

# Postoperative pneumocranium after endoscopic transnasal optic canal decompression

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Received: 2023-07-09 Accepted: 2023-11-20

**DOI:10.18240/ijo.2024.05.24**

**Citation:** Lu SJ, Yu B, Wu WC. Postoperative pneumocranium after endoscopic transnasal optic canal decompression. *Int J Ophthalmol* 2024;17(5):973-975

**Dear Editor,**

We present the first time, a case of a patient developed cerebrospinal fluid (CSF) leak and pneumocranium following optic canal decompression (OCD).

## INTRODUCTION

Indirect traumatic optic neuropathy (ITON) impairs visual functions and quality of life. Endoscopic transnasal optic canal decompression (ETOCD) is one of the standard treatment strategies for the ITON. During the ETOCD, the optic nerve sheath are usually incised for sufficient decompression of optic nerve after removal of optic canal, which is associated with complications like CSF leakage, ophthalmic artery injury, and optic nerve injury<sup>[1]</sup>. Generally, the mild CSF leak is common and can heal spontaneously using conventional treatment, the severe CSF leak requires surgical repair<sup>[2]</sup>. However, the severe CSF leak combining with pneumocranium is extremely rare after ETOCD. In this case, we discussed the possible causes and current management of CSF leak and pneumocranium in one case, apart from the other possible inducements for pneumocranium post transnasal endoscopic surgery.

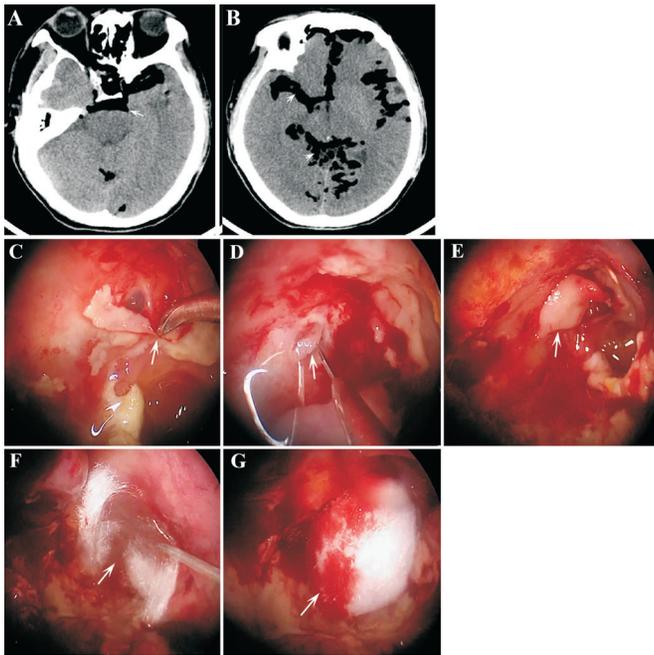
## CASE REPORT

A 64-year-old male with right clear rhinorrhea for 1mo and headache for 2d was admitted to our hospital on Feb. 16<sup>th</sup>, 2020. This patient had a history of ITON and underwent ETOCD on Jan. 10<sup>th</sup>, 2020 elsewhere. However, he developed

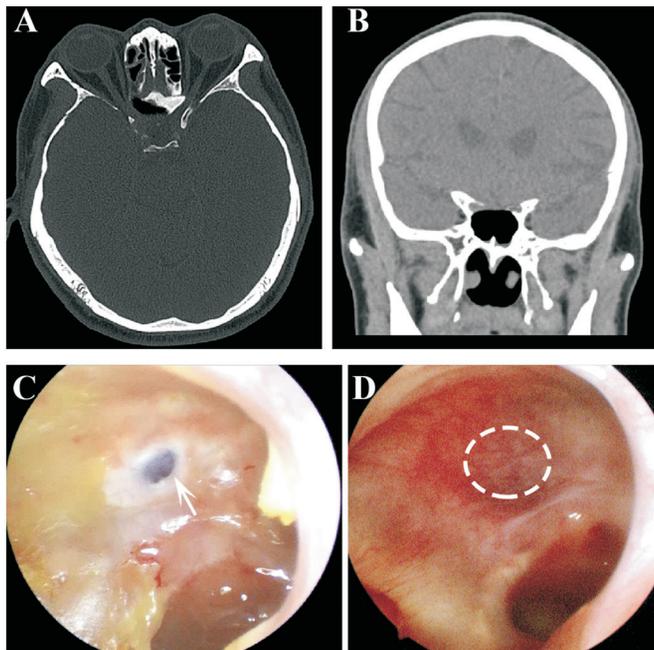
intermittent right clear rhinorrhea without headache, dizziness, or vision loss for one month postoperatively, but he did not consult the physician due to the coronavirus disease 2019 pandemic. Two days prior (Feb. 14<sup>th</sup>, 2020), he developed a severe headache after sneezing and increased rhinorrhea. He was admitted to our institute, where a computed tomography (CT) scan revealed pneumocranium (Figure 1A, 1B). The endoscopic examination revealed a bone defect beneath the cranial entrance of the optic nerve with pulsating leakage of the clear CSF. Following the primary admission diagnoses of pneumocranium, right CSF leak, and right eye ITON (after decompression), he underwent endoscopic transethmoidal repair of CSF leak under general anesthesia. The fistula was repaired by a piece of bone and a piece of nasal mucosa, the cavity was filled with MeroGel (hyaluronic acid, HA) and absorbable hemostatic cotton (Figure 1C-1G). Postoperatively, the patient was positioned supine with 30° head up for 1wk. Besides, intravenous cefazolin (2.0 g *b.i.d.*) and metronidazole (0.5 g *q.d.*) was given for 1wk. Postoperatively, the patient's headache was significantly relieved on the first day and completely disappeared on the 3<sup>rd</sup> day. He was discharged on the 8<sup>th</sup> day postoperatively, whereas the pneumocranium was disappeared as revealed in the 2wk postoperative cranial CT scan (Figure 2A, 2B). At 1mo postoperatively, the fistula was well covered with the mucosa and healed completely (Figure 2C, 2D). The ethical committee of Wenzhou Medical University approved (approval No. 204-K-178-01) the study protocol, which followed the Declaration of Helsinki. Informed consent was acquired from this patient.

