16. Converse JM, Smith B, Obear MF, et al: Orbital blow-out fractures: A ten year survey. Plast Reconstr Surg 39:20, 1967
17. Nielsen IM, Vibe P, Andersen M, et al: Bilateral orbital floor fractures. Scand J Plast Reconstr Surg 19:189, 1985
18. Rubin PAD, Bilyk JR, Shore JW: Orbital reconstruction using porous polyethylene sheets. Ophthalmology 101:1697, 1994
19. Iizuka T, Mikkonen PM, Paukka P, et al: Reconstruction of orbital floor with polydioxanone plate. Int J Oral Maxillofac Surg 20:83, 1991
20. Morriston AD, Sanderson R, Moos KF: The use of Silastic as an orbital implant for reconstruction of orbital wall defects: Review of 311 cases treated over 20 years. J Oral Maxillofac Surg 53:412, 1995
21. Park HS, Kim YK, Yoon CH: Various applications of titanium mesh screen implant to orbital wall fractures. J Craniofac Surg 6:555, 2001
22. Stromberg BV, Knibbe M: Anisocoria following reduction of bilateral orbital floor fractures. Ann Plast Surg 21:486, 1988

J Oral Maxillofac Surg
62:1435-1438, 2004

Inadvertent Intracranial Placement of a Nasogastric Tube in a Patient With Severe Craniofacial Trauma: A Case Report

Paloma Rodrigues Genú, DDS, MS, David Moraes de Oliveira, DDS,†*
Ricardo José de Holanda Vasconcellos, DDS, PhD,‡ Ricardo Viana Bessa Nogueira, DDS,§ and
Belmiro Cavalcanti do Egito Vasconcelos, DDS, PhD‖

Nasogastric intubation is a well-established procedure in many clinical situations. Insertion of a nasogastric tube (NGT) is generally a routine, simple task, although it is often carried out under emergency conditions and on unconscious or uncooperative patients. The introduction of an NGT is often recommended after initial stabilization to remove and evaluate gastric contents, decrease the likelihood of aspiration, and prevent gastric dilation from the ileus and for a variety of other conditions that are common after multiple injuries.[1] Like other clinical procedures, it is not free of risk or complications, such as pressure necrosis of the tip of the nose, nasal hemorrhage, rhinitis, conjunctivitis, ear symptoms, sinusitis, pharyngitis, rupture of esophageal varices, laryngeal injuries, pulmonary hemorrhage, bronchopleural fistula, pneumothorax, pneumomediastinum, pneumonia, ventilatory failure, massive aspiration, perforation (bronchus, esophageal, nasopharyngeal, duodenal, gastric, or rectal), and death.[2,3] One complication that is not very frequent, but can be catastrophic, is the inadvertent intracranial placement of an NGT.

The inadvertent introduction of an NGT into the intracranial cavity was first described by Martinelle et al[4] in 1974. Since then, 33 additional cases have been reported in the international literature.[5,6] A complex craniofacial fracture is the most common antecedent in such cases. Intracranial NGT placement has been reported after pathosis or surgery of the base of the skull,[7,8] and iatrogenic cases have also been documented.[9-13]

Our purpose was to describe a case of severe craniofacial fracture in which the NGT was positioned intracranially. We also hope to alert anesthesiologists and surgeons treating traumatized patients with craniofacial injuries of the possible hazards associated with nasogastric intubation.

Report of a Case

A 53-year-old man was injured when riding his motorcycle without his helmet. Initially, he was admitted to the local emergency hospital for treatment of head and face trauma.

On admission, his vital signs were unstable; he had an orotracheal tube, and he was breathing with the support of an air mask unit. He also had an NGT (Sidplast Ind Com Ltd, Rio Largo, AL, Brazil) placed. His pulse was 120/min and his blood pressure was 180/70 mm Hg; he was able to react to pain stimuli. The patient was able to move only his left leg and arm. The physical examination of his head and face revealed a deep wound in the left side of his forehead,

Received from the Department of Oral and Maxillofacial Surgery, University of Pernambuco, Recife, Brazil.

*Student, Master's Program.

†Student, Master's Program.

