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CASE REPORT/SURGICAL VIDEO

Step by step endoscopic CSF leak repair: cribriform defect

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Background: Cerebrospinal fluid (CSF) rhinorrhea from anterior skull base defects carries a significant risk of ascending bacterial meningitis and mandates definitive surgical repair. Spontaneous leaks occurring in the context of elevated intracranial pressure represent a distinct and increasingly recognised clinical subset associated with identifiable radiological markers of idiopathic intracranial hypertension. Transnasal endoscopic repair has emerged as the preferred approach, offering direct visualisation, low morbidity, and success rates exceeding 90%.

Objective: To present a detailed step-by-step video account of transnasal endoscopic CSF leak repair employing a multilayer gasket-seal closure augmented with a vascularised nasoseptal flap, with full documentation of surgical decision-making, intraoperative technique, and perioperative management principles.

Case Description: A 45-year-old female presented with a 3-month history of spontaneous, left-sided, posture-dependent clear rhinorrhea. High-resolution CT of the paranasal sinuses demonstrated a focal bony defect (~2 mm) in the left cribriform plate with adjacent fluid density. MRI cisternography confirmed active CSF communication through this defect at the junction of the nasal septum and the middle turbinate attachment, along with an empty sella and periventricular white matter signal changes indicative of chronically elevated intracranial pressure.

Surgical Technique: The procedure was performed under general anaesthesia using a fully endoscopic transnasal approach. Sequential operative steps comprised: (1) anterior septoplasty via a Killian incision using a bovine-tip electrode for corridor creation and concurrent harvest of cartilage for gasket use; (2) endoscopic identification and cauterisation of the herniated meningocele sac, followed by precise delineation of the cribriform defect measuring 8 mm × 3 mm straddling the middle turbinate attachment; (3) partial middle turbinectomy for optimal exposure and margin preparation; (4) intracranial underlay placement of fascia lata harvested from the ipsilateral thigh; (5) press-fit insertion of a carved autologous cartilage gasket within the bony defect; (6) extracranial overlay placement of a second fascia lata layer; and (7) inset of a posteriorly pedicled nasoseptal flap based on the posterior septal branch of the sphenopalatine artery, secured with fibrin glue over the entire repair construct.

Results: No intraoperative complications were encountered. Complete resolution of rhinorrhea was achieved immediately postoperatively. The patient was discharged on postoperative day 3. Follow-up endoscopy at 6 weeks demonstrated full mucosalisation of the repair site with intact flap healing. Acetazolamide therapy was initiated for presumed raised intracranial pressure and continued under ophthalmological surveillance.

Keywords: *CSF rhinorrhea, skull base surgery, endoscopic repair, nasoseptal flap, fascia lata graft, cribriform plate defect, cerebrospinal fluid leak*

Case presentation

Patient history

A 45-year-old female (Patient X) presented with a 3-month history of left-sided, intermittent clear watery nasal discharge. The rhinorrhea was described as continuous, unilateral, and characteristically increased on forward bending or Valsalva manoeuvre — features highly suggestive of CSF rhinorrhea. There was no antecedent history of head trauma, prior sinonasal surgery, or infectious sinusitis. No neurological deficits were noted on examination. General physical examination was unremarkable, and the patient was normotensive.

Diagnostic investigations

Computed tomography — paranasal sinuses (high-resolution CT)

High-resolution CT of the paranasal sinuses with multiplanar reconstruction was performed to evaluate bony anatomy and identify skull base defects. Key findings included:

- Mild deviation of the nasal septum to the left with a left-sided bony septal spur
- Mild hypertrophy of the right inferior turbinate
- Focal bony defect measuring approximately 2 mm in the left cribriform plate
- Subtle adjacent fluid density in the region of the defect, suggestive of CSF leak
- No evidence of sinonasal mass, polyp, or inflammatory sinus disease

MRI cisternography

MRI cisternography was performed using high-resolution T2-weighted sequences to characterise the defect and confirm active CSF communication. Salient findings included:

- Defect measuring approximately 2 mm in the left cribriform plate at the ethmoid roof, located at the junction of the nasal septum and middle turbinate attachment
- Signal characteristics consistent with CSF tracking into the nasal cavity through the identified defect
- Empty sella, indicative of chronically elevated intracranial pressure — a key finding raising suspicion for IIH as the aetiology of the spontaneous leak (1)
- Mild diffuse cerebral atrophy
- Periventricular white matter hyperintensities consistent with chronic microangiopathic changes

Patient was then planned for Trans Nasal Trans Endoscopic CSF leak repair surgery (2, 3).

Surgical technique

All procedures were performed under general anaesthesia with the patient in the supine position, head elevated 15–20 degrees. Intravenous prophylactic antibiotics (Cefazolin 2 g) were administered 30 minutes prior to incision. Neuronavigation using CT and MRI fusion data was available for intraoperative guidance. The following steps were executed in sequence.

