

# Frontal Sinus Mucocele with Massive Skull Destruction

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A 63-year-old female complained of left frontal headache and swelling for several months. Physical examination revealed a left supraorbital soft, nontender, nonpulsatile mass without bruit. The left eye was displaced downward with respect to the normal right globe. Based on the clinical and radiological findings, the patient was diagnosed as a mucocele arising from the left frontal sinus. The patient underwent a transcranial approach through coronal incision. In this patient, large portions of the anterior and posterior frontal sinus walls were destroyed in association with epidural spread, so we performed cranialization of the frontal sinus and removed the mucosal wall with the aid of a microscope. With a brief review we present a patient with mucocele of the frontal sinus extending into the intracranial and intraorbital region, which was successfully treated by a transcranial approach.

**KEY WORDS :** Mucocele · Transcranial approach · Frontal sinus · Cranialization.

## Introduction

Mucocele is generally defined as accumulation of mucous secretion in the paranasal sinus caused by obstruction due to the inflammation, fibrosis, trauma, previous surgery, anatomical abnormality, or mass lesion<sup>4,7</sup>. Mucoceles mainly develop in the frontal sinus and less frequently in the other sinuses<sup>2,3,7,9,11</sup>. As a result of their infection or expansile growth, mucoceles of the frontal sinus can give rise to intracranial and orbital complications<sup>1,2</sup>. Surgical intervention is recommended in most cases. The surgical procedure adopted in the case of frontal sinus mucoceles depends on the localization and extent of the mucocele. We report a case of mucocele of the frontal sinus extending into the intracranial and intraorbital region, which was successfully treated by a transcranial approach.

## Case Report

A 63-year-old female complained of left frontal headache and swelling for several months. The patient visited an ophthalmologist at another hospital due to progressive proptosis and diplopia. She denied having had any facial trauma or endonasal surgery. Computed tomography(CT) and magnetic resonance image(MRI) were performed, and the patient

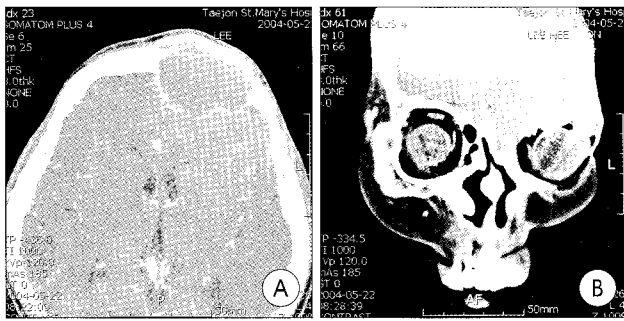


**Fig. 1.** A 63-year-old female showing the left supraorbital soft, nontender, non-pulsatile mass without bruit. The left eye is displaced downward with respect to the normal right globe.

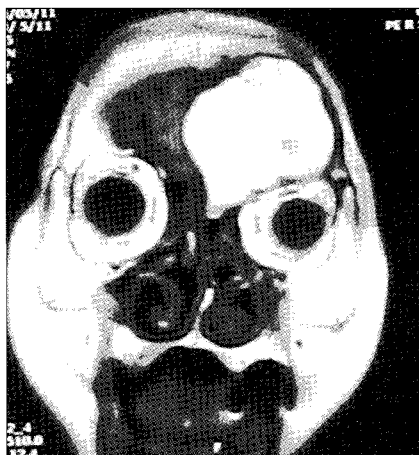
was transferred to our hospital for further examination and treatment. Physical examination revealed a left supraorbital soft, nontender, nonpulsatile mass without bruit. The left eye was displaced downward with respect to the normal right globe

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**Fig. 2.** A : Contrast enhanced axial computed tomography(CT) scan shows an isodense homogenous mass filling the left frontal sinus with erosion of anterior and posterior wall of frontal sinus. B : Coronal CT scan shows large bony destruction of superior orbital wall.



**Fig. 3.** T1-weighted coronal magnetic resonance image shows homogenous high signal mass that extends intracranially and intraorbitally.

and posterior wall of the frontal sinus (Fig. 2). The margin of the lesion was smooth and the mass was not enhanced by contrast media. Three-dimensional(3D) bone CT demonstrated a defect of the sinus wall and orbital roof. MRI showed that the mass was hyperintense on the T1 and T2-weighted images (Fig. 3). Sagittal MR imaging showed extension of the lesion intracranially and extracranially.

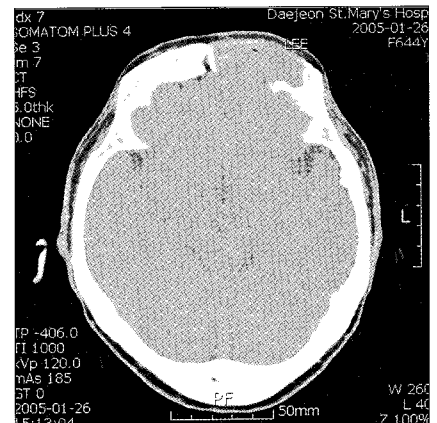
Based on the above findings, the patient was diagnosed with mucocele arising from the left frontal sinus with massive intracranial and intraorbital extension. The patient underwent a transcranial approach through coronal incision. A thick mucous membrane and thick, dark brown greasy material was found throughout the bony defect (Fig. 4). Intraoperative gram stain was negative and cultured. Partial removal of the bony wall of the sinus and radical removal of the mucous lining were done carefully by burr and microscope. Obliteration of the nasofrontal ostium was performed by free fat graft with the help of an otorhinolaryngological surgeon. The orbital roof and epidural space was reconstructed with a mesh plate and an abdominal fat graft. The communication between the anterior cranial fossa and the nasal cavity was obliterated by

(Fig. 1). Vision, ocular motility and facial sensation were normal. Skull radiography showed a large round radiolucent lesion at the left frontal bone. CT showed an isodense homogenous mass filling the left frontal sinus with erosion of the orbital roof, as well as the anterior



**Fig. 4.** Intraoperative view of the fronto-orbital mucocele after coronal approach. A thick mucous membrane and dark brown greasy material was found through the bony defect.

the frontal galeal flap. The anterior wall of the frontal sinus and frontal bone were reconstructed with bone cement. The culture report of the fluid sent for microorganism during surgery was negative. The postoperative course was uneventful and evidence of recurrence was not found during the 20 months of followup (Fig. 5).



