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Case report

Combined flanged intrascleral intraocular lens fixation with corneal transplant

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ABSTRACT

Purpose: To report clinical outcomes and surgical technique of flanged intrascleral intraocular lens fixation with double-needle combined with either penetrating keratoplasty (PKP) or ultrathin Descemet-stripping automated endothelial keratoplasty (UT-DSAEK).

Observations: Five patients underwent combined flanged intrascleral intraocular lens fixation with double-needle technique and keratoplasty. Three patients underwent triple procedure (open sky intrascleral intraocular lens fixation with double-needle and PKP) secondary to ocular trauma or a failed corneal transplant. Two patients underwent combined UT-DSAEK and intrascleral intraocular lens fixation for pseudophakic bullous keratopathy (PBK) and anterior chamber intraocular lens (AC IOL).

Conclusion: Flanged intrascleral intraocular lens fixation with double-needle technique combined with PKP or UT-DSAEK was shown to be a safe and effective method of visual rehabilitation without additional intraoperative complications.

1. Introduction

Ocular trauma or complicated cataract surgery resulting in dislocated crystalline lens, dislocated intraocular lens, or aphakia can result in significant corneal dysfunction and visual impairment. Simultaneous secondary IOL implantation and corneal transplantation, whether penetrating or endothelial keratoplasty ,provides an option to restore vision.

Several modifications to the intrascleral fixation of a posterior chamber intraocular lens (PC IOL) have been reported, including the double-needle technique first described by Yamane in 2014.[1] This method is now viewed as an alternative for eyes with inadequate capsular support.[2–6]

The purpose of this study is to present clinical outcomes of five cases of flanged intrascleral intraocular lens fixation with the double-needle technique combined with corneal transplantation. In addition, we will report a slight modification of the technique first described by Yamane.[1,2]

2. Surgical technique

2.1. Intrascleral intraocular lens fixation with double-needle combined with penetrating keratoplasty

The donor cornea was trephined using an 8.0 mm disposable trephine, and the host cornea was trephined with a 7.75 mm suction disposable trephine to approximately 80% depth. A sharp blade was used to enter the anterior chamber at the base of the trephination groove, Healon (Johnson&Johnson, USA) was instilled into the anterior chamber and corneal scissors were used to complete the circular keratotomy. Anterior vitrectomy was performed through the pupil using the Centurion® (Alcon Laboratories, USA). The limbus was marked at 6 and 12 o'clock and a secondary mark was measured 2.0 mm from the limbus. From the inferior mark, a third mark was measured 2.0 mm inferionasally and from the superior mark, a fourth mark was made 2.0 mm superotemporally. The IOL haptic was verified to fit into the thin-walled 30-gauge needle (TSK ultra-thin wall needle; Tochigi Seiko, Tochigi, Japan), and subsequently placed into the anterior chamber. Two angled scleral tunnels were made parallel to the limbus at the marked locations using the 30-gauge needle and the inferior haptic of the IOL was externalized using a micro forceps (Microsurgical

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Technology, USA). The haptic was then threaded into the lumen of the needle and slowly removed from the eye. This procedure was repeated with the superior haptic. Once externalized, both haptic tips were marked 1.0 mm from the end using calipers, and were then cauterized to create a flanged tip. The cauterized flanges were subsequently fixed into the scleral tunnels and covered with conjunctiva. The donor cornea was grasped with a Colibri 0.12mm forceps and 10.0 nylon sutures were passed through the donor and recipient stroma then tied and trimmed.

2.2. Intrascleral intraocular lens fixation with double-needle combined ultra-thin descemet-stripping automated endothelial keratoplasty

The intrascleral intraocular lens fixation was performed similar to that for PKP. After IOL implantation, the haptics remained external to the conjunctiva as the descemetorhexis was performed and the UT-DSAEK graft (DSAEK graft thinner than 100μm) was prepared, inserted and unfolded in the anterior chamber. After the graft had adhered to the host's posterior stroma, the anterior chamber was filled with air to elevate intraocular pressure. The main incision was closed and a corneal roller was used to massage out interface fluid and reposition the graft. The flanged haptics were then fixed into the scleral tunnels and covered with conjunctiva.

All surgeries were performed by the same experienced surgeon under general anesthesia (KMR).

2.2.1. Case 1

A 41-year-old male with a history of traumatic corneal laceration and uveal prolapse in the left eye (OS), presented for evaluation of a corneal transplant. The patient exam showed a positive Seidel, numerous central corneal sutures and crystalline view impairment due to corneal opacity (Fig. 1). B-scan showed no signs of retinal detachment, vitreous hemorrhage or endophthalmitis. Intraocular pressure (IOP) was 10 mmHg in the left eye. Distance-corrected visual acuity (DCVA) was hand motion (HM) at presentation. The patient was planned for a combined PKP and intrascleral IOL fixation. The surgical procedure was performed as described above. A Sensar AR40e (Johnson&Johnson Vision, USA) 3-piece PC IOL was implanted. There were no intraoperative complications. At 6 months postoperatively patient presented with a clear graft, DCVA was 20/30, IOL was well centered, and no haptic erosions were observed. IOP was 12 mmHg and the retina was attached 360 degrees.

2.2.2. Case 2

A 74-year-old male, with a history of proliferative diabetic retinopathy, vitreous hemorrhage, advanced glaucoma, and multiple anterior segment surgeries including two Ahmed valves and a previous complicated cataract surgery in the right eye, presented for evaluation of corneal transplantation. Anterior segment examination revealed aphakia, stromal opacity, deep scarring, and 3+ guttata associated with bullous keratoplasty. Preoperative DCVA was HM in both eyes and IOP was measured at 18 mmHg. Fundus exam did not show active vitreous hemorrhage. The patient underwent combined PKP and intrascleral IOL fixation as described above. A CT Lucia 602 with polyvinylidene fluoride (PVDF) haptics (Carl Zeiss AG, Germany) PC IOL was implanted. A new vitreous hemorrhage was noted intraoperatively, thus anterior vitrectomy was performed and no intraoperative complications were observed (Fig. 2). Patient was referred to a retinal specialist for additional panretinal photocoagulation (PRP) after surgery. At 1-month postoperatively, we observed exposure of the inferior IOL haptic, which was re-cauterized, repositioned in the scleral tunnel, and covered with Tutoplast® Sclera (Katena Products Inc., USA). At 6 months postoperatively the corneal graft was clear, IOP was 19 mmHg, and DCVA was 20/150 with a manifest refraction of −4.00 sphere. The diabetic retinopathy was stable, IOL was centered, and the haptics were in position.

2.2.3. Case 3

A 52-year-old male with a history of ocular trauma, status post PKP for keratoconus, and corneal laceration with graft dehiscence in the left eye (OS), presented for evaluation of corneal re-transplantation. Examination revealed stromal edema with Descemet's folds 3+ haze, and aphakia. DCVA was 20/400 with a manifest refraction of +16.00–2.00 @ 74. The patient was planned for a combined PKP and intrascleral IOL fixation.

In this case, we were able to visualize the anterior chamber (Fig. 3), thus, the sclerotomies were performed before trephination of the cornea. After corneal trephination, open sky intrascleral IOL fixation was performed. All other steps were performed as described previously. A MA60AC (Alcon Laboratories, USA) PC IOL was implanted (Video 1). There were no intraoperative complications. At 3 months follow up the

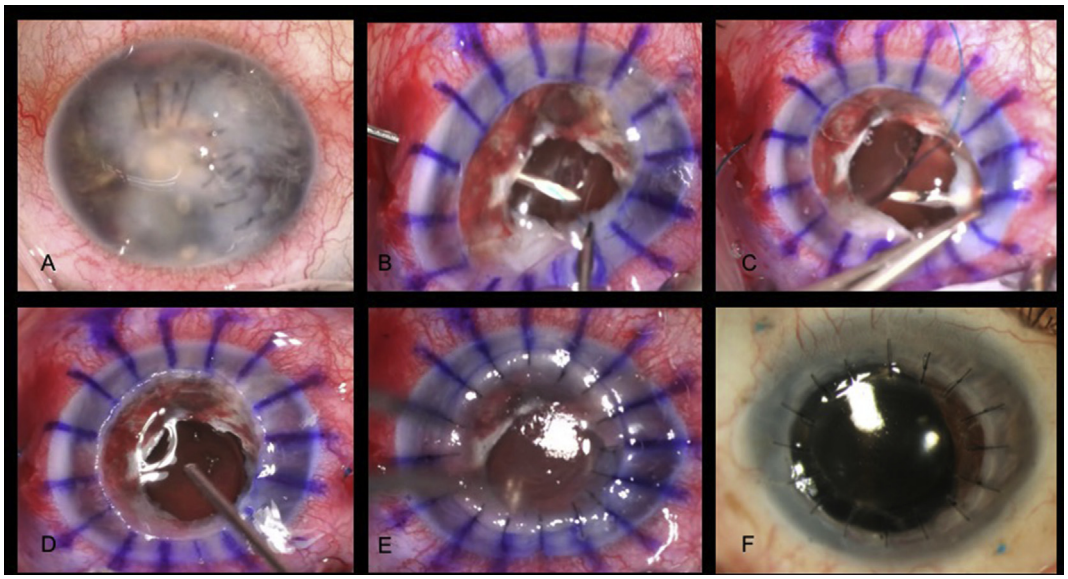

Fig. 1. 41 year-old male with history of ocular trauma. A. view of cornea preoperatively B. after trephination of the host cornea, sclerotomies were performed with a thin-walled 30G needle and the IOL haptic was inserted into the lumen of the needle C. After the first needle was secured, the second needle was passed though the sclera D. anterior vitrectomy in open sky fashion after intrascleral IOL fixation E. Corneal donor placement F. 3 weeks postoperatively.

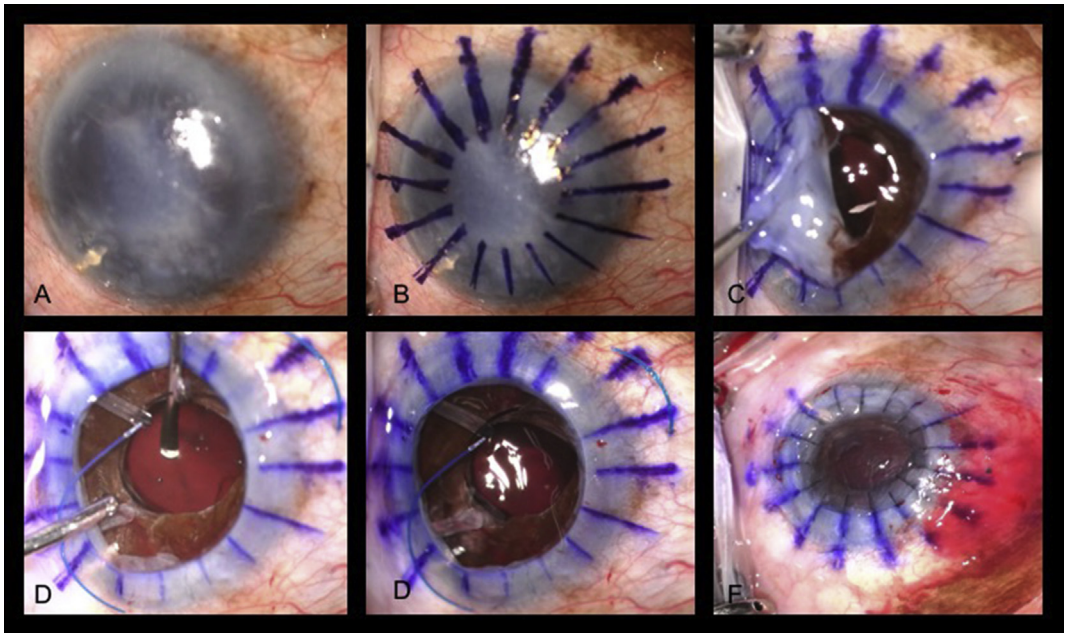

Fig. 2. A 74 year old male with multiples anterior segment surgeries, which included a complicated cataract surgery and two tube shunts. A. Preoperative slit lamp photo. The severe edema prevented an adequate view of the anterior segment B. The corneal was marked for penetrating keratoplasty with a radial marker C. Before complete removal of host cornea, a thin-walled 30G was inserted through the sclera D. After complete removal of the host cornea, the first IOL haptic was secured within the sclera. E. Final aspect of the surgery.

corneal graft remained clear, DCVA was 20/150 with a manifest refraction of +3.00 sphere, IOP was 20 mmHg and there were no retinal or choroidal detachments. The IOL remained centered and no conjunctival erosion was noted.

Supplementary video related to this article can be found at https://doi.org/10.1016/j.ajoc.2018.11.006

2.2.4. Case 4

A 77-year old male with a history of complicated cataract surgery in the left eye (OS) including posteriorly dislocated lens and anterior placement of a 3-piece IOL, presented for evaluation of a corneal transplant. Examination demonstrated diffuse punctate epithelial erosions with Descemet's folds, 2+ haze, and existing anterior chamber 3-piece IOL. Preoperative DCVA was HM in the left eye. The patient underwent combined UT-DSAEK and intrascleral IOL fixation.

The surgical procedure was performed as described above. A MA60C (Alcon Laboratories, USA) was implanted. There were no intraoperative complications (Fig. 4). At 6 months follow up the corneal graft remained clear, DCVA was 20/30 with a manifest refraction of −1.00 –3.00 @ 65, IOP was 24 mmHg, and the implanted IOL was well centered without evidence of conjunctival erosion.

2.2.5. Case 5

A 76-year old male with a history of complicated cataract surgery in

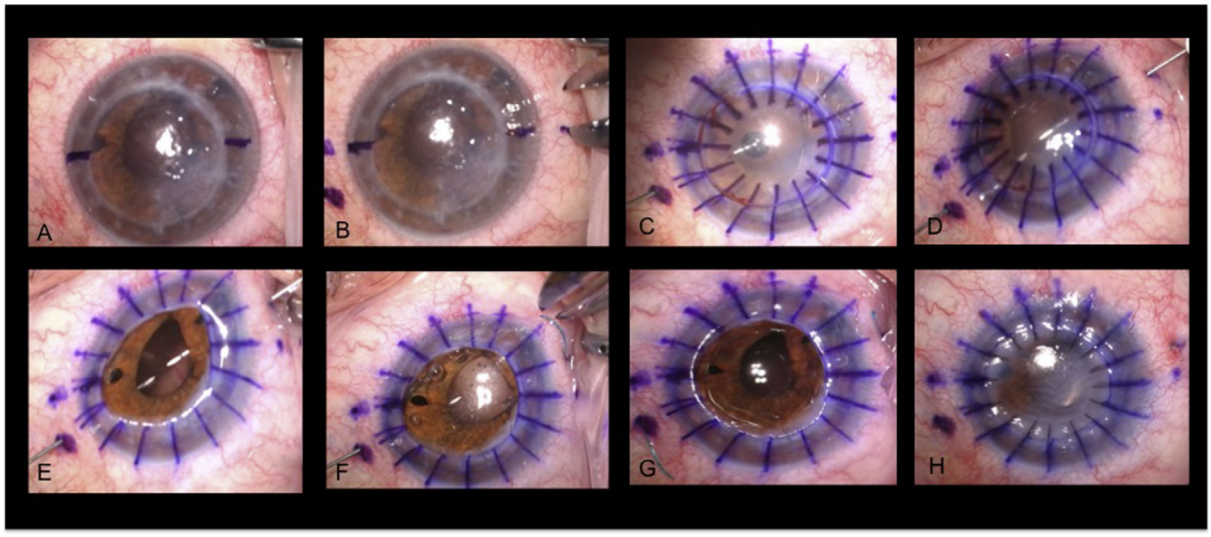

Fig. 3. A 52-year-old male with a history of ocular trauma, status post penetrating keratoplasty A. Failed corneal transplant and aphakia B. Corneal marks were done at 6 and 12 o'clock; a second mark was done 2.0mm from the first and a third mark was made 2.0mm towards the main incision and 2.0mm away from it. C and D. Before complete trephination, the needles were passed through the sclera. E. Complete trephination was performed after the passage of the needles through the sclera F. The first haptic was secured and a 1.0mm mark was done with calipers to mark the flanged position; the second needle remained until the completely passage of the lens G. Aspect of surgery after both haptics were secured within the sclera and cauterization of the flange was done H. Final aspect of surgery.

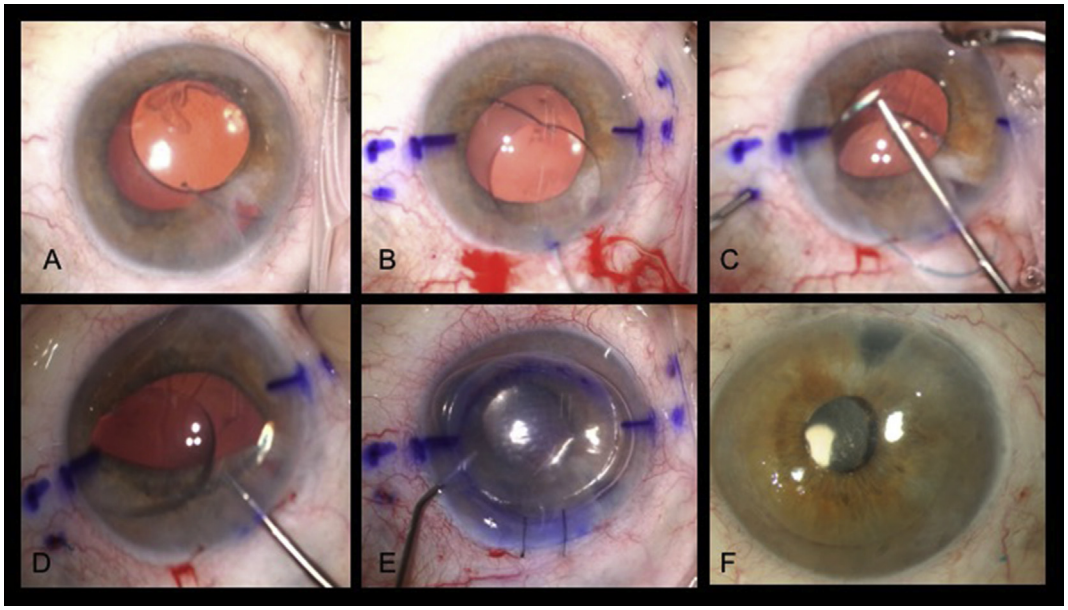

Fig. 4. A 77-year old male with bullous keratopathy and anterior placement of a 3-piece IOL. A. Anterior chamber 3-piece PMMA IOL B. A mark was made at the 0 and 180 meridian, as well as 2 other marks: one 2.0mm from the first one and then 2.0mm towards and main incision, and 2.0mm away from the incision. C. The AC IOL was removed through the main incision. D. Through the main incision, the new IOL was implanted and the haptics were inserted in the lumen of the needle. E. After descemetorhexis, the ultra-thin DSAEK graft was inserted through the main incision, two sutures were placed in the cornea and an air bubble to maintain the corneal graft in position. F. 1-month postoperatively.

the right eye (OD), including 3 prior procedures and 2 displaced IOLs, presented for evaluation of a corneal transplant. Examination revealed corneal edema with Descemet's folds, 2+ haze, and existing AC IOL. DCVA was 20/150 with a refraction of +2.5 –4.50 @ 90°. The patient was planned for a combined UT-DSAEK and intrascleral IOL fixation.

The surgical procedure was performed as described above. CT Lucia 602 with PVDF haptics (Carl Zeiss AG, Germany) was implanted. There were no intraoperative complications (Video 2). At 6 months follow up the cornea graft was clear, DCVA was 20/50 with a manifest refraction of +1.25 –0.50 @ 15, IOP was 18 mmHg, and there was no evidence of retinal or choroidal detachments. The IOL remained centered, flanged tips were buried under conjunctiva, and no evidence of conjunctival erosion was noted.

Supplementary video related to this article can be found at https://doi.org/10.1016/j.ajoc.2018.11.006

3. Discussion

Corneal laceration after ocular trauma and scarring after infectious keratitis in aphakic patients usually leads to a full thickness corneal transplant, while complicated cataract surgery resulting in pseudophakic or aphakic bullous keratopathy is indicative of endothelial keratoplasty.[4] UT-DSAEK, with grafts thinner than 100μm, offer better quality of vision when compared to standard DSAEK.[8] There are, however, certain concerns regarding combined procedures. A triple procedure offers the advantage of faster visual rehabilitation and decreased probability of re-transplantation due to corneal graft failure. Concerns include unpredictable keratometry and astigmatism, as well as, inaccurate IOL power calculation due to unknown postoperative keratometry readings.[7] When performing UT-DSAEK, it is required to account for a small hyperopic shift after surgery.[8] By contrast, a staged surgery requires the stabilization of corneal keratometry after suture removal, which may take up to 12 months. Nevertheless, stable keratometry allows for improved IOL planning. Taking these concerns into consideration, performing combined procedures as documented does not appear to have an unfavorable outcome on corneal grafts or visual acuity.[4,7] Without capsular support for PC IOL implantation, sutureless techniques have been reported with similar results of trans-scleral suturing.[1,2,9] Agarwal et al. described a fibrin glue-assisted sutureless PC IOL implantation technique in 2007.[9] Although it has a similar learning curve, it requires at least two additional surgical steps, such as conjunctival peritomy and scleral flaps, and adds the possibility of episcleral bleeding. In triple procedures, particularly in open-sky approach, the Yamane technique may reduce intraoperative risks of choroidal effusion and expulsive hemorrhage due to its shorter duration.[1,9]

