CASE REPORT

Skull base injury with extensive pneumocephalus after transnasal endotracheal intubation

David Schwarz, Dirk Beutner, Antoniu-Oreste Gostian, Andreas Anagiotos

Medical Faculty, Department of Otorhinolaryngology, Head and Neck Surgery, University of Cologne, Cologne, Germany

Correspondence to

Dr Andreas Anagiotos,
andreas.anagiotos@gmail.com

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SUMMARY

Iatrogenic injuries of the frontal skull base commonly occur during endoscopic sinus surgery. In this paper, we present a rare case of cranial base injury after transnasal endotracheal intubation for dental surgery. A 61-year-old otherwise healthy man presented at the emergency department with headache, right leg weakness and watery nasal discharge on the left side. He underwent a dental surgery under general anaesthesia with transnasal endotracheal intubation 2 days earlier. A CT of the head showed a bone defect of the left skull base with a bifrontal pneumocephalus. Urgent endoscopic sinus surgery with exposure of the skull base was performed. The anterior part of the middle nasal turbinate was found dislocated and resulted in an injury of the lateral lamella of the cribriform plate. After endoscopic reconstruction of the bone defect, the patient showed a rapid improvement of symptoms. Two years after surgery the patient is free of symptoms.

BACKGROUND

The particular anatomy and localisation of the frontal skull base predispose to injuries, which in many cases are iatrogenic. Mostly, these frontal base defects occur during endoscopic sinus surgery.¹ In addition to the anatomical proximity of the paranasal sinuses to the skull base, the anterior part of the middle turbinate inserts at the very thin lateral lamella of the cribriform plate.² Therefore, every manipulation on the middle turbinate is associated with a relevant risk of frontal skull base injury. Theoretically, such a complication is possible in the course of any intervention in the nasal cavity. We report a case of an otherwise healthy patient with a skull base fistula and pneumocephalus due to dislocation of the middle nasal concha after transnasal endotracheal intubation.

CASE PRESENTATION

A 61-year-old otherwise healthy man presented at the emergency department of our hospital 2 days after a dental implant surgery under general anaesthesia in an outpatient clinic. The anaesthesia was carried out by a specialist anaesthesiologist in private practice. Left blind nasotracheal intubation was performed; this was described as difficult and successful intubation was achieved after several failed attempts. A 7.0 mm cuffed endotracheal tube with preloaded stylet used for both oral and nasal intubations was inserted.

A couple of hours after surgery, the patient reported acutely occurred headache, weakness of his right leg and epistaxis alternating with watery

nasal discharge on the left side. The patient was then presented at the emergency department of our hospital. Physical examination confirmed the paresis of his right leg and revealed neck stiffness. Nose endoscopy showed multiple mucosal lesions with a partial avulsion of the middle nasal turbinate on the left side. The right nasal cavity was normal during endoscopy.

INVESTIGATIONS

Laboratory examination of the nasal discharge resulted in a positive β -trace protein, which corresponds to cerebrospinal fluid (CSF). In addition, a CT of the skull was performed and showed an enormous bifrontal pneumocephalus (figures 1 and 2). After detailed viewing of the CT scan, a bone defect in the region of the cribriform plate could be identified (figure 2).

TREATMENT

Since of the rapid progression of the neurological symptoms, urgent surgical treatment with endoscopic sealing of the skull base defect and intravenous antibiotic therapy with ampicillin/sulbactam was decided. Surgery was performed under general anaesthesia. After exposing the left skull base, a bone defect of approximately 2×1 cm was identified in the cribriform plate region at the site of

Figure 1 Initial axial CT scan showing the massive, bilateral pneumocephalus (*).

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Figure 2 Initial coronal CT scan showing the skull base defect at the lateral lamella of the cribriform plate (arrow) and the massive, bilateral pneumocephalus (*).

avulsion of the middle nasal turbinate. Dura mater was partially ruptured and pulsating outflow of CSF was seen.

