



# Iatrogenic Pneumocephalus in a Conscious Non-Traumatic Patient: A Rare Complication of Nasogastric Tube Placement

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## Abstract

### Background:

While insertion of a nasogastric tube (NGT) is a common procedure in clinical settings, it can lead to multidisciplinary complications involving the head, neck, and thoracic regions, with one rare but serious complication being iatrogenic NGT pneumocephalus, first reported in 1974.<sup>2</sup>

### Case Synopsis:

A 66-year-old male presented to an outside hospital with symptoms of a small bowel obstruction s/p a fall 3 weeks prior. An attempt at a NGT placement caused headache and signs of a left CN III palsy. CT scans revealed a significant defect in the cribriform plate, left subdural and subarachnoid hemorrhages, and pneumocephalus along the anterior and middle fossa.

The patient underwent an operative repair of the left cribriform 3 mm x 5 mm defect with CSF leak. This involved wide endoscopic approach to the skull base with repair of the cribriform plate defect using free mucosal graft from the middle turbinate.

### Discussion:

Iatrogenic NGT insertion has been reported in past literature where contributing factors include trauma and previous sinonasal surgery. Cases describing instances of delayed identification of NGT pneumocephalus due to imaging artifact or difficulty identifying emerging neurological symptoms necessitate a modest approach to sinonasal operations. Even with no predispositions, this case emphasizes the need for skilled technique with NGT insertion and an understanding of the presenting symptoms of pneumocephalus and CSF leak.

### Conclusion:

This text discusses the rare complication of a non-traumatic NGT pneumocephalus on a fully conscious individual with no predispositions. Similar cases are reviewed, and methods to reduce potential for pneumocephalus secondary to sinonasal surgery are discussed.

