Inadvertent Intracranial Insertion of Nasogastric Tubes: An Overview and Nursing Implications

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ABSTRACT

Nasogastric tubes are a commonly used medical device. There are numerous complications associated with their use, one of the most significant is when they are inadvertently inserted into the cranium. Clinicians need to be aware of this complication and the type of patient who is most susceptible.

KEY WORDS

nasogastric tubes, intracranial, complications

Introduction

Nasogastric (NG) tubes are a common medical device that can be used for various purposes including prevention of nausea, vomiting and gastric distension, removal of stomach contents for analysis, and lavage of the stomach (Kozier, Erb, Berman & Burke 2000). Other reasons for use include medication administration and enteral feeding.

As with any medical device that is designed to be inserted into the body, an NG tube can cause great harm with potentially fatal consequences. One such consequence is when the tube is inadvertently inserted into the cranium via a defect in the cranial vault. This unfortunate complication may occur if clinicians are not aware that it can occur or not aware of the type of patient most at risk.

The aim of this paper is therefore to highlight this complication of NG tube insertion so that its occurrence can be avoided.

Case Reviews

Various cases (see Table 1) have been reported in the literature of patients who have had an NG tube inadvertently inserted into the cranium. Investigative scans of these patients revealed that skull fractures allowed the NG tube to pass into the cranium. Baskaya (1999) proposed four pathways or mechanisms by which this can occur: a basilar skull fracture extending across the cribiform plate; a comminuted fracture of the base of the skull involving the floor of the anterior cranial fossa; an unusually thin cribiform plate; and a cribiform plate thinned by sinusitis.

Table 1. Patients who had a nasogastric tube inserted intracranially

Author	Mechanism of Injury	Signs or Symptoms	Cerebral Injuries on Scan or X-ray	Outcome
Adler *et al* (1992)	gunshot wound	massive facial swelling, bilateral 'raccoon eyes', bleeding from nose and ears	fractured floor of anterior and middle cranial fossae; pneumocephalus	brain dead soon after admission
Arslantas *et al* (2001)	MVA	large frontomaxillary wound	multiple fractures to base of skull	good health in the 10 months since accident
Castiglione *et al* (1998)	physical assault, blunt object	cuts and bruises to scalp and face	extensive facial fractures, air within frontal and temporal regions	died within 3 hours of admission
Ferreras *et al* (2000)	MVA	fronto-naso-ethmoidal collapse, bilateral periorbital haematoma, CSF rhinorrhoea, mobility of middle third of face	comminuted fractures of anterior walls of frontal sinuses, nondisplaced fracture of posterior wall of left frontal sinus, Le Fort II fracture	discharged 25 days after admission with no deficit
Fletcher *et al* (1987)	MVA	palpable supraorbital & maxillary fractures	fracture supraorbital rim, depressed frontal fracture , Le Fort II fracture	survived with minimal hemiparesis
Fletcher *et al* (1987)	gun shot wound	bilateral orbital ecchymosis & oedema, bilateral ruptured globes	multiple comminuted fractures of orbits, orbital roofs and cribiform plate	resides in a nursing home
Fremstad & Martin (1978)	MVA	blood coming from nostrils and ear, crepitus over maxilla; massive peri- and retro-orbital haematomas	extensive fracture of right frontal bone extending to floor of anterior cranial fossa	died
Galloway & Grudis (1979)	motorbike accident	no specific head injuries described	fracture cribiform plate; fracture frontal, temporal and parietal bones, pneumocephalus	died 3 days after admission
Gregory *et al* (1978)	struck in face by car tyre rim	large facial laceration, visible open fractures of nasal bone and medial aspect of right orbital wall, CSF rhinnorhoea	extensive fractures of right orbit, right frontal bone, nasal bones and left maxillary sinus	discharged on 14th postoperative day
Katz & Faibel (1994)	fall from 4th floor of building	facial lacerations; eccymotic eyelids	fracture face and base of skull, pneomocephalus	died 2 weeks later
Seebacher *et al* (1975)	MVA	bleeding from mouth and nose; nasal fracture, eccymotic eyelids	fractures to frontal area, left orbit & right parietal area, fracture anterior fossa	died
Wyler & Reynolds (1977)	fell 60 feet landing on face	obvious facial displacement, bleeding from nose and ears	fracture cribiform plate	died within 1 hour of admission

Many of the patients cited in the literature had signs or symptoms on admission that are suggestive of basilar skull fracture or anterior fossa fracture including periorbital ecchymosis ('raccoon eyes') and cerebro-spinal fluid (CSF) or blood rhinorrhoea (Barker 2002, 412; McQuillan, Von Rueden, Harstock & Whelan 2002). CSF or blood otorrhoea were also cited as symptoms and these may indicate middle fossa fracture (Barker 2002).

