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doi: 10.48095/cccsnn2026334

# Isolated orbital mucocele as a late sequela following skull base fracture – case report and review of the literature

## Izolovaná mukocéla očnice ako neskorý následok zlomeniny základne lebky – kazuistika a prehľad literatúry

Dear Editor,

Mucocele is benign, slow-growing, mucus-filled cavity in the paranasal sinuses caused by inflammation, trauma, surgery or anatomical abnormalities [1]. We report a rare case of isolated orbital mucocele that developed as a late sequela following a skull base fracture. In addition, we reviewed English-language literature using PubMed database to identify relevant articles published through August 2025.

A 49-year-old female was referred to our department with downward deviation of the globe and exophthalmos on the right, without pain or oculomotor dysfunction. Until then, the patient had been monitored for a progressive intraorbital process for more than 10 years at a different institution, without any imaging studies. The patient had sustained a head injury 17 years earlier (she was hit by a motorcycle as a pedestrian). A CT scan was not performed at that time. However, as a consequence of the injury, the patient had prolonged swelling of the right eye, without CSF leakage. A subsequent CT scan of the orbit and paranasal sinuses revealed a well-encapsulated cystic lesion with a calcified wall in the right extraconal region, measuring 2,3 × 2,8 × 1,5 cm, compressing the globe and the superior rectus muscle (Fig. 1). A defect in the ethmoid sinus (Fig. 1) was visualized on CT bone scans. MRI of the orbit revealed an expansive lesion. On fluid attenuated inversion recovery (FLAIR) sequences, the lesion showed hyperintense signal and compressed superior rectus muscle beneath the orbital roof (Fig. 1) and showed no convincing enhancement on post-contrast MRI (Fig. 1). Based on clinical symptoms and imaging findings, the diagnosis of orbital mucocele was established, and surgical intervention was indicated. We performed a modified one-piece orbitozygomatic (OZ) craniotomy. During separation of the periorbita, a pus-like liquid was released. After removal of the bone flap, a partially calcified cavity lined with epithelium was observed (Fig. 2). The epithelium was removed and sent for histological examination. The walls of the partially calcified cavity were drilled out, while the periorbita was preserved. In accordance with preoperative CT findings, during revision of the cavity we identified a defect in the ethmoid sinus, from which the suspected mucocele originated (Fig. 2). Finally, revision of the ethmoid and frontal sinus defect following OZ craniotomy was performed (Fig. 2). The paranasal sinus defect was obliterated with fat tissue, glue, and TachoSil (Takeda, Tokyo, Japan). The dura mater remained intact. Histologically, the cyst walls were lined with pseudostratified ciliated columnar respiratory epithelium without atypia. The cyst wall was fibrous, with microfragments of bone tissue and no significant inflammatory infiltration. Microbiological culture of the specimen revealed Cutibacterium acnes, which is part of the normal flora of mucosal surfaces [2]. Therefore, the diagnosis of mucocele was confirmed. The postoperative course was uneventful. The patient was discharged on postoperative day 5, and the proptosis regressed after surgery. A postoperative MRI performed six months after surgery confirmed complete removal of the mucocele, with no signs of recurrence.

Skull base fractures, though often asymptomatic, may lead to serious complications such as neurovascular injury, tissue contusions and CSF leakage [3]. Orbital mucoceles represent a rare, slow-growing pathology that may develop as a late complication of trauma, including paranasal sinuses fractures [4]. In general, a mucocele is a tumor-like lesion lined by respiratory mucosa, typically found in the paranasal sinuses and filled with mucus [5]. The most common mechanism of mucocele formation after trauma include obstruction of the sinus drainage pathway and entrapment of mucosal membrane within fracture lines. As these trapped cells continue to produce mucus, a cyst may develop, which can subsequently lead to remodeling of the bony walls or even expansion beyond the sinus boundaries. The development of a mucocele following trauma

**The Editorial Board declares that the manuscript met the ICMJE "uniform requirements" for biomedical papers.**
Redakční rada potvrzuje, že rukopis práce splnil ICMJE kritéria pro publikace zasílané do biomedicínských časopisů.

