

Full-thickness homologous keratoplasty for the repair of a perforated corneal ulcer in a dog

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A 3-year-old neutered female Shih Tzu dog was presented with a history of epiphora and protrusion of a mass from the left eye for the previous three days, suspected to have resulted from self-inflicted trauma. Ophthalmic examination revealed a large, nearly circular perforated ulcer located centrally in the cornea, measuring approximately 8 mm in diameter. Biomicroscopic evaluation showed complete loss of all corneal layers at the centre of the defect, with the iris protruding through the opening and covered only by a thin fibrinous membrane. The peripheral cornea exhibited moderate oedema, obscuring visualization of the iris. Based on these findings, the condition was diagnosed as a large perforated corneal ulcer with staphyloma. Owing to the extensive size of the defect, conventional corneoconjunctival grafting was considered inadequate, and homologous corneal grafting was therefore planned.

The patient was maintained on standard medical therapy for corneal ulceration until surgery, which was performed three days later. The treatment protocol included topical instillation of gatifloxacin eye drops every 4 hours, flurbiprofen eye drops twice daily, 1% atropine eye drops three times daily, and carboxymethyl cellulose eye drops four times daily. Systemic therapy consisted of cefpodoxime administered orally at 5 mg/kg twice daily and carprofen at 4 mg/kg once daily.

A donor cornea was procured from the preserved eye of a dog that had been euthanized approximately 20 days earlier due to irreparable injuries sustained in an automobile accident. The eyes had been harvested and stored individually in sterile plastic containers at -70°C, following the preservation technique described by Lacerda *et al.* (2017).

On the day of surgery, the donor eye was removed from the freezer and thawed at room temperature in Ringer's lactate (RL) solution containing 20 mg tobramycin. The patient was anaesthetized and prepared aseptically for ocular surgery. Centralization of the globe was achieved using atracurium (0.25 mg/kg, i.v.), and a lateral canthotomy was performed to provide wider surgical exposure. Following placement of an eyelid speculum, the globe was stabilized using a 20 mm Flieringa ring secured to the perilimbal area with simple interrupted 4-0 silk sutures involving the Tenon's capsule.

To prepare the recipient bed, a 10 mm corneal trephine was used to create a full-thickness circular incision in the healthy peripheral cornea surrounding the protruding lesion, thereby completely excising the malacic corneal tissue. The peripheral iris adherent to the corneal defect was gently separated using a cyclodialysis spatula. A

central iridotomy was then performed, and the protruding iris-fibrin mass was excised en bloc. Mild iridal haemorrhage was controlled during lavage of the anterior chamber (AC) with 1:1000 adrenaline diluted in RL solution. Subsequently, 0.3 mL lignocaine was instilled into the AC, and the defect was temporarily covered with moist gauze.

The thawed donor eye was then removed from the storage container, and an 11 mm corneal trephine was used to harvest a full-thickness donor graft. The recipient AC was maintained using 2% hydroxypropyl methylcellulose ophthalmic solution (Appavisc PFS) to reposition the iris posteriorly and preserve chamber depth during keratoplasty.

The harvested graft was trimmed appropriately and positioned over the recipient bed, intentionally keeping it approximately 0.5 mm larger than the defect to compensate for postoperative tissue shrinkage. The graft was secured using 10-0 polyamide sutures incorporating approximately 70% corneal thickness in each bite. Four cardinal sutures were first placed at the 12, 3, 6, and 9 O'clock positions, followed by additional simple interrupted sutures spaced approximately 2 mm apart. Before placement of the final suture, the viscoelastic material was aspirated and flushed from the AC using RL solution and an irrigation-suction cannula. The AC was then reformed with an air bubble, and absence of wound leakage was confirmed.

The canthotomy incision was routinely closed in two layers using 6-0 polyglactin-910 for the conjunctiva and 4-0 braided silk for the eyelid margins. A subconjunctival injection containing gentamicin (4 mg) and dexamethasone (4 mg) was administered circumferentially around the perilimbal region. Postoperatively, topical Neosporin-H ointment, 1% atropine, and flurbiprofen eye drops were administered. Systemic therapy included amoxicillin-clavulanic acid (20 mg/kg, b.i.d), carprofen (4 mg/kg, s.i.d), and furosemide (4 mg/kg, b.i.d) for 14 days. An Elizabethan collar was advised for one month to prevent self-trauma.

On the 7th PO day, the corneal graft exhibited mild-to-moderate oedema with focal epithelial erosions, and the fluorescein dye test remained positive. At this stage, immunosuppressive therapy was initiated both topically and systemically. Topical 0.2% cyclosporine eye drops were instilled q.i.d, along with oral cyclosporine administered at 5 mg/kg body weight twice daily.

