Surgical Technique

Vacuum rhexis – A novel capsulorhexis technique for white cataracts

Sandeep Mahajan, Gitanjli Sood, Ravi Garg

Capsulorhexis in white intumescent cataract is often associated with extension leading to radial tears or biradial extension "Argentinian flag sign" and associated complications. We describe a novel technique of managing this situation. Vacuum rhexis is performed with a 24 G bent cannula attached to a 10-ml syringe. The flap is lifted and then caught using 24 G cannula. The suction is manually controlled by the surgeon, and the rhexis is completed using circumferential movement. The chamber stability is well maintained as there is no leakage, and the bent tip gives excellent fulcrum for movement. The advantage of this technique is that a single port is used for maintaining the chamber stability and it needs no special surgical instruments. Vacuum rhexis is a novel surgical technique used for performing successful continuous curvilinear capsulorhexis (CCC) of adequate size in white and intumescent cataracts, with a consistent and predictable outcome.

Key words: Capsulotomy, vacuum rhexis, white cataract

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In India, especially in the rural parts of the country, people still present for cataract surgery at the intumescent or hypermature stage. In a study on elderly patients, it was found that around 13.5% of cases had white cataract at presentation.[1] White cataracts are often a surgical challenge as capsulorhexis in these scenarios can extend on giving the initial nick to anytime thereafter leading to Argentinian flap sign or it can run off in any of the clock hours. This is due to the raised intralenticular pressure due to accumulation of fluid inside the lens capsule and fragile capsule. As soon as the initial nick is given, the lens decompresses, leading to rhexis extension radially or biradially.

In today's world, cataract surgery has become a refractive surgery and with availability of premium intraocular lenses and patients' expectations, these cases are a surgical challenge. Till date, many techniques have been advised to get over the situation and one can use them according to the surgeon's preference. Even femtosecond laser-assisted cataract surgery (FLACS) does not give an assured continuous curvilinear capsulorhexis (CCC) in white intumescent cataracts. Hence, we describe here a new technique for achieving a CCC in these white intumescent or non-intumescent cataracts. The authors obtained very predictable and consistent results with this approach, with no extension of rhexis in more than 500 cases operated so far.

Surgical Technique

After due surgical consent is taken and giving peribulbar anesthesia, the patient is prepared for surgery. Self-retaining wire speculum is inserted. Corneal entry is made with lance tip 15° blade [Fig. 1a], and anterior capsule is stained with trypan blue dye (0.03%; 50% dilution of 0.06% dye) (Auroblue; Aurolabs, Madurai, India) under air [Fig. 1b]. This is followed by injection of viscoelastic (2% hydroxypropyl methyl cellulose). We do not make the chamber very tight as overfilling the anterior chamber sometimes leads to development of reverse Argentinian flap sign on giving the initial nick as discussed subsequently. After giving the initial nick in the anterior capsule with bent cystitome, a curved flap of anterior capsule is raised [Fig. 1c]. Then, a 24 G bent canula attached to 10-ml syringe (single-use plastic disposable syringe) is introduced and any loose cortical matter is aspirated [Fig. 1d], following which the flap is lifted using suction at the edge [Fig. 1e]. This is followed by circumferential rotation of the rhexis flap [Fig. 1f–h]. In between, the vacuum can be released to release the flap and it is grasped again near the extending edge to get a better control [Fig. 1i and j]. The shaft of the bent needle at the corneal incision gives an excellent fulcrum for circumferential rotation of the flap and the rhexis is completed [Fig. 1k, l]. Maneuvering the rhexis through single incision gives excellent chamber stability. The vacuum is manually controlled; so, anytime the surgeon feels the vacuum is more, he can immediately release it. The flap does not get aspirated into the lumen of the needle. If the initial

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rhexis is small, then the rhexis can be enlarged using orange peel maneuver. After initiating the rhexis and aspirating the liquefied cortex as described above [Fig. 2a–d], we note that the rhexis is small. Then, as we approach toward the initial rhexis edge, the flap is again grasped using vacuum [Fig. 2e] and with gentle movement, it is circumferentially rotated along the initial rhexis like we peel an orange [Fig. 2f and g]. Following completion of capsulorhexis [Fig. 2h], phacoemulsification is completed in the usual manner [Video 1].

