Use of Radiopaque Intraorbital Catheter in the Treatment of Sino-Orbito-Cranial Mucormycosis

Sino-orbital mucormycosis, especially with intracranial involvement, is a devastating infection affecting mostly immunocompromised patients. When combined with systemic therapy and surgical débridement, intraorbital amphotericin B infusion can be an important adjunctive therapy for orbital mucormycosis.[1] Correct placement of the intraorbital catheter can be critical to proper drug delivery. We describe a technique using a barium-embedded neurosurgical catheter for intraorbital drug delivery. Intraoperative fluoroscopy can also be used to assess and adjust catheter tip placement to achieve optimal results.

Methods. An upper eyelid crease incision is made, followed by dissection to the superior orbital rim. A subperiosteal dissection plane is developed along the roof and medial wall of the orbit. Attention is next directed to placement of the barium-embedded catheter (Innervision Ventricular Catheter; Medtronic, Inc, Minneapolis, Minnesota) (**Figure**, A). Scissors are used to make a small opening into the periorbita 10 mm posterior to the rim. The catheter and stylet are then gently threaded into the orbit and 4-0 chromic suture is used to secure the catheter to the periorbita to simplify eventual removal of the catheter. The periosteum is reapproximated over the catheter (Figure, B). The catheter is then tested by infusion with 2 mL of isotonic sodium chloride solution while the globe and pupil are observed. Next, a small stab incision is made through the skin lateral to the tail of the brow, and subcutaneous blunt dissection with a curved hemostat is used to tunnel into the eyelid crease opening (the subcutaneous plane avoids injury to the facial nerve). The catheter is externalized (Figure, B) and secured to the skin with 6-0 silk sutures using the sleeve provided with the catheter. An 18-gauge angiocatheter

