Inadvertent Intracranial Insertion of Nasotracheal Suction Catheters Compared to Nasogastric Tubes in Transsphenoidal Surgery & Basal Skull Fracture Patients

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Abstract

Inadvertent intracranial insertions of (NG) nasogastric tubes have been documented in over 40 case reports, but case reports of inadvertent intracranial insertions of (NT) nasotracheal suction catheters have not been found. Since NG tubes and NT suction catheters are similar, nasally introduced tubes, it is likely that even with a lack of case reports, both devices are at equal risk of intracranial insertion. Speculative possibilities are discussed to why the incidence of these case reports differs so greatly. Raising awareness to the subject, susceptible patient populations, preventative protocols and alternate routes to nasal suctioning are discussed.

Background Information

Transsphenoidal surgery is a type of surgery in which surgical instruments are inserted into part of the brain by going through the nose and drilling out the sphenoid bone (a butterfly-shaped bone at the base of the skull).[1] Transsphenoidal surgery is used to remove tumors of the pituitary gland and is usually patched up with a piece of fat from the abdomen.[1,2] With a suggested average of about 5500 patients undergoing transsphenoidal operations every year in the US, you may be in contact with transsphenoidal surgery patients.[3]

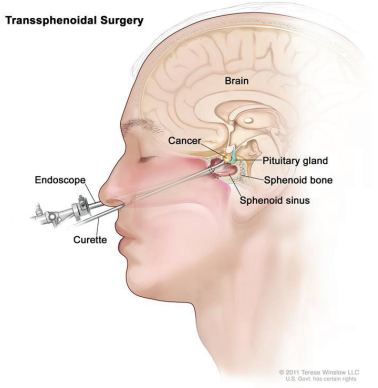

Figure 1. Illustration of transsphenoidal pituitary surgery with instruments inserted intracranially

Basilar skull fracture (or basal skull fracture) is a fracture of the base of the skull, typically involving the temporal bone, occipital bone, sphenoid bone, and/or ethmoid bone.[4,5] Basal skull fractures are often not detectable with skull x-rays or even CT scans.[6] They are frequently diagnosed by clinical findings, making clinical assessment skills critical.[6]

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Signs and symptoms[6]

- Battle's sign — is ecchymosis behind the ear
- Raccoon eyes — is periorbital ecchymosis ie "black eyes"
- Cerebrospinal fluid rhinorrhea
- Cranial nerve palsy
- Bleeding from the nose and ears
- Hemotympanum
- Conductive or perceptive deafness, nystagmus, vomitus
- In 1 to 10% of patients, optic nerve entrapment occurs:[7] the optic nerve is pressed by the broken skull bones, causing irregularities in vision.
- Serious cases usually result in death

Auto accidents are a frequent cause of basilar skull fractures. Other causes include assaults and violence, motorcycle accidents, bicycle accidents, slip and fall accidents, or any other direct blow to the head. Basilar skull fractures are famously associated with the auto racing accident contributing to the death of Nascar driver Dale Earnhardt Sr.[8] Occurring in 4% of severe head injury patients, you may be in contact with basal skull fracture patients.[4,5]

Raising Awareness & Understanding

In the transsphenoidal surgery or basal skull fracture patient, there is little protection of the pathway that leads up through the nose and into the brain. The basal skull, which is normally protecting that pathway, has been either drilled out or fractured. Since there are risks of CSF leaks in these patients immediately post-op or post trauma, there are restrictions against blowing their nose, sneezing or even coughing.[2] With the high risk for perforation, any type of nasally introduced tube should be absolutely contraindicated.

Case Reviews

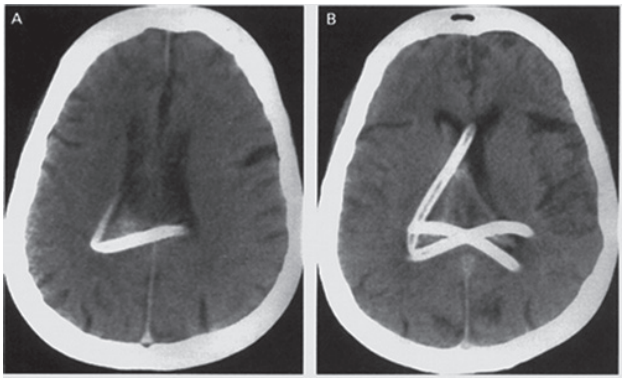

Figure 2. Computerized tomography scan showing the intracranial placement of the nasogastric tube.

