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Massive cavernous sinus bleeding secondary to Valsalva maneuver in endoscopic pseudomeningocele surgery: a case report

Can Korkmaz[1], Mehmet Ozan Durmaz[1], Adem Doğan[2], Ahmet Murat Kutlay[1], Yusuf İzci[1]

[1]*University of Health Sciences Türkiye, Gülhane Faculty of Medicine, Department of Neurosurgery, Ankara, Türkiye*
[2]*Şehitkamil State Hospital, Clinic of Neurosurgery, Gaziantep, Türkiye*

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Corresponding Author:
Can Korkmaz, M.D., University of Health Sciences Türkiye, Gülhane Faculty of Medicine, Department of Neurosurgery, Ankara, Türkiye
cankorkmaz.md@gmail.com

ORCID:
orcid.org/0000-0002-1489-4354

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ABSTRACT

Ventral skull base pseudomeningoceles (PMCs) are extremely rare. We report a life-threatening intraoperative complication of the endoscopic approach that has not been previously documented. A 64-year-old man presented with left-sided bloody rhinorrhea. Radiologic evaluation revealed a giant cystic lesion occupying nearly the entire ventral skull base, consistent with a PMC. Endonasal endoscopic surgery was planned. Since the site of cerebrospinal fluid leakage could not be identified intraoperatively, we requested the anesthesiologist to perform the Valsalva maneuver. This resulted in profuse bleeding from the left cavernous sinus (CS). Hemostasis was achieved, and the skull base defect was successfully repaired. Untreated skull base PMCs that erode the medial wall of the CS may progressively enlarge and pose a life-threatening risk. This case highlights the risk of CS hemorrhage during intracranial pressure-raising maneuvers such as the Valsalva maneuver in PMCs that erode the medial cavernous wall. Surgeons should remain alert to this potential complication in this type of high-risk case.

Introduction

A cranial pseudomeningocele (PMC) is defined as an abnormal extradural collection of cerebrospinal fluid (CSF). Although meningoceles (MC) and meningoencephaloceles (MECs) of the skull base are well-recognized conditions routinely encountered by skull base surgeons and rhinologists, PMCs involving the ventral skull base have been rarely reported. These lesions can result from iatrogenic, traumatic, or congenital defects (1-7). When symptomatic, PMCs typically present with CSF rhinorrhea and a pulsatile or compressible nasal mass (1,2,5,7). Untreated CSF rhinorrhea can lead to severe and well-recognized complications, including meningitis, pneumocephalus, and brain abscess (8,9).

Here, we report a case of massive cavernous sinus (CS) bleeding during endoscopic treatment of PMC, a life-threatening intraoperative complication that, to our knowledge, has not yet been reported. The patient has consented to the submission of the case report to the journal.

Case Presentation

A 64-year-old man presented with a longstanding history of nasal obstruction that had recently worsened. Additionally, he described mild intermittent bloody rhinorrhea from the left nostril over the past two days. There was no history of recent trauma; however, the patient recalled undergoing paranasal sinus surgery 15 years earlier. On physical examination, a very mild bloody CSF leak was observed from the left nostril, particularly while standing. Neurological examination was unremarkable. The β-2 transferrin test result was positive. Nasal endoscopy revealed pulsatile mucosal bulging with a mild bloody CSF leak originating from a defect within the bulging area. The patient underwent imaging evaluation with computed tomography (CT), CT angiography, and magnetic resonance imaging (MRI), including diffusion sequences.

MRI revealed a massive cystic lesion (8×6×7 cm) occupying almost the entire ventral skull base and extending into the left middle cranial fossa and infratemporal fossa (Figure 1a,b,c,d). CT revealed extensive bone resorption involving the anterior cranial fossa, sella floor, clivus, and sphenoid sinuses, accompanied by focal bony defects (Figure 1e,f). Notably, the CSF rhinorrhea resolved spontaneously during the diagnostic work-up. Nevertheless, endoscopic endonasal surgery was planned to repair the identified dural and osseous defects.

