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Orbital Injury With Medial Rectus Tear and Cerebrospinal Fluid Leak Following Functional Endoscopic Sinus Surgery: A Case Report

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Abstract

Functional endoscopic sinus surgery (FESS) is widely used as a safe and effective treatment for paranasal sinus disorders. However, complications may occur because of the close anatomical relationship between the paranasal sinuses, orbit, and skull base. We report a 32-year-old man with hypertension, diabetes mellitus, and hypercholesterolemia whose earlier FESS had been complicated by left orbital injury with a medial rectus muscle tear. Postoperatively, he developed persistent severe headache requiring daily analgesics, together with restricted motility of the left eye, diplopia, and proptosis, and underwent medial rectus repair four months later. He subsequently developed unilateral left-sided rhinorrhea. Computed tomography demonstrated defects of the left lamina papyracea and thinning of the left lateral lamella, and a cerebrospinal fluid (CSF) leak was suspected despite a magnetic resonance imaging CSF protocol showing no definite leak. Approximately 19 months after the initial surgery, he underwent navigation-guided revision left FESS, which confirmed defects of the lamina papyracea and cribriform plate; the skull base defect was repaired with a nasal floor overlay graft. Following surgery, the headache resolved, with no rhinorrhea, no bleeding, intact vision, and no diplopia. At seven months of follow-up, the patient remains well with no complaints.

Categories: Otolaryngology
Keywords: endoscopic csf leak repair, functional endoscopic sinus surgery, medial rectus muscle injury, orbital injury, skull base defect

Introduction

Functional endoscopic sinus surgery (FESS) has become a widely accepted surgical technique for the management of paranasal sinus disease. The procedure restores normal sinus ventilation and drainage through a minimally invasive endoscopic approach by removing obstructing bone, diseased mucosa, or polyps from the sinus drainage pathways [1].

Despite its effectiveness and safety profile, complications may occur because of the close anatomical relationship between the paranasal sinuses, orbit, and anterior skull base. The thin bony boundaries separating these regions, particularly the lamina papyracea, cribriform plate, and lateral lamella, make them susceptible to injury during surgery. Breach of the lamina papyracea may injure the orbital contents, including the extraocular muscles [2].

One recognized complication of FESS is cerebrospinal fluid (CSF) leakage, which occurs when the fluid surrounding the brain and spinal cord escapes through a defect in the skull base or dura mater. When this defect communicates with the nasal cavity, the condition presents as CSF rhinorrhea [2].

Although orbital injury and CSF leak are recognized complications of FESS, their simultaneous occurrence in a single patient is rare and has seldom been described. Documenting such cases is important because both injuries may share a common anatomical mechanism at the junction of the lamina papyracea and the anterior skull base, and because recognition of an obvious orbital injury may draw attention away from a concurrent skull base defect, delaying the diagnosis of a CSF leak and exposing the patient to the risk of meningitis. Reporting this combination may therefore help surgeons anticipate, recognize, and manage both complications promptly.

Case Presentation

A 32-year-old man with a known history of hypertension, diabetes mellitus, hypercholesterolemia, and electronic cigarette (vape) use was evaluated for complications of a previous bilateral functional endoscopic sinus surgery. His regular medications included basal-bolus insulin (insulin aspart and insulin degludec), valsartan, amlodipine, and rosuvastatin.

The initial procedure was complicated by left orbital injury with medial rectus muscle tear. Following surgery, the patient complained of continuous severe headache, which was relieved only by daily analgesics. He also developed restricted motility of the left eye, diplopia, and proptosis. Four months after the initial surgery, he underwent medial rectus repair by the ophthalmology team.

Approximately 15 months after the initial surgery, the patient presented with unilateral left-sided rhinorrhea and persistent left-sided diplopia. Clinical evaluation raised suspicion of CSF leakage, and computed tomography (CT) and magnetic resonance imaging (MRI) were subsequently performed.