‡Assistant Professor.

§Student, Master's Program.

‖Chairman, PhD Program.

Address correspondence and reprint requests to Dr B. Vasconcelos: Department of Oral and Maxillofacial Surgery, University of Pernambuco, Av General Newton Cavalcanti, 1650, Camaragibe, Pernambuco, Brazil 54753-220; e-mail: belmiroc@terra.com.br

0278-2391/04/6211-0017$30.00/0
doi:10.1016/j.joms.2004.07.005

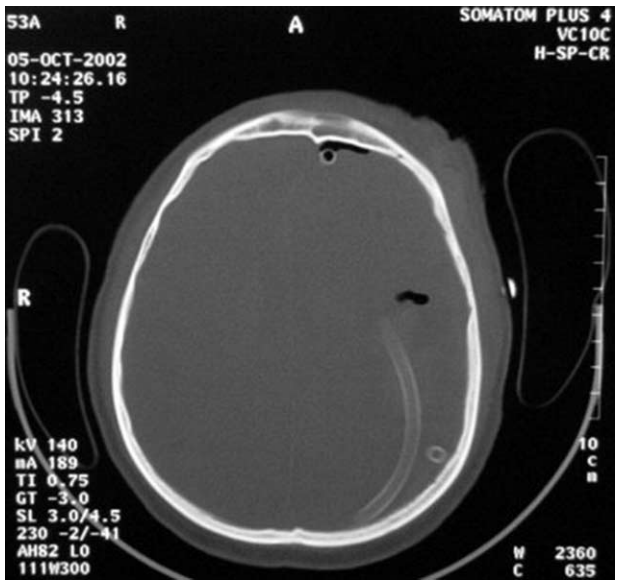

FIGURE 1. Computed axial tomography showing pneumoencephalos and a localized intracranial nasogastric tube.

Genú et al. Inadvertent Intracranial Placement of an NG Tube. J Oral Maxillofac Surg 2004.

periorbital edema and ecchymosis in his left orbit, rhinorrhea, and a flattening of the left side of his face, and his facial height appeared to be increased. Intraoral examination showed an edentulous maxilla and mandible and mobility of the mandible.

High-resolution computed tomography (CT) scanning of the brain revealed a traumatic subarachnoid hemorrhage, brain concussion, diffuse cerebral edema, pneumocephaly, and an image of an intracranial NGT (Fig 1). Apparently the NGT, after insertion into the nose, had crossed the cribriform plate and reached the posterior cranial fossa (Figs 2A, B, 3A, B). Further examination of the CT scans revealed a nasoethmoid fracture, fracture of the sphenoid sinus, fracture of the left temporal bone, bilateral mandibular fractures, fracture of the left zygoma, and presence of blood within all of the facial sinuses (Figs 4A, B). At this point, the NGT was removed and the patient was taken to the intensive care unit. After 2 days, he underwent a procedure for the installation of a cerebrospinal fluid drain and a transducer to monitor the intracranial pressure. During the following days, the patient developed hemiplegia of the right arm and leg and iliac-femoral deep venous thrombosis. Anticlotting therapy was then administered. After 35 days, the patient was taken to the operating room, where the facial fractures were treated using rigid internal fixation; on the 68th day, he underwent a surgical procedure to treat a chronic frontal subdural hematoma. On the 80th day he was discharged, and he still had the same neurologic complications.

Discussion

The placement of an NGT is a common practice in trauma surgery that in some cases does not receive due attention. The physical examination is often a poor predictor of tube malposition, especially in a patient with an obtunded mental state. The placement of an NGT is often first evaluated by aspiring fluid or insufflating air and auscultation of the abdomen to induce a "pseudoconfirmation gurgle." Both maneuvers may yield false-positive results.[14]

Radiographic imaging is commonly used to confirm the position of the tube and is strongly recommended