Surgery

Following the induction of general anesthesia, 10 mg of dexamethasone and 45.5 mg of pheniramine hydrogen maleate were administered. A lumbar puncture was performed, revealing an opening pressure of 15 cm H_2O. Subsequently, a lumbar drain was inserted, and 10 mL of CSF was withdrawn, mixed with 0.2 mL of 10% fluorescein, and reinjected into the intrathecal space.

The mucosal bulging was incised and CSF was drained using rigid endoscopes. Clotted blood within the PMC cavity, which was suspected to be the source of the bloody rhinorrhea, was aspirated and the cavity was irrigated. No meningeal herniation was detected. As a result of bone resorption and remodeling of the skull base, the optic nerves, chiasma, the left parasellar carotid artery, and the intracavernous portions of cranial nerves III, VI, V1, and V2 were clearly visualized (Figure 2a).

Although a blue light filter was used, the site of CSF leakage could not be identified. Accordingly, we requested the anesthesiologist to perform the Valsalva maneuver. Immediately after the Valsalva maneuver was performed, profuse bleeding occurred from the left CS. The bleeding was controlled using gentle pressure, irrigation, and the application of topical hemostatic agents with cottonoids. Following hemostasis, the medial wall of the left CS was covered with a thin layer of fat graft. An oversized fascia lata graft was placed as an onlay, encompassing the entire exposed skull base. Finally, the vascularized septal mucosal flap was transposed over the fascia lata and tissue adhesive was applied to stabilize the reconstruction (Figure 2b). The nasal cavity was packed with a large piece of gelfoam and a Merocele® nasal tampon (Medtronic, Minneapolis, MN) to support the reconstruction. Postoperative CT performed in the early period was unremarkable (Figure 2c,d). External lumbar drainage was continued for three days. The Merocele® nasal tampon was removed on postoperative day 5. The patient was discharged on postoperative day 6 with no evidence of CSF leakage. At 1-year follow-up, the patient

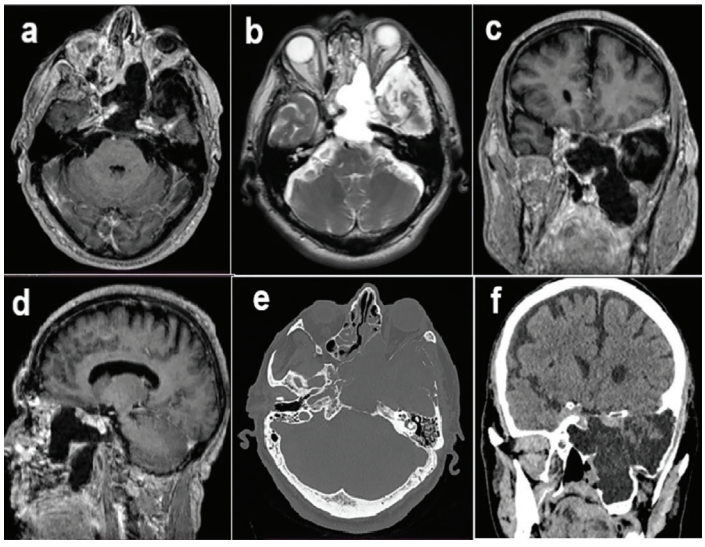

Figure 1. Preoperative axial T1-W (a), axial T2-W (b), coronal T1-W (c), and sagittal T1-W (d) MRI showing a giant cystic mass occupying almost the entire ventral skull base, involving the left cavernous sinus, and also extending into the left middle cranial fossa, and infratemporal fossa. Preoperative axial bone window (e), and coronal (f) CT scans demonstrating significant bone resorption in the ventral skull base including anterior fossa, sella floor, clivus, and sphenoid sinuses as well as bony defects in some areas

MRI: Magnetic resonance imaging, CT: Computed tomography

remained free of CSF leakage, and MRI showed no abnormalities related to the skull base reconstruction (Figure 2e).

Discussion

Skull base PMCs are rare lesions that are known to result from traumatic or iatrogenic causes and can also occur spontaneously (1-5,7,10,11). Regardless of etiology, a ventral skull base PMC of this size has not been previously reported.