CT of the paranasal sinuses (navigation protocol) demonstrated postoperative changes from the previous bilateral FESS, including bilateral uncinectomy and partial middle and inferior turbinectomy, more marked on the right. There was marked thinning and rarefaction of the left lateral lamella extending to the anterior planum ethmoidale, measuring approximately 0.6 cm (Figure *1A*). Multiple focal defects involved the medial wall of the left orbit (lamina papyracea), with the largest defect measuring approximately 6.6 mm (Figures *1A*, *1B*). These findings were associated with reduced volume of the left medial extraconal fat, a tethering appearance of the left medial rectus muscle, and partial medialization of the optic nerve. Additional findings included chronic pansinusitis, with opacification of the left frontal sinus and anterior ethmoid air cells (Figure *1B*).

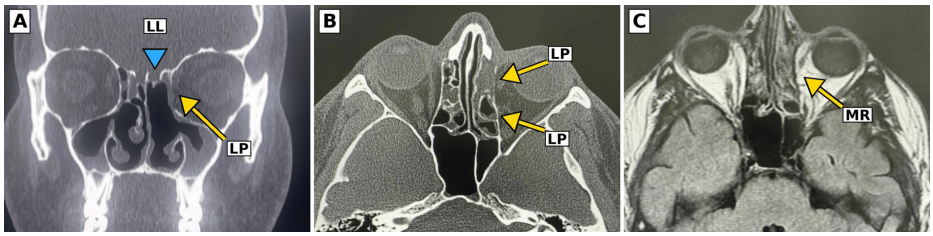


FIGURE 1: Preoperative imaging before revision surgery

(A) Coronal non-contrast CT image (bone window) showing postoperative changes of the previous FESS, with a defect of the left lamina papyracea (LP, yellow arrow) and thinning of the left anterior skull base at the lateral lamella (LL, blue arrowhead). (B) Axial CT image showing opacification of the left anterior ethmoid cells with thinning and focal defects of the adjacent left lamina papyracea (LP, yellow arrows), compared with the intact right side. (C) Axial MRI showing a thinned left medial rectus muscle (MR, yellow arrow) lying against the medial orbital wall, compared with the normal right medial rectus.

The patient's left side is on the right of each image.

MRI using a dedicated CSF rhinorrhea protocol did not demonstrate definite evidence of a CSF leak at the time of imaging, and the olfactory bulbs and subfrontal CSF spaces were unremarkable. However, it showed reduced bulk of the left medial rectus muscle and medialization of the left optic nerve (Figure *1C*).

Approximately 19 months after the initial surgery, the patient was admitted with persistent headache and nasal obstruction, with a diagnosis of chronic rhinosinusitis with orbital and skull base complications, and was planned for navigation-guided revision FESS with possible CSF leak repair. Preoperative laboratory investigations, performed three weeks before surgery, showed an elevated random blood glucose of 14.8 mmol/L, reflecting suboptimal glycemic control, with normal renal function, electrolytes, and coagulation profile (international normalized ratio 1.08). He was classified as American Society of Anesthesiologists (ASA) physical status III [3]. His blood pressure was initially poorly controlled, and his antihypertensive medication was adjusted by the internal medicine team; once the blood pressure reached 140/91 mmHg, surgery proceeded in view of its urgent nature. Blood glucose was managed perioperatively with an insulin sliding scale.

The following day, the patient underwent revision left FESS with repair of the CSF leak under general anesthesia with oral endotracheal intubation, using image-guided navigation. Local infiltration was performed, and intravenous ceftriaxone 2 g was given intraoperatively. Intraoperative examination revealed a lateralized left middle turbinate with a synechia attached to the inferior turbinate, a defect in the superior part of the lamina papyracea at the level of the fovea ethmoidalis, and a defect involving the cribriform plate and lateral lamella.

