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Case Report

Pott's puffy tumor due to bone wax in open hypophysectomy: unforeseen consequences

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ABSTRACT

Pott's puffy tumor is a rare condition characterized by the accumulation of pus and granulation tissue beneath the periosteum of the frontal bone, typically resulting from an infection that spreads from the frontal sinuses. This condition often leads to localized demineralization and necrosis of the affected bone. Neurosurgical procedures involving craniotomy commonly breach the frontal sinus, making it susceptible to infections. While such postoperative infections are uncommon, they pose significant challenges in management. Various methods have been employed to reconstruct the anterior skull base following neurosurgical procedures, including cranialization and obliteration of the frontal sinus. However, incomplete removal of mucosa or the presence of bone wax within the sinus outflow tract can lead to complications such as cellulitis, abscess formation, chronic sinusitis, or the development of mucoceles and muco-pyoceles. In this report, we present two cases of open hypophysectomy where bone wax inadvertently obstructed the frontal sinus outflow tract, resulting in persistent infection and subsequent frontal osteomyelitis. The frontal sinusitis after craniotomy may be related to the inadequate sinus management, especially bone wax ramming the frontal sinus leading to frontal sinus mucosa secretion obstruction and poor drainage. Avoiding bone wax as an obliterating material and meticulous removal of mucosa with drilling of the underlying bone to remove mucosal imbrications and complete obliteration of the frontal recess is essential in both frontal sinus obliteration and cranialization.

Keywords: Frontal osteomyelitis, Pott's puffy tumor, Bone wax, Frontal craniotomy

INTRODUCTION

Neurosurgical procedures often necessitate accessing the skull base or treating neurological conditions through various craniotomies, which may involve entry into the frontal sinus.

Such interventions invariably disrupt the integrity of the frontal sinus mucosa. To mitigate potential complications, various techniques for reconstructing the frontal sinus have been advocated.

Bone wax is commonly employed to pack the frontal sinus following craniotomy. However, its use carries the risk of triggering refractory sinusitis and osteomyelitis, as elucidated in this report.[1-3]

CASE REPORTS

Two cases of intractable osteomyelitis are being discussed. Both had required craniotomy for hypophysectomy and presented with unresolving swelling over frontal sinus. The case details are summarized below.

Case 1

A 45-year-old male presented with a non-healing wound over the left side of the forehead persisting for two years, associated with purulent, foul-smelling discharge. He had

undergone a left pterional craniotomy six years earlier for a growth hormone–secreting invasive pituitary adenoma, followed by two sessions of gamma knife therapy for residual tumor. Clinical examination revealed coarse facial features suggestive of acromegaly, and a 1×1 cm ulcerated lesion located 2 cm superior to the supraorbital ridge with pale granulation tissue and purulent discharge. Radiological evaluation demonstrated an expanded left frontal sinus filled with soft tissue density and bony sclerosis, with a defect in the anterior wall while the posterior wall remained intact (Figure 1). The patient was managed with combined endoscopic and external debridement. Intraoperatively, the left frontal recess was found to be completely filled with polypoidal tissue, while the frontal sinus cavity itself was occupied by granulation tissue and infected bone. Infected bone wax lining the sinus walls was identified as the source of persistent infection and was meticulously removed through a combined approach. Both endoscopic clearance and external debridement were performed after widening the anterior wall defect, ensuring thorough removal of the diseased tissue and foreign material (Figure 3).

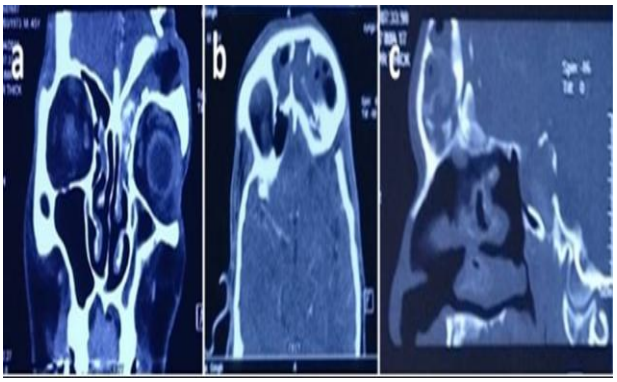

Figure 1: Case 1- Computed tomographic scans of paranasal sinuses (a) coronal view, obstructed naso-frontal drainage pathway; and (b, c) axial and sagittal views, expanded frontal sinus with bony sclerosis and filled with soft tissue.

Figure 2: Case 2- T1 magnetic resonance imaging coronal view, showing right frontal sinus filled with soft tissues and secretions and obstructed drainage pathway.

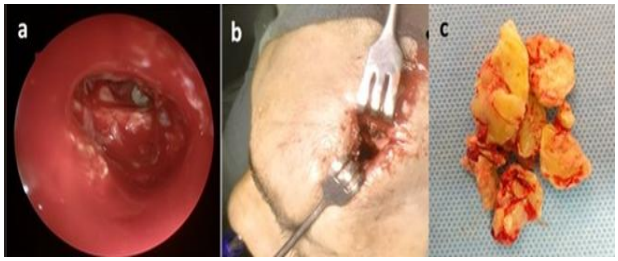

Figure 3: Case 1- Endoscopic view of the frontal sinus filled with granulations and bone wax; (b) defect in anterior wall of frontal sinus which was widened to supplement the endoscopic removal of bone wax; and (c) retrieved bone wax.

