Endoscopic sinus surgery under the navigation system for a frontal sinus cyst: a case report

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Draf's drainage surgery, an endonasal micro-endoscopic approach to establish one of three types of frontal sinus drainage, is becoming the standard operative procedure in Europe and America especially for recurrent cases. We reported a recurrent frontal sinus cyst that we treated in accordance with Draf's drainage surgery under the navigation system. The patient was an 81-year-old male, who complained of diplopia when gazing upward. His left eyeball was displaced downward, and there was a disorder of sursumduction. Emergency computed tomography (CT) showed that there was soft shadow in the left frontal sinus that had infiltrated into the left orbita. We performed an external incision with Killian's operation opening the lesion. The patient visited our hospital again with the same complaints 3 months later. Emergency CT showed findings that were similar to the previous time. We performed endonasal frontal sinus opening surgery in accordance with Draf's drainage surgery type III with the navigation system. Postoperative nasal fiberscopy 4 months later showed that the frontal duct penetrating to the frontal sinus remained open above the base of the middle nasal turbinate. Although there is a trend that Killian's operation causes mucoceles, endoscopic sinus surgery is unlikely to cause mucoceles. Moreover, we can perform this operation safely with the navigation system.

Key words: endoscopic sinus surgery, navigation system, frontal sinus cyst

Introduction

Opening paranasal sinuses is complex and individual difference is large; and that, while being especially careful regarding risky parts, such as the orbita and tectorium, makes it a technique that requires great precision. Although endonasal surgery is indicated even for frontal sinus disease, such as chronic inflammation of paranasal sinuses and frontal sinus cyst, Draf's drainage surgery, an endonasal micro-endoscopic approach to establish one of three types of frontal sinus drainage (Figure 1), is becoming the standard operative procedure in Europe and America, especially for recurrent cases.1

We report a case of recurrent frontal sinus cysts that we treated with Draf's drainage surgery using a navigation system for the first time in our department for which there was remarkable improvement.

Case report

The patient was an 81-year-old male who presented with diplopia as the chief complaint. He noticed left narrowing of the optic fissure in early October and visited a local internal medicine clinic in late October. Although there was no noticible disorder of eye movement, he complained of diplopia when gazing upward. He underwent magnetic resonance imaging (MRI) of the head after a few days. Because the MRI showed a shadow in the left frontal sinus, he was referred to Kitasato University Hospital and visited us in late November. There was no history of nasal sinus surgery.

Otolaryngological findings at the first visit revealed a swelling in the left root of the nose, the left eyelid was drooping, and the left optic fissure was narrowing. The left eyeball was displaced downward, and there was a remarkable disorder of sursumduction. An emergency computed tomography (CT) showed that there was a soft shadow in the left frontal sinus that had infiltrated into the left orbita. Moreover, bone thickening of the left nasofrontal duct was remarkable (Figure 2). Findings of anterior rhinoscopy indicated that there was mild edematous change at the bilateral inferior nasal turbinate.

We performed an emergency endoscopic operation opening the anterior ethmoid sinus. When we observed...
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the base of the frontal sinus, there was a bony closure. Therefore, we performed an external incision with the Killian's operation and opened the lesion. We diagnosed a cyst located in the sinus. We shaved as much as possible from the frontal sinus to the nasal cavity, opened it to around the base of the middle nasal turbinate, and inserted a silicon drainage tube. We removed the tube after 1 week, and the patient was discharged the next day.

In early February of the following year, the man visited the outpatient clinic of our hospital because his left eyelid was drooping again. An emergency CT showed findings similar to those the previous time, therefore, we performed an emergency operation that day. Before the operation, we explained to the patient and his family that the procedure requires a two-stage opening of the base of the frontal sinus. In the first stage of this emergency operation, we performed drainage by an outside incision again, opened the nasal cavity, and inserted a silicon tube. We performed an endonasal frontal sinus opening surgery in accordance with Draf's drainage surgery type III, with a navigation system (Medtronic Stealth, Minneapolis, MN, USA) and curved drill (Medtronic XPS system, Minneapolis, MN, USA) for the second stage. In the first stage, we confirmed the position endoscopically (0°) and shaved the middle nasal meatus and the base of nose with a curved drill (6,000 rotations/min). For the second stage, we changed the endoscope (70°) and opened the wound widely. We were careful not shave the lateral side too much, because there is a possibility of damaging the lacrimal sac. After we confirmed the base of the frontal sinus, we expanded it as much as possible, opened the inside, and additionally shaved the septum of the frontal sinus completing the Median drainage (Figure 3). We confirmed patency through to the right frontal sinus with sound, and reconfirmed the position with a probe (Figure 4). Postoperative nasal fibrescopy after 4 months showed that the frontal duct was patent through to the frontal sinus and remained open above the base of the middle nasal turbinate (Figure 5).

