Corneal staining during cataract surgery: Natural course, ASOCT features, and preventive measures

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We report the natural course of the accidental injection of trypan blue into the corneal stroma while performing a routine cataract surgery by a resident during a training session. The corneal staining resolved with conservative medical treatment over 7 weeks. This case describes the anterior segment optical coherence tomography (ASOCT) features of corneal staining. It emphasizes on the relatively benign nature of this dye and the follow-up course. Causes that may be responsible for this untoward complication are highlighted with the necessary preventive measures that need to be taken care are also discussed.

Key words: Anterior segment optical coherence tomography, corneal staining, trypan blue

Trypan blue dye has been used in various intraocular surgeries and its safety profile has been well documented.[1–3] Anterior segment optical coherence tomography (ASOCT) is an efficient tool providing *in vivo* cross-sectional imaging and layer-by-layer analysis of corneal pathology.[4]

We report a case of inadvertent injection of trypan blue into the cornea by a trainee while attempting to stain the anterior capsule during routine cataract surgery and describe its ASOCT features.

Case Report

A 42-year-old female came with complaints of gradual dimness of vision for distance in her left eye since 1.5 years. Her best-corrected vision (BCVA) was 20/20 in her right eye and 20/200 in her left eye. Clinical examination revealed pseudophakia in the right eye and nuclear cataract with posterior subcapsular cataract in the left eye. Fundus was normal in both eyes. Patient was advised to undergo left eye phacoemulsification with posterior chamber intraocular lens (PCIOL) implantation.

During surgery, instead of injecting the trypan blue (0.06%) (Sunways India, India) dye into the anterior chamber, there was accidental injection of dye into the corneal stroma, resulting in diffuse staining of the cornea with dye. As the visualization of anterior segment worsened, the surgery was deferred.

In the immediate postoperative period, slit-lamp examination revealed diffuse stromal edema. She underwent serial slit-lamp photography and ASOCT for documentation and follow-up of the corneal status [Figs. 1a, b and 2a].

Patient was advised to use tapering dose of topical Gatiquin-P [gatifloxacin (0.3%) prednisolone (1%)] eye drops (Cipla, India). During her follow-up visit, corneal edema started decreasing [Figs. 1c, d and 2b]. Over the next 7 weeks, the corneal edema completely resolved [Figs. 1e, f and 2c] and the vision attained to the preoperative level of 20/200. The findings were comparable to the ASOCT (Optovue, Inc, CA, USA) showing separation of stromal lamellae in the early weeks and compact cornea at 7 weeks. The patient underwent uneventful cataract surgery after 2 months with PCIOL implantation resulting in a good surgical outcome with postoperative uncorrected distance vision of 20/20.

Discussion

Continuous curvilinear capsulorrhexis is the most crucial step of cataract surgery and trypan blue helps in performing this step with ease due to better visualization by providing a contrast between the stained anterior capsule and the lens matter.[5] Its safety has been documented in previous studies.[6,7]

In this case, there was an accidental injection of trypan blue into the corneal stroma. This could have happened due to multiple reasons like, faulty focusing of the microscope, poor stereopsis of the operating surgeon, lack of surgical experience, misdirection of the cannula during injection of trypan blue, use of blunt instruments, improper wound construction, and repeated maneuvering during entry through the side port. It is, therefore, imperative that every operating surgeon, especially in the early days of learning should assess his refraction, use appropriate spectacles if necessary, and be aware of his/her sense of depth perception. The microscope should be adjusted to the correct focus. Following precautions must also be taken like directing the needle or cannula downwards towards center of lens during insertion, ensuring complete insertion of the needle tip inside the anterior chamber prior to injection, making

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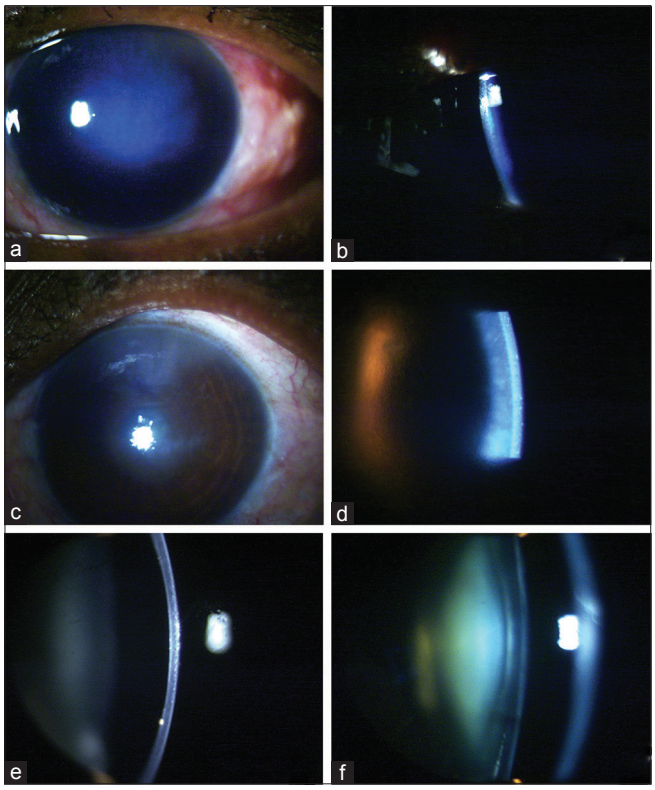