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Accepted for review: 8. 1. 2026
Accepted for print: 29. 7. 2026

proLékaře.cz | 12.11.2026

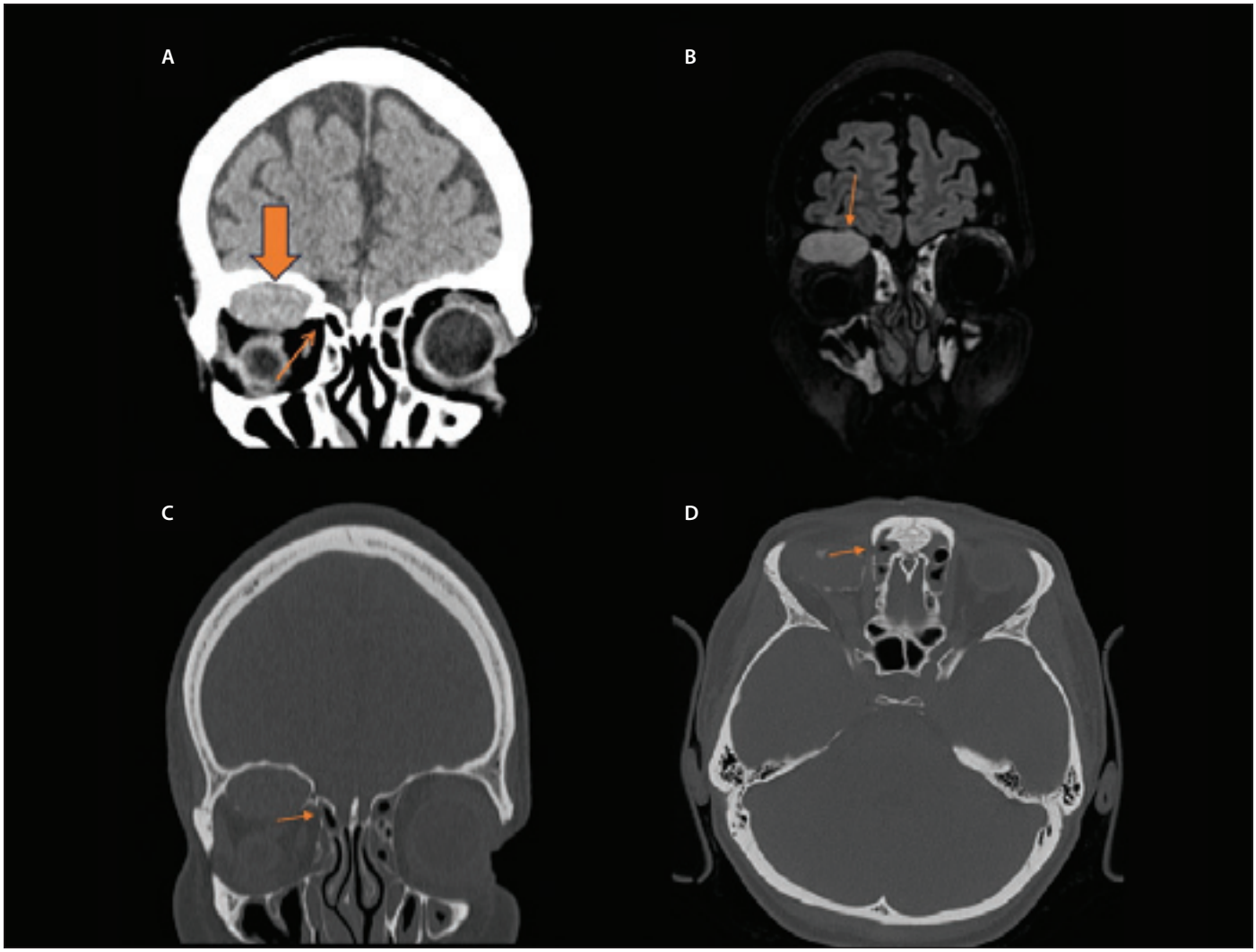




Fig. 1. (A) Preoperative contrast-enhanced CT. The image shows an expansile soft-tissue lesion in the superior part of the right orbit, closely compressing the globe and the superior rectus muscle (orange arrow). Communication between the fractured ethmoid sinus and the orbital cavity is observed. (B) On MRI T2-weighted FLAIR images, a hyperintense lesion is seen in the right extraconal space beneath the orbital roof, compressing the superior rectus muscle. Coronal (C) and axial (D) CT bone window images demonstrate a defect in the ethmoid sinus.