**Fig. 5.** Postoperative follow-up computed tomography at 8 months shows no definite recurrence evidence.

## Discussion

It is generally accepted that a mucocele occurs due to obstruction of the natural orifice of the paranasal sinus and subsequent accumulation of excreted substances in the sinus<sup>4,7</sup>. Mucoceles typically develop in the frontal sinus and less frequently in the ethmoid, or in the maxillary and sphenoid sinuses<sup>2,3,7,9,11</sup>. The frontal sinus begins as an evagination of the frontal recess. Development begins at age 2, adult configuration is reached at 15 years, and maximum size is achieved

ved by age 20<sup>12)</sup>. The nasofrontal duct is 2mm to 2cm in length and runs from the posteromedial aspect of the frontal sinus floor to the middle meatus. Accumulation of mucous secretion leads to pressure change. Pressure induced necrosis and release of natural osteolytic factors lead to the destruction of the surrounding bony structures<sup>8)</sup>. Because of their slow, progressive, growing nature, the majority of frontal sinus mucoceles frequently present late in their development, only after orbital or cranial invasion has already occurred<sup>3,10,11)</sup>. The most common initial symptoms are those of headaches, periorbital pain and visual changes; the most common findings are those of periorbital swelling and proptosis<sup>3,10,11)</sup>. The frequency of cranial base destruction by paranasal sinus mucocele is reported to be 10~20%<sup>6,10)</sup>. If intraorbital growth develops as a consequence of destruction of the orbital roof, diplopia and proptosis may occur. Destruction of the posterior frontal sinus wall results in a direct connection between the mucocele and the epidural space. Although the dura can withstand pressure exerted by the mucocele and has the tendency to resist possible infection, intradural growth with severe complications, such as meningoencephalitis and pneumocephalus can develop in very rare cases<sup>2,6)</sup>.

CT is currently the first diagnostic method for identification of paranasal sinus pathology and the extent of bone destruction<sup>10)</sup>. On CT scan, mucoceles usually appear as an isodense mass, filling the sinus structure and bulging against adjacent anatomical structures, but without infiltration<sup>7)</sup>. MRI is very helpful in differentiating mucoceles from meningoencephaloceles and other tumors. MRI findings of mucocele are generally reported to show high intensity on T1-weighted and T2-weighted images due to their high protein and water content<sup>6,10)</sup>.

The traditional treatment for paranasal sinus mucoceles has been marsupialization, evacuation of their contents and complete removal of the mucosal lining<sup>1,5,7)</sup>. On the other hand, recent reports show that complete removal of the lining is not necessary and only marsupialization via endoscope is sufficient<sup>1,5)</sup>. Generally, the choice of surgical access depends on the localization and extension of the mucocele. In most cases, the causes are found to be from previous endonasal operations and pronounced development of nasal polyposis. In these cases, endoscopic endonasal marsupialization of the mucocele into the nasal cavity represents the method of choice<sup>2,5,11)</sup>. This approach allows the normal mucosa and possibly the still existing bony structure of the frontal sinus infundibulum to be preserved. If endonasal access to the mucocele of the frontal sinus cannot be achieved and the drainage function cannot be guaranteed, or if intracranial extension is confirmed, a transcranial procedure is indicated<sup>2,3,7,10)</sup>. Moreover, it is highly possible with an invasive intracranial lesion that drainage of

the lesion without removal of mucous membranes will lead to recurrence. In these cases, three important aspects must be encompassed. First, especially in the case of intracranial and intraorbital involvement, reliable sanitation of mucoceles of the frontal sinus should be confirmed<sup>2)</sup>. Second, drainage of the mucocele into the nose or complete removal of the mucocele and the mucosa of the frontal sinus, as well as reliable closure of the frontal infundibulum, should be guaranteed<sup>2)</sup>. Third, preservation or reconstruction of the anterior wall of the frontal sinus may be necessary to protect the frontal brain, as may be reconstitution of the contour of the forehead and orbit<sup>2)</sup>.

In the present patient, large portions of the anterior and posterior frontal sinus walls were destroyed in association with epidural spread, so we chose to perform cranialization of the frontal sinus and obliteration of the nasofrontal ostium. Because of complications such as meningitis, cerebrospinal fluid leakage and recurrence, we tried to remove the whole mucosa from the bony recesses and from the dura mater very carefully with a burr and microscope. For reconstruction, we simply used the frontal galeal flap and artificial bone material instead of the vascularized myofacial flap and a split-thickness bone graft because evidence of infection was not found.

## Conclusion

**M**ucocele arising in the frontal and/or the other sinuses are clinically silent and can involve both orbit and anterior cranial fossa extensively. If endonasal access to the mucocele of the frontal sinus cannot be achieved and the drainage function cannot be guaranteed, or if intracranial extension is confirmed, a transcranial procedure is indicated. With a brief review, we report a case of mucocele of the frontal sinus extending into the intracranial and intraorbital region which was successfully treated by a transcranial approach.

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