![Figure 1](image1.png)

*Figure 1.* Draf’s drainage surgery types

![Figure 2](image2.png)

*Figure 2.* Findings of emergency CT at the first visit

There was a soft shadow in the left frontal sinus that had infiltrated into the left orbita, and bone thickening of the left nasofrontal duct was remarkable.
Figure 3. Intraoperative findings
We significantly shaved the septum of the frontal sinus (*).

Figure 4. Findings using the navigation system
The navigation system showed that the apex of the probe was in the frontal sinus, therefore, we could operate safely while reconfirming the position.

Figure 5. Postoperative nasal fiberoptic findings (after 4 months)
The frontal duct was patent through to the frontal sinus and remained patent (white arrow) above the base of the middle nasal turbinate (*).
Discussion

Navigation surgery is also referred to as image-guided surgery, in which surgeons can intraoperatively ascertain the operating position on a CT or MRI image using a probe. Although the origin of the use of this system is neurosurgery, it is now frequently used in otolaryngology as well. The navigation procedures are: (1) taking a CT and processing the CT image on the computer, (2) after setting the navigation arm on the operating table and securing the patient's head, matching the position of the CT image and the position of the monitor image in the operating room, (3) operating using a probe and recognizing the position by real-time axial, coronal, and sagittal CT imaging (Figure 4). Because this surgery was a reoperation and the anatomy was abnormal, we performed it in consideration of those aspects known to be safe and less risky.

However, there are some disadvantages to this procedure, and it takes time to set up. Setting up mainly entails capturing preoperative imaging and registration. Therefore, it may be not suitable for emergency surgery. For this procedure, we needed to undertake a two-stage operation.

The point of frontal sinus opening surgery is considered with the opening and expansion of the physiological opening part that penetrates the nasal cavity, i.e., the frontal recess or the nasofrontal duct. Although we performed both traditional surgery and the most recent surgery on the same patient in just a short period, regarding opening the base of the frontal sinus, endoscopy certainly seemed beneficial according to the results. Though this is largely due to the recent progress of surgical assistive devices, the degree of the surgeon's experience in surgery seems to also affect the postoperative course. This is primarily because there are not relatively that many cases.

Draf allows forward expansion by introducing the drill to endonasal surgery. Furthermore, he classified three different types: Type I is a simple drainage that involves removing the anterior and middle ethmoidal cells down to the skull base so that the frontal sinus infundibulum drains at its most inferior point; Type II is an extended drainage that is achieved by resecting the floor of the frontal sinus from the lateral orbital border to the nasal septum anterior to the posterior wall of the frontal sinus; Type III is a median drainage of the frontal sinus that is established by removing the superior nasal septum in the region of the frontal sinus floor and extending the drainage of both frontal sinuses by removing part of the interfrontal sinus septum (Figure 1). In this case, surgery was in accordance with Type III.

The surgical points include the following. (i) We observed the operative part to a sufficient extent. (ii) We took the synchro between the navigated position and the direction of the endoscope, obtaining an accurate image. (iii) We opened the base of the frontal sinus while trying to keep away from the risky parts. Specifically, we opened the inside wide without operating on the more risky outside. As a result, the septum of the frontal sinus was opened. (iv) We did not insert a silicon tube.

These factors are not limited to this case: (i) and (ii) are necessary in endoscopic surgery. Regarding (iii) it was very effective because we could proceed safely and certainly with the navigation system and curved drill. A certain type of penetration is necessary to prevent postoperative stenosis and closure. Regarding (iv), we did not insert a silicon drainage tube because it was a foreign body, and cicatrical stenosis and adhesion were strong in past progress. We could maintain opening of the base of the frontal sinus in the early 3-day postoperative period, employing gauze tampons, continuation of frequent nasal treatment, and administration of an anti-allergic agent.

Although there is a trend that Killian's operation causes mucoceles, endoscopic sinus surgery is unlikely to cause mucoceles. While this is likely because there are not many cases, this plan will be used to perform a standard external frontal sinus operation, for example Killian's operation in an emergency operation and to perform endoscopic sinus surgery safely and successfully using the navigation system to help avoid as many risks as possible.

Conclusions

- We treated recurrent frontal sinus cysts in accordance with one of Draf's three surgical procedures using guided navigation.
- We performed the operation safely and successfully with the guided navigation.
- The prognosis is currently uneventful without recurrence or stenosis.
- This case, yet again, confirms the efficaciousness and safety of the navigation system.

References