FLAIR – fluid attenuated inversion recovery

Obr. 1. (A) Predoperačné vyšetrenie CT s podaním kontrastnej látky. Snímka zobrazuje mäkkotkanivovú expanzívnu léziu v hornej časti pravej očnice, ktorá komprimuje očnú guľu a priamy horný sval (oranžová šípka). Viditeľná je priama komunikácia medzi zlomeninou čuchovej dutiny a dutinou očnice. (B) Na snímkach MR v sekvencii T2-FLAIR je v pravom extrakonálnom priestore pod stropom očnice viditeľná hypersignálna lézia komprimujúca horný priamy sval. Koronálne (C) a axiálne (D) snímky CT v kostnom okne znázorňujú defekt v oblasti čuchovej dutiny.

FLAIR – fluid attenuated inversion recovery

may not occur immediately, as it can take time for mucus to accumulate and cause noticeable symptoms, as seen in our case. We believe that the latter mechanism was responsible for the formation of the orbital mucocele in our patient, as migration and proliferation of respiratory epithelial cells from the ethmoid sinus into the orbit at the time of skull base fracture may have occurred. However, as the patient did not undergo CT imaging at the time of trauma, the exact origin of the mucocele in our case remains debatable. Nevertheless, the history of trauma together with later imaging findings makes this hypothesis the most plausible explanation.

The symptomatology of orbital mucocele is typically characterized by exophtalmos, globe displacement, and oculomotor dysfunction, accompanied by diplopia or altered vision when significant compression of optic structures is present [6]. MRI signal intensity is variable and depends on the relative proportions of water, mucus and protein [7]. Treatment of mucocele is complete surgical removal, including the epithelial lining, to minimize the risk of recurrence from residual mucosa [8]. In our case, the orbital mucocele was removed via a modified one-piece OZ approach, which was selected due to the size of the lesion and presence of calcified walls requiring drilling. Compared with endoscopic approaches, we believe OZ cra-