Case 2

A 14-year-old male presented with right facial and periorbital swelling for one week, associated with right frontal headache. He had a past history of right frontal craniotomy and transcranial excision of a non-functioning pituitary macroadenoma one year earlier. On examination, he had right periorbital and facial edema with preserved vision and normal extra-ocular movements. Nasal endoscopy revealed congested and edematous nasal mucosa. Imaging confirmed a right frontoethmoidal mucocele with associated pre-septal cellulitis (Figure 2). The patient was managed initially with a course of intravenous antibiotics, followed by endoscopic drainage of the mucocele. Intraoperatively, the right frontal recess was found to be filled with polypoidal tissue and purulent discharge, while the frontal sinus was occupied by polypoidal tissue along with multiple pieces of bone wax obstructing the natural drainage pathway, all of which were removed endoscopically (Figure 4).

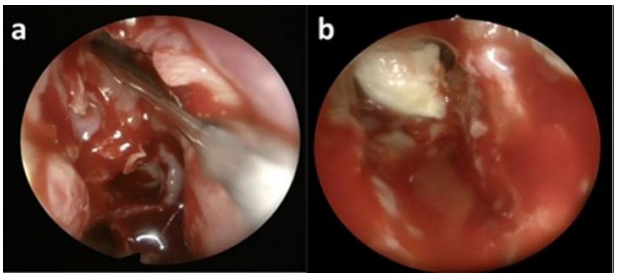

Figure 4: Case 2- (a) Polypoidal tissue filling and obstructing the frontal recess; and (b) bone wax visible in the frontal sinus.

DISCUSSION

Pott puffy tumor arises when infection spreads from the frontal sinus into the frontal bone, producing diploic inflammation that subsequently leads to localized demineralization and perforation of the anterior wall of the frontal sinus. This process culminates in subperiosteal abscess formation accompanied by granulation tissue. The entity is associated with a heightened risk of meningitis, intracranial abscess, and venous sinus thrombosis, and

therefore prompt recognition along with aggressive medical and surgical intervention is essential for favorable outcomes.[1] Bifrontal craniotomy remains a well-established approach for managing anterior skull base neoplasms and anterior cerebral artery aneurysms. Nevertheless, the procedure frequently entails violation of the frontal sinus (FS), which may predispose to multiple postoperative complications secondary to the open FS. These complications include cerebrospinal fluid (CSF) leak and a spectrum of infections such as meningitis, brain abscess, subdural or epidural abscess, and subcutaneous or subperiosteal abscess.[2] The mucosa of the FS demonstrates a tendency to form mucoceles, particularly when the naso-frontal duct (NFD) is obstructed. Such mucoceles generally follow a slow and insidious course, with progressive enlargement that may culminate in delayed infection. To prevent these sequelae, different reconstructive strategies for the anterior skull base have been described, notably cranialization and obliteration of the FS. Cranialization consists of removal of the posterior sinus wall, meticulous extirpation or cauterization of the sinus mucosa, and permitting the frontal lobe to rest against the anterior wall and sinus floor. Obliteration, on the other hand, involves permanent closure of the frontal recess and filling of the sinus cavity with biological or synthetic materials. A wide variety of materials have been utilized for this purpose, including fat, fascia, muscle, galeal or pericranial flaps, bone, and titanium plates. Preservation of NFD patency remains the single most important factor in preventing mucocele formation and late-onset infection. Schramm and Maroon have reported that complications of the frontal sinus are predominantly inflammatory in nature, including frontal bone osteomyelitis, cellulitis, subcutaneous or subperiosteal abscess, chronic frontal sinusitis, mucocele, and mucopyocele. Predisposing factors encompass entrapment or migration of incompletely excised mucosa into craniotomy or burr-hole sites, obstruction of the frontal recess, mucosal inflammation due to foreign bodies, and pre-existing allergy or chronic sinusitis.[4] Intracranial spread of mucoceles has also been documented as a sequela of unrecognized posterior wall injury during craniotomy.[5] In 1892, Sir Victor Horsley introduced the bone wax technique (Horsley Method) to achieve regional hemostasis and mechanical stability in neurosurgery. However, inadequate protection of the frontal sinus and tamponade with bone wax have been implicated in the pathogenesis of frontal sinusitis following transfrontal craniotomy.[6] Reports indicate that frontal abscess and fistula formation are more frequently observed when this technique is employed. The recommended treatment consists of foreign body removal and restoration of frontal recess drainage. Mann et al in their evaluation of 39 cases of post-craniotomy frontal sinus pathology, concluded that the use of bone wax and sinus cavity obliteration with muscle were unreliable techniques.[7] Bone wax continues to be extensively used for hemostasis and sinus obliteration and is generally regarded as safe. Nevertheless, it may provoke chronic inflammation, act as a mechanical barrier to osseous regeneration, hinder bacterial clearance in cancellous bone, and incite the formation of foreign-body granulomas.[8] Adverse outcomes related to bone wax application have been reported across several craniofacial procedures.[9-14] Liu et al described a cohort of thirty-four patients with frontal sinusitis after transfrontal craniotomy, all of whom had documented bone wax packing.[15] In these cases, bone wax and associated inflammatory granulation tissue were removed either endoscopically or by conventional frontal sinus surgery. Resolution was defined by disappearance of postoperative sinus inflammation and re-establishment of unobstructed sinus drainage.

Two cases are a very small number to draw any significant conclusions, especially since these cases have emerged from a centre where a high volume of such neurosurgical procedures is performed. The cases, however, highlight the need for addressing the frontal sinus meticulously, if violated and recognize the complications in such cases early.

CONCLUSION

The frontal sinusitis after craniotomy may be related to the inadequate sinus management, especially bone wax ramming the frontal sinus leading to frontal sinus mucosa secretion obstruction and poor drainage. Avoiding bone wax as an obliterating material and meticulous removal of mucosa with drilling of the underlying bone to remove mucosal imbrications and complete obliteration of the frontal recess is essential in both frontal sinus obliteration and cranialization.

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