

Pseudo-cerebrospinal Fluid Rhinorrhea After Skull Base Surgery

—Case Report—

Hideo HAMADA, Shunro ENDO, Takuya AKAI, Masayoshi OHI,
Masanori KURIMOTO, and Akira TAKAKU

Department of Neurosurgery, Toyama Medical and Pharmaceutical University, Toyama

Abstract

A 41-year-old female underwent complete resection of a left petroclival meningioma via an anterior transpetrosal approach, during which the greater superficial petrosal nerve was divided. On the 14th day after the operation, she first noticed leakage of clear fluid from her right nostril whenever the ambient room temperature rose. This pseudo-cerebrospinal fluid rhinorrhea may have developed because of parasympathetic hypersensitivity due to division of the greater superficial petrosal nerve.

Key words: pseudo-cerebrospinal fluid rhinorrhea, skull base surgery, parasympathetic hypersensitivity, greater superficial petrosal nerve

Introduction

Pseudo-cerebrospinal fluid (CSF) rhinorrhea is a postoperative complication occurring after skull base surgery, which was first described under this term by Cusimano and Sekhar in 1994.¹⁾ This complication occurs after surgery of the cranial base which usually involves dissection or removal of the petrous or cavernous carotid artery, the greater superficial petrosal nerve, and the pericarotid sympathetic plexus.

We present a case of this complication which developed after removal of tentorial meningioma via the transpetrosal approach.

Case Report

A 41-year-old female developed dysesthesia of the right side of the face and consulted our hospital in August 1994. Neurological examination on admission revealed dysesthesia of the right ophthalmic division of the right trigeminal nerve. Magnetic resonance (MR) imaging disclosed a solid mass of the right petrous apex, extending to the posterior part of the ipsilateral cavernous sinus (Fig. 1).

Anterior petrosectomy was performed through a

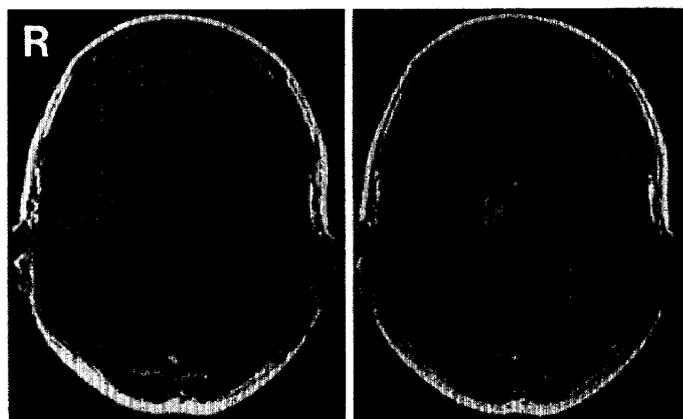


Fig. 1 T₁-weighted magnetic resonance images, without (left) and with (right) gadolinium-diethylenetriaminepenta-acetic acid, revealing a homogeneously enhanced lesion in the right petrous apex, extending to the cavernous sinus.

subtemporal craniotomy, and a petroclival-cavernous sinus meningioma was totally removed. During petrosectomy, the greater superficial petrosal nerve was sacrificed to prevent injury to the facial nerve. The petrous internal carotid artery was only identified without exposure, and the eustachian tube was not injured.

After the operation, she developed temporary

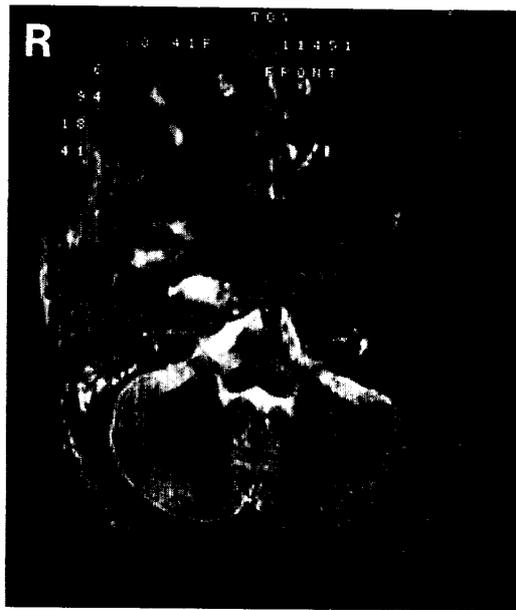


Fig. 2 Postoperative T₂-weighted magnetic resonance image showing no fluid in the middle ear.

anesthesia of the ophthalmic and maxillary divisions of the right trigeminal nerve and absent ipsilateral lacrimation. Two weeks later, she also suffered leakage of a clear fluid from her right nostril during exercise and whenever the ambient room temperature rose. This phenomenon was evidently most apparent in the bathroom. Tests of this fluid for CSF such as glucose-oxidase test paper were negative. Valsalva maneuver did not exacerbate the fluid leakage. Microscopic examination of the ear by an otolaryngologist revealed no fluid in the middle ear and postoperative MR imaging showed no fluid in the middle ear (Fig. 2).