These cases are not the only ones published in the literature of patients who have had NG tubes inadvertently inserted into the cranium. However those not published in the English language have not been reviewed (see for example Casagli, Malacarne, Tosi & Biancofiore 1994; Desbordes, Roulades, Morichaud, Desplat & Meriel 1982; Estebe, Fleureaux, Lenaoures & Malledant 1994; Krauland & Schneider, 1983).

Non-trauma Victims

Not all of the patients cited in the literature who had an NG tube inserted intracranially were trauma victims. Freij and Mullett (1997) reported the case of a 59 year old female admitted to hospital with status epilepticus. An NG tube was inserted to reduce the risk of aspiration. Three attempts were made at inserting the tube, each attempt only produced blood-stained aspirate. A follow up x-ray revealed that the tube was located intracranially. The patient was admitted to a neurosurgical unit but died from sepsis secondary to pneumonia and meningitis. Autopsy found an anatomical defect, believed to be congenital, in the fronto-ethmoidal region of the skull base.

Nathoo and Nadvi (1999) described the transnasal repair of a unilateral choanal atresia in a neonate. On the second postoperative day a CSF leak was observed resulting in meningitis. The leak resolved with conservative management. A feeding NG tube was inserted on the fourteenth day and a subsequent computerised tomography (CT) scan showed the tube had passed 'through the basi-sphenoid region... entering the third ventricle through its floor and passing through the pineal region and into the posterior interhemispheric cistern' (Nathoo & Nadvi 1999, 409). The NG tube was removed uneventfully and at a six-month check up the child had reached the appropriate milestones.

Guerra, Slade and Kelly (1979) described a 40 year old male who underwent a right frontal craniotomy for a pituitary tumour. The patient awoke in the recovery room where an NG tube was inserted. The patient's neurological status subsequently deteriorated. It was noted that when air was injected into the NG tube, air and fluid was simultaneously expelled from an epidural drain that was insitu. An x-ray revealed the intracranial location of the tube. The patient died four days after the operation.

Hande and Nagpal (1991) described a 62 year old male who underwent excision of a pituitary tumour via the transsphenoidal approach. He was fed postoperatively through an NG tube. Because of progressive deterioration in his condition, a CT scan was performed which showed the intracranial location of the tube and pneumocephalus. The tube was removed but the patient died two days later. Hande and Nagpal (1991) believe the tube dislodged the bone used to reconstruct the floor of the sella turcica, resulting in meningitis and death.

Metheny (2002) also described a patient who underwent a transsphenoidal resection of a pituitary tumour. The patient's condition deteriorated on the seventh day and her management included the insertion of an NG tube. A short time later a CT scan was performed showing the intracranial presence of the tube. The patient survived but suffered severe neurological damage, which was directly attributed to the NG tube.

Implications

Intracranial placement is a potential complication of NG tube insertion, particularly in the trauma victim. In fairness to the clinicians involved, the majority of the cases cited in the literature occurred more than 10 years ago at a time when trauma nursing was not the specialty it is today. It could be hypothesised that these disasters happened for a variety of reasons, such as clinicians' lack of knowledge or awareness of all the risks of the procedures they were performing. For example, of the 12 patients described in Table 1, at least seven of them had signs or symptoms suggestive of skull fracture. The insertion of an NG tube is contraindicated in such situations.

In only a few of these cases was the poor outcome directly related or believed to be related to the NG tube, although in the presence of severe traumatic brain injury, this would be difficult to prove. Unfortunately few of the reports described why the NG tube was inserted. Presumably it was to prevent the risk of aspiration in the unconscious patient, although not all the patients were unconscious when the tube was inserted. Alarmingly some of the patients showed neurological deterioration immediately after the tube was inserted. The main treatment for this was an investigative scan rather than tube removal.

Not all of the cases were trauma victims. Three of the cases cited occurred in patients who had surgery on the pituitary gland, two of these via the transsphenoidal route. One of these patients had an existing anatomical defect that may have otherwise remained undetected. It was unfortunate for this patient, and the clinicians involved, that an NG tube was required. This case highlights how a device as simple as an NG tube has the potential to do harm, a caveat that every clinician should remember.

Awareness of those factors thought to predispose a patient to unintentional intracranial intubation should form part of every clinicians' patient assessment, particularly when a nasogastric tube is required. Certainly, patients presenting with signs and symptoms indicative of traumatic head injury and in particular skull fracture, would require careful regard if gastric access was required. In these patients, the orogastric route is the safest option. Similar consideration must also be afforded to the equally vulnerable patient who has undergone craniofacial surgery because neurological deterioration post NG tube insertion may be due to rupture of the cribriform plate, or congenital abnormality.

Conclusion

The insertion of a nasogastric tube is not without the potential for serious complication in the susceptible patient. The risk of intracranial penetration by a nasogastric tube has been shown to be a factor for consideration during tube insertion. Whilst some clinicians may be aware of this risk, others may not. The recentness of some of the published cases supports the latter.

References

Adler, J., Graeb, D. & Nugent, R. (1992) Inadvertent intracranial placement of a nasogastric tube in a patient with severe head trauma. *Canadian Medical Association Journal. 147*(5) 668–9

Arslantas, A., Durmaz, R., Cosan, E. & Tel, E. (2001) Inadvertent insertion of a nasogastric tube in a patient with head trauma. *Child's Nervous System. 17*(1–2) 112–4

Barker, E. (2002) *Neuroscience Nursing – A Spectrum of Care.* (2nd edn.) St Louis, Mosby

Baskaya, M. (1999) Inadvertent intracranial placement of a nasogastric tube in patients with head injuries. *Surgical Neurology. 52*(4) 426–7

Casagli, F., Malacarne, P., Tosi, G. & Biancofiore, G. (1994) Accidentale introduzione di una sonda nasogastrica in cavita carnica di un panziente colpito da trauma cranico e facciale di non grave entita. *Minerva Anestesiologica. 60*(5) 277–9

Castiglione, A., Bruzzone, E., Burrello, C., Pisani, R., Venture, F. & Canale, M. (1998) Intracranial insertion of a nasogastric tube in a case of homicidal head trauma. *American Journal of Forensic Medicine and Pathology. 19*(4) 329–34

Desbordes, J., Roulades, G., Morichaud, G., Desplat, A. & Meriel, P. (1982) Penetration intra-cranienne d'une sonde gastrique: a propos d'un cas. *Annales Francaises d Anesthesie et de Reanimation. 1*(2) 191–2

Estebe, J., Fleureaux, O., Lenaoures, A. & Malledant, Y. (1994) Penetration intra-cranienne d'une sonde nasogastrique chez un traumatise cranien grave. *Annales Francaises d Anesthesie et de Reanimation. 13*(6) 843–5

Ferreras, J., Junguera, L. & Garcia-Consuegra, L. (2000) Intracranial placement of a nasogastric tube after severe craniofacial trauma. *Oral Surgery Oral Medicine Oral Pathology Oral Radiology and Endodontics. 90*(5) 564–6

Fletcher, S., Henderson, L., Miner, M. & Jones, J. (1987) The successful surgical removal of intracranial nasogastric tubes. *Journal of Trauma. 27* 948–52

Freij, R. & Mullett, S. (1997) Inadvertent intracranial insertion of a nasogastric tube in a non-trauma patient. *Journal of Accident and Emergency Medicine. 14*(1) 45–7

Fremstad, J. & Martin, S. (1978) Lethal complication from insertion of nasogastric tube after severe basilar skull fracture. *Journal of Trauma. 18*(12) 820–2

Galloway, D. & Grudis, J. (1979) Inadvertent intracranial placement of a nasogastric tube through a basal skull fracture. *Southern Medical Journal. 72* 240–1

Gregory, J., Turner, P. & Reynolds, A. (1978) A complication of nasogastric intubation: intracranial penetration. *Journal of Trauma. 18*(12) 823–4

Guerra, B., Slade, T. & Kelly, P. (1979) Intracranial introduction of a nasogastric tube in a patient with a pituitary tumor. *Surgical Neurology. 12*(2) 135–6

Hande, A. & Nagpal, R. (1991) Intracranial malposition of a nasogastric tube following transnasal transsphenoidal operation. *British Journal of Neurosurgery. 5* 205–7

Katz, M. & Faibel, M. (1994) Inadvertent intracranial placement of a nasogastric tube. *American Journal of Roentgenology. 163* 222

Kozier, B., Erb, G., Berman, G. & Burke, K. (2000) *Fundamentals of Nursing – Concepts, Process and Practice.* (6th edn.) Englewood Cliffs, Prentice Hall

Krauland, W. & Schneider, S. (1983) Perforation der Schadelbasis bei nasogastraler Intubation. *HNO. 31*(7) 247–51

McQuillan, K., Von Rueden, K., Harstock, R. & Whelan, E. 2002, Trauma Nursing – From Resuscitation Through Rehabilitation (3rd edn). Philadelphia, Saunders

Metheny, N. (2002) Inadvertent intracranial nasogastric tube placement. *American Journal of Nursing. 102*(8) 25–7

Metheny, N. (2000) Achieving successful nasogastric tube placements in emergency situations. *American Journal of Critical Care. 9*(5) 303–6

Nathoo, N. & Nadvi, S. (1999) Intracranial malposition of a nasogastric tube following repair of choanal atresia. *British Journal of Neurosurgery. 13*(4) 409–10

Seebacher, J., Nozik, D. & Mathieu, A. (1975) Inadvertent intracranial introduction of a nasogastric tube, a complication of severe maxillofacial trauma. *Anesthesia. 42* 100–2

Wyler, A. & Reynolds, A. (1977) An intracranial complication of nasogastric intubation. *Journal of Neurosurgery. 47* 297–8