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Tools and techniques

Endoport-assisted surgical evacuation of a deep-seated cerebral abscess

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ABSTRACT

Conventional surgical treatment for cerebral abscesses includes craniotomy or stereotactic aspiration. Deep-seated, large abscesses pose a challenge to neurosurgeons, due to the risk of injury to the cortex and white matter tracts secondary to the brain retraction necessary to access the lesion. The endoport is a tubular conduit that can be employed for minimally invasive approaches to deep-seated intracranial lesions, and it may reduce the length of dural opening, size of corticotomy, and retraction-related injury. In this technical note, we present the first report of an adult with a deep cerebral abscess which was successfully treated with endoport-assisted surgical evacuation. The endoport has been shown to be useful for the treatment of other intracranial pathologies, and we believe that this technology may be employed for the evacuation of appropriately selected cerebral abscesses.

1. Introduction

The morbidity and mortality associated with cerebral abscesses have drastically decreased over the last four decades. This is attributable to improved neuroimaging, surgical techniques, and antimicrobial therapy [1]. Current surgical treatment methods include craniotomy for resection or stereotactic needle aspiration of the abscess [2,3]. The former approach is generally performed for large, multiloculated abscesses causing mass effect or superficial lesions located in non-eloquent brain areas, whereas the latter is utilized for deep-seated abscesses or those located within or adjacent to eloquent regions [4,5]. Despite recent technological advancements, neurosurgeons continue to face considerable challenges in safely and definitively treating large, subcortical abscesses with deep extension [6].

The endoport is a tubular conduit that can be used as a retractor system for minimally invasive approaches to deep-seated intracranial lesions [7]. Previous reports from our institution detail the various aspects of endoport-assisted microneurosurgery for various pathologies [8–10]. This technology allows for visualization of deep-seated lesions with a potential reduction in cortical injury and retraction-related complications, such as venous infarction and cerebral edema [11]. In this technical note, we describe the first case of endoport-assisted surgical evacuation of a cerebral abscess in an adult.

2. Technical note

A 33-year-old male initially presented to our emergency department following a penetrating orbital injury to the left eye by a metal rod. He sustained a full-thickness laceration of the medial left upper eyelid and left upper canaliculus with extension into the medial canthal area, for which he underwent repair by our institution's ophthalmologists. No neuroimaging was obtained at that time and neurosurgery was not consulted. Nine days later, he returned to our emergency department with progressive left orbital swelling, lethargy, and altered mental status. Brain computed tomography (CT) demonstrated a comminuted fracture of the left orbital roof associated with a large, left frontal lobe abscess, resulting in significant cerebral herniation (Fig. 1).

The patient was taken emergently to the operating room for a bifrontal craniotomy and frameless stereotactic neuronavigation-guided abscess needle aspiration using the StealthStation system (Medtronic Sofamor Danek, Inc., Memphis, TN, USA). Bone

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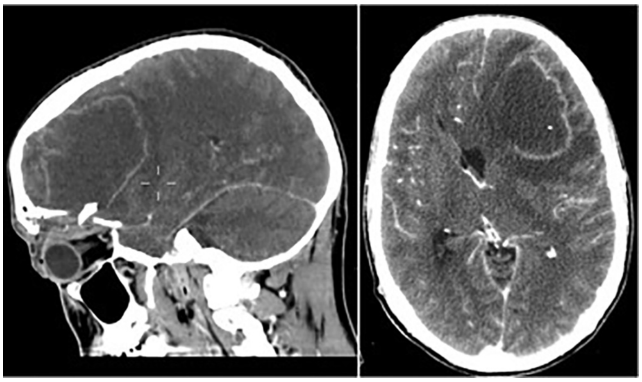

Fig. 1. CT scan of head with intravenous contrast on first presentation to emergency department. A) Sagittal view demonstrating a comminuted fracture of the left orbital roof with bone fragments in left superior orbit and left frontal lobe. B) Axial view demonstrating a large associated left frontal lobe abscess resulting in severe rightward midline shift, left uncal and medial temporal lobe herniation, and descending cerebral herniation.

fragments were removed from the fractured left orbital roof where they had torn the inferior frontal dura. Additionally, the frontal sinus was cranialized, and a vascularized pericranial graft was used to repair the anterior cranial fossa. Postoperatively, broad-spectrum antibiotics were administered to the patient.

Postoperative brain magnetic resonance imaging (MRI) demonstrated a residual abscess cavity with peripheral diffusion restriction and vasogenic edema (Fig. 2). The patient improved neurologically and was discharged home on postoperative day (POD) 4. The patient was prescribed a course of vancomycin and metronidazole for cultures growing coagulase-negative Staphylococcus from the left eye and Bacillus species from the cerebral abscess. These cultures speciated to Propionibacterium acnes three days later, and the patient's antibiotic regimen was subsequently changed to ceftriaxone and metronidazole.

