

ANTERIOR CAPSULE STAINING USING 0.025% TRYPAN BLUE IN ALL PHACOEMULSIFICATION CATARACT SURGERIES

V.D. Karthigeyan¹

HOW TO CITE THIS ARTICLE:

VD Karthigeyan. "Anterior capsule staining using 0.025% trypan blue in all phacoemulsification cataract surgeries". Journal of Evolution of Medical and Dental Sciences 2013; Vol. 2, Issue 47, November 25; Page: 9066-9071.

ABSTRACT: PURPOSE: To describe the use of anterior capsule staining in all phacoemulsification cataract surgery using a 0.025% trypan blue solution. **METHODS:** Thirty eyes of 30 patients with cataracts were submitted to phacoemulsification using a direct injection of 0.2 to 0.5 ml of 0.025% trypan blue in the anterior chamber through the side port before injecting viscoelastic injection. All patients had preop ophthalmologic examination prior to surgery. **RESULTS:** In all cases the capsule became stained with a faint blue color that enabled an adequate visibility of the flap while doing anterior capsulorhexis through the side port using a 26G needle. There were no intra-operative or postoperative complications. The endothelial cell loss varied between 1.37% and 6.67% (mean 3.90%). **CONCLUSION:** Staining the anterior capsule with 0.025% trypan blue solution allows a good visibility of the capsular flap and facilitates the confection of capsulorhexis in cataracts without red reflex.

KEYWORDS: Cataract; Cataract extraction; Lens capsule; Crystalline/surgery; Trypan blue/therapeutic use; Dyes

INTRODUCTION: The anterior capsulorhexis is resistant to radial tears during the various surgical steps and also offers the advantages of in the bag intraocular lens (IOL) implantation. Another advantage of capsulorhexis is the opportunity of a safe sulcus IOL implantation over the anterior capsule rim in cases of a posterior capsule rent. For a good control when performing a capsulorhexis, the visualisation of the anterior capsular flap margin is necessary and the lack of an adequate red reflex renders the technique very difficult. Many techniques have been proposed to help the surgeon to perform a capsulorhexis in cataracts without red reflex. The purpose of this report is to describe the use of 0.025% trypan blue solution to allow better anterior capsular flap visibility and a safe capsulorhexis in cataracts without red reflex.

METHODS: Thirty eyes of 30 patients with cataracts being the main cause of defective vision and no other known ocular disease were submitted to phacoemulsification and IOL implantation. The ages varied between 52 and 79 years (mean 68). All surgeries were done by the same surgeon (VDK), using the same equipment (Laurette - Bausch & Lomb), under peribulbar anaesthesia, with a three plane clear corneal incision, the "stop and chop" technique and an implant with a 5.25 mm optical zone.

After the ancillary paracentesis, made in the limbus 70 to 90° away from the area where the clear cornea incision should be done, 0.2 to 0.5 ml of 0.025% trypan blue was injected in the anterior chamber, followed by filling of the anterior chamber with a viscoelastic solution, leaving the anterior capsule with a faint blue coloration. After the clear corneal incision, Anterior capsulorhexis was performed using the 26G needle through the side port 2 clock hours away from the inferotemporal end of the superotemporal phacotunnel. The 0.025% trypan blue solution was

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obtained by diluting 0.1 ml of the 0.1% commercially available solution in 0.3 ml of Ringer lactate solution. The total effective used ultrasound power was recorded for each case. All patients had visual acuity, intraocular pressure (IOP) and anterior chamber reaction evaluated before surgery and on days 1, 6, 30 and 40 postoperatively.



Anterior lens capsule before staining with trypan blue dye on the left
Post capsulorhexis image after staining with trypan blue on the right.

RESULTS: Anterior capsulorhexis was successfully performed in all eyes. In two of them it was necessary to inject more viscoelastic after the initial capsular puncture because of liquefied cortical material leakage. The contrast between the stained capsular flap and the white cortical material allowed a safe control of the anterior capsulorhexis progression and the remaining anterior capsule edge was still stained during phacoemulsification. By the time of cortical aspiration, the faint blue coloration had disappeared from the anterior capsule rim. The remaining surgical steps were uneventful. On the first postoperative day, mild corneal stromal edema was seen in one eye and moderate edema in five eyes. By the 6th postoperative day the edema had vanished in all cases. There was no increase in IOP or any evidence of residual stain in the anterior segment during the postoperative period. The visual acuity, IOP and endothelial cell count before surgery and on day 40 are showed in Table 1. The endothelial cell loss varied between 1.37 to 6.67% (mean of 3.90%).

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S.NO	VISUAL ACUITY		INTROCUULAR PRESSURE		ENDOTHELIAL CELL COUNT		
	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL	CELL LOSS %
1	CF 3M	6/6	16	12	2791	2654	1.37
2	CF 4M	6/6	12	12	2492	1980	5.12
3	HM	6/6	18	14	2398	2211	1.87
4	CF3M	6/12	14	16	2428	2383	1.45
5	CF 4M	6/9	12	12	2460	2200	2.60
6	CF3M	6/9	14	12	2392	2180	2.12
7	CF 1M	6/6	16	14	2402	2100	3.02
8	CF 2M	6/9	12	12	2386	2066	3.20
9	CF3M	6/6	18	14	2478	2062	4.16
10	HM	6/9	16	14	2492	2020	4.72
11	CF 4M	6/12	12	16	2611	2100	5.11
12	CF3M	6/6	12	16	2511	2030	4.81
13	CF 2M	6/6	16	16	2486	2040	4.46
14	CF 4M	6/6	16	12	2391	2021	3.70
15	CF 1M	6/12	16	12	2532	1970	5.62
16	CF3M	6/6	12	14	2564	2010	5.54
17	CF 2M	6/6	16	12	2480	2380	5.12
18	CF 4M	6/6	16	14	2472	1968	5.58
19	CF3M	6/6	16	14	2478	2308	1.70
20	CF 1M	6/6	18	16	2566	1955	6.11
21	CF 2M	6/6	16	16	2671	2282	3.89
22	CF3M	6/6	16	12	2677	2018	6.59
23	CF 4M	6/6	16	16	2741	2074	6.67
24	HM	6/6	12	14	2712	2190	5.22
25	CF 1M	6/12	16	16	2681	2076	6.05
26	CF3M	6/9	16	16	2460	2082	3.78
27	CF 1M	6/9	16	16	2562	2030	5.32
28	CF 4M	6/9	12	14	2967	2392	5.75
29	CF3M	6/9	14	14	2328	2084	2.44
30	CF 1M	6/12	14	14	2489	2049	4.40

