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Argentinian flag sign during refractive laser-assisted cataract surgery – A case report

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ABSTRACT

Purpose: The Argentinian flag sign, or radial capsular tear extensions, is a rare complication when performing capsulorhexis during cataract surgery. Identifying and managing this complication early is important to prevent the tear from propagating around the periphery leading to posterior capsular rupture or vitreous loss.
Observations: The Argentinian flag sign was previously reported in a case of femtosecond laser-assisted cataract surgery (FLACS). However, our report presents the first case after FLACS using the Catalys™ Precision Laser System, a platform which has been associated with a larger percentage of complete capsulotomies when compared to other platforms. Radial extensions of the capsular tear were observed in a 27-year-old male patient with an intumescent cataract in left eye. The complication was managed by manually redirecting and completing the radial extension flaps, along with delicate phacoemulsification and manual cutting of capsular edge in areas with significant capsular-IOL overlap.
Conclusions and importance: Our case report highlights that despite the Catalys™ Precision Laser System success rates, radial tears may occur, especially in highly pressurized intumescent cataract. Therefore, surgeons must be prepared to optimize the surgical techniques to prevent the occurrence of this complication, as well as identify and manage it when it presents.

1. Introduction

Argentinian flag sign is a rare complication when performing capsulorhexis, mostly seen in intumescent cataracts stained with trypan blue. When there is a spontaneous radial tear of the capsule, the protrusion of a white cataract between the blue-stained capsule on either side resembles the appearance of the Argentinian flag.[1]

The Argentinian flag sign typically arises in intumescent cataracts after the initial puncture of the anterior capsule. The large nucleus of a white cataract is compressed equatorially against the capsular edge, resulting in a barrier between the fluid-filled anterior and posterior subcapsular compartments. When the anterior capsule is perforated, the anterior subcapsular compartment is depressurized and the cataract is displaced anteriorly by the pressure within the posterior subcapsular compartment.[2] When this occurs, the radial extension of the capsular tear is often referred to as the Argentinian flag sign. The radial tear can lead to various complications, including zonule rupture, posterior capsule rupture, vitreous leakage, nucleus drop, and posterior dislocation of the intraocular lens (IOL).[3,4]

Multiple approaches have been utilized to enhance the outcomes and minimize the risks of uncontrolled tearing of the anterior lens capsule in intumescent cataracts.[5–9] The use of trypan blue to provide predictable and uniform staining of the anterior capsule, the use of a highly cohesive viscoelastic to maintain a pressurized anterior chamber assisting in flattening the anterior capsule, and the use of aspiration of the liquified cortical matter to equilibrate of pressures between anterior and posterior subcapsular chambers are common techniques to decrease risk of uncontrolled radial tears.[2,8] Different ophthalmic viscosurgical devices, endodiathermy devices,[10] and a 2-stage capsulorhexis[11] have also been proposed.

Performing capsulotomy step with femtosecond laser assisted cataract surgery (FLACS) is another approach used to create predictable circumlinear capsulotomies and mitigate extension of capsular tears. FLACS uses multiple rapid pulses of photoionizing high-energy light that

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together form a circular cut over the anterior capsule. This dissipates the subcapsular pressure over a larger surface over a rapid completion time, when compared to manual capsulorhexis, thereby reducing the risk of radial extension of capsular tears. In cases of intumescent cataracts, the most common reason for microadhesions or incomplete capsulotomies during FLACS, which could predispose to radial extensions, is the sudden release of cloudy liquified cortex into the anterior chamber on initiation of the capsulotomy.[12] This cloudy fluid disrupts the surgical field and impairs the delivery of the laser to the appropriate plane.[13]

There are multiple lasers commercially available for FLACS. The Catalys™ Precision Laser System (Abbott Medical Optics Inc, CA, USA) has been described to be one of the most efficient compared to other platforms. This system is associated with a larger percentage of complete capsulotomies compared to others,[14] making the risk of radial extension even less likely. Despite the safety of FLACS in completing free-floating capsulotomies, a case of the Argentinian flag sign has been reported with the LenSx femtosecond laser platform (Alcon, Fort Worth, TX, USA).[15] In this case report, we present the first similar case after FLACS using the Catalys™ Precision Laser System platform.

2. Case report

A 27-year-old male patient presented to our institute complaining of reduced vision in the left eye (LE). The patient had no prior ocular or medical history. His uncorrected distance visual acuity at presentation was 20/25 in the right eye (RE) and hand motion in the LE and did not improve with correction. Slit-lamp examination revealed a white cataract in the LE. A B-scan of the LE was preformed, revealing no posterior segment mass or retinal detachment. The risks and benefits of the cataract surgery were reviewed with the patient and the patient consented to cataract surgery with FLACS. The patient provided written consent for the presentation and publication of this medical case.

The patient had a central corneal thickness of 598 μm, aqueous depth of 2.1mm, anterior chamber depth of 2.7mm, and lens thickness of 5.6mm. The femtosecond laser was programmed for capsulotomy, lens fragmentation and softening, arcuate incisions and cataract incisions. The procedure was performed using the Catalys™ Precision Laser System (Abbott Medical Optics Inc, CA, USA). The capsulotomy parameters used in this case were a diameter of 5.2 mm, incision depth of 0.6 mm, horizontal spot spacing of 5 μm, vertical spot spacing of 10 μm, pulse energy of 4.0 μJ and laser time of 1.6s.

During the capsulotomy, the absence of a non-interrupted "champagne bubble" gas release phenomena 360° surrounding the capsulotomy was noted. A leakage of milky cortex into the anterior chamber was also noted (Fig. 1A). Once the laser-assisted portion of the procedure was completed, the patient was brought into the operating room. The capsulotomy was noted to be incomplete with adhesions at 12:00 and 7:00 o'clock and radial extensions at 12:00 and 7:00 o'clock (Fig. 1E). Utrata capsular forceps were used to redirect and complete the radial extension flaps where visualized. Delicate phacoemsulfication and cortex aspiration was undertaken with care to not extend the radial capsular tears. An asymmetric multifocal IOL (LENTIS Mplus MF30) was inserted in the capsular bag following phacoemulsification (Figure D,E, F). Once the lens was in the appropriate location, MST micro-scissors and micro-graspers were used to redefine the capsular edge where there was significant capsular-IOL overlap (Figure G,H). Fig. 1 shows the successful implantation of a the IOL in the capsular bag. The patient's distance vision was 20/50–1 (LE) at 1 week, and 20/30–1 (LE) at 3 week post-operatively. Intermediate vision was 20/20 + 2 (LE) and near vision was 20/20–1 (LE) at 5 week post-operatively.

3. Discussion

Capsulotomy is one of the most difficult steps in cataract surgery for intumescent cases due to the highly pressurized posterior subcapsular system and increased risk of radial extension of capsular tears. The capsulotomy step during FLACS dissipates the subcapsular pressure across a larger surface over a short period of time, when compared to

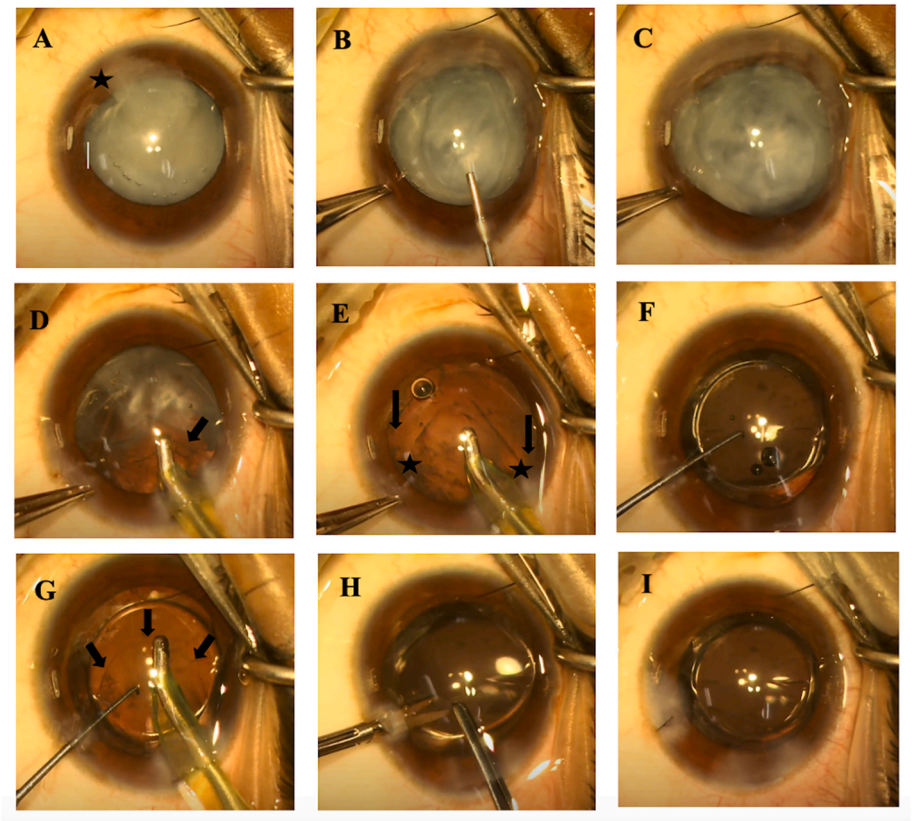

Fig. 1. A) Intraoperative image at the start of the operation: a plume of cortex is visible in the anterior chamber (star). **B,C)** Radial extension of the capsular tear and the Argentinian flag sign became evident. **D)** Phacoemulsification was performed in the context of an incomplete capsulotomy with an adhered anterior capsule flap (arrow). **E)** The anterior capsule flap is evident with 2 areas of incomplete capsulotomy (indicated by stars) and 2 radial extensions (indicated by arrows). **F)** An asymmetric multifocal IOL was placed in the capsular bag micro-grasper and micro-scissors were used to redirect the radial extension. **G)** The anterior capsule flap (arrows) was laid over the intraocular lens. **H)** MST micro-holding forceps and scissors were used to amputate the overlapping anterior capsule flap. **I)** The surgery was successful with the implantation of an asymmetric multifocal IOL centered in the capsular bag.

manual capsulorhexis, thereby reducing this risk. FLACS also allows for great precision in the creation of the anterior capsulotomy, achieving complete capsulotomies with better circularity, size predictability and consistency than manual continuous curvilinear capsulorhexis.[16–18]

Although geometric accuracy has been demonstrated for all commercially available laser platforms, there have been reports on differences between the Catalys™ Precision Laser System and the LenSx laser platform in the creation, execution, and edge quality of the capsulotomy. In comparison to other platforms, the Catalys™ Precision Laser System has been reported as a robust laser system, demonstrating superiority in complete capsulotomy when compared to the LenSx laser platform.[19–22] Conrad-Hengerer et al., evaluated the use of femtosecond laser–assisted capsulotomy in eyes with intumescent cataract using the Catalys™ Precision Laser System and concluded that FLACS was safe to avoid intraoperative capsule complications related to increased intracapsular pressure.[23]

Femto-second laser assisted capsulotomies have been shown to contain micro-irregularities resembling "postage stamp-like" perforations. While these irregularities could theoretically lead to weaker capsule edges and increased risk for anterior capsular tears, such findings have not been reported. However, complication of femto-second laser assisted capsulotomies can still occur, especially in highly pressurized intumescent cataracts. As demonstrated by Adam et al.,[15] intumescent white cataracts may represent a potential risk of incomplete capsulotomies. The high intracapsular pressure and subsequent leakage of the milky cortex into the anterior chamber can lead to obscuration of the anterior lens surface, leading to a movement of the capsule under the focus of the laser, resulting in uncut regions and radial tears.

The incidence of capsulotomy complications, including radial capsule tears as seen in the Argentinean flag sign, are significantly lower when a femtosecond laser is used to create the capsulotomy. However, our case report highlights that despite the Catalys™ Precision Laser System success rates, radial tears may occur in very intumescent or white cataracts. Therefore, surgeons must be aware of the obstacles and difficulties in performing successful surgery in eyes with a highly pressurized subcapsular pressure. Intraoperative measures that may mitigate against further complication include the use of trypan blue, proper anterior chamber inflation with viscoelastic, decompression with aspiration of cortical material, minimal capsular manipulation, delicate phacoemulsification, and gentle IOL insertion with minimal manipulation to ensure near 100% capsular IOL overlap (especially in the optic/haptic junctions).

4. Conclusion

The Argentinian flag sign or radial capsular tear extensions may occur during FLACS using the Catalys™ Precision Laser System during intumescent cataract surgery. Therefore, surgeons must be prepared to optimize the surgical techniques to prevent the occurrence of this complication, and be mindful to identify and manage it when it does present.

Patient consent

The patient consented to publication of the case in writing.

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Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Declaration of competing interest

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