The surgical steps included medialization of the middle turbinate with release of the synechia, left middle meatal antrostomy, left uncinectomy, removal of the left middle turbinate, anterior and posterior ethmoidectomy, biopsy, sphenoidotomy, and left frontal sinusotomy (Draf IIb) [4], during which a left frontal sinus mucocele was cleared. A nasal floor graft was harvested and applied as an overlay graft over the cribriform plate and lateral lamella defect (Figure *2A*), and a silastic T-shaped stent was placed in the left frontal sinus after the Draf IIb sinusotomy (Figure *2B*). Hemostasis and graft stabilization were achieved

using Surgicel® oxidized regenerated cellulose (Ethicon, Inc., Raritan, New Jersey, United States), Surgiflo® Hemostatic Matrix (Ethicon, Inc.), and Gelfoam® absorbable gelatin sponge (Pfizer Inc., New York City, New York, United States). A finger-glove Merocel® nasal pack (Medtronic plc, Galway, Ireland) was placed at the end of the procedure, which lasted approximately three hours.

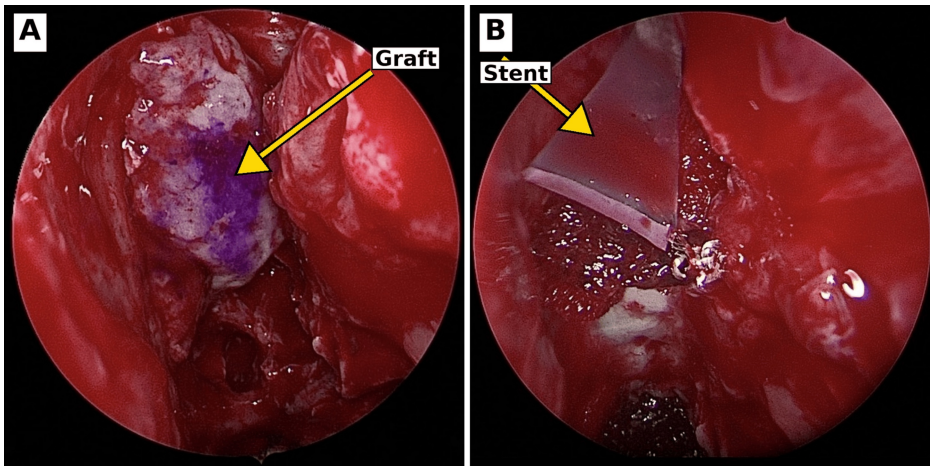


FIGURE 2: Intraoperative endoscopic views of the left nasal cavity during revision surgery

(A) Nasal floor graft (arrow) placed as an overlay over the cribriform plate and lateral lamella defect. (B) Silastic T-shaped stent (arrow) in the left frontal sinus after Draf IIb sinusotomy.

The left anterior ethmoid specimen was sent for histopathological examination. Macroscopically, it consisted of a single piece of grayish-white tissue measuring 0.5 × 0.5 × 0.1 cm, which was submitted entirely for examination. Microscopically, the specimen showed chronic polypoid rhinosinusitis with a fragment of bone showing remodeling (Figure *3*).

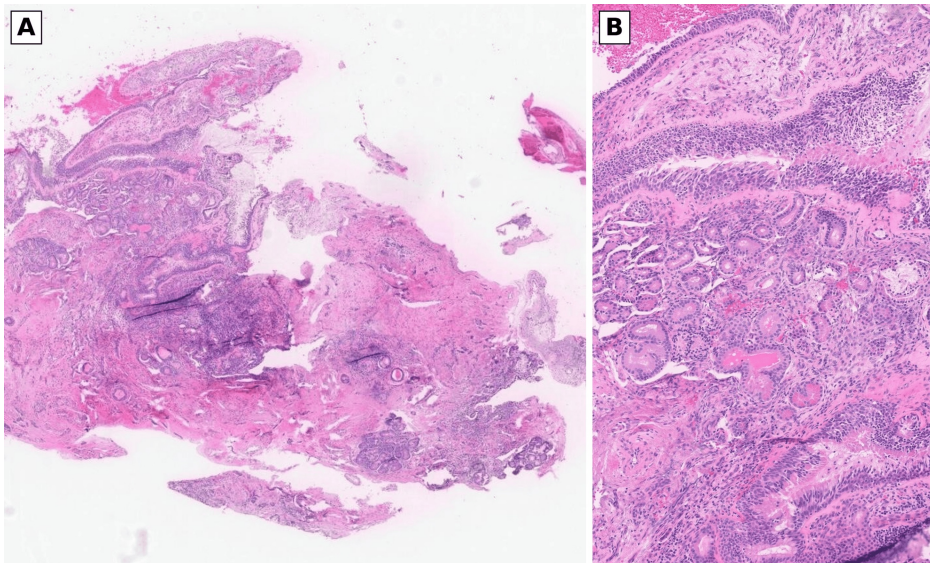


FIGURE 3: Histopathology of the left anterior ethmoid specimen (hematoxylin and eosin)