The CT Scans in Figure 2 are examples of a non-trauma patient, where a congenital anomaly and inadvertent intracranial placement of NG tube occurred.[9] The patient had the tube surgically removed but subsequently died; the necropsy report concluded the causes of death were bronchopneumonia and meningitis.[9]

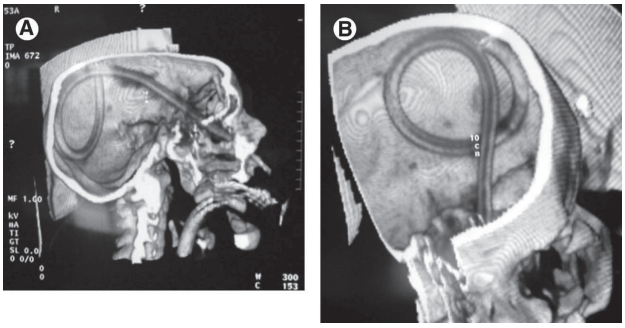

Figure 3. (A, B) Computed tomography (superficial 3-dimensional reconstruction) showing the intracranial course trajectory of nasogastric tube. *Genu et al. Inadvertent Intracranial Placement of an NG Tube. J Oral Maxillofac Surg 2004.*

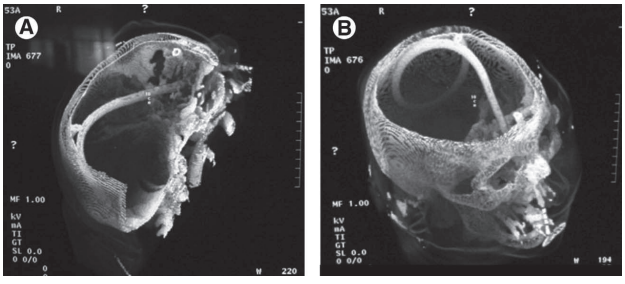

Figure 4. (A, B) Computed tomography (superficial 3-dimensional reconstruction) showing the intracranial course trajectory of nasogastric tube. *Genu et al. Inadvertent Intracranial Placement of an NG Tube. J Oral Maxillofac Surg 2004.*

The CT Scans in Figures 3 & 4 are examples of where a 53-year-old man was injured riding his motorcycle. He suffered several basal skull fractures and an inadvertent intracranial placement of NG tube occurred.[10] Upon admission the patient could only react to painful stimulus and move his left arm and leg.[10] The patient was discharged 80 days later with the same neurological complications he was admitted with.[10]

Discussion

According to Paul et al[11] in 2003, inadvertent intracranial placements of NG tubes were documented in over 40 reported cases.[12,13] Five case reports of inadvertent intracranial placement during nasotracheal intubation with nasotracheal tubes also exist.[12,14-17] Intracranial placement of a Foley catheter, inserted to tamponade severe epistaxis, has been reported four times.[18-21] Additionally 5 cases were reported of intracranial placement of nasopharyngeal airways.[22-26]

No case reports were found documenting inadvertent intracranial placement of NT suction catheters. The most appropriate case report found was not intracranial, but cervical esophageal perforation due to the use of (NP) nasopharyngeal and NT suction catheters in premature infants.[27] After several blind attempts to NP and NT suction, bleeding was noted from the nose and mouth of the premature infants.[27] With the physician's suspicions raised and the known delicate nature of premature infants, the physician performed NP and NT suctioning under flexible endoscopy.[27] Only then did the physician locate the bleeding and visualize lacerations leading to the cervical esophageal perforation.[27]

Speculated Possibilities

The stationary nature of the NG tube and customary X-ray to confirm its placement may be the reason case reports are found occasionally documenting NG tubes inadvertently inserted intracranially.

The quick, in and out nature of using NT suction catheters and no X-ray to confirm its placement, may be the reason case reports do not exist documenting NT suction catheters inadvertently inserted intracranially.

Conclusion

Although case reports do not exist documenting inadvertent intracranial placement of NT suction catheters, over 40 case reports exist of NG tubes inadvertently placed intracranially. Since the NG tube and NT suction catheter are similar devices, it is likely that both are at equal risk of insertion intracranially. X-rays and CT scans documenting NT suction catheters inserted into the brain also do not exist, but it is not common practice to leave NT suction catheters in place and confirm placement with an X-ray. The lack of evidence should not suggest that inadvertent intracranial placement of NT suction catheters does not exist, only that the evidence does not exist.

Protocols Towards Prevention

1. Review education of NP & NT suctioning contraindications for both the RT and RN staff.

2. Initiating appropriate signage above the at risk patient's head of bed, for example, "Nothing To Be Placed Up Nose." Ensure signage follows the patient throughout his or her hospital stay.

3. Reinforce the importance of checking the past medical history of patients before NP & NT suctioning.

Alternate Routes to Suctioning

Immediately post-op transsphenoidal surgery or immediately post trauma basal skull fracture patients may be absolutely contraindicated for any type of suctioning, due to risk of increasing (ICP) intracranial pressure, causing a CSF leak.[2] If suctioning is needed and appropriate, consider alternate routes to suctioning, other than NP and NT routes.

1. *Oropharyngeal Suctioning* is the suctioning of the oral and back of the tongue area, where secretions begin to pool. This can be performed with various types of suction swabs or Yankauer tip suction devices.
2. *Oral Laryngopharyngeal Suctioning* is the suctioning of the vocal cord area with a suction catheter. The vocal cord area is where secretions can pool and cause aspiration. This area is roughly 3 inches further than the oropharyngeal area in an adult, so a suction swab or Yankauer will not reach in this situation.[28]
   a. *Awake Patient* — Since the patient is awake, minimizing the gag reflex and stimulating a strong cough is key. They may not always be cooperative, so it is important to not let your patient damage or bite off a piece of the suction catheter. The No-Bite V can be used to assist laryngopharyngeal suctioning in a quick manner, causing minimal suctioning stress to your patient.[29]
   b. *Lethargic Patient* — Since the patient is lethargic, they may have a diminished gag reflex. Oral airways may be

feasible in this situation, but if oral cavity pressure ulcers or gag reflex is an issue, The No-Bite V has proven to be a more comfortable way to suction.[29]

3. *Oral Tracheal Suctioning* is the suctioning of the trachea via the oral route on a non-intubated patient. These are usually patients who are too lethargic to cough up secretions on their own, possibly a rapid response type situation where an intubation is trying to be avoided. Oral tracheal suctioning can be done via The No-Bite V and has proven to prevent some cases of intubation.[30]

References

1 National Cancer Institute at the National Institute of Health. NCI Dictionary of Cancer Terms. 2009. http://www.cancer.gov/dictionary?CdrlD=476651. Accessed 22nd March 2013.

2 Mayfield Clinic for Brain & Spine. Endoscopic Transsphenoidal Surgery. 1998. http://www.mayfieldclinic.com/PE-EndoPitSurg.htm. Accessed 22nd March 2013.

3 Swearingen, B. The Importance of Experience in Surgical Treatment of Pituitary Tumors. MGH Neuroendocrine Center Bulletin. 2005; 11 (1): 3-6.

4 Graham DI, Gennareli TA. Chapter 5, "Pathology of Brain Damage After Head Injury" Cooper P, Golfinos G. 2000. Head Injury, 4th Ed. Morgan Hill, New York.

5 Orlando Regional Healthcare, Education and Development. Overview of Adult Traumatic Brain Injuries. 2004. http://ebookbrowse.com/overview-adult-brain-injury-pdf-d21713943. Accessed on 22nd March 2013.

6 London Health Sciences Centre. Basal Skull Fractures. 2007. http://www.lhsc.on.ca/Health_Professionals/CCTC/edubriefs/baseskull.htm. Accessed 22nd March 2013.

7 Singh J, Stock A. Head Trauma.2006. http://www.Emedicine.com. Accessed 22nd March 2013.

8 Bomberger M R. Types of Traumatic Brain Injury: Basilar Skull Fracture. 2013. http://www.avvo.com/legal-guides/ugc/types-of-traumatic-brain-injury-basilar-skull-fracture. Last accessed 22nd March 2013.

9 Freij M S, Mullett T H. Inadvertent intracranial insertion of a nasogastric tube in a non-trauma patient. Journal of Accident & Emergency Medicine. 1997; 14: 45-7.

10 Genu et al. Inadvertent Intracranial Placement if a Nasogastric Tube in a Patient With Severe Craniofacial Trauma: A Case Report. J Oral Maxillofacial Surgery. 2004;62:1435-8.

11 Paul et al. Intracranial placement of a nasotracheal tube after transnasal trans-spenoidal surgery. Br J of Anaesth 2003: 91 (4): 601-4.

12 Marlow TJ, Goltra DD, Jr, Schabel SI. Intracranial placement of a nasotracheal tube after facial fracture: a rare complication. J Emerg Med 1997; 15: 187-91.

13 Gianelli Castiglione A, Bruzzone E, Burrello C, et al. Intracranial insertion of a nasogastric tube in a case of homicidal head trauma. Am J Forensic Med Pathol 1998; 19: 329-34.

14 Horellou MF, Mathe D, Feiss P. A hazard of naso-tracheal intubation. Anaesthesia 1978; 33: 734

15 Cameron D, Lupton BA. Inadvertent brain penetration during neonatal nasotracheal intubation. Arch Dis Child 1993; 69: 79-80.

16 Allen F, Riopelle J, Sinha A. Case report: intracranial placement of a nasotracheal tube in a patient with Goldenhar syndrome associated with cribriform plate agenesis. Anesth Analg. 2011 Jan; 112 (1):198-200

17 Bailey, Craig R. Intracranial Placement of a Nasotracheal Tube After Transnasal Trans-sphenoidal Surgery. Survey of Anaesth. 2004; 48 (4):196.

18 Engel M, Reif J, Moncrief E. Inadvertent intracranial placement of a Foley catheter. A rare iatrogenic complication of severe frontomaxillary trauma. Rev Stomatol Chir Maxillofac 1992; 93: 333-6.

19 Pawar SJ, Sharma RR, Lad SD. Intracranial migration of Foley catheter—an unusual complication. J Clin Neurosci 2003; 10: 248-9.

20 Sarkari A, Tandon, V, Agrawal D, Mahapatra A K. Intracranial Foley catheter-Inadvertent malpositioning in setting of severe craniofacial trauma. Indian Journal of Neurosurgery 2012; 1: 185-6.

21 Woo H J, Bai C H, Song S Y, Kim Y D. Intracranial Placement of a Foley Catheter: A Rare Complication. Otolaryngology. Head and Neck Surgery. 2008; 138 (1): 115-6.

22 Steinbruner D, Mazur R, Mahoney PF. Intracranial placement of a nasopharyngeal airway in a gun shot victim. Emerg Med J. 2007 Apr;24(4):311.

23 Ellis D Y, Lambert C, Shirley P. Intracranial placements of nasopharyngeal airways: is it all that rare? Emerg Med J. 2006 Aug; 23 (8): 661.

24 Muzzi D A, Loasso T J, Cucchiara R F. et al. Complication from a nasopharyngeal airway in a patient with a basilar skull fracture. Anesthesiology. 1991 Feb; 74 (2): 366-8.

25 Schade K, Borzotta A, Michaels A. Intracranial malposition of nasopharyngeal airwary. J Trauma. 2000 Nov; 49 (5): 967-8.

26 Martin J E, Mehta R, Aarabi B. et al Intracranial insertion of a nasopharyngeal airway in a patient with craniofacial trauma. Mil Med. 2004 Jun;169 (6): 496-7.

27 Soong W J. Endoscopic Diagnosis and Management of Iatrogenic Cervical Esophageal Perforation in Extremely Premature Infants. J Chin Med Assoc. 2007; 70 (4): 171-5.

28 NJR Medical. The No-Bite V. 2011. http://njrmedical.com/no_bite_v.php. Accessed 22nd March 2013.

29 NJR Medical. The No-Bite V: Proving to be a More Comfortable Suctioning Method in Hospice & Palliative Care for "The Death Rattle". Resp Ther, J Pulm Tech. 2013; 8 (2): 38,46.

30 NJR Medical. The No-Bite V: The New Standard of Care When Nasotracheal Suctioning is Contraindicated. Resp Ther, J Pulm Tech. 2012; 7 (6): 25-6.