## DISCUSSION

Currently, the common treatments for ITON involve observation, high-dose corticosteroids, and OCD. Many studies have shown visual acuity improvement in patients who underwent OCD. The sooner OCD was performed, the more significant benefit patients got from the intervention<sup>[3]</sup>. Optic canal fracture is a dangerous signal which indicates poor prognosis, for ITON patients with apparent intrathecal hemorrhage or canal compressive fracture, OCD helps remove blood clots and bone fragments, relieving the compression and avoiding secondary injury<sup>[4]</sup>. For patients who have no



**Figure 1** Pneumocranium and endoscopic tranethmoidal repair A, B: Skull CT scan showed intracranial gas; C: Removal of proliferative mucosa; D: Placement of bone graft; E: Coverage of fistula with mucosa graft; F: Fill of Merogel; G: Fill of absorbable cotton. CT: Computed tomography.



**Figure 2** Disappear of Pneumocranium and repair of fistula A, B: Skull CT scan 2wk after CSF leak repair, the gas was absorbed. Endoscopic views before (C) and after (D) CSF leak repair. CT: Computed tomography; CSF: Cerebrospinal fluid.

response to observation and corticosteroids treatments, OCD can also be a final attempt of vision rescue.

CSF leak is one of the possible postoperative complications of ETOCD. The CSF leak of this patient was thought as an iatrogenic injury due to defect of canal bony or optic nerve sheath might formed during the ETOCD, when nasal dressing

was absorbed and the patient was up from bed, the symptom presented. It is vital to keep a balance between sufficient decompression and surgical secondary injury. Studies have tried to reduce the risk of CSF leak by only decompressing the length of the shortest wall of the optic canal rather than removing all medial wall and applying intermittently punctuated incision on optic nerve sheath rather than consecutive incision, the results were satisfied<sup>[4]</sup>.

Autograft is encouraged to avoid potential risks including human immunodeficiency virus (HIV), hepatitis B virus (HBV) or another transmittable virus. Free nasal mucosal grafts and bone grafts can be acquired from the middle turbinate, nasal septum or nasal floor and the middle turbinate or septum respectively. For pedicled nasal mucosal grafts from middle turbinate and septum, contract tendency should be noticed<sup>[5]</sup>. This patient had a long time of CSF rhinorrhea, the mucosa proliferated extensively, it had to be removed carefully to expose the fistula. We used a piece of bone taken from the nasal septum to fill the fistula and the intracranial pressure acted on the bone and the fistula, thus forming a mechanical atresia for fixation.

In this case, the patient presented the rarest symptom of pneumocranium after ETOCD. The cranial contents communicated directly with the nasopharynx. Based on the history, the patient had the habit of pinching his nose while sneezing. We speculated that when the patient pinched the nose while sneezing, the sudden increase of pressure in the nasal cavity could not be released. As a result, the intense pressure manipulated the CSF fistula, causing air to enter into the intracranial from the fistula.

This case reminded us of the risk of pneumocranium after transnasal endoscopic surgery. If surgery leaves a defect which connects the cranial fluid to the nasopharynx directly intentionally or accidentally, any minor manipulations result in either increase of nasal air pressure (such as positive pressure ventilation, sneezing, obstructive sleep apnea) or a decrease of CSF pressure (excessive CSF drainage or leakage, resection of a huge sellar mass) might result in pneumocranium. When air continued to enter the skull but cannot be expelled, a tension pneumocranium will occur, which can be life-threatening.

ETOCD is a challenging surgery that requires the high proficiency of the surgeons. Moreover, its complications and postoperative care need special attention. The possibility of CSF leakage and pneumocranium in patients after transnasal endoscopic surgery should be considered carefully. Therefore, actions should be taken promptly when CSF leakage is present to avoid the inducements of postoperative pneumocranium.

**ACKNOWLEDGEMENTS**

**Authors' contributions:** Lu SJ, Yu B: Conception and design and draft the manuscript; Wu WC: Revise the manuscript

critically for important intellectual content and final approval.

**Conflicts of Interest:** Lu SJ, None; Yu B, None; Wu WC, None.

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