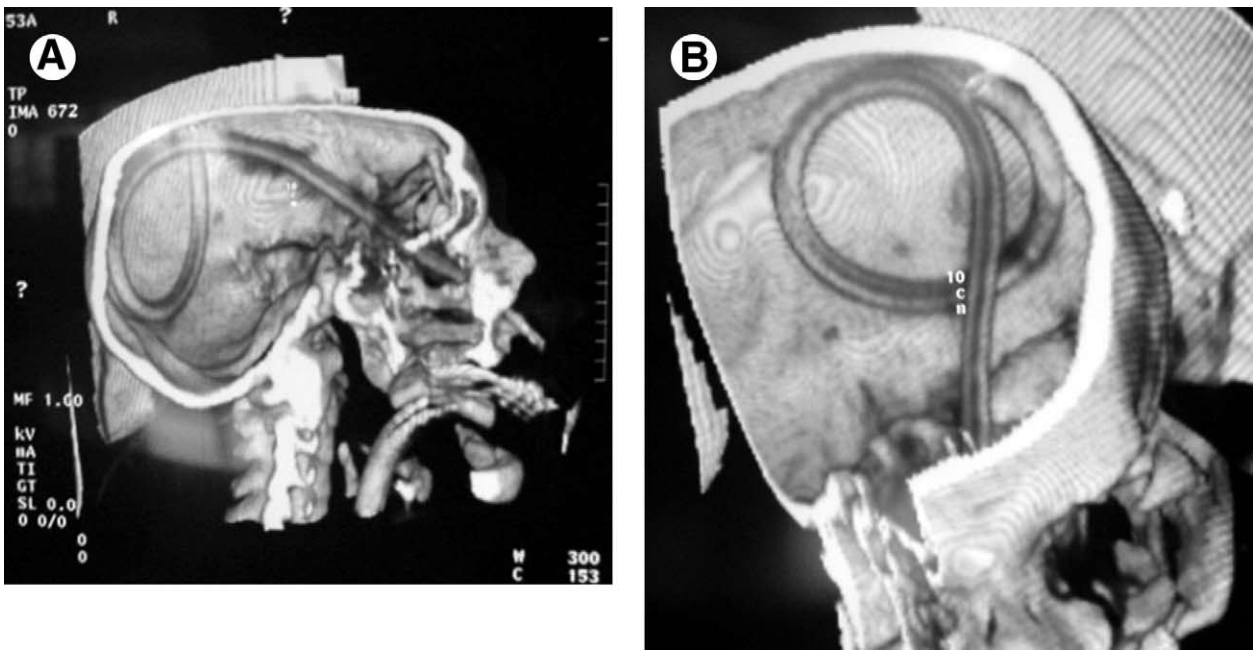

FIGURE 2. (*A, B*) Computed tomography (superficial 3-dimensional reconstruction) showing the intracranial course trajectory of nasogastric tube.

Genú et al. Inadvertent Intracranial Placement of an NG Tube. J Oral Maxillofac Surg 2004.