Discussion

The nasal gland and its innervation are illustrated in Fig. 3. The maxillary division of the trigeminal nerve regulates vasodilation and the increase of mucus secretion, and these functions are innervated by the parasympathetic nervous system via the greater superficial petrosal nerve. In contrast, vasoconstriction and the suppression of mucus secretion are innervated by the sympathetic nervous system.²⁻⁴⁾ The most likely pathophysiological explanation for pseudo-CSF rhinorrhea is related to the parasympathetic status after surgical interruption of the sympathetic innervation during skull base surgery.¹⁾ However, how this complication develops despite sectioning of the greater superficial petrosal nerve remains unknown. Reinnervation of the nasal mucosa

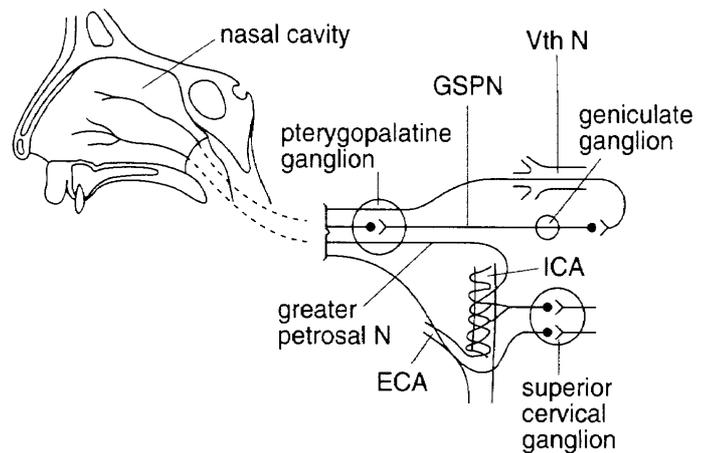


Fig. 3 Nasal gland and its innervation. ECA: external carotid artery, GSPN: greater superficial petrosal nerve, ICA: internal carotid artery, N: nerve.

without concomitant sympathetic reinnervation occurs, and there are the presence of other pathways that extend parasympathetic fibers to the nasal mucosa.¹⁾

The nasal hypersecretion in our patient had the character of pseudo-CSF rhinorrhea. The ipsilateral greater superficial petrosal nerve had been sacrificed and the disturbance of the trigeminal nerve function was obvious. However, no operative procedure affecting the sympathetic nervous system was performed. Pathophysiological sectioning of the greater superficial petrosal nerve seems to cause vasoconstriction and the suppression of mucus secretion. Based on our observations, we consider that parasympathetic and postganglionic hypersensitivity related to the pterygopalatine ganglion or the maxillary division of the trigeminal nerve may occur and cause imbalance of the autonomic nervous system of the nasal gland regulation after sacrifice of the greater superficial petrosal nerve, thus causing this pseudo-CSF rhinorrhea. The true pathophysiology and appropriate treatment of pseudo-CSF rhinorrhea developing as a complication after skull base surgery is still unclear, and further investigations are required.

References

- 1) Cusimano MD, Sekhar LN: Pseudo-cerebrospinal fluid rhinorrhea. *J Neurosurg* 80: 26-30, 1994
- 2) Gray H: [*Anatomy of the Human Body (II)*]. Tokyo, Hirokawa Publishing, 1982, pp 991-1010 (Jpn)
- 3) Horiguchi M, Matsunaga M, Goto N, Kanzaki J, Ouchi T: [The trigeminal nerve and the facial nerve]. *Clin Neurosci* 8(6): 14-23, 1990 (Jpn)

- 4) Platzer W: *Perkopf Anatomie, Atlas der topographischen und angewandten Anatomie des Menschen, 1 Band: Kopf und Hals*. Munchen, Urban & Schwarzenberg, 1987, pp 135-137 (Ger)

Address reprint requests to: H. Hamada, M.D., Department of Neurosurgery, Toyama Medical and Pharmaceutical University, 2630 Sugitani, Toyama 930-0194, Japan.