Many a times, during routine capsulorhexis, we note that despite aspirating the fluid at the center initially, as we reach midway in the rhexis, more fluid egresses out from the periphery as the capsular entry is made larger. This is the stage when the rhexis runs out usually. In our technique, we hold the capsular flap; so, the authors describe that we should not leave the flap at this moment [Fig. 3a] when the fluid egresses from the periphery. Move the rhexis beyond that meridian [Fig. 3b] and then aspirate the cortex [Fig. 3c]. This is

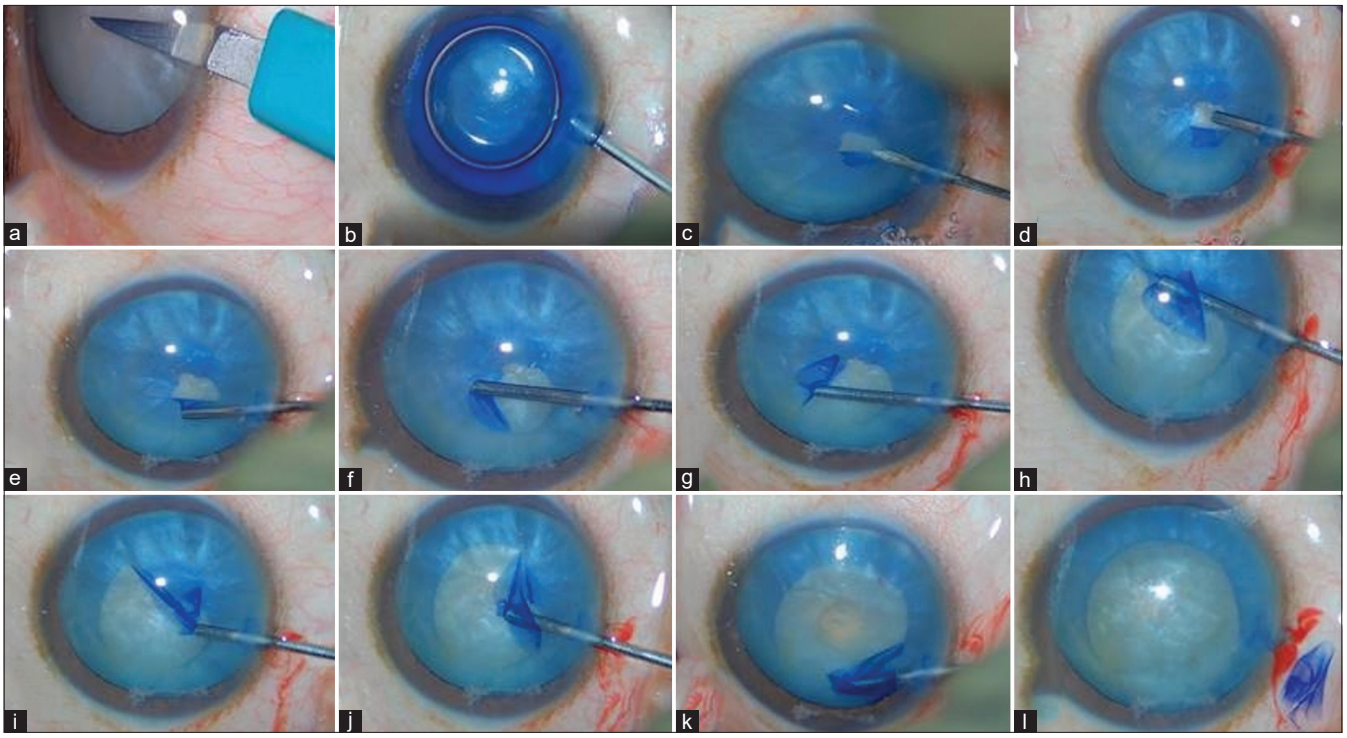

Figure 1: Vacuum rhexis is done through side port corneal entry (a) after staining the capsule (b). An initial nick is followed by aspiration of fluid (c and d). A 24-G bent canula is used to hold the flap of rhexis at the edge using vacuum built manually through an attached syringe. The flap is circumferentially rotated and the rhexis completed (e-l)