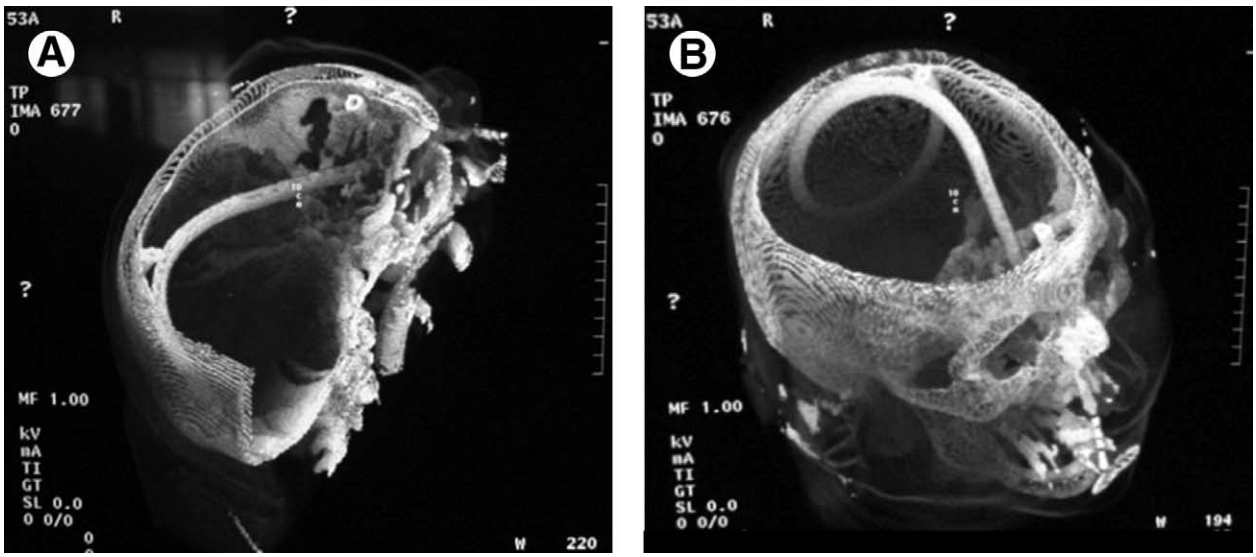

FIGURE 3. (*A, B*) Computed tomography (volumetric 3-dimensional reconstruction) showing the intracranial course trajectory of nasogastric tube.

Genú et al. Inadvertent Intracranial Placement of an NG Tube. J Oral Maxillofac Surg 2004.

before the tube is used for enteral feeding or the instillation of drugs or other material. However, the radiograph may be misinterpreted. Despite its occasional fallibility, radiographic confirmation should be mandatory before material is lavaged through an NGT.[14] This could minimize the rate of inadvertent insertion of NGT and the associated potential morbidity and mortality. Radiographs from cases of intracranial placement of NGT show the tubes coiling in the vault of the skull, apparently not within the brain substance.[15] When such a misplacement has been established, an emergency CT study is essential, with the provision of adequate antibiotic coverage.

In the patient with craniofacial trauma, and particularly in the patient with cerebrospinal fluid rhinorrhea, insertion of the gastric tube through the nasal cavity may be hazardous. Bouzarth[16] report 5 cases of intracranial NGT insertion, in which spinal fluid leakage was noted in only 1 case. In dealing with patients with obvious facial and basal skull fractures, the emergency physician should be alerted to the fact that the region of the cribriform plate or sphenoid sinus may

FIGURE 4. (*A*) Computed coronal tomography showing fracture of the sphenoid sinus and fracture of the left temporal bone. (*B*) Superficial 3-dimensional reconstruction showing a nasoethmoid fracture, bilateral mandibular fracture, and fracture of the left zygomatic bone.

Genú et al. Inadvertent Intracranial Placement of an NG Tube. J Oral Maxillofac Surg 2004.

be fractured, and this could lead to a communication between the nasopharynx and the intracranial cavity, regardless of whether the dura is lacerated.[1,17] Blind nasogastric intubation is contraindicated in this situation to prevent contamination or injury to the intracranial contents.[1,18] Gustavsson et al[19] emphasize that the apparently easy introduction of an NGT does not necessarily mean that the tube has entered the stomach, in patients with severe maxillofacial trauma.

If NGT placement is chosen, gastric intubation should be performed under fluoroscopic guidance,[20] endoscopic guidance,[20] or direct vision.[21] The orogastric tube is another option.[21] To prevent intracranial placement, Sliwa and Marciniak[22] recommended that tubes passed nasally be inserted and advanced perpendicularly to the face. Lipov and Sosis[23] report that the use of the fiberoptic bronchoscope for NGT placement is useful in patients with basal skull fractures without midface or nasal trauma. A larger tube seemed to be safer than the small-caliber tube.[20]

The consequences of inadvertent NGT positioning within the cranial cavity are serious, with a reported mortality rate of 64%. Also, severe complications may occur in the form of hemiparesis, intracranial bleeding, decerebrate posturing, respiratory arrest, suctioning of brain parenchyma, blindness, loss of the sense of smell, meningitis, decreased mental status, and persistent cerebrospinal fluid fistula.[24] Cerebral damage caused by NGT cannot always be clearly proved because it is difficult to distinguish it from the damage caused by initial trauma. Establishing the cause and effect between death and intracranial NGT is therefore problematic.[6]

Some authors recommend craniotomy with removal of the previously segmented tube under direct visualization.[24] Others advocate retrieval through the nose.[1,5,18,19,25] Ferreras et al[5] state that there is no available scientific evidence to suggest that either technique offers any prognostic advantages. In any case, the best approach is clearly to prevent this complication.

