slide' technique appears to provide an optimal gateway to the vitreous cavity in selected eyes with stage 4 ROP.

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Conflicts of interest

There are no conflicts of interest.

References

1. Early Treatment for Retinopathy of Prematurity Cooperative Group. Revised indications for the treatment of retinopathy of prematurity: Results of the early treatment for retinopathy of prematurity randomized trial. Arch Ophthalmol 2003;121:1684-96.
2. Singh SR, Katoch D, Handa S, Kaur S, Moharana B, Dogra M, *et al*.

Safety and efficacy of 532 nm frequencydoubled NdYAG green laser photocoagulation for treatment of retinopathy of prematurity. Indian J Ophthalmol 2019;67:860-5.

3. Sanghi G, Dogra MR, Das P, Vinekar A, Gupta A, Dutta S. Aggressive posterior retinopathy of prematurity in Asian Indian babies: Spectrum of disease and outcome after laser treatment. Retina 2009;29:1335-9.
4. Hartnett ME, Maguluri S, Thompson HW, McColm JR. Comparison of retinal outcomes after scleral buckle or lens sparing vitrectomy for stage 4 retinopathy of prematurity. Retina 2004;24:753-7.
5. Lakhanpal RR, Sun RL, Albini TA, Holz ER. Anatomic success rate after 3-port lens-sparing vitrectomy in stage 4A or 4B retinopathy of prematurity. Ophthalmology 2005;112:1569-73.
6. Gadkari S, Kamdar R, Kulkarni S, Kakade N, Taras S, Deshpande M. Vitreoretinal surgery for advanced retinopathy of prematurity: Presentation and outcomes from a developing country. Can J Ophthalmol 2015;50:54-60.
7. Gonzales CR, Boshra J, Schwartz SD. 25-Gauge pars plicata vitrectomy for stage 4 and 5 retinopathy of prematurity. Retina 2006;26:S42-6.
8. Dogra M, Singh SR, Dogra MR. Commentary: Vitrectomy for stage 4 and 5 retinopathy of prematurity - Selecting the right approach to the vitreous cavity. Indian J Ophthalmol 2019;67:938-9.
9. Babu N, Shah PK, Narendran V, Kalpana N, Kim R. An easy method to raise the 25-gauge trocar and cannula system for retinopathy of prematurity- related lens-sparing vitrectomy. Retina 2014;34:1014-5.
10. Wong IY, Iu LP, Lai CH. A simple modification to the 25-gauge trocar and cannula system for retinopathy of prematurity related lens-sparing vitrectomy. BMC Ophthalmol 2016;16:38.
11. Olsen TW, Aaberg SY, Geroski DH, Edelhauser HF. Human sclera: Thickness and surface area. Am J Ophthalmol 1998;125:237-41.
12. Rizzo S, Patelli F, Chow DR. Vitreo-Retinal Surgery: Progress III. Berlin: Springer; 2009. Chapter 5, 23-gauge one-step instrumentation; p. 45-8.
13. Tucker SM, Enzenauer RW, Levin A, Morin JD, Hellman J. Corneal diameter, axial length, and intraocular pressure in premature infants. Ophthalmology 1992;99:1296-300.
14. Ho LY, Ranchod TM, Drenser KA, Capone A Jr, Trese MT. Ab interno incision for pediatric vitreoretinal surgery. Retina 2010;30:1542-3.