## Introduction

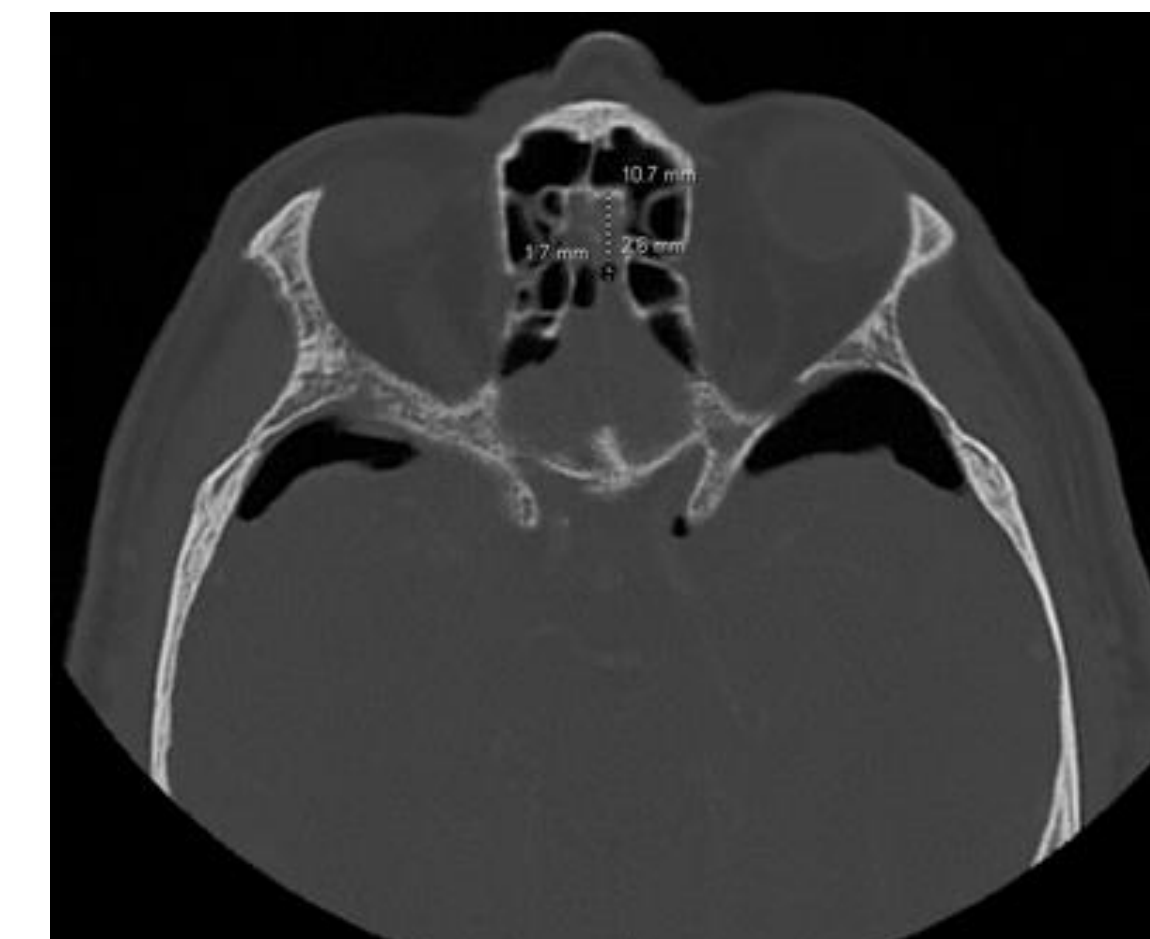
- Nasogastric tube (NGT) insertion is a commonly performed medical procedure that involves the insertion of a flexible tube through the nose, down the throat, and into the stomach. The procedure is performed for a variety of indications, such as feeding, medication administration, gastric decompression, and aspiration of stomach contents for diagnostic or therapeutic purposes.
- Severe complications of NGT insertion include accidental placement into unintended spaces as it passes through the oral cavity, pharynx, esophagus, and the stomach. Potentially significant outcomes necessitate procedural proficiency, and NGT complications are often overlooked due to their ubiquity within clinical care.
- Iatrogenic NGT pneumocephalus is a rare complication that is most often seen in cases of traumatic head injuries and occasionally past endoscopic sinonasal surgery. Due to its significant morbidity, X-ray is routinely performed to confirm NGT placement, however in the case of trauma, neurological sequela can often be overlooked.
- This case report on a non-traumatic conscious NGT skull base injury with resultant pneumocephalus and its subsequent skull base repair shows the importance of proper NGT execution.

## Case Report

- Pt is a 66 year-old male who presented to an outside hospital, having fallen three weeks prior, with symptoms consistent with a small bowel obstruction.
- There was an attempt to place a nasogastric tube, but the patient subsequently developed a headache and signs of a left cranial nerve (CN) III palsy.
- A CT Head found signs of pneumocephalus and left subdural and subarachnoid hemorrhages.
- He was transferred to the Albany Medical Center for neurosurgical evaluation. Initial neurosurgical evaluation revealed normal CTA.
- Repeat fine cut CT showed a 5mm x 3mm defect in the cribriform plate allowing passage of air through the defect into the anterior cranial fossa.
- There was associated pneumocephalus along the anterior and middle fossa with tenting of the bilateral frontal lobes. Additional findings included a left occipital lobe intraparenchymal hemorrhage, subdural hemorrhage along the posterior falx and tentorial leaflets, and a small left subarachnoid hemorrhage tracking along the frontal lobes, primarily left sided.



A



B



C

Figure 1 Intracranial complications after insertion of nasogastric tube. A, B, and C.

CT scans show pneumocephalus arising from 3 mm x 5 mm cribriform plate defect medial to the left agger nasi cell

## Hospital Course

- On initial otolaryngology evaluation there were no findings of CSF rhinorrhea. The patient was noted to have a left sided septal deviation on examination.
- The patient was initially treated conservatively, however, symptoms and pneumocephalus persisted. Decision was made to proceed forward with closure of the defect.
- Full endoscopic approach to the left sided anterior skull base was performed. The skull base was skeletonized. A free mucosal graft was harvested from the left middle turbinate.
- A 3 mm x 5 mm cribriform defect was visualized. No active CSF leakage was noted however pulsations of the tissue and frontal lobe were visualized through the defect.
- Skull base repair was performed with free mucosal graft.
- Post-op course showed improvement of patient's neurological symptoms with gradual improvement of the CN III palsy to near baseline over a three-month period. Concerns for continued CSF rhinorrhea were dispelled with close follow-up imaging over the subsequent months.

## Discussion

- Insertion of a nasogastric tube (NGT) is a commonly performed procedure in emergency departments, intensive care units, and operating rooms. It is used for a variety of indications, including stomach decompression, identification and management of gastrointestinal bleeding, aspirate analysis, and administration of medications or nutrition. Despite its seemingly straightforward technical requirements, NGT placement can pose complications, including epistaxis, esophageal perforation, esophagitis, bronchopleural fistula, pneumothorax, laryngeal injuries, sinus infection, pulmonary hemorrhage, pneumomediastinum, and traumatic intracranial perforations.<sup>1</sup>
- Pneumocephalus is a rare but serious complication that was first described in literature by Martinelle et al. in 1974.<sup>2</sup> Since then, there have been 48 reported cases of iatrogenic intracranial NGT placement prior to 2015. A literature review of intracranial NGT placement found that 63% of cases were in the setting of trauma, 20% were in non-traumatic settings, and 17% occurred after skull base surgery.<sup>3</sup>
- One of the challenges in identifying traumatic NGT perforation through the cribriform plate is that often there is no pre-insertion imaging to compare with after suspected injury has occurred. This was highlighted in a case report where CSF rhinorrhea was mistaken for gastrorrhagia, and gastric lavage with cold saline was performed prior to the realization of the error via imaging. In another case, an NGT that had coiled through three ventricles was mistaken for the patient's chronic ventriculoperitoneal shunt on x-ray, possibly due to the patient's significant hydrocephalus.<sup>4</sup>
- The present case report describes a rare occurrence of NGT placement in a fully conscious individual with no known craniofacial anatomical predispositions or previous sinonasal surgeries. His only predisposing anatomical variant was a left sided septal deviation. To the best of our knowledge, only one similar case has been reported in the literature in 1990, where a NGT was placed due to refractory emesis on a patient with no craniofacial surgical history, resulting in pneumocephaly of the right anterior and middle cranial fossae. Survival was not reported in that case.<sup>5</sup> In the current patient's case, the iatrogenic NGT placement resulted in a 5 x 3 mm defect of the left cribriform plate with resultant pneumocephalus, subarachnoid hemorrhage, and subdural hematoma from the left anterior and middle fossae.
- Previous endoscopic skull-based surgery is a risk factor for iatrogenic NGT intracranial placement. Two techniques for mitigating this risk during skull-based surgery include conservative sphenoidotomies, such as the "1.5 approach," and the submucosal "tunnel" technique for septal deviation correction, as well as the transseptal approach to fortifying the cranial base after transsphenoidal surgery.<sup>3,6</sup> As the case report highlights, even in individuals with no known anatomical predispositions or surgeries, iatrogenic intracranial NGT placement can occur, emphasizing the need for careful attention to patient positioning, NGT insertion technique, and appropriate imaging when warranted.

## Conclusion

- The text discusses the common medical procedure of nasogastric tube (NGT) insertion and its potential complications. It highlights the severe and potentially fatal complications that can occur due to the accidental placement of the NGT in unintended spaces.
- One such rare complication is iatrogenic NGT pneumoencephaly, which can lead to significant morbidity. The case report presented in the text shows the importance of proper NGT execution and highlights the potential difficulties in identifying NGT perforations through the cribriform plate.
- The text emphasizes the need for proper training and caution while performing this procedure as NGT complications are often overlooked due to its frequent use.

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