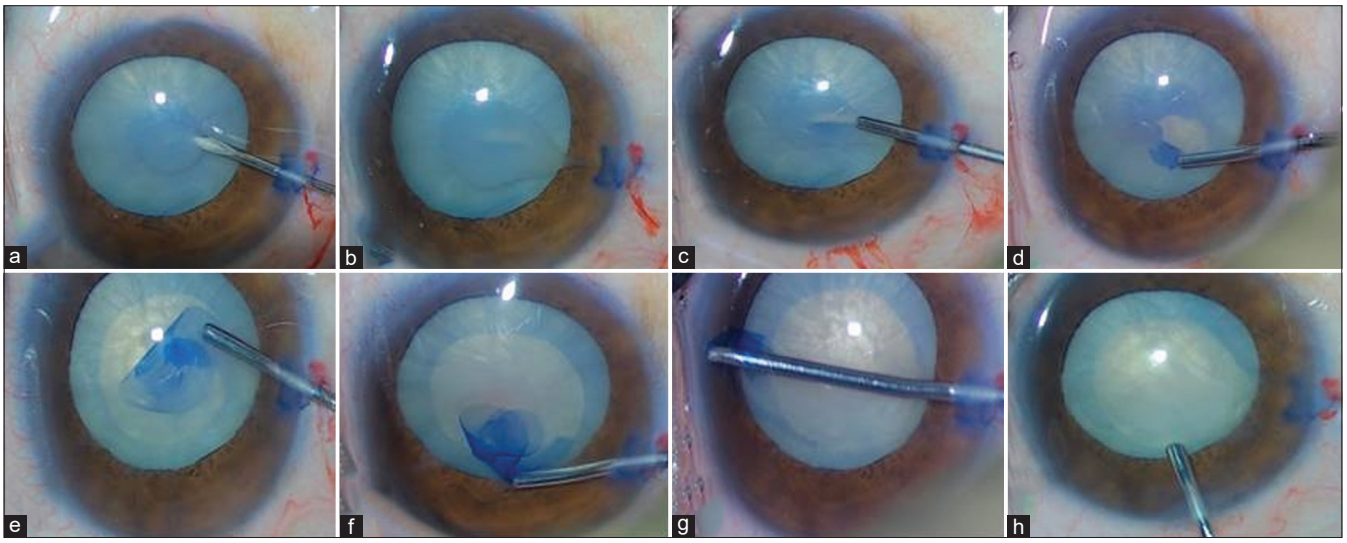

Figure 2: Vacuum rhexis is initiated and liquefied cortical matter is aspirated through 24-G bent canula (a-c). The initial circumference of the rhexis is smaller as the flap is rotated with vacuum (d and e). The rhexis is grasped at the edge near completion and enlarged by gradually pulling it out and rotating (f-h)

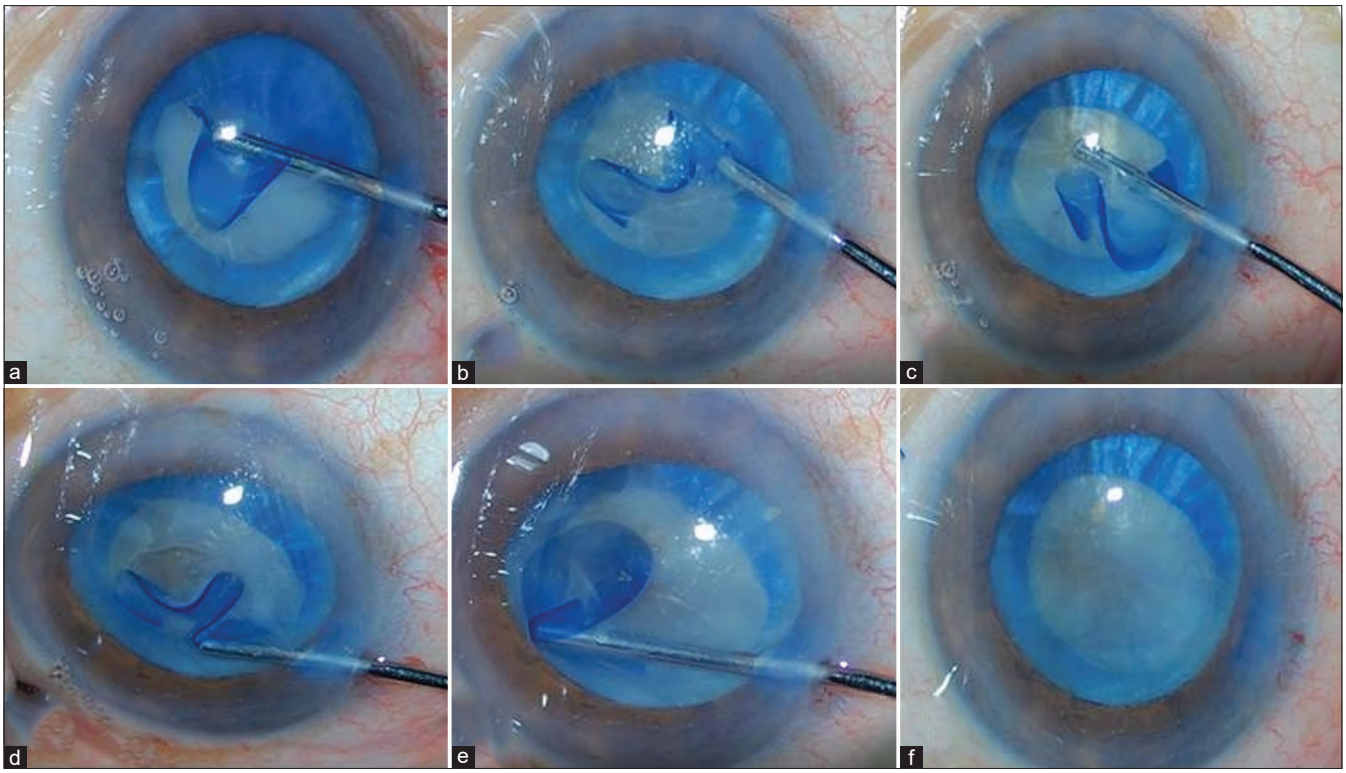

Figure 3: In cases where there is escape of liquid cortex as we move toward the edge (a), there is risk of extension if we leave the flap for additional maneuvers. The vacuum rhexis flap is gradually pulled beyond this point and then the cortex is aspirated (b and c), thus preventing rhexis extension. Then, the rhexis is completed (d-f)

followed by completion of rhexis and enlargement [Fig. 3d–f and Video 1; Case 1].

The surgeon (SM) has operated more than 500 cases of intumescent and white cataract so far using this technique. There was no case in which capsulorhexis extended and phacoemulsification could not be completed.

Discussion

Capsulorhexis in white cataract is the most challenging situation in even the best of hands, as the incidence of incomplete capsulorhexis in such cases has been reported to be around 3.85%–28.3%.[2,3]

Various techniques have been described by far for achieving a CCC in white cataracts. These are initial decompression of the lens by aspirating the liquefied cortex by giving an initial capsular nick and aspirating with a 27 G needle. In another technique, the authors mention making an initial puncture with bevel down 30 G needle, aspirating the liquid cortex, and pushing the nucleus toward the edge to release the posterior pressure.[4] Phacocapsulotomy is another technique used in these scenarios where initial opening in the capsule is made with phaco tip and simultaneous aspiration of cortex is done with a part of the nucleus. It has the disadvantage of unpredictable capsular opening and zonular dehiscence if more pressure is used.[5] Use of cohesive viscoelastic to maintain the anterior chamber has been advised along with all of the above techniques. Two-stage capsulorhexis is often used in which the initial rhexis is made smaller followed by aspiration of liquefied cortex and then enlarging it using snail track technique.[6] Sewing needle capsulotomy is another technique for these intumescent cataracts that uses a special instrument to create initial small circular opening in the anterior capsule that allows the pressure to vent out, followed by completion of capsulorhexis.[7] Use of cohesive viscoelastic to maintain the anterior chamber has been followed in almost all the techniques. Newer capsulotomy devices using nano-pulse technology with nitinol ring and Capsulaser also have limited evidence of safety in white cataracts.

Even the use of the latest technology FLACS in white cataract does not always assure of consistency. Argentinian flag sign has also been reported with FLACS in white intumescent cataracts.[8] The edges of femto rhexis have micro-irregularities, which can extend in the presence of high intralenticular pressure. In a study, it was seen that in around 10% of eyes, there was capsular attachment of 1–2 clock hours after femto laser and 40% cases had microadhesions. So, these cases have the potential of rhexis extension when the rhexis is manually completed.[9]

We also recommend against overfilling of the anterior chamber with viscoelastic, as this can lead to increase in pressure in the anterior chamber, preventing fluid escape when the initial nick is given, which by itself leads to capsulorhexis extension. Similar phenomenon was reported in non-intumescent cataracts as reverse Argentinian flag sign.[10]

The advantage of vacuum rhexis is that the surgery can be done under routine viscoelastic and there is no need for using cohesive viscoelastic. There is no additional instrument required. This cuts down the cost for surgery. The rhexis can also be done using simcoe canula in which vacuum can be built in a manner similar to that used to aspirate cortex in manual

small-incision cataract surgery. The chamber stability is very well maintained, and the cortex is aspirated using the same canula; so, this avoids unnecessary change of instruments and makes surgery faster.

The technique will have a learning curve, but can be easy to master for those already using simcoe canula for aspiration. Though we have not encountered any case of rhexis extension by far, even if one encounters that, it can be managed like in other scenarios with other techniques. The author did the vacuum rhexis initially in cases of immature cataract and as the technique gets mastered, we can shift to difficult cases of white cataract. But once mastered, this could be a boon in a surgeon's life as rhexis is the single most important factor determining outcome in white cataracts.

Conclusion

Vacuum rhexis is a novel surgical technique for performing successful CCC of adequate size in white and intumescent cataracts. The advantage is that it does not need any additional instrument and is easy to master.

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Conflicts of interest

There are no conflicts of interest.

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