By the 14th PO day, the peripheral host cornea showed improved transparency. Superficial 360° neovascularization of the host cornea, along with extensive vascular

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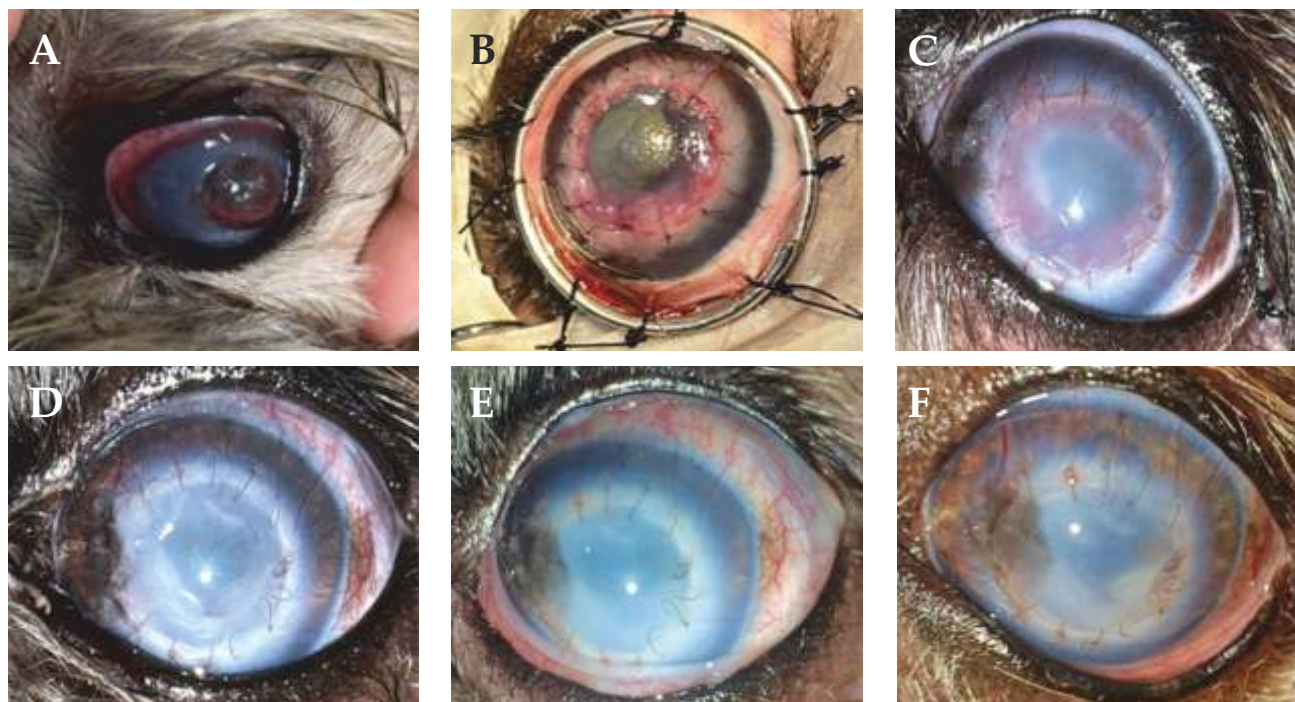


Fig. 1: Large perforated corneal ulcer with staphyloma in a dog: (A) Initial presentation; (B) Immediately after keratoplasty; (C) 14 days after surgery; (D) 1 month after surgery; (E) 2 months after surgery; (F) 3 months after surgery.

ingrowth into the graft, was evident. Although the menace response remained absent, the dazzle reflex was positive. The epithelial defects had almost completely healed, with only faint fluorescein uptake observed on the corneal surface. At this stage, Neosporin-H ointment was replaced with a topical gatifloxacin-prednisolone combination administered six times daily. Cyclosporine therapy was continued.

At one month, gradual integration of the graft with the host corneal bed was observed, with a few newly formed blood vessels extending towards the centre of the graft. A dense circumferential corneal opacity persisted at the interface. Mild superficial corneal melanosis was noted over the ventromedial quadrant of the graft. At this stage, the menace response became positive. The topical gatifloxacin-prednisolone combination was replaced with moxifloxacin-dexamethasone eye drops administered four times daily, while the remaining treatment regimen was continued unchanged.

Follow-up examinations at the second and third months revealed progressive reduction in residual corneal opacity and improved integration of the graft with the host tissue. The superficial melanosis over the ventromedial quadrant increased until the second month but subsequently stabilized. The number of corneal blood vessels gradually decreased, and by the third month only a single active vessel remained. Although the transparency of the graft improved progressively over time, it did not attain the clarity of a normal cornea. Nevertheless, the animal regained functional vision in the affected eye within one month of surgery, with further improvement corresponding to the gradual increase in corneal transparency.

It could be concluded that corneal grafting or keratoplasty is essential for restoration of vision in

complicated large corneal ulcer. There are different kinds of grafts and grafting techniques that have been utilized both in human and animals with variable rate of success (Hansen and Guandalini, 1999; Vanathi *et al.* 2002; Wilson and Kaufman, 1990). Though a higher rate of success has been reported with fresh homologous partial-thickness corneal grafts (Vail *et al.*, 1997; Brooks, 2010; Lacerda *et al.*, 2017) the use of full-thickness frozen corneal graft was the only option in the present case under the given circumstances. It was utilized with success by managing the pre and postoperative challenges by modifying the treatment strategies that ultimately resulted in restoration of functional vision of the dog.

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