Thus, it seems prudent not to routinely insert tubes into the nose of patients with severe maxillofacial trauma and clinical or radiographic evidence of a basilar skull fracture unless the integrity of the base of the skull is ensured. If NGT placement is necessary, one should take special precautions as outlined to prevent intracranial placement of the NGT.

References

1. Fremstad JD, Martin SH: Lethal complication from insertion of a nasogastric tube after severe basilar skull fracture. J Trauma 18:820, 1978
2. Hafner CD, Wylie JH, Brush BE: Complications of gastrointestinal intubation. Arch Surg 83:163, 1961
3. Kannan S, Morrow B, Furness G: Tension pneumothorax and pneumomediastinum after nasogastric tube insertion. Anaesthesia 54:1012, 1999
4. Martinelle F, Montaut J, Hazeaux C, et al: Pénétration intracranienne d'une sonde gastrique à travers une déhiscence traumatique de la lame criblée. Cahiers d'Anesthésiologie 22: 345, 1974
5. Ferreras J, Junquera LM, Garcia-Consuegra L: Intracranial placement of a nasogastric tube after severe craniofacial trauma. Oral Surg Oral Med Oral Pathol Oral Radiol Oral Endod 90:564, 2000
6. Castiglione AG, Bruzzone E, Burrello C, et al: Intracranial insertion of a nasogastric tube in a case of homicidal head trauma. Am J Forensic Med Pathol 19:329, 1998
7. Hande A, Nagpal R: Intracranial malposition of a nasogastric tube following transnasal transsphenoidal operation. Br J Neurosurg 5:205, 1991
8. Guerra B, Slade TL, Kelly PJ: Intracranial introduction of a nasogastric tube in a patient with a pituitary tumor. Surg Neurol 12:135, 1979
9. Freij RM, Mullett ST: Inadvertent intracranial insertion of a nasogastric tube in a non-trauma patient. J Accid Emerg Med 14:45, 1997
10. Van der Anker JN, Baerts W, Quak JME, et al: Iatrogenic perforation of the lamina cribrosa by nasogastric tube in an infant. Pediatr Radiol 22:545, 1992
11. Glasser SA, Garfinkle W, Scanlon M: Intracranial complication during insertion of a nasogastric tube. AJNR Am J Neuroradiol 11:1170, 1990
12. Fletcher SA, Henderson LT, Miner ME, et al: The successful surgical removal of intracranial nasogastric tubes. J Trauma 27:948, 1987
13. Young RF: Cerebrospinal fluid rhinorrhea following nasogastric intubation. J Trauma 19:789, 1979
14. Thomas B, Cummin D, Falcone RE: Accidental pneumothorax from a nasogastric tube. N Engl J Med 355:1325, 1996
15. Marlow TJ, Goltra DD Jr, Schabel SI: Intracranial placement of a nasotracheal tube after facial fracture: A rare complication. J Emerg Med 15:187, 1997
16. Bouzarth WF: Intracranial nasogastric tube insertion. J Trauma 18:818, 1978
17. Wyler AR, Reynolds AF: An intracranial complication of nasogastric intubation—Case report. J Neurosurg 47:297, 1977
18. Gregory JA, Turner PT, Reynolds AF: A complication of nasogastric intubation: Intracranial penetration. J Trauma 18:823, 1978
19. Gustavsson S, Albert J, Forsberg H, et al: The accidental introduction of a nasogastric tube into the brain—Case report. Acta Chir Scand 144:55, 1978
20. Bhattacharyya N, Gopal HV: Examining the safety of nasogastric tube placement after endoscopic sinus surgery. Ann Otol Rhinol Laryngol 107:662, 1998
21. Adler JS, Graeb DA, Nugent RA: Inadvertent intracranial placement of a nasogastric tube in a patient with severe head trauma. Can Med Assoc J 147:668, 1992
22. Sliwa JA, Marciniak C: A complