



Endoscopic Middle Cranial Fossa Reconstruction with a Subtemporal Keyhole

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■ **BACKGROUND:** Skull base reconstruction is an essential technique for repairing cerebrospinal fluid (CSF) leakage. A reliable method for middle cranial fossa (MCF) reconstruction with minimal invasiveness has not been reported. An initial case of endoscopic MCF reconstruction with a subtemporal keyhole is described.

■ **CASE DESCRIPTION:** A 57-year-old man developed severe meningitis and was diagnosed with spontaneous CSF leakage from bone defects on the tegmen tympani. Endoscopic MCF reconstruction with a subtemporal keyhole was carried out. Three skin incisions, including 1 subtemporal incision for a subtemporal keyhole and 2 temporal line incisions on the superior temporal line, were made, and a 0-degree endoscope was introduced into the subcutaneous space. The deep temporal fascia (DTF) was bluntly dissected and separated from the superficial temporal fascia and the temporal muscle, and the DTF was incised to shape a pedicled flap under endoscopic view. Blood supply to the pedicled DTF flap was confirmed with indocyanine green angiography. A subtemporal keyhole was then made, and a 30-degree endoscope was used to explore the extradural space of the MCF floor, visualizing the bone defects on the tegmen tympani. The vascularized DTF flap passed easily through the subtemporal keyhole and adequately overlaid the bone defects. The patient's postoperative course was uneventful, and the CSF leakage disappeared without mastication problems.

■ **CONCLUSIONS:** This purely endoscopic technique using a vascularized DTF flap provided reliable MCF reconstruction through a subtemporal keyhole. This technique is

also expected to be applicable for MCF reconstruction after subtemporal keyhole surgery for skull base tumors.

Reconstruction of the skull base is an essential technique to repair cerebrospinal fluid (CSF) leakage attributed to spontaneous, post-traumatic, and postoperative conditions. Endoscopic endonasal surgery established minimally invasive reconstruction methods using the vascularized septal mucosal flap for CSF leakage from the anterior midline skull base, and these methods have been widely accepted for postoperative skull base reconstruction after surgery for anterior midline skull base tumors, contributing to the development of endoscopic endonasal skull base surgery.¹⁻⁴

At present excellent results of transcranial keyhole surgery for tumors have been reported,^{5,6} but skull base reconstruction through a keyhole, especially subtemporal keyhole surgery to the middle cranial fossa (MCF), has only been discussed. Therefore, we previously investigated a novel reconstruction technique in a cadaver study and reported the potential advantages of endoscopic subtemporal MCF reconstruction using the deep temporal fascia (DTF) (Figure 1).⁷ The newly developed endoscopic technique is able to harvest a vascularized DTF flap, to allow access to the whole surface of the MCF floor, and to apply the vascularized DTF flap on the MCF with a subtemporal keyhole and minimal invasiveness. The nuances of initial clinical experience with endoscopic subtemporal MCF reconstruction are presented.

CASE DESCRIPTION

A 57-year-old man developed severe meningitis with otorrhea and aural fullness. He had no history of head injury or otolaryngologic diseases, and his body mass index was 23.0 kg/m²,

Key words

- Endoscopy
- Minimally invasive surgery
- Skull base

Abbreviations and Acronyms

CSF: Cerebrospinal fluid
CT: Computed tomography
DTF: Deep temporal fascia
MCF: Middle cranial fossa
MR: Magnetic resonance

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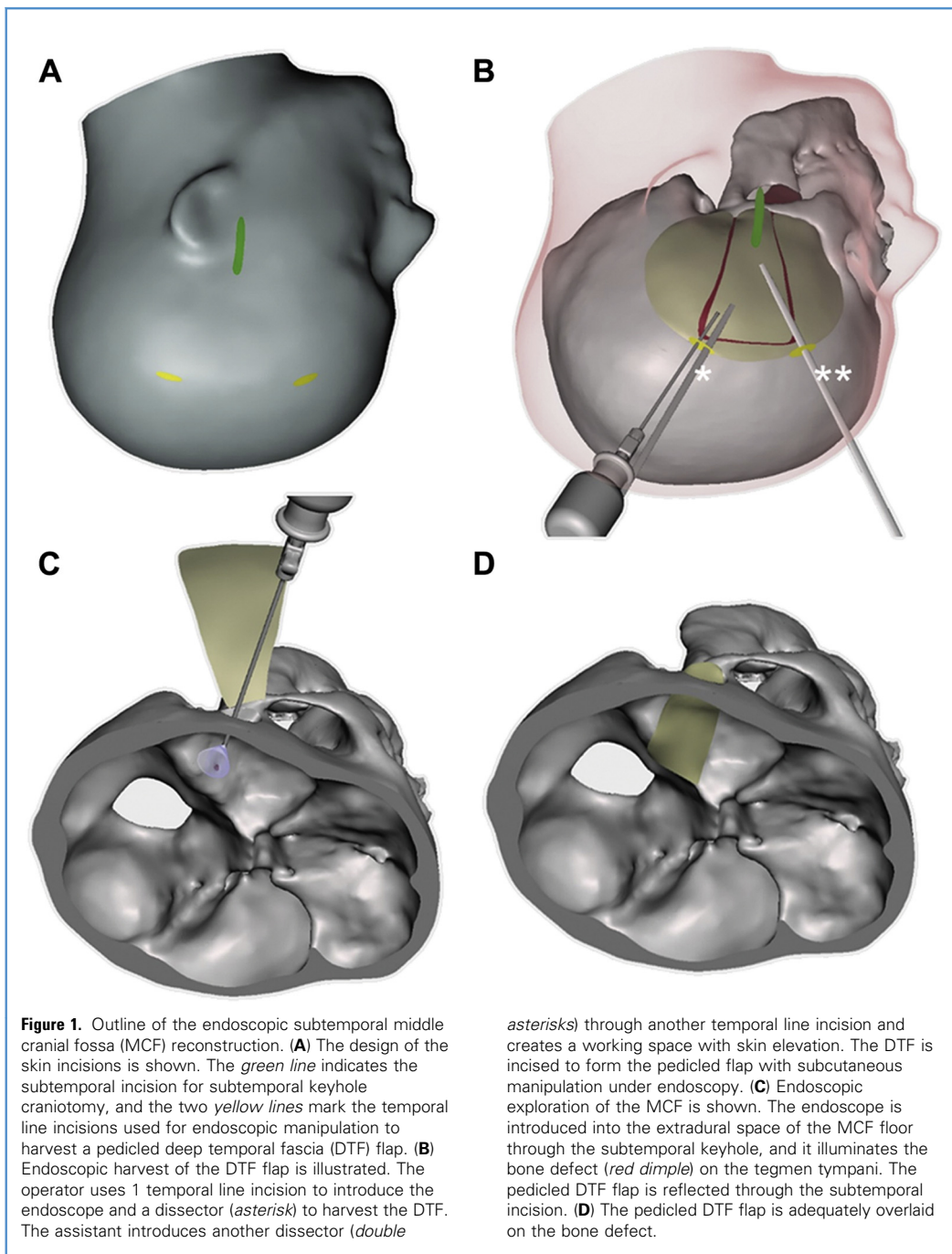


Figure 1. Outline of the endoscopic subtemporal middle cranial fossa (MCF) reconstruction. **(A)** The design of the skin incisions is shown. The *green line* indicates the subtemporal incision for subtemporal keyhole craniotomy, and the two *yellow lines* mark the temporal line incisions used for endoscopic manipulation to harvest a pedicled deep temporal fascia (DTF) flap. **(B)** Endoscopic harvest of the DTF flap is illustrated. The operator uses 1 temporal line incision to introduce the endoscope and a dissector (*asterisk*) to harvest the DTF. The assistant introduces another dissector (*double*

asterisks) through another temporal line incision and creates a working space with skin elevation. The DTF is incised to form the pedicled flap with subcutaneous manipulation under endoscopy. **(C)** Endoscopic exploration of the MCF is shown. The endoscope is introduced into the extradural space of the MCF floor through the subtemporal keyhole, and it illuminates the bone defect (*red dimple*) on the tegmen tympani. The pedicled DTF flap is reflected through the subtemporal incision. **(D)** The pedicled DTF flap is adequately overlaid on the bone defect.

indicating that he was not obese. Computed tomography (CT) and 3-dimensional CT revealed effusion in the left tympanic cavity and mastoid air cells (**Figure 2A**). A group of small temporal bone defects, each with a diameter of approximately 2 mm, and slight pneumocephalus around the bone defects were seen on the tegmen tympani (**Figure 2B** and **C**). Another bone defect, which was 3.5 mm in diameter and apart from the pneumocephalus, was observed lateral to the groove for the greater

superficial petrosal nerve (**Figure 2C**). Magnetic resonance (MR) cisternography did not show any encephalocele. The clinical diagnosis was spontaneous CSF leakage from the bone defects on the tegmen tympani. Endoscopic subtemporal MCF reconstruction was carried out (**Video 1**). The institutional ethics committee approved this approach, and informed consent was obtained from the patient. After insertion of the spinal drainage, the head was fixed so that the sagittal plane was parallel to the


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