(A) Low-power view of polypoid sinonasal mucosa with stromal edema and a chronic inflammatory infiltrate (original magnification ×4). (B) Higher-power view showing respiratory-type epithelium, seromucous glands, and a chronic inflammatory infiltrate in the lamina propria, consistent with chronic polypoid rhinosinusitis (original magnification ×10).

The patient was extubated uneventfully and admitted to the intensive care unit for pain management,

monitoring of vital signs, and recording of fluid intake and output. He was kept *nil per os* until fully awake, followed by a soft diet as tolerated, and was maintained on strict bed rest with bathroom privileges for 24 hours, with deep vein thrombosis prophylaxis and head elevation to 40°. Medical therapy included intravenous clindamycin 600 mg three times daily and ceftriaxone 1 g twice daily, acetazolamide 250 mg twice daily for three months, lactulose 15 mL three times daily, cetirizine once daily for two weeks, intravenous omeprazole 40 mg once daily, and intravenous paracetamol and ondansetron as needed. He was instructed to avoid heavy lifting, bending forward, nose blowing, and to sneeze with the mouth open, and to minimize unnecessary movements. He also received smoking cessation counseling.

On the evening of surgery, the patient was conscious, alert, and oriented, with the nasal pack in place, no anterior or posterior nasal bleeding, intact vision bilaterally, and no diplopia. On the first postoperative day, he was afebrile and vitally stable, with clinically normal eye movements and vision, and was transferred from the intensive care unit to the ward. The nasal pack was removed on the second postoperative day, and the patient was discharged with no headache and no complaints. At the one-week follow-up after revision surgery, the headache had resolved, and there was no rhinorrhea, no nasal bleeding, and no diplopia, with vision intact. At seven months after revision surgery, the patient reported feeling well with no complaints.

Discussion

FESS is widely used in the management of paranasal sinus disease due to its minimally invasive nature and effectiveness in restoring sinus ventilation and drainage [1,2]. Despite its safety profile, complications may occur because of the close anatomical relationship between the paranasal sinuses, orbit, and anterior skull base [2].

From an epidemiological perspective, the overall rate of major complications of FESS has been reported to be approximately 1% in large series [5]. Orbital injury occurs in about 0.07% of cases [5], and most orbital complications present as periorbital ecchymosis, orbital emphysema, or transient diplopia. More severe orbital complications, including extraocular muscle injury, optic nerve injury, orbital hematoma, and permanent visual loss, are considerably less frequent [6].

Cerebrospinal fluid leak is another recognized complication, occurring in approximately 0.17% of procedures [5]. It typically results from injury to the cribriform plate or lateral lamella of the skull base, which are among the thinnest anatomical regions separating the sinonasal cavity from the anterior cranial fossa. When a skull base defect communicates with the nasal cavity, it presents clinically as CSF rhinorrhea [2]. In the present case, MRI did not demonstrate a definite leak, which may reflect the intermittent nature of small iatrogenic leaks; a negative MRI does not exclude a CSF leak when the clinical findings and CT evidence of a skull base defect support the diagnosis [7].

Although orbital injury and CSF leak are individually well described, their simultaneous occurrence is uncommon. Large studies report these complications separately [5], and their combined occurrence in a single patient is rarely described. This highlights the unusual nature of the present case.

In the present case, the location of the defects may explain the simultaneous occurrence of both injuries. The lamina papyracea and the lateral lamella of the cribriform plate meet at the superomedial part of the ethmoid sinus, near the fovea ethmoidalis. Intraoperatively, the orbital defect was found in the superior part of the lamina papyracea at the level of the fovea ethmoidalis, immediately adjacent to the defect in the cribriform plate and lateral lamella. This suggests that both injuries may have resulted from a single loss of surgical orientation, with dissection directed too far superiorly and medially, rather than from two separate events, although this cannot be confirmed without the operative records of the initial surgery. The risk of such injury is increased when the olfactory fossa is deep, and the lateral lamella is long and thin, as described in the Keros classification [8], and when the skull base is low or asymmetric [9]. Bleeding, extensive disease, and distorted anatomy may further obscure these landmarks during surgery.

The CSF leak in this patient was not repaired until approximately 19 months after the initial surgery. Several factors may have contributed to this delay. In the early postoperative period, attention was focused on the more obvious orbital injury, which required medial rectus repair, while the persistent headache was managed with analgesics. Imaging for a CSF leak was performed only after the patient developed unilateral rhinorrhea, and the MRI did not demonstrate an active leak at the time of examination. In addition, the records of the initial surgery were not available, which limited early assessment of the extent of the injury. Persistent postoperative headache may be an early sign of CSF leakage due to low intracranial pressure [7]. In this case, the headache resolved after the repair; however, this association does not independently confirm the diagnosis, because the frontal sinus mucocele and chronic sinusitis were treated during the same procedure and may also have contributed to the headache. Delayed repair is not without risk, as a persistent communication between the subarachnoid space and the nasal cavity predisposes the patient to ascending bacterial meningitis, and closure of the leak has been shown to prevent this complication [10]. Therefore, a CSF leak should be considered in patients with persistent headache or unilateral rhinorrhea after FESS, particularly when an orbital injury indicates that dissection extended beyond the sinus boundaries, and the adjacent skull base should be inspected whenever an orbital injury is recognized during surgery.

Given the proximity of critical structures, intraoperative image-guided navigation has become increasingly important, particularly in revision surgery, distorted anatomy, and skull base involvement. Navigation systems may improve anatomical localization by providing real-time spatial orientation, although evidence that they reduce complication rates remains limited [11]. Navigation was used during the revision surgery in the present case. This case further emphasizes the importance of careful preoperative radiological evaluation, detailed knowledge of sinonasal anatomy, and meticulous intraoperative technique in minimizing complications [12].

The use of frontal sinus stenting remains controversial, as routine use may cause infection, granulation tissue formation, and stent obstruction; however, selective use is advocated in high-risk situations, including revision surgery, extensive mucosal disease, and advanced frontal sinus procedures such as Draf IIb or Draf III [4,13]. The frontal recess is particularly prone to restenosis, and stents act as mechanical spacers that preserve the neo-ostium and prevent synechiae during healing [12,13]. In the present case, prior surgery, altered anatomy, and a skull base defect justified placement of a silastic T-shaped stent.

Management of iatrogenic skull base defects with CSF leak is typically performed using endoscopic repair techniques, which have become the standard of care due to their high success rates and low morbidity. The choice of reconstruction depends on the size and location of the defect and may include free mucosal grafts, fascia lata, fat grafts, or vascularized flaps such as the nasoseptal flap [14]. In this case, a nasal floor graft was used as an overlay graft to repair the cribriform plate defect. In addition, the patient's suboptimally controlled diabetes and smoking may impair mucosal healing, which supported strict postoperative care and smoking cessation counseling. Successful repair requires precise identification of the defect, adequate preparation of surrounding mucosa, and secure graft stabilization using materials such as oxidized regenerated cellulose, gelatin sponge, or fibrin sealants [14].

A limitation of this report is that the CSF leak was not confirmed by beta-2 transferrin analysis of the nasal fluid; the diagnosis was based on the clinical presentation, CT findings, and intraoperative identification of the skull base defect. In addition, the operative records of the initial surgery were not available.

