Nasoseptal Flap Closure of Traumatic Cerebrospinal Fluid Leaks

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ABSTRACT

Objectives: The vascularized nasoseptal flap has become a principal reconstructive technique for closure of defects following endonasal skull base surgery. Despite its potential utility, there has been no report of using the nasoseptal flap to repair traumatic cerebrospinal fluid (CSF) leaks and documenting the outcomes of this application. Specific concerns in skull base trauma include septal trauma with disruption of the flap pedicle, multiple leak sites, and issues surrounding persistent leaks after craniotomy. Study Design: Retrospective case series. Methods: We performed a retrospective review of all patients who underwent nasoseptal flap closure of traumatic CSF leaks by the primary author. Demographic data, use of CSF diversion techniques, and outcomes were analyzed. Results: Fourteen traumatic leak patients were repaired with nasoseptal flaps. The defect etiology was motor vehicle collision in 8 patients (57%), prior sinus surgery in 4 (29%), and assault in 2 (14%). At the time of nasoseptal flap repair, four patients had failed prior avascular grafts and two had previously undergone cranietomies for repair. Follow-up data was available for all patients (mean 10 months). The overall success rate was 100 percent (no leaks), with 100 percent coverage including three patients with multiple leak sites. Defect size varied (range, 4-10 weeks). Patients had a mean of 2.5 debridements during the healing process and routine nasal irrigation three times per day until complete mucosalization and BID for 6 months postoperatively.

INTRODUCTION

• Traumatic injury to the ventral skull base carries a high risk of developing CSF leak and ascending infection.
• The goals of treatment are to:  
  • Recreate the watertight barrier between the arachnoid space and the sinonasal tract  
  • Eliminate dead space  
• Specific concerns in skull base trauma include septal damage, multiple leak sites, and persistent CSF leak  
• Methods of repair vary:
  • The pedicled nasoseptal flap, based on the nasoseptal artery, is gaining popularity based on success rates and the large area available for reconstruction (Figure 1)  
  • No report describing the use of the nasoseptal flap to repair traumatic CSF leaks and documenting the outcomes of this application

METHODS & MATERIALS

Patient Population
• All nasoseptal flap closures of traumatic CSF leaks by the primary author (A.Z.)

Operative Technique
• Superior Incision – made 1-2 cm below the superior aspect of the septum (to preserve olfactory epithelium) and extended laterally along the inferior aspect of the sphenoid os  
• Inferior Incision – made along the maxillary crest or onto the nasal floor and curved laterally along the choanal arch  
• Vertical Incision – joins these two incisions anteriorly, close to the mucocutaneous junction

Flap Harvest
• Flap elevated in an anterior-to-posterior fashion in a submucoperichondrial plane and stored in the nasopharynx or the antrum

Flap Reconstruction
• Dural substitute used to cover the exposed intracranial structures  
• Nasoseptal flap rotated over the defect and surrounding denuded boney areas, secured with Surgicel (Ethicon, Cornelia, GA)  
• DuraSeal (Confluent Surgical, Waltham, MA) sprayed over the entire surface of the flap  
• Reconstruction splinted in place with either a 10-mL Foley balloon or tampon sponges  
• Two layers of Gelfoam (Pfizer, New York, NY) prevent splinting materials from adhering to the flap  
• Splinting materials remain in place for 5-7 days, with concomitant antibiotic coverage

Outcomes
• Outcome data was obtained from review of postoperative clinic notes

RESULTS

Fourteen patients with traumatic CSF leaks were repaired with the nasoseptal flap. The clinical data and outcomes for all fourteen traumatic CSF leak repairs were collected.

The mean age was 49 years (range, 15 - 80 years), with 8 males and 6 females. The etiology of the defect was motor vehicle collision in 8 patients (57%), prior surgery in 4 (29%), and assault in 2 (14%). Defect size varied from 4 mm to 3.4 cm (longest axis) and three patients had multiple leak sites. At the time of nasoseptal flap repair, four patients had failed prior avascular grafts and two had previously undergone cranietomies for repair. Follow-up data, including postoperative endoscopy, was available for all patients (mean, 10 months). All areas of the ventral skull base were represented (cribriform, sphenoïd, and clivus).

In all cases, a viable flap was observed without necrosis and with rapid mucosalization. The overall success rate was 100 percent (no leaks), with 100 percent coverage – including three patients with multiple leak sites. We encountered no infectious or wound complications; however, one patient developed persistent headaches and elevated intracranial pressures, requiring placement of a ventriculoperitoneal shunt.

Postoperative healing was complete with no crusting and 100% mucosalization by 10 weeks in all patients (range, 4-10 weeks). Patients had a mean of 2.5 debridements during the healing process and routine nasal irrigation three times per day until complete mucosalization and BID for 6 months postoperatively.

DISCUSSION

• Endoscopic endonasal repair of traumatic CSF leaks with the NSF has a success rate of approximately 95% - comparable to that of traditional approaches.
• Nasoseptal flap benefits include:  
  • Nasoseptal arteries provide a rich vascular pedicle, which speeds wound healing and increases the arc of rotation  
  • Accelerated postoperative recovery period decreases the risk of intracranial injury  
• Nasoseptal flap limitations include:  
  • Must decide to save the flap preoperatively  
  • Septal trauma or prior nasal surgery may have rendered the flap non-viable

CONCLUSIONS

• Defect location, size, and type of CSF leak should guide reconstruction  
• The nasoseptal flap is a versatile and reliable local reconstructive technique for ventral base traumatic defects  
• Large flap that can cover the entire ventral skull base  
• Low patient morbidity  
• Exceptional overall leak repair rate (100% in this series)  
• Nasoseptal flap closure should be considered safe and effective in traumatic CSF leaks

REFERENCES


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