Impact of Trypan Blue (TB) Staining of the Anterior Capsule on Capsulorhexis in Various Grades of Cataract

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Continuous curvilinear capsulorhexis (CCC) is a critical step in phacoemulsification. An intact CCC, of an appropriate size and shape is mandatory for successful phacoemulsification. Moreover, this also happens to be the most difficult step to learn in phaco and also tricky in certain special situations like a white cataract.

Many techniques have been proposed for improving anterior capsular visualization. The most reliable method is the use of a dye to stain the anterior capsule. Indocyanine Green (ICG) first used by Horiguichi et al. and Trypan blue reported by Melles et al. work beautifully in this regard. They are much superior to fluorescein which being a smaller molecule diffuses into the lens and vitreous. Recently trypan blue (TB) dye has been used with a great degree of success to facilitate CCC in these situations. This paper studies the impact of trypan blue on CCC in various grades of cataract. Staining of the anterior capsule for better visualization is necessary in any situation where either the red reflex is poor or visualization of the capsule is compromised. The presence of the asteroid hyalosis, corneal scarring, corneal oedema or the dark brunescent nucleus are examples of this situation.

Materials and Methods

200 successive cases of phaco emulsification where anterior capsule was stained with trypan blue were included in the study. The patient profile and the type of cataract were noted down. Video recording of the CCC was made in randomly selected cases.

Good mydriasis was achieved in all cases with a combination of tropicamide and phenylephrine eye drops. Flurbiprofen eye drops were used four times one hour prior to surgery. All operations were performed under peribulbar anaesthesia. Temporal clear corneal incision and 2 paracenteses were fashioned.

Staining of the anterior capsule

The anterior chamber was filled with an air bubble through the inferior paracentesis. Trypan blue 0.06% (0.1ml) was squirted on to the anterior capsule under the air bubble through the same paracentesis wound. After a 20 seconds contact time, the excess trypan blue was washed off from the anterior chamber by bimanual I/A.

CCC was performed using a bent 26 G needle under viscoelastic cover (Fig 1). Capsulorhexis forceps was used in some patients with intumescent or hypermature cataracts.

Video recording was performed with and without the red reflex enhancer

(a) before trypan blue staining (fig 2) (b) after trypan blue staining of the anterior capsule (Fig 3) (c) during the progression of the CCC and (Fig 4) (d) after the CCC and removal of the anterior capsular flap (Fig 5).
Results

200 consecutive patients undergoing phacoemulsification whose anterior capsules were stained by trypan blue were included in the study. There were 115 males and 85 females. The average age was 65 (range 38 to 83). 113 patients (56.5%) had satisfactory red reflex, 44 patients (22%) had poor reflex and the rest 43 (21.5%) with white cataracts had no red reflex. All the patients had well dilated pupils.

Capsulorhexis was complete in all cases. Trypan blue had a dampening effect on the red reflex in patients with good reflex to start with, and had no contributory effect to the success of the capsulorhexis. However the dye was found to be of great aid in eyes with dull reflex or no reflex (white cataracts) whatsoever.

There were some patients (23) with good red reflex who had grade III nuclear sclerosis, though by and large, patients with lesser grades of nuclear sclerosis tended to have brighter red reflex.

Subjectively there was lesser chance of damage to the capsulorhexis margin by the phaco tip owing to enhanced visibility of the stained capsulorhexis margin.

Discussion

Capsulorhexis is a prerequisite for successful phacoemulsification. However this also happens to be the most difficult step to learn during the learning curve, and in certain situations like a white cataract, capsulorhexis may be quite difficult to accomplish even by an experienced surgeon.

Capsulorhexis requires direct and easy visualization of the anterior capsular flap. The visualization of the flap may be difficult (a) by the untrained eye during the early stage of the learning curve, (b) when sub capsular cortex gets disturbed and gets mixed with the capsular flap and (c) when the red reflex is not well visualized by a very basic microscope or due to a very dense or white cataract. Various staining techniques of the anterior capsule have been described in the literature. Fluoroscein, methylene blue, trypan blue and indocyanine green have been used for this purpose. In January 1999, Melles et al reported the use of Trypan blue dye in 30 patients with mature white cataracts. There were no complications reported which were
attributable to the dye. Trypan blue creates a much darker staining and provides superior visualization when compared to ICG. Unlike ICG there is no particulate suspension with trypan blue and it is much more convenient to use because there is no mixing involved.

Because it is supplied in a smaller amount it is less expensive. Trypan blue staining lasts longer usually through all the phacosteps and hence there is less chance of damage to the dye stained and easily visualized capsulorhexis margin.

Trypan blue is commercially available in the Indian market at an affordable price. It is now extensively used and has been found to be very effective with no clinically relevant toxicity to the corneal endothelium. A 20 second contact time was enough to achieve adequate staining of the anterior capsule in all cases.

This study looked into the effectiveness of trypan blue with respect to the density of the cataract. The results and their implications are summarized here.

1. If a given case of cataract is associated with a bright red reflex, staining of the anterior capsule with trypan blue is associated with significant dampening of the red reflex. Hence, capsulorhexis can be achieved quite easily without staining if the red reflex is bright. On the contrary, capsular staining in this scenario may not offer any additional benefit as far as enhanced visibility of the capsular flap is concerned.

2. If the red reflex is dull or absent for whatever reason, the stained anterior capsule greatly enhances the visibility of the anterior capsular flap and facilitates the performance of the capsulorhexis.

3. Trypan blue should be used to stain the anterior capsule by a beginning phaco surgeon if he is using a lower end microscope which may lack in satisfactory red reflex or other user friendly features. Enhanced visibility will also greatly reduce the chances for damages to the capsulorhexis margin by the phaco tip.

**Conclusion**

In conclusion, trypan blue staining of the anterior capsule is strongly recommended for capsulorhexis in all cases during the initial stages of the phaco learning curve. Use of trypan blue should also be strongly considered for capsulorhexis in white cataracts.

**References**