Innovations in Ophthalmology

Double peak sign on ultrasonography: A new prognostic marker before surgery for white cataract

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A mature,hypermature ,or white cataract needs posterior segment evaluation before surgery for prognostification. Ultrasonography is the preferred method for this. White cataract or intumescent cataract risks intraoperative capsulorhexis running out leading to devastating complications due to high intralenticular pressure. Altghough sligh-lamp examination before surgery can gives clue regarding fluid pockets under anterior capsule in these types of cataract, fluid in posterior compartment of lens can be detected by ultrasonography. The author here described a new sign, the double peak sign which can predict the high intra-lenticular pressure especially in posterior compartment of the lens. So if it detected before surgery,all precautions can be taken during surgery to prevent complications. The A-scan overlay on the B-scan in ultrasonography can detect the hypoechoic area corresponding to the lequified cortex in between solid lens nucleus and posterior capsule, so giving rise to the double peak sign which is described here as an innovation.

Key words: AB-scan, Argentinian flag sign, capsulorhexis, ultrasonography, white cataract

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DOI:
10.4103/IJO.IJO_2418_23

Quick Response Code:

A mature, hypermature, or white cataract needs posterior segment evaluation before surgery for prognostication. The A-scan, time-amplitude scan, and the B-scan, brightness amplitude scan, have an essential role. B-scan with A-scan overlay helps detect retinal diseases like retinal detachment, vitreous diseases like hemorrhage or vitritis, degeneration, and optic nerve head cupping, explaining the visual prognosis to the patient before surgery.[1] It also gives some vital information about the posterior aspect of the lens in mature cataracts, which guides proper management. In some circumstances, lens posterior capsule (PC) integrity also gets detected to rule out PC defects.[2] Intumescent cataract risks intraoperative capsulorhexis running out, leading to devastating complications due to high intralenticular pressure. B-scan with A-scan overlay can help assess this risk before surgery, so that the surgeon can take all precautions to prevent this and anticipate future complications.

Innovation/Technique

Here, we would like to highlight the role of A-scan overlay on the B-scan in evaluating the lens content or status of the lens cortex, like cortical liquefaction in mature or white cataracts. The mature or white cataract usually has fluid pockets under the capsule due to the liquefaction of the cortex. In slit-lamp biomicroscopy, we can see these fluid pockets under the anterior capsule [Fig. 1]. The liquefied cortex, especially in the posterior aspect of the lens, which cannot be assessed by slit lamp can be detected on an A-scan with a double spike of almost equal amplitude of around 80%–90% reflectivity. These spikes are due to the difference in the interface between PC, liquefied cortex, and the solid nucleus. We want to label these two close spikes as *double peak sign* [Fig. 1]. One peak or spike is for PC and another is for the dens nuclear posterior margin, which is separated from the capsule by a liquefied cortex that represents a hypoechoic area in between these two spikes. In mature cataracts where the cortex is not liquefied, there will be only a single high spike representing PC because, in such cases, both the nucleus and PC are very close without any liquefied fluid in between them. For proper evaluation and documentation of the lens spikes, an axial scan is done with A-scan mode kept "ON" in the Ophthalmic Ultrasound Scanner MARVEL AB (Appasamy Associates). The patient is to be positioned supine, with the examiner at the headend of the patient, and the ultrasonography probe has to be placed vertically over the eyeball with closed lids with a coupling agent over the lids. The thumb, index, and middle finger are used to hold the probe and the fourth and fifth fingers are placed on the nose and brow when scanning the left eye and on the temple and zygomatic area when scanning the right eye for stability. The A-scan mode is kept "ON" while doing the B-scan for the posterior segment

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Received: 02-Sep-2023 Revision: 03-Nov-2023
Accepted: 01-Dec-2023 Published: 05-Feb-2024

Cite this article as: Nayak B, Lalitha CS, Moharana B, Panda BB. Double peak sign on ultrasonography: A new prognostic marker before surgery for white cataract. Indian J Ophthalmol 2024;72:S712-4.

evaluation. After screening the posterior segment for other abnormalities in the retina and vitreous, the focus should be on PC for its high spike. When the surgeon or operator gets this, he has to look for any second spike close to this of the same or nearly the same height as the spike corresponding to the posterior margin of the lens nucleus [Video Clip 1].

When the surgeon finds two high spikes of 80%–90% reflectivity very close, there is a high chance of separation of the nucleus from the capsule due to the liquefied cortex, so there is more possibility of increased intralenticular pressure and intraoperative complications. The surgeon prepares accordingly to manage the case and take the possible precautions before and during surgery to get a perfect capsulorhexis. Sometimes, the capsulorhexis runs away radially on both sides from the initial nick at the center due to high intralenticular pressure leading to the Argentinian flag sign [Fig. 1]. If the surgeon does not get the second spike, then there is unlikely separation of the nucleus from PC, less chance of liquefied cortex, and therefore, less chance of increased intralenticular pressure. All mature white or brown cataracts do not show the same double peak sign as the posterior cortex may not be liquefied in all those cases **[**Fig. 2**].** So, in these cases, there will be less intralenticular pressure from the posterior part of the lens, and hence a lesser risk of complication [Video Clip 2].

In our experience, in cases where the double peak sign was noted on ultrasonography, we faced the problem of extension of the capsulorhexis, sometimes leading to the Argentinian flag sign. But the surgery could be completed successfully without complications due to preparedness. However, in cases with a single spike, the capsulorhexis was well managed with an uneventful surgery.

Discussion

Detection of this "double peak sign" on ultrasonography plays a vital role in managing these cases, as this liquefied cortex is associated with raised intralenticular pressure. Raised intralenticular pressure poses difficulty at an important/crucial step of the cataract surgery like capsulorhexis and leads to an extension of the rhexis or Argentinian flag sign. Especially when planning for phacoemulsification, the surgeon has to take all precautions to prevent extension of the capsulorhexis. Because when the surgeon gives a nick on the anterior capsule in this type of cataract, the whitish fluid which is present under the anterior capsule as liquified cortex comes out suddenly and can be sucked with the same cystitome needle itself or by a 27 G cannula, so that the intralenticular pressure decreases to some extent and we can do a safe capsulorhexis.[3] However, when there is posterior compartment fluid behind the nucleus inside PC, even after the suction of anterior fluid, the intralenticular

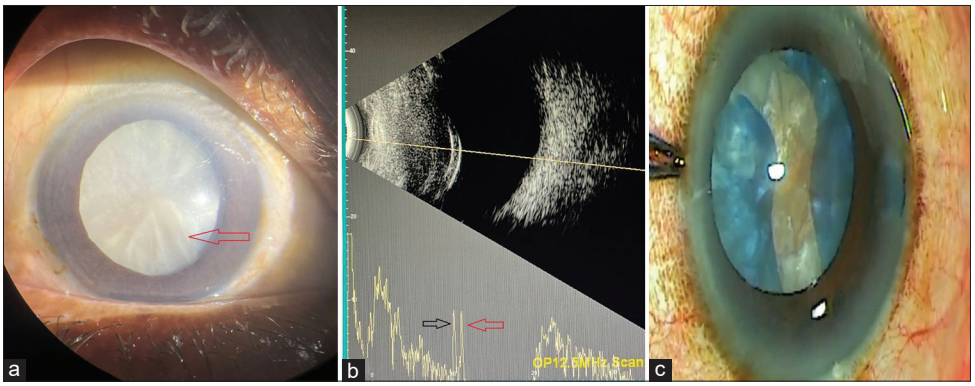

Figure 1: (a) Mature senile cataract with some fluid pockets in the anterior cortex (empty red arrow). (b) B-scan ultrasonography with A-scan overlay shows two full spikes compared to the retina and sclera: one corresponding to the posterior capsule of the lens (empty red arrow) and another representing the nucleus posterior margin. The hypoechoic area between the peaks corresponds to the liquefied cortex. (c) Classic Argentinian flag sign due to the radial extension of capsulorhexis from the central nick to both sides of the lens

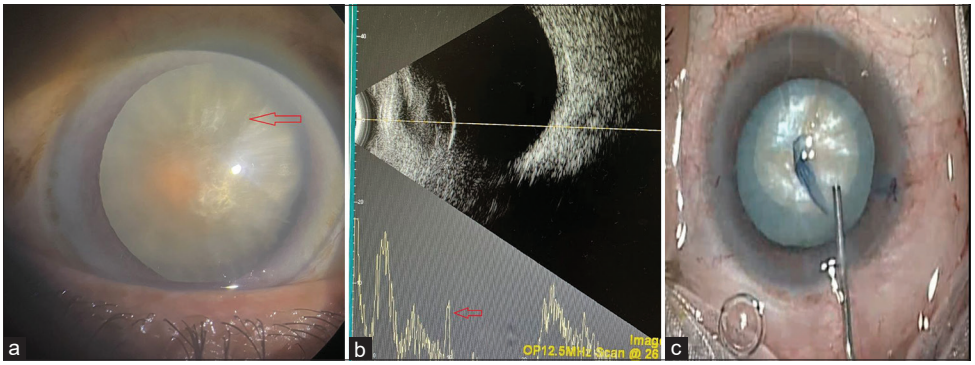

Figure 2: (a) Mature senile brown cataract with some fluid pockets in the anterior cortex (empty red arrow) appreciated in slit-lamp biomicroscopy. (b) B-scan ultrasonography with A-scan overlay shows one full spike compared to the retina and sclera, corresponding to the posterior capsule of the lens (empty red arrow). (c) A successful capsulorhexis after withdrawing of liquefied cortex only as there was less or no posterior intralenticular pressure

pressure still persists. In this case, there is still the risk of extension of capsulorhexis to the periphery up to the lens equator or sometimes beyond the lens equator, leading to posterior capsular rent and creating a nightmare for the surgeon to continue phacoemulsification. Sometimes, the capsulorhexis extends toward both sides from the initial nick by cystitome, leading to the famous "Argentinian flag sign," after which the surgeon has to manage the surgery by various techniques to save the nucleus drop into the vitreous cavity and finish the phacoemulsification safely.[4,5] For a successful capsulorhexis and then phacoemulsification with an intraocular lens (IOL) implantation, the surgeon prefers different techniques like repeat anterior chamber formation with high-molecular-weight viscoelastic, capsulorhexis by rhexis microforceps, phaco capsulotomy, limited anterior vitrectomy through pars plana route to reduce the vitreous upthrust, preoperative mannitol to reduce vitreous pressure, two-stage rhexis, and femtosecond laser-assisted cataract surgery (FLACS).[6-9]

Although other modalities like swept-source–based optical coherence tomography (SS-OCT) have described multiple echoes inside the lens in intumescent cataracts suggestive of liquefied cortex recently, the cost of the machine is a barrier to be utilized in all places.[10] Secondly, the clarity of the "double peak sign" on ultrasonography by our method seems to be a better predictor of posterior compartment intralenticular pressure.

Conclusion

Patients with white or intumescent cataracts showing a fluid cavity in the anterior cortex in slit-lamp biomicroscopy examination should be evaluated for fluid in the posterior cortex on ultrasonography. Identifying this "double peak sign" guides in planning appropriate surgical procedures and adequate pre-op preparation to prevent complications. As this vital ultrasonography sign has not been discovered before or is not found in literature, this new invention, if practiced routinely, will hint about the intralenticular pressure and provide an alarm to the surgeon to be better prepared preoperatively and counsel the patient about the risks and complications accordingly.

Patient's informed consent

Appropriate consent has been taken for publication purposes.

Financial support and sponsorship: Nil.

Conflicts of interest: There are no conflicts of interest.

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