Step 1: Anterior septoplasty and correction of septal deviation

A Killian incision was made at the mucocutaneous junction of the left nasal vestibule. Subperichondrial and subperiosteal dissection was carried out bilaterally along the septal framework. The deviated quadrilateral cartilage was scored and repositioned.

The bovie electrocautery with a fine-tipped bovine electrode was used to facilitate controlled subperichondrial dissection and haemostasis throughout the septoplasty, enabling precise tissue handling with minimal mucosal trauma.

Step 2: Endoscopic identification and delineation of the CSF leak

A 0-degree rigid nasal endoscope (4 mm) was introduced via the left nasal cavity. Under direct endoscopic visualisation, the skull base was systematically inspected.

The meningocele/encephalocele sac prolapsing through the defect was identified and carefully cauterised using bipolar electrocautery at low power to devitalise the herniated tissue without thermal injury to adjacent intracranial structures. Following cauterisation and shrinkage of the herniated tissue, the bony defect was precisely delineated using a Freer elevator and a fine-tipped suction. The defect was confirmed to measure 8 mm x 3 mm, straddling the attachment of the middle turbinate — a transversely oriented defect that extended from the lateral lamella across the cribriform plate.

Step 3: Partial middle turbinectomy

To ensure adequate exposure of the skull base defect and to create a flat, accessible platform for the multilayer repair, the anterior one-third to one-half of the left middle turbinate was excised using through-cutting forceps and Blakesley

TABLE 1 | Post operative events were uneventful. Post extubation, nasal packing was done and patient was stable. After 2 days, nasal packing was removed and no CSF leak was observed.

Timestamp	Surgical Stage	Visual Description
0:00	Title / Introduction	Opening title card displayed: "Step by Step Endoscopic CSF Leak Repair: Cribriform Defect"
0:15	Initial Nasal Endoscopy / Orientation	Endoscope enters the nasal cavity. Nasal mucosa, septum and turbinate structures visible. A metal suction/probe instrument is introduced for initial survey. Pale/whitish tissue at cribriform region visible on right side.
0:30	Mucosal Dissection & Tissue Preparation	Active tissue manipulation begins with significant mucosal bleeding. Suction and dissection instruments visible. Mucosa being elevated and separated from bony structures in preparation for defect access.
1:00	Ethmoid / Cribriform Area Exposure	Wider endoscopic field achieved. Bleeding partially controlled with suction. Long thin probe/suction instrument navigating toward the cribriform area. Surrounding ethmoid air cells being cleared to improve access.
1:30	Continued Dissection Toward Defect	Targeted dissection continues. The instrument angles superiorly toward the skull base region. Tissue margins being defined around the suspected defect location.
1:45	Defect Identification	A focal darker area becomes visible centrally, consistent with the cribriform plate defect site. Suction/probe directed precisely at the leak point. Surrounding mucosa being cleared to expose clean defect margins.
2:00	Defect Preparation / Margin Clearing	Continued work at the defect site with probe/sucker angling into the area. Bony margins being denuded of mucosa to allow graft adherence. Some active CSF pulsation may be occurring.
2:30	Graft / Tissue Flap Preparation	Whitish graft material or tissue flap visible being manipulated. Scissors or grasper seen handling the flap edges. Graft being shaped and positioned for placement over the defect.
3:00	Graft Placement – First Layer	Graft material being actively positioned over the defect. Forceps visible pressing and securing the material. Darker defect area being covered by the graft in an underlay or overlay technique.
3:30	Graft Securing / Tucking	Further manipulation of graft edges to ensure they are tucked under the bony margins. Additional tissue flap or fat graft introduced to supplement the repair. Field shows active hemostasis alongside graft placement.
4:00	Additional Graft Layering	Second or additional layer of graft/material applied over initial repair. Instruments pressing layered material firmly against the skull base. Multi-layer repair technique being executed.
4:30	Reinforcement & Haemostasis	Continued packing and reinforcement of the repair. Suction removing blood and fluid to maintain visibility. Instruments verifying graft apposition against the cribriform defect margins.
5:00	Absorbable Packing Placement	Absorbable packing material (likely Gelfoam or Surgicel) being introduced into the nasal cavity over the repair site. Instruments carefully tamponading the repair with packing material.
5:30	Nasal Packing / Bolstering	Packing material further advanced and bolstered. Graft now well covered. Suction clearing the operative field for final inspection. Instrument profile consistent with Blakesley forceps or packing applicator.
6:00	Cautery / Final Haemostasis	Diffuse red field suggesting ongoing haemostasis. Possible bipolar cautery or suction cautery being applied to bleeding points. Field is being optimized before final inspection.
6:30	Field Inspection	Endoscope surveying the nasal cavity post-repair. Relatively clear field with well-positioned packing visible. Surgeon assessing the integrity of the reconstruction before withdrawal.
7:00	Final Mucosal Survey	Smooth mucosal surfaces visible with minimal active bleeding. Endoscope being used for a final sweep of the nasal cavity. Repair site confirmed covered and packing in place.
7:30	Completion / Endoscope Withdrawal	Final endoscopic view before instrument withdrawal. Nasal cavity appearance consistent with a completed repair. End of the operative procedure.