Three days later, the patient re-presented to the emergency department again with persistent fevers. Although he was neurologically non-focal, a brain MRI demonstrated interval increase in size of the left frontal abscess, primarily at the deep portion of the cavity with extension to the ependymal lining of the ventricle. At this time, we decided to proceed emergently with endoport-assisted surgical evacuation of the deep-seated abscess. After general anesthesia was induced, the patient was placed in a supine position and a three-point fixation Mayfield Skull Clamp System (Integra, Plainsboro, NJ, USA) was applied. The StealthStation neuronavigation system was used to determine the optimal trajectory to the abscess using the endoport. The prior incision was re-opened, and the bone flap was removed.

Next, using neuronavigation, the BrainPath endoport system (NICO, Indianapolis, IN, ISA) was inserted into the deep abscess lateral to the ventricle (Fig. 3). This system is comprised of an outer sheath, which attaches to a Greenberg retractor for stabilization, and an inner obturator. The diameter of the outer sheath is 13.5 mm, and the length varies between 50, 60, and 75 mm. In this case, we used the 75 mm outer sheath. The inner obturator has a blunt, tapered tip which is 15 mm longer than the outer sheath (or 8 mm longer for the 50 mm outer sheath) and designed to minimize injury to the cortex and underlying white matter tracts. In this case, the use of the endoport also allowed for preservation of the pericranial graft by limiting the area needed for entrance [8].

The operating microscope was used for dissection and resection of the abscess using standard bimanual technique. Thick, purulent fluid was evacuated from the abscess cavity, and the lateral inferior aspect of this cavity was opened, demonstrating another purulent locule. After sufficient deep abscess resection, the endoport system was retracted, and further purulent fluid was evacuated. The endoport was then re-angled anteriorly, and additional abscess was excised. The bone was then re-plated after hemostasis was achieved. Postoperative MRI showed marked improvement in the appearance of the abscess (Fig. 4).

The patient had an uncomplicated postoperative course and was discharged home on POD 4 without neurological deficits. An MRI performed 6 weeks after discharge demonstrated definite overall improvement in the size and appearance of the postsurgical left upper frontal abscess cavity, surrounding edema, and mass effect (Fig. 5). He completed eight weeks of antibiotic therapy with vancomycin, ceftriaxone, and metronidazole, and he remained asymptomatic at his eight-week follow-up appointment.

3. Discussion

While surgical excision of cerebral abscesses poses greater operative risk to the patient compared to needle aspiration, the

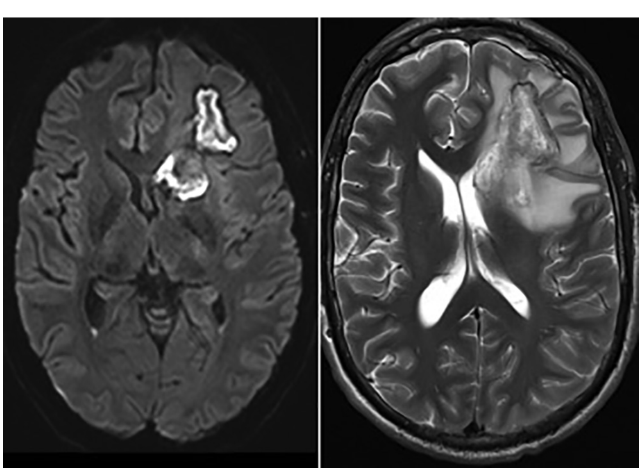

Fig. 2. MRI of brain after first bifrontal craniotomy and left frontal abscess washout. A) Diffusion-weighted imaging demonstrates restriction in the periphery of the residual abscess cavity. B) T2-weighted MRI without contrast reveals a smaller abscess cavity in the left frontal lobe with surrounding vasogenic edema and mild intraventricular extension. There is improvement in mass effect as compared to the CT scan in Fig. 1.

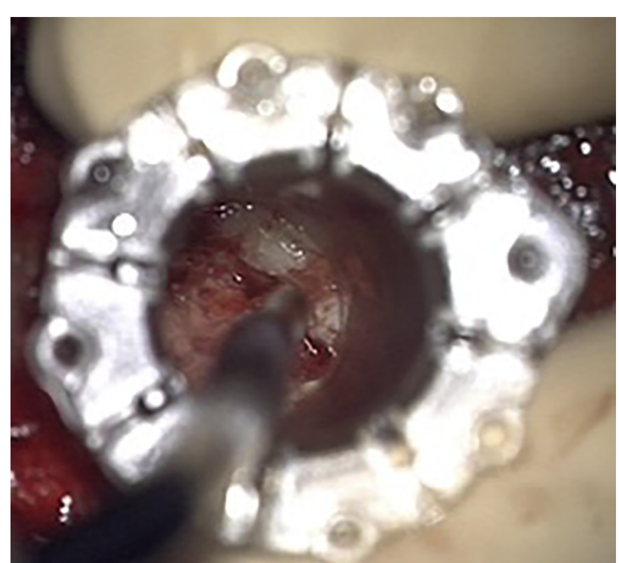

Fig. 3. Intraoperative view through the endoport with underlying abscess material.

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