The intrascleral IOL fixation with double-needle technique was first described by Yamane[1] in 2014 and later modified into a flanged technique.[2] The technique is considered safe and reproducible, although,[1,3] challenges remain to be addressed. For example, the haptics of 3-piece IOLs routinely used for secondary implantation including the MA60C (Alcon Laboratories, USA) or Sensar AR40e (Johnson&Johnson vision, USA) are made of polymethyl methacrylate (PMMA), which makes it difficult for the intraocular manipulation of the trailing haptics. Additionally, the haptics may be more susceptible to breakage or bending.[5] The CT Lucia 602 with PVDF haptics is easier to maneuver within the anterior chamber and less susceptible to breaks or conjunctival erosion of the haptics. In certain cases, (eg. Case 1, 3, 4) the CT Lucia with PVDF haptics IOL was not available and we were forced to use a different 3-piece IOL. Although not the perfect IOL for the case, there were no intra or postoperative complications such as haptics break or conjunctival erosion with the PMMA haptics IOLs.

Before the procedure, we verified the IOL haptic fit into the thin wall 30-gauge needle to avoid previously reported problems of the haptics not fitting into the lumen of the needle.[3,10] Different from Yamane,[1,2] we marked the haptic 1.0mm after its exteriorization and before cauterization, in order to achieve better IOL centration. Postoperative OCT measurements have shown that 1.0mm of the haptic is necessary to make a flange diameter of 0.3mm, which is the size required to fit the scleral tunnel created by the 30G needle. Our modification of the technique ensures the flanged haptics are symmetrical and decreases the risk of decentration. In addition, we exteriorized the leading haptic entirely before inserting the trailing haptic, as described by Kim.[5]

Intraoperative complications during an open-sky IOL fixation have

been reported, including vitreous prolapse, choroidal hemorrhage due to changes in IOP, and retinal detachment due to vitreous traction, specifically related to the longer duration of the procedure.[7] It is important to perform anterior vitrectomy in these cases to reduce the risk of vitreous traction and retinal detachment and, if possible, pass the needles before the completion of the keratotomy, when the globe and intraocular pressure are stable. The intrascleral flanged technique is a faster procedure which may decrease intraoperative complications as observed in this case series.

Postoperative complications as reported by Yamane include iris capture, vitreous hemorrhage and cystoid macular edema (CME).[1,2,11] There is also a risk of vitreous traction and thereby retinal tear.[2] Combined procedures did not yield a statistically significant difference in postoperative endothelial cell count or complications when compared to corneal transplantation alone.[4,12] One patient (case 2) presented with an extruded haptic at 1 month postoperatively. The open communication between the vitreous and ocular surface pose a chance of endophthalmitis. To address this risk, we surgically repositioned and covered the exposed haptic with Tutoplast® Sclera.

In this case series of combined corneal transplantation and sutureless secondary IOL fixation, all patients recovered visual function and we did not observe cases of cystoid macular edema, retinal detachment, vitreous loss or choroidal hemorrhage. All patients presented with a centered IOL postoperatively.

4. Conclusion

Flanged intrascleral intraocular lens fixation with double-needle technique combined with PK or UT-DSAEK offers a safe and effective method of visual rehabilitation not associated with increased intraoperative complications.

Patients consent

This retrospective study (case series) adhered to the tenets of the Declaration of Helsinki and was approved by the Medical University of South Carolina (MUSC) institutional review board (IRB) with a waiver of consent because the data were collected as a part of normal practice care provision. Consent to publish the case series was not obtained. This report does not contain any personal information that could lead to the identification of the patients.

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Authorship

All author attests that they meet the current ICMJE criteria for authorship.

Conflicts of interest

The authors have no financial disclosures.

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