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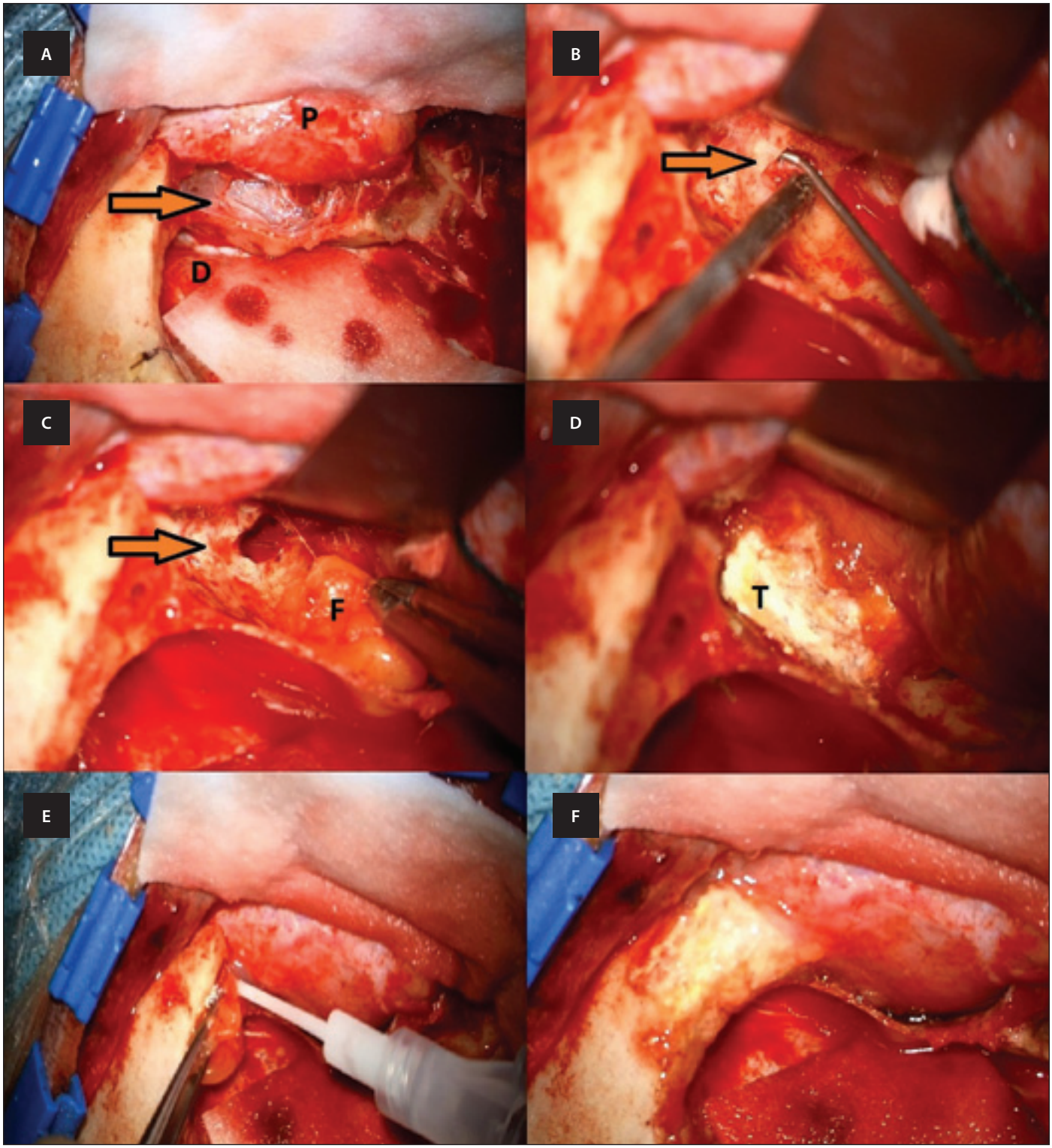



Fig. 2. (A) Following modified orbitozygomatic craniotomy, after removal of the bone flap, a partially calcified cavity lined with epithelium was observed in the orbit (arrow). (B) A defect in the ethmoid sinus is shown (arrow). (C, D) Reconstruction of the ethmoid sinus defect (arrow) using fat tissue, glue and TachoSil. (E, F) Revison of the frontal sinus following orbitozygomatic craniotomy using glue and TachoSil.

D – dura; F – fat; P – periorbita; T – TachoSil

Obr. 2. (A) Po modifikovanej orbitozygomatickej kraniotómii a odstránení kostného laloka bola v očnici pozorovaná čiastočne kalcifikovaná dutina vystlaná epitelom (šípka). (B) Je znázornený defekt v čuchovej dutine (šípka). (C, D) Rekonštrukcia defektu čuchovej dutiny (šípka) s použitím tukového tkaniva, lepidla a materiálu TachoSil. (E, F) Revízia čelovej dutiny po orbitozygomatickej kraniotómii s použitím lepidla a materiálu TachoSil.

D – dura; F – tuk; P – periorbita; T – TachoSil

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niotomy provided better exposure and facilitated management of the defect.

A literature review was conducted using the PubMed database to identify relevant English-language articles by using combinations of search terms and synonyms for "mucocele", "orbital mucocele", "sequela of skull base trauma", and "mucocele after skull base trauma" through August 2025. To the best of our knowledge, our case represents only the second reported instance of an isolated orbital mucocele developing as a late sequela following skull base fracture in the English-language literature. The only previously published case was reported by Rajabi et al. in 2012, where the mucocele arose exclusively within the orbit, without communication with the paranasal sinuses [9].

Isolated orbital mucocele may develop as a rare complication following a skull base fracture. When present, complete surgical removal of mucocele, including the epithelial lining, along with revision of the underlying bone defect, is recommended. Similar to other late complications following skull base fractures, a mucocele may develop and become symptomatic several years after the initial injury, as demonstrated in our case. This highlights the importance of long-term follow-up in selected patients after skull base trauma.

## Conflict of interest

The authors declare they have no potential conflicts of interest concerning drugs, products, or services used in the study.

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