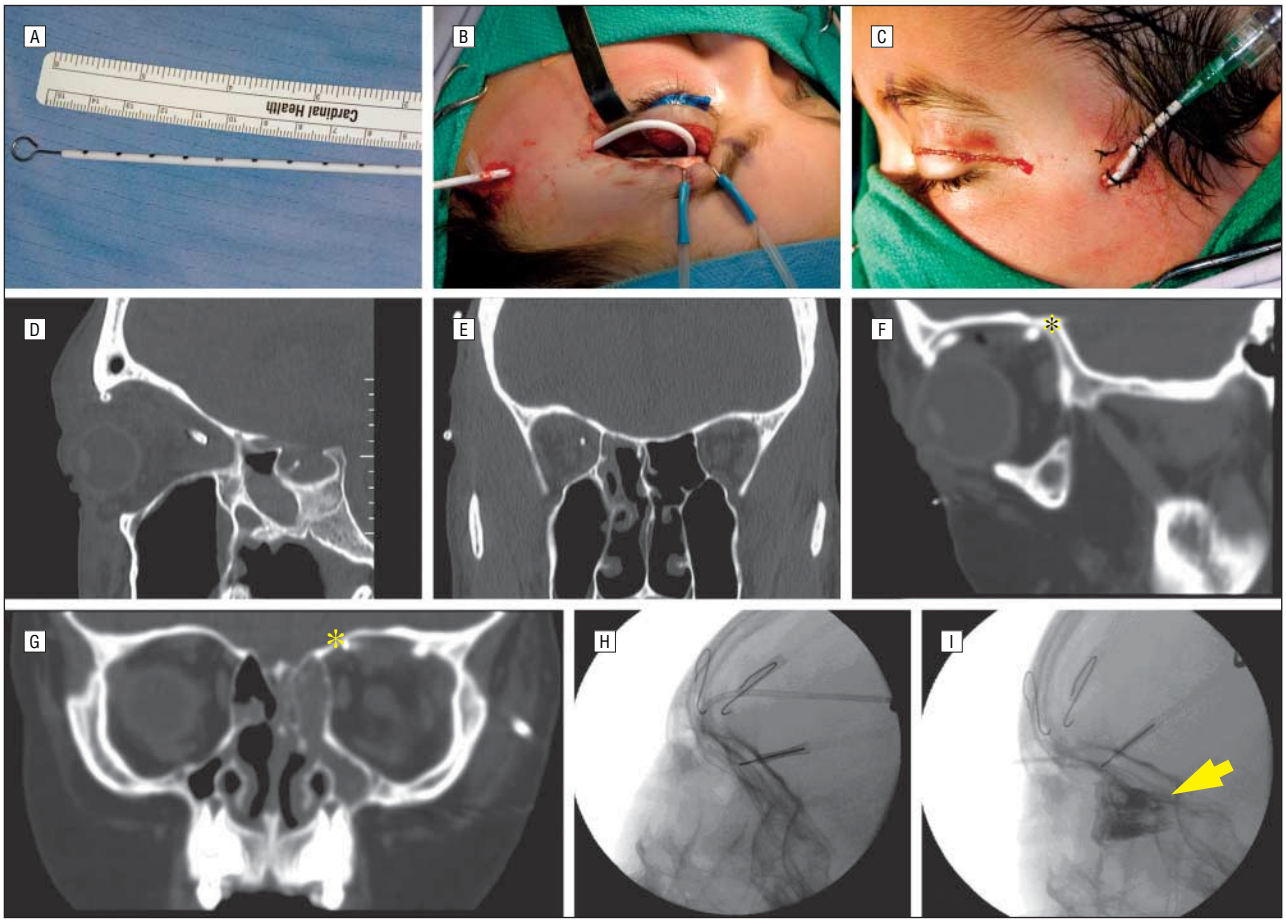

Figure. Surgical technique and results. A, Radiopaque catheter was used to facilitate visualization. Ten-millimeter marks on the catheter can be used to aid in localization. The Innervision Ventricular Catheter (Medtronic, Inc, Minneapolis, Minnesota) is 15 cm long and made of translucent silicone elastomer containing a barium-impregnated stripe. B, Placement of the intraorbital catheter and externalization through a lateral stab incision. C, Catheter placement after closure. Sagittal (D) and coronal (E) computed tomographic scans of patient 1 revealing excellent position of the radiopaque catheter tip. Sagittal (F) and coronal (G) computed tomographic scans of patient 2 showing the catheter (asterisk) curving inside the orbit and pointing away from the orbital apex. H and I, Intraoperative fluoroscopy allows for localization of the catheter tip. H, Sagittal view before the infusion of iohexol. I, Immediately after iohexol infusion. The infusate (arrow) can reveal the direction of fluid spread.

is cut to a point, threaded into the Innervision catheter, and secured with 6-0 silk sutures. A cap is placed on the catheter. The eyelid crease incision is closed in a layered fashion (Figure, C).

Case 1. Patient 1 was a 47-year-old man with AIDS resistant to aggressive antiviral therapy who had orbital pain and eyelid swelling. He was found to have mucormycosis of the right paranasal sinuses, orbit, and cranial cavity. Following sinus débridement and initiation of systemic amphotericin B therapy, the orbit was explored and an intraorbital catheter was placed as described earlier. A lateral suture tarsorrhaphy was placed to help prevent conjunctival prolapse. Postoperative imaging revealed the catheter to be in good position (Figure, D and E). Two milliliters of amphotericin B at a concentration of 1.25 mg/mL was infused intraorbitally for 4 weeks, along with systemic administration of liposomal amphotericin B and posaconazole as well as amphotericin B nasal spray. The patient's orbital infection improved despite his severely immunocompromised state. He maintained excellent vision in both eyes with no evidence of optic neuropathy. During the next 6 months, he developed liver failure and ascites. He died of complications related to hepatorenal failure. At the time, there was no evidence of progression of his *Rhizopus* infection.

Case 2. Patient 2 was a 7-year-old boy with pre–B-cell acute lymphoblastic leukemia after induction therapy who had left orbital pain and diplopia. At his initial visit, his mucormycosis involved the nasal sinuses, left orbit, cavernous sinus, and brain, including thrombosis of the left internal carotid artery. An intraorbital catheter was placed for infusion of amphotericin B into the orbital apex along with systemic amphotericin B and posaconazole as well as amphotericin B nasal spray. After subcutaneous fluid was noted at 1 day postoperatively, an orbital computed tomographic scan revealed that the radiopaque catheter made a U-turn at the orbital apex, pointing away from the superior orbital fissure (Figure, F and G). In the operating room, the catheter was repositioned with the aid of intraoperative fluoroscopy using a 1:1 dilution of iohexol, a nonionic, low-osmolarity, low-toxicity, iodinated contrast medium[2] (Omnipaque; GE Healthcare, Chalfont St Giles, Buckinghamshire, England) (Figure, H and I). A lateral temporary suture tarsorrhaphy was placed to help prevent conjunctival prolapse. Intraorbital amphotericin B was infused for 2 weeks (1 mL of amphotericin B at a concentration of 1 mg/mL 2-3 times daily), during which time the patient's disease progression was halted and began to regress. After 20 days, his catheter was pulled. For the following year, his medical care alternated between chemotherapy for his leukemia and antifungals for his mucormycosis. The patient died 16 months later following severe intraventricular hemorrhage and cerebral edema.

Comment. Treatment of sino-orbito-cranial mucormycosis is challenging and often requires a multidisciplinary team approach. If possible, the immune compromise should be reversed. Until the immune system regains function, combining systemic and local therapy appears to provide patients with the best chance of clinical improvement and survival. In many cases, orbital exenteration can be avoided. Infusion of antifungal medications through an intraorbital catheter has become an important adjunct to consider in the treatment of this disease.[1,3-6]

Our technique uses a radiopaque barium-embedded neurosurgical catheter that is widely available in hospitals with a neurosurgical service. The use of intraoperative fluoroscopy can confirm excellent catheter positioning. Systemic treatment recommendations for patients with mucormycosis continue to evolve, and the use of systemic posaconazole is expanding.[6,7] Both of our patients were treated with systemic liposomal amphotericin B and posaconazole. Thus, we cannot comment on the relative contribution of each aspect of the multifaceted treatment of these 2 patients beyond our observation that their disease was progressive until the sinus disease was debulked and intraorbital amphotericin B administration was initiated. As the optimal antifungal agents, dosing, and routes of administration are established, this method of intraorbital catheter placement may be useful when intraorbital infusion is desired.

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Risk Factors for Contact Lens–Related *Fusarium* Keratitis

I read with interest the article by Khor et al[1] concluding that use of ReNu MultiPlus (Bausch & Lomb, Rochester, New York) significantly increased the risk of contact lens–related *Fusarium* keratitis in Singapore. The conclusions contradict the results of studies carried out by the Centers for Disease Control and Prevention and the Department of Health in Hong Kong.[2,3] Khor and colleagues reference on several occasions that the Centers for Disease Control and Prevention study did not show an association with ReNu MultiPlus and that the available evidence suggests that