Surgical Technique

Star CanVac-continuous curvilinear capsulorhexis - A novel, safe rhexis technique in intumescent total cataracts

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Achieving a complete uniform capsulorhexis in an intumescent cataract is perhaps the most crucial and challenging step for surgeons. Star CanVac CCC is a new manual technique for creating a continuous curvilinear capsulorhexis (CCC) in intumescent total cataracts. Small centripetal tears in the shape of a star are created in the center of the anterior lens capsule by using a 26-G cystotome. This allows equal distribution of forces secondary to increased intralenticular pressure, thereby avoiding unidirectional or bidirectional tear extension. Subsequently, a 25-G flat-tipped fine cannula connected to a syringe is used to hold the free capsular flap. The piston of the syringe is withdrawn to create a stable suction pressure, and the rhexis is completed without withdrawing the instrument from the anterior chamber. Our technique is safe, affordable, and an alternative method to routine CCC or expensive techniques such as Femto or Zepto capsulotomy for white intumescent cataracts.

Key words: Argentinean flag sign, continuous curvilinear capsulorhexis (CCC), intumescent cataract

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Performing continuous curvilinear capsulorhexis (CCC) in intumescent cataracts is challenging due to the greater propensity for rhexis extension, secondary to increased intralenticular pressure. Total cataracts are more common in the developing world and more so in this COVID-19 pandemic due to backlog. Capsulorhexis made by a 26-G cystotome involves a sheering and tearing action on the capsule; this further increases the risk of capsular extension due to the high intralenticular pressure, thereby losing the advantages of in-the-bag phacoemulsification and in-the-bag placement of the intraocular lens [Figs. 1 and 2].[1] Thus, any surgical technique that decompresses the bag initially decreases the chance of extension of rhexis margin and further complications. Star CanVac CCC is a new manual technique for creating a CCC for intumescent total cataract by using a 26-G cystotome bent at the tip and a 25-G flat-tipped fine cannula connected to a 5-mL syringe half filled with balanced salt solution (BSS).

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The study adhered to the tenets of the Declaration of Helsinki. Approval was obtained from the ethics committee, and written informed consent was taken from patients. The study included patients with visual loss secondary to mature intumescent cataracts. Eyes with associated zonular dialysis, subluxation, capsular fibrosis, or cataract secondary to ocular inflammation were excluded. Preoperative evaluation included refraction, complete slit-lamp biomicroscopic examination, Goldmann applanation tonometry, and fundus evaluation by B-scan for posterior segment evaluation (surgery eye). Biometry was performed using IOL Master 700 (Zeiss, Germany) or ultrasound-guided immersion A-scan (Occuscan, RxP, Alcon Laboratories, Inc.) wherein the IOL master was unable to calculate axial length. IOL power calculation was done using the Barrett Universal II formula. The intumescence of the cataract was diagnosed clinically by slit-lamp examination, where the surgeon noticed fluid clefts between cortical fibers and confirmed by shallow ACD in optical biometry with increased lens thickness when compared to the other eye (phakic eyes). The same was confirmed on the table while performing capsulorhexis.

Tropicamide 1.0% and phenylephrine 2.5% eyedrops are used for preoperative mydriasis. The procedure is performed under peribulbar anesthesia with lidocaine hydrochloride 2.0% (xylocaine); the eye is prepped and draped. A side port is created 45° from the planned main corneal incision site, and the anterior capsule is stained with trypan blue 0.06% (Auroblue, Aurolabs. India). The anterior chamber is filled with an ophthalmic viscosurgical device (Appavisc, Appasamy associates, India).