The defect was sealed by a combination of underlay and onlay technique (sandwich technique) with layers of bovine pericardium (Tutopatch), coagulation sponge (Tachosil) and fibrin glue. A middle concha mucosa flap was placed as a last layer. Finally, a silicon foil was inserted to cover the reconstructed skull base and the nose was packed.

OUTCOME AND FOLLOW-UP

During the postoperative course, no further rhinorrhoea was observed, the paresis of the right leg was regressive and a control CT scan 3 days after surgery showed a regressive pneumocephalus. The nasal packing was removed 2 days after surgery. The patient was discharged free of symptoms. Two years after surgery the patient is free of symptoms and regular follow-up revealed no evidence for rhinorrhoea of CSF.

DISCUSSION

Skull base injuries may be caused by accidental trauma or may be iatrogenic. In most cases, they are of traumatic origin (80%).³ Iatrogenic skull base injuries can be caused by different surgical interventions. Among them, endoscopic sinus surgery is the most common cause, with a rate of CSF leakage in less than 1%.¹

Other, very rare causes of cranial base injuries have been reported in the literature over time. For example, skull base injury with inadvertent insertion of nasogastric tube into the brain is well described.^{4–6} In these cases, the patient had either a severe head trauma or underwent sinus or skull base surgery in the past. The presented case report describes and discusses a case of skull base injury after transnasal endotracheal intubation in an otherwise healthy patient. No former pathology of the nose or the skull base was known. To the best of our knowledge, this is the first reported case of such a complication after transnasal endotracheal intubation in a patient with no former pathology of the skull base.

In this case report, surgical exploration revealed a bone defect in the cribriform plate region at the site of avulsion of the middle nasal turbinate. It was obvious that the insertion of the transnasal anaesthesia tube during the previous surgery resulted in an avulsion of the anterior part of the middle concha, which in turn caused a bone fracture of the skull base.

The anterior ethmoid region is one of the most vulnerable areas for iatrogenic skull base injuries in sinus surgery.⁷ In addition to the anatomical proximity of the ethmoid cells to the skull base, the anterior part of the middle turbinate inserts at the very thin lateral lamella of the cribriform plate.² Therefore, every manipulation on the middle turbinate is associated with a relevant risk of skull base injury. These anatomical considerations are important not only for the ENT surgeon or the neurosurgeon, but obviously for the anaesthesiologist as well. Thus, any forced insertion of transnasal anaesthesia tube—particularly through the upper level of the nasal cavity—should be avoided.

In case of an iatrogenic skull base injury, it is of paramount importance that the suspicion is raised immediately and the patient is instructed to avoid blowing his nose. Otherwise, various amounts of air could be pumped into the inside of the skull resulting in a massive pneumocephalus. Depending on the extent of pneumocephalus, various neurological symptoms are possible, not excluding fatal progress in the case of a brainstem incarceration. The diagnosis is verified through CT scan and examination of the nasal discharge (β-trace protein). Intravenous antibiotics and surgical reconstruction with sealing of the skull base make up the main treatment procedure in every case of such a fistula.^{8–9} The indication for an early intervention (within 72 h) is defined by the extent of the injury and symptoms, especially pneumocephalus and neurological signs. For isolated fractures in the area of the sphenoid sinus or the ethmoid bone, endonasal access is preferred.^{10–11}

Skull base injuries can be reliably reconstructed with a high success rate.³ In our case, sealing of the fistula was successful and the patient remains free of symptoms 2 years after surgery.

Learning points

- ▶ Transnasal endotracheal intubation can lead to skull base injuries through avulsion of the middle nasal turbinate.
- ▶ This complication can be prevented by using an appropriately sized endotracheal tube, lubricating the endotracheal tube prior to insertion and avoiding forced insertion.
- ▶ In case of occurrence of the signs and symptoms aforementioned, patients must be admitted for further assessment and investigation to rule out complications.

Contributors All the authors contributed to the planning, conduct and reporting of the work described in this article, performed the literature search and wrote the article. AA is responsible for the overall content as the guarantor and had the idea for the article. AA and DB managed the case.

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