

Management of Frontal Sinus Cerebrospinal Fluid Leaks and Encephaloceles



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KEYWORDS

- Cerebrospinal fluid leak • Encephalocele • Frontal sinus • Anterior cranial base
- Skull base tumor • Endoscopic sinus surgery • Endoscopic skull base surgery

KEY POINTS

- Comprehensive preoperative workup including history, physical, imaging, and confirmatory laboratory testing will help determine the cause for cerebrospinal fluid leak or encephalocele.
- Hemostasis with topical and infiltrative vasoconstrictors aids in visualization and decreases risk of surgical error.
- Careful and complete exposure surrounding the encephalocele helps the surgeon control bleeding and permits greater working area.
- Aggressive postoperative antiemetics, stool softeners, and nasal packing support the repair against spikes in intracranial pressure in the early postoperative period.
- Vigilant postoperative endoscopy with debridement increases the chance of frontal sinus patency long-term.



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INTRODUCTION

Traditional management of frontal sinus pathology (eg: trauma, neoplasms) involving the posterior table has primarily included the osteoplastic flap or cranialization procedures intended to obliterate or ablate the frontal sinus. However, recent developments in technical expertise, widespread frontal sinus training, and advancements in instrumentation now permit excellent surgical access to

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the frontal sinus posterior table using endoscopic approaches.^{1–12} Mounting evidence indicates outcomes are equivalent to open techniques for eligible cases with the advantage of decreased morbidity and lack of external incisions. Skull base defects secondary to a variety of causes, including trauma, neoplasm, iatrogenic, congenital, and spontaneous pathology, may often be repaired using endoscopic techniques. The presence of cerebrospinal fluid (CSF) rhinorrhea indicates there is an open communication to the intracranial space, which places patients at risk for meningitis and other cerebral complications. To prevent these life-threatening sequelae, identification of the leak and repair of the associated defect is integral to appropriate management. Recognition of leaks preoperatively involves a high degree of clinical suspicion, imaging, laboratory testing, and nasal endoscopic examination. Careful surgical technique, individualized to each patient's pathology and anatomy, is vital to successful treatment and reducing the risk of postoperative complications, such as stenosis of the frontal recess, anosmia, intracranial hemorrhage, orbital complications, and persistence or recurrence of the CSF leak. The following discussion reviews pertinent frontal sinus anatomy, preoperative assessment, surgical techniques, types of repair, postoperative management, and published outcomes.

PREOPERATIVE PLANNING AND OUTCOMES

Preoperative evaluation should begin with a thorough history and physical examination, nasal endoscopy, and radiographic imaging. Patients will often describe constant or intermittent clear rhinorrhea associated with a salty or metallic taste and may complain of headaches from low or high (spontaneous CSF leaks from idiopathic intracranial hypertension) intracranial pressure (ICP). Additional symptoms reported with CSF leak or encephalocele may include unilateral or bilateral nasal obstruction, nausea, and neck stiffness. History of head trauma, prior sinus or neurologic surgery, congenital abnormalities, prior episodes of meningitis, and obesity should be assessed.

To identify the presence of a CSF leak, several diagnostic tools are available (**Table 1**). The invasiveness of the test and risks to patients with each of these tests should be considered carefully, as should the reported sensitivity and specificity of the test. Test characteristics depend significantly on the patient population studied, defect size, leak flow rate, and individual interpretation of results. Although a study may reveal the location of the leak, further investigation may be required during the surgery (discussed in surgical technique section) to definitively identify the location or assess for simultaneous leaks that may not have been detected during the original evaluation.

Surgical repair is generally indicated for all patients with active CSF leakage due to spontaneous, iatrogenic, and neoplastic causes to prevent intracranial infection. Conversely, for those with traumatic causes of CSF leak, bed rest and stool softeners are usually first-line therapy, as many leaks will close without further intervention. For those with congenital defects, surgical removal and repair is often indicated for children presenting with nasal obstruction from the intranasal encephalocele. Active CSF leak is less common, so observation for small, asymptomatic encephaloceles is a reasonable strategy.

Contraindications for skull base repair include patients with high risks of bleeding and severe medical comorbidities. Patients on anticoagulation or with low platelets from blood dyscrasias or disorders are at increased risk for intracranial hemorrhage. Careful consideration of holding anticoagulation in patients with cardiovascular

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