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Multiple small centripetal tears are created in the center of the anterior lens capsule in the shape of a star by using a regular 26-G cystotome introduced through the side port [Fig. 3a]. This distributes the forces acting due to increased intralenticular pressure on the capsular margin uniformly and helps to avoid unidirectional or bidirectional tear extension. Subsequently, by using a 25-G flat-tipped fine cannula connected to a 5-mL syringe half filled with BSS, the free capsular flap is grasped with vacuum and suction pressure is created by withdrawing the piston of the syringe in a controlled motion to create a circular rhexis. This is done without withdrawing the instrument from the anterior chamber and aspirating liquefied or viscous cortex by using the same cannula. The vacuum is released by releasing the suction on the piston or pushing the piston gently, and the capsule near the base of the tear is re-grasped several times to complete the CCC [Fig. 3b-f]. The Video is available on www.ijo.in - STAR Can Vac capsulorhexis [Video 1].

The study included patients that underwent cataract surgery between April 2019 and March 2021 with an average follow-up period of 3.4 ± 1.2 months (range: 2–9 months). Star CanVac CCC was attempted in 260 eyes of 260 patients with intumescent total cataracts. Of these, 122 patients were male and 138 patients were female. The mean age of the cohort was 54 ± 8.2 years (range: 39–78 years). A complete star cannula vacuum continuous curvilinear capsulorhexis (STAR CanVac-CCC) was achieved in 259 (99.6%) cases except for one case (0.38%) that had rhexis extension; none of the eyes had a posterior capsular tear. Double rhexis was done in 33 cases (12.7%), triple rhexis in seven cases (2.7%), and rhexis enlargement was needed in 14 cases (5.4%). None of the cases had an Argentinean flag sign. In one case that had rhexis extension, phacoemulsification was performed taking all precautions to avoid wrap-around tear. All eyes had in-the-bag IOL implantation, except in one case that had rhexis extension.

Discussion

Howard Gimbel and Thomas Neuhann introduced capsulorhexis, which has become the standard method of anterior capsulorhexis. Performing a well-centered, circular, optimally sized capsulorhexis not only offers safety to phacoemulsification but also decreases the rate of posterior capsular opacification and minimizes the IOL shift in the postoperative period. Intumescent cataract challenges surgeons in many ways. There is no red glow and the anterior capsule is convex with increased intralenticular pressure and a shallow anterior chamber. The primary factor to address in intumescent cataracts for a successful capsulorhexis is to decrease the intralenticular pressure.

We report our technique of Star CanVac CCC in which a small star-shaped opening is created centrally by using a 26-G cystotome. This debulks the intralenticular pressure and distributes forces acting due to increased intralenticular pressure on the capsular margin to avoid unidirectional or bidirectional tear extension. Then, by using a 25-G flat-tipped fine cannula, the free capsular flap is vacuumed and capsulorhexis is carried out gently in circular motion without withdrawing the instrument from AC. A 25-G cannula was used because it is neither too small to create insufficient vacuum nor too large to aspirate too much OVD with subsequent AC collapse or cause flap amputation. Our technique has the advantage of decompressing the capsular

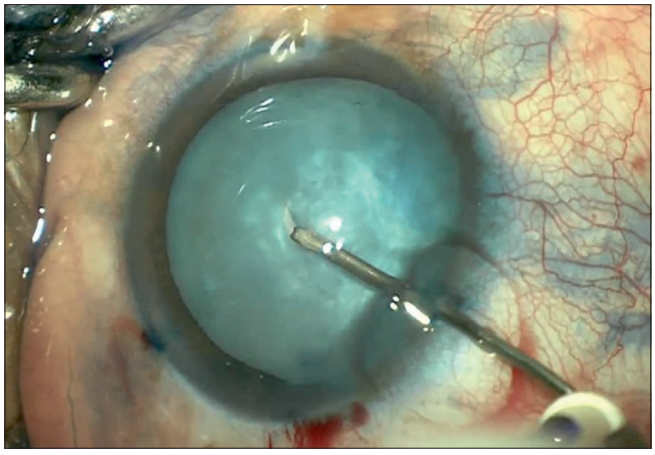

Figure 1: Rhexis initiated in intumescent cataract without decompression

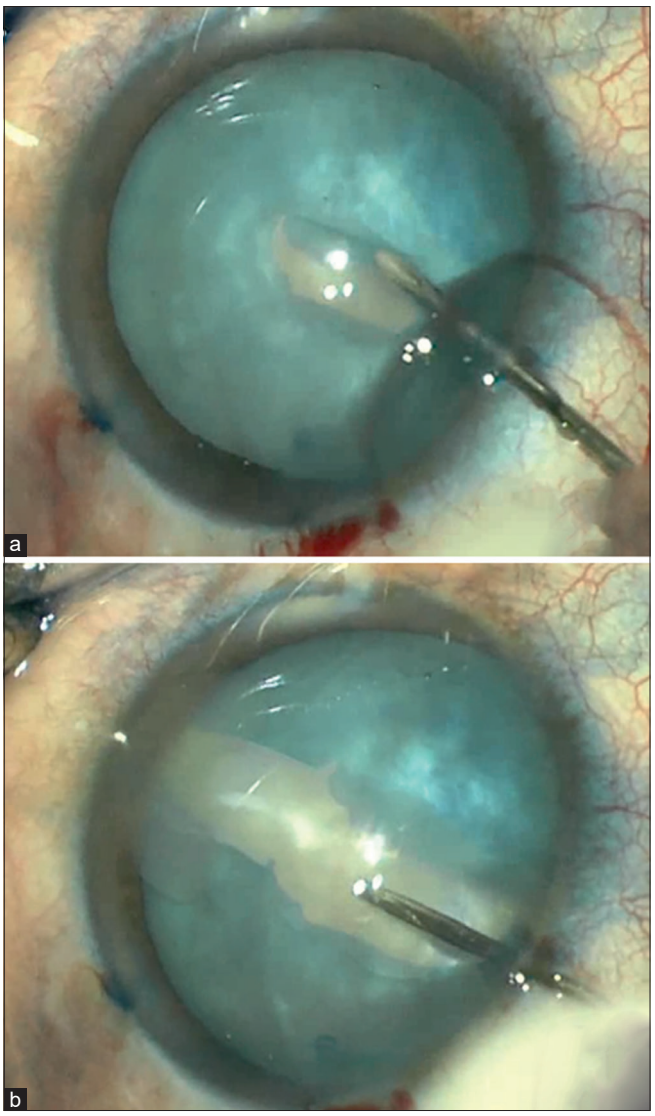

Figure 2: (a) Due to high intralenticular pressure, rhexis starts extending. (b) Within seconds, rhexis extends bidirectionally - Argentinean flag sign

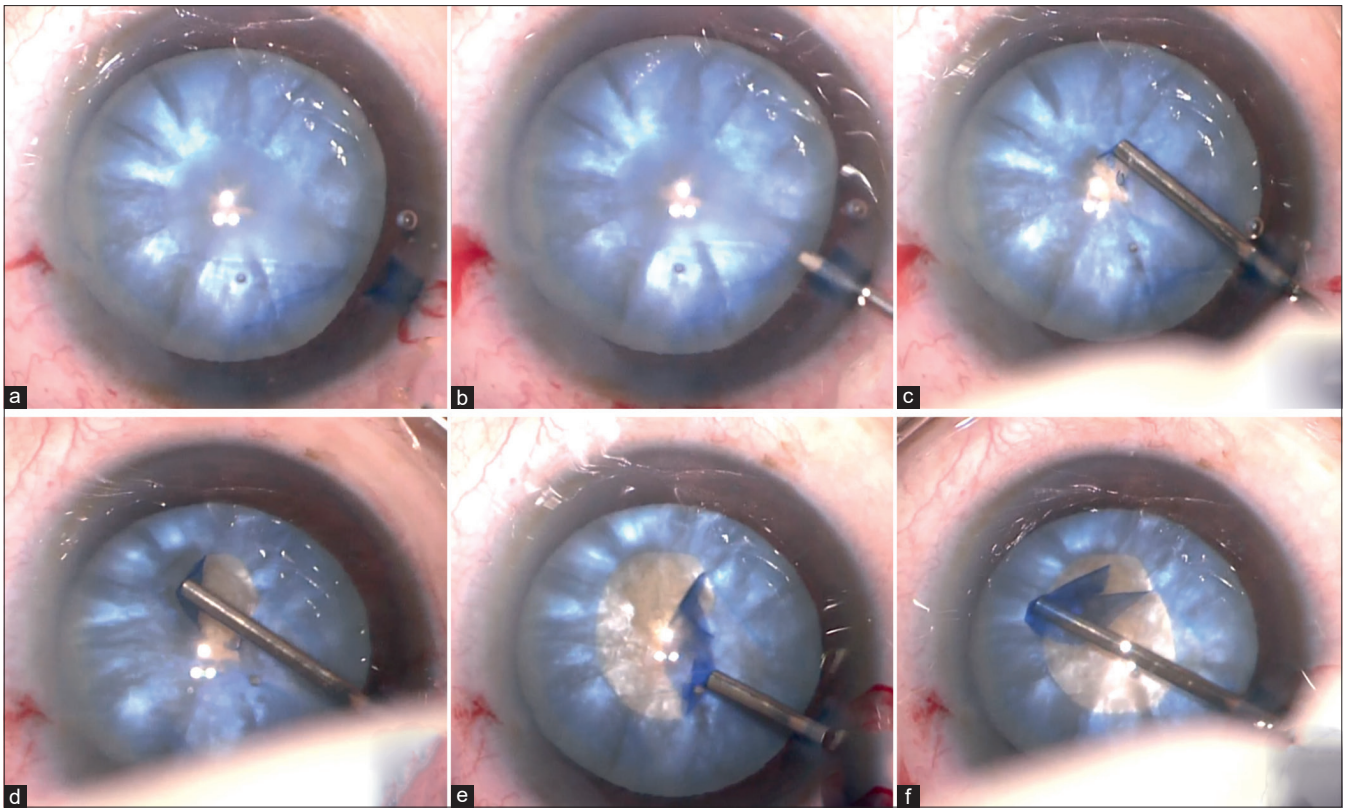

Figure 3: (a) After staining anterior lens capsule, multiple small centripetal tears in the shape of STAR is created, (b) OVD is injected, (c) STAR CanVac CCC started using a 25-G flat-tipped fine cannula, (d) STAR CanVac CCC in progress, (e) Flap regrapsed and redirected when required, (f) STAR CanVac CCC is completed

bag first and then performing capsulorhexis without any chamber collapse. This technique is an improvisation of our own technique of CanVac CCC,[2] with an additional step of creating star-shaped centripetal anterior capsular tears to debulk the distended capsular bag and hence minimize rhexis extension.

Femtosecond laser capsulotomy and Zepto precision pulse capsulotomy (Mynosys Cellular Devices Inc.)[3,4] have been described to be advantageous in intumescent cataracts; however, high incurred costs and limited availability are associated limitations. The technique of using an irrigation/aspiration cannula was attempted in eyes with immature cataracts; however, using this method in eyes with mature intumescent cataracts can be difficult because the jet of fluid from the irrigation cannula can cause rhexis extension. Brierley described a vacuum capsulorhexis technique that uses a 25-G cannula attached to a phaco irrigating handpiece and an anterior chamber maintainer.[5]

Our technique is inexpensive and can be adopted in intumescent cataracts in manual small incision cataract surgery as well as phacoemulsification. The learning curve is not steep, and it is a useful, inexpensive, safe technique and may be an alternative promising method to routine CCC by using a 26-G cystotome, Utrata, or microrhexis forceps in challenging cases such as white intumescent cataracts.

Conclusion

In conclusion, STAR CanVac CCC is a safe and inexpensive technique in white intumescent cataracts and helps to avoid Argentinean flag sign or rhexis extension and further complications associated with the same.

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Conflicts of interest

There are no conflicts of interest.

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