A dural defect is a common pathological finding in MC, MEC, and PMC. In skull base PMC, CSF is not contained within a meningeal protrusion but accumulates behind the mucosa of the paranasal sinuses and may extend into the soft tissues of the infratemporal or pterygopalatine fossa (1-5,7,11-14). Although clear, watery rhinorrhea is the most common presenting symptom in all of these pathologies, our patient presented with bloody CSF rhinorrhea, an unusual finding. To our knowledge, MC, MEC, and PMC presenting with bloody CSF rhinorrhea in the absence of acute trauma or recent surgical intervention have not been reported in the literature. The finding of bloody CSF, as seen in our case, without recent surgery or trauma highlights the importance of comprehensive preoperative imaging.

According to some authors, increased hydrostatic pressure caused by fluid entrapment through a ball-valve or slit-valve mechanism can lead to bone resorption (1,3,4,15). In our case, we observed thinning and weakening of the medial meningeal wall of the CS, which lies adjacent to the lateral wall of the sphenoid sinus. We presume that increased pressure during the Valsalva maneuver led to rupture of the already weakened medial wall of the CS, resulting in bleeding. Therefore, in cases of PMC where the lateral wall of the sphenoid sinus appears to be thinning and weakening on preoperative imaging, the Valsalva maneuver should be avoided or applied with extreme caution both preoperatively and intraoperatively. This case also raises the concern that patients with giant PMC involving the CS may be at risk of similar bleeding complications during daily activities that increase intracranial pressure.

Conclusion

To our knowledge, this may represent the largest iatrogenic PMC of the ventral skull base reported to date. An untreated skull base PMC can enlarge over time and lead to life-threatening complications. This case highlights the risk of CS hemorrhage during intracranial pressure-raising maneuvers, such as the Valsalva maneuver, in patients with skull base PMCs eroding the medial cavernous wall. Surgeons should exercise particular caution in such high-risk cases and be prepared for potential complications.

Ethics

Informed Consent: The patient provided informed consent for publication of this case report.

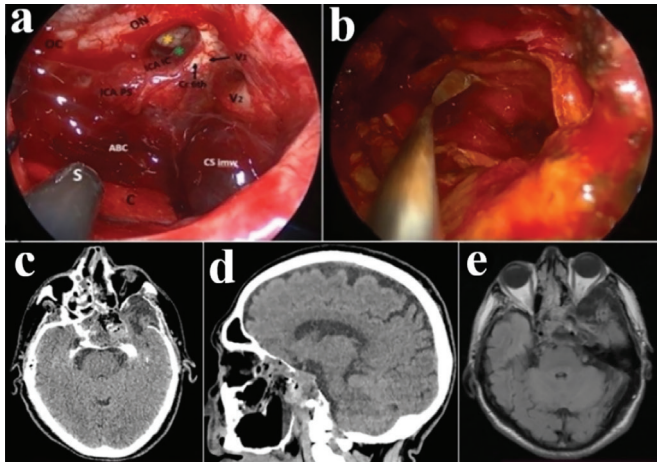

Figure 2. (a) Intraoperative endoscopic view. All neurovascular structures are visible because of bony dehiscence. OC=optic chiasm, ON=left optic nerve, ICA-PS=left parasellar carotid artery, ICA-IC=intracavernous horizontal segment of the left carotid artery, V1=left ophthalmic nerve, Cr 6th=left sixth cranial nerve, V2=left maxillary nerve, CS imw=inferior part of the medial wall of the left cavernous sinus, yellow asterisk=the base of the left anterior clinoid process, green asterisk=left third cranial nerve, C=cottonoid, S=suction. (b) Placement of the fascia lata in on-lay fashion. Axial (c), sagittal (d) CT scans obtained in the early postoperative period, and axial,T2-W MRI (e) obtained one year postoperatively showing acceptable outcome of skull base reconstruction

CT: Computed tomography, MRI: Magnetic resonance imaging

Footnotes

Authorship Contributions

Surgical and Medical Practices: M.O.D., A.M.K., Concept: C.K., Design: C.K., Data Collection or Processing: A.D., Analysis or Interpretation: C.K., M.O.D., A.M.K., Y.İ., Literature Search: A.M.K., Y.İ., Writing: C.K., A.M.K.

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