Conclusions

The simultaneous occurrence of orbital injury and CSF leak as complications of a single functional endoscopic sinus surgery is rare, and their combined presentation has seldom been described in the literature. We present this case to highlight this uncommon combination and its possible shared mechanism at the junction of the lamina papyracea and the anterior skull base. Persistent headache after FESS may warrant evaluation for an underlying CSF leak, even when MRI does not demonstrate active leakage, although its resolution after repair does not by itself confirm the diagnosis. As a single case report without beta-2 transferrin confirmation or the operative records of the initial surgery, these observations should be interpreted with caution and cannot be generalized. Nevertheless, this case highlights the importance of careful surgical planning, the potential role of intraoperative navigation in high-risk cases, and prompt multidisciplinary management involving otolaryngology and ophthalmology teams.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Omar Altawash, Lulwah Al Saidan, Mariam Alshammari, Marwan Al-Qunaee

Acquisition, analysis, or interpretation of data: Omar Altawash, Lulwah Al Saidan, Mariam Alshammari, Marwan Al-Qunaee

Drafting of the manuscript: Omar Altawash, Lulwah Al Saidan, Mariam Alshammari, Marwan Al-Qunaee

Critical review of the manuscript for important intellectual content: Omar Altawash, Lulwah Al Saidan, Mariam Alshammari, Marwan Al-Qunaee

Disclosures

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References

1. Kennedy DW, Zinreich SJ, Rosenbaum AE, Johns ME: Functional endoscopic sinus surgery. Theory and diagnostic evaluation. Arch Otolaryngol. 1985, 111:576-82. 10.1001/archotol.1985.00800110054002
2. Stankiewicz JA: Complications of endoscopic sinus surgery. Otolaryngol Clin North Am. 1989, 22:749-58.
3. Mayhew D, Mendonca V, Murthy BV: A review of ASA physical status - historical perspectives and modern developments. Anaesthesia. 2019, 74:373-9. 10.1111/anae.14569
4. Draf W: Endonasal micro-endoscopic frontal sinus surgery: the Fulda concept . Oper Tech Otolaryngol Head Neck Surg. 1991, 2:234-40. 10.1016/S1043-1810(10)80087-9
5. Ramakrishnan VR, Kingdom TT, Nayak JV, Hwang PH, Orlandi RR: Nationwide incidence of major complications in endoscopic sinus surgery. Int Forum Allergy Rhinol. 2012, 2:34-9. 10.1002/alr.20101
6. Rene C, Rose GE, Lenthall R, Moseley I: Major orbital complications of endoscopic sinus surgery . Br J Ophthalmol. 2001, 85:598-603. 10.1136/bjo.85.5.598
7. Oakley GM, Alt JA, Schlosser RJ, Harvey RJ, Orlandi RR: Diagnosis of cerebrospinal fluid rhinorrhea: an evidence-based review with recommendations. Int Forum Allergy Rhinol. 2016, 6:8-16. 10.1002/alr.21637
8. Keros P: On the practical value of differences in the level of the lamina cribrosa of the ethmoid (Article in German). Z Laryngol Rhinol Otol. 1962, 41:809-13.
9. Heaton CM, Goldberg AN, Pletcher SD, Glastonbury CM: Sinus anatomy associated with inadvertent cerebrospinal fluid leak during functional endoscopic sinus surgery. Laryngoscope. 2012, 122:1446-9. 10.1002/lary.23305
10. Bernal-Sprekelsen M, Alobid I, Mullol J, Trobat F, Tomás-Barberán M: Closure of cerebrospinal fluid leaks prevents ascending bacterial meningitis. Rhinology. 2005, 43:277-81.
11. Fried MP, Moharir VM, Shin J, Taylor-Becker M, Morrison P: Comparison of endoscopic sinus surgery with and without image guidance. Am J Rhinol. 2002, 16:193-7.
12. Weber R, Draf W, Kratzsch B, Hosemann W, Schaefer SD: Modern concepts of frontal sinus surgery . Laryngoscope. 2001, 111:137-46. 10.1097/00005537-200101000-00024
13. Weber R, Mai R, Hosemann W, Draf W, Toffel P: The success of 6-month stenting in endonasal frontal sinus surgery. Ear Nose Throat J. 2000, 79:930-2, 934, 937-8 passim.
14. Wang EW, Zanation AM, Gardner PA, et al.: ICAR: endoscopic skull-base surgery. Int Forum Allergy Rhinol. 2019, 9:S145-365. 10.1002/alr.22326