forceps. Care was taken to preserve the posterior lamella and turbinate attachment to avoid destabilisation of the middle turbinate remnant. The turbinectomy revealed the full extent of the bony defect spanning the cribriform plate and confirmed its dimensions and configuration.

The edges of the bony defect were freshened circumferentially with a diamond burr to remove residual mucosa, creating a raw, vascular surface that would promote adhesion and integration of the grafts.

Step 4: Multilayer reconstruction — underlay fascia lata

A 3 x 3 cm piece of fascia lata was harvested from the patient's left thigh through a small longitudinal incision. Adequate graft dimensions exceeding the skull base defect by a minimum of 5 mm on all margins were ensured. The graft was trimmed to the appropriate size and hydrated.

The first layer of fascia lata was introduced into the nasal cavity with alligator forceps and positioned as an intracranial underlay. The graft was carefully manoeuvred under endoscopic visualisation through the bony defect, ensuring it lay flat against the intradural surface. Gentle pressure was applied to confirm stable seating of the underlay component.

Step 5: Cartilage gasket placement

A piece of septal cartilage obtained during the prior septoplasty was carved and shaped to fit snugly within the bony defect. The cartilage gasket was sized to be approximately 0.5 mm smaller than the defect dimensions on each side to permit insertion while achieving a firm press-fit when seated. The cartilage was placed within the bony defect in direct apposition with the underlay fascia lata, effectively sandwiching the dura between the intracranial underlay and the extracranial cartilage. This gasket creates a mechanical seal analogous to a flanged plug and is the hallmark of the gasket-seal technique (4).

Step 6: Overlay fascia lata

A second, larger piece of fascia lata was then placed as an extracranial overlay over the cartilage gasket and the surrounding bony rim of the defect. This overlay layer was positioned to extend well beyond the bony margins in all four directions, providing complete soft tissue coverage. The overlay fascia was inspected to confirm circumferential contact with the freshened bony edges, ensuring a watertight secondary seal.

Step 7: Elevation and inset of the nasoseptal flap

Prior to the repair steps, at the onset of the procedure, the right-sided mucoperichondrial and mucoperiosteal nasoseptal flap had been elevated based on the posterior septal artery — a branch of the sphenopalatine artery. The flap was elevated from the posterior septum from just posterior to the columella anteriorly to the sphenoid face posteriorly, and from the floor of the nasal cavity inferiorly to the level of the olfactory strip superiorly. The posterior pedicle was preserved intact to maintain robust vascular supply (5).

The fully elevated nasoseptal flap was then rotated superiorly and medially to cover the repair site. The flap was draped over the overlay fascia lata and the cartilage gasket, ensuring complete coverage of the defect and its reconstructed margins. The flap edges were apposed to the surrounding mucosal margins and secured using fibrin glue (Tisseel) applied circumferentially to reinforce the seal and promote adhesion (5).

Post operative events were uneventful. Post extubation, nasal packing was done and patient was stable. After 2 days, nasal packing was removed and no CSF leak was observed.

Step-by-Step Transnasal Endoscopic Cerebrospinal Fluid Leak Repair: Cribriform Defect with Multilayer Gasket-Seal Closure and Nasoseptal Flap Reconstruction.[2026]. Video file. Duration: 7 min 41 sec. Resolution: 1920×1080, 24 fps.

VIDEO 1 | Pre-operative high-resolution CT of the paranasal sinuses (coronal and sagittal multiplanar reconstructions) demonstrating a focal bony defect in the left cribriform plate with adjacent fluid density, followed by MRI cisternography confirming active CSF communication and radiological markers of raised intracranial pressure (empty sella). Intraoperative endoscopic footage documents the sequential steps of transnasal endoscopic CSF leak repair: anterior septoplasty via Killian incision with cartilage harvest, endoscopic identification and cauterisation of the herniated meningocele sac, partial middle turbinectomy for defect exposure, intracranial underlay placement of fascia lata, press-fit autologous cartilage gasket insertion, extracranial overlay fascia lata placement, and inset of a posteriorly pedicled nasoseptal flap secured with fibrin glue. Total operative footage duration: approximately 7 minutes 41 seconds.
https://youtu.be/Acj_xoiRrWY

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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