Figure 1: Slit-lamp images of cornea. (a) Immediate postoperative period: Diffuse slit examination showing diffuse stromal staining of cornea. (b) Immediate postoperative period: slit image showing diffuse stromal staining with edema, (c) Three weeks postoperative period: diffuse slit examination showing reduced stromal staining of cornea. (d) Three weeks postoperative period: slit image showing reduced staining and edema. (e) Seven weeks postoperative period: slit image showing normal compact cornea. (f) Seven weeks postoperative period: slit image showing nuclear grade of cataract

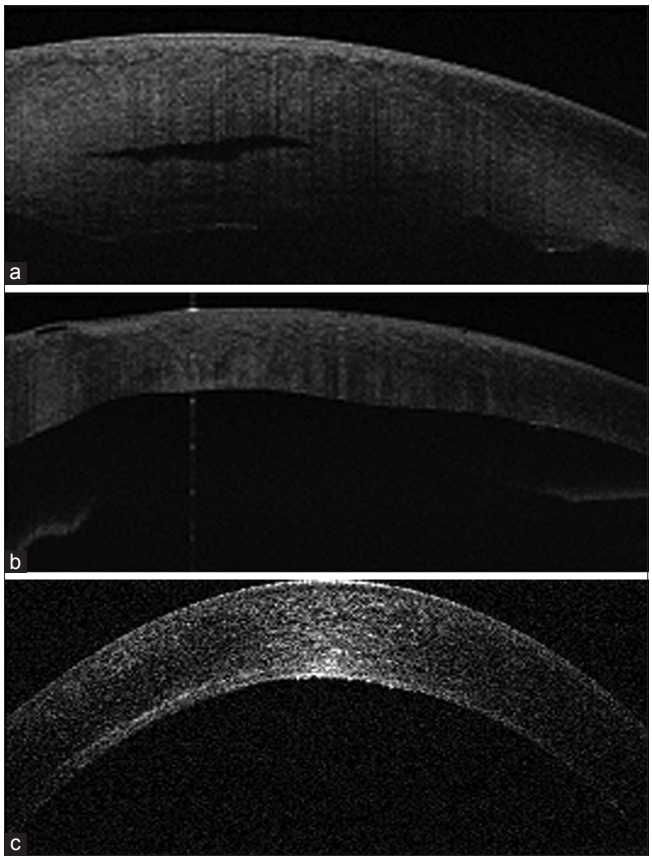

Figure 2: ASOCT images of cornea. (a) Immediate postoperative period shows increase in central corneal thickness with separation of stromal lamellae with hyporeflectivity in between lamellae suggestive fluid/edema. (b) Three weeks postoperative period shows decrease in central corneal thickness with separation of stromal lamellae with minimal hyporeflectivity in between lamellae. (c) Seven weeks postoperative period showing normal cornea thickness with compact arrangement of stromal lamellae

bi-valved side ports with adequate length (a very long wound shall cause difficulty in maneuvering and a very short wound shall be more prone to leakage), and finally using adequately sharp-tipped instruments.

ASOCT is a novel technology at present that produces the optical biopsy of the cornea which gives us direct clue to the pathology.[8] The role of ASOCT in analyzing the diagnosis of Descemet's membrane (DM) detachment in presence of corneal edema and its resolution post treatment has been very well documented.[8] Jhanji *et al*. have reported a similar case which was successfully managed by conservative treatment.[9] In our case, ASOCT findings confirmed that there was only edema with separation of the stromal lamellae without any DM detachment. It completely correlated with the slit-lamp findings. Balance salt solution (BSS) injection into stroma has been reported as one of the technique of deep anterior lamellar keratoplasty, wherein the BSS injected into the corneal stroma finds the path of least resistance and leads to detachment of the DM. Similarly, here in our case of accidental dye injection into the stroma could have also led to DM detachment. The management would then defer requiring surgical intervention such as intra-cameral gas injection. Thus the use of ASOCT not only provides the objective methods of follow-up but also helps us in deciding the treatment modality. We presume that the trypan blue from cornea would have disappeared through the natural drainage system of peripheral corneal lymphatics as confirmed by Singh *et al*.[10] Though it does not require any surgical intervention, a good follow up and regular monitoring of the patient is necessary to document the course of events to allow for any intervention if necessary.

Conclusion

In conclusion, one should be cautious in injecting trypan blue as it can stain the cornea if not injected carefully. Though rare, this complication could occur in the early period of cataract surgery training. Hence all the eye surgeons should be aware of this complication. This report not only highlights the natural course of corneal staining, the role of ASOCT in decision making and also provides the necessary measures to avoid the said complication.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published

and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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