TABLE 1: PREOPERATIVE AND POSTOPERATIVE 40TH DAY ASSESSMENT ARRAY

CF - counting fingers

HM - hand movements close to face

M - metres

Intraocular pressure - recorded with applanation tonometer in mm hg

DISCUSSION: Many techniques have been suggested to improve safety in anterior capsulorhexis confection of cataracts without red reflex, such as the use of a optic fiber endoilluminator in a lateral position, endodiathermy, air filling of the anterior chamber, two step anterior capsulorhexis under

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high magnification, autologous blood impregnation and the injection of various vital stains in the anterior chamber like a solution of gentian violet and methylene blue, brilliant cresyl blue, fluorescein, trypan blue 0.1% and indocyanine green. Anionic (acidic) dyes such as trypan blue are less injurious to ocular tissue than cationic (basic) dyes. The endoilluminator and the endodiathermy imply in additional costs with sophisticated devices, and the endodiathermy capsulotomy is considered weaker than the traditional CCC. The two-step anterior capsulorhexis involves a change in the emulsification technique to work within a small anterior capsulorhexis and the additional risk of a radial tear or peripheral escape during the enlargement of the primary anterior capsulorhexis .

Trypan blue was decided to be used for all the patients because the deemed outcome as well as proceeding with phacoemulsification depended on a good capsulorhexis. During cataract surgery, it (1) enhances capsular visualization for the safe completion of the capsulorhexis (the critical step in cataract surgery); (2) stains the anterior capsule, highlights the capsulorhexis, and provides a landmark during the remainder of the procedure; and (3) helps surgeons achieve a perfectly centered capsulorhexis that overlaps the IOL's optic by 0.5 to 1 mm or to create a "re-rhexis" in cases of severe capsular phimosis. Apart from issues relating to decentration, a perfect capsulorhexis may be a critical determinant of final IOL power, because the IOL's final position in the capsular bag is determined in part by the size of the capsulorhexis. A visible rhexis margin can prevent inadvertent damage during nuclear emulsification, such as phacoemulsification of the anterior capsular edge or passage of the chopper on top of the anterior capsule.

Among the vital stains, brilliant cresyl blue has never been used *in vivo*; the gentian violet and methylene blue solutions result in corneal edema and endothelial decompensation, fluorescein must be injected underneath the anterior capsule, staining the lens epithelium, not the capsule itself and it can stain the cornea and lens cortex also. Indocyanine green seems to be a good option, but it is expensive, not available in a fractionated fashion, has a life span of only 8 hours after dilution and must be kept protected from light.

Trypan blue is a vital stain classically used to evaluate damaged endothelial cells, presenting no toxicity in concentrations as high as 0.3%. Since it does not stain the healthy endothelial cells, it poses no risk of lowering intraoperative visibility. The safety of intraoperative use of trypan blue in extracapsular cataract surgery has already been proved with follow-up periods up to 8 years. Trypan blue provides several advantages in cataract surgery.

The rate of conversion to an extracapsular cataract extraction in white cataract as the result of an incomplete Capsulorhexis has been as low as 3.85% when Trypan Blue is used compared with 28.3%, when no dye has been used. Trypan Blue use has also been described to stain the leading edge of a lost capsulorhexis. Recently Melles et al. reported the use of 0.1% trypan blue to perform CCC in cataracts without red reflex. They advocated the use of an air bubble in the anterior chamber with injection of the stain between the air and the anterior capsule to prevent its dilution. We used the injection of a 0.025% solution without an air bubble in the chamber and achieved sufficient capsular staining. Injecting the dye between an air bubble and the capsule is not a easy maneuver and the size of the bubble is critical, since it can prevent the complete staining of the anterior capsule. Anterior capsulorhexis was safely performed with postoperative corneal findings similar to those usually seen in surgeries without it. Additionally, using a solution that is diluted starting from its original commercial presentation, without

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performance decay, represents a cost reduction that is an important goal of present phacoemulsification. Another possible application of capsular staining is in the training of new surgeons, since the improvement in flap visibility may help to control its progression for beginners even when the cataract has a good red reflex.

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AUTHORS:

1. V.D. Karthigeyan

PARTICULARS OF CONTRIBUTORS:

1. Consultant, Department of Ophthalmology, Hindu Mission Hospital, Chennai

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr V.D Kartigeyan
16B, TKC Street,
New Perungalathur, Chennai 63.
Email – vd.karthigeyan@gmail.com

Date of Submission: 30/10/2013.

Date of Peer Review: 31/10/2013.

Date of Acceptance: 12/11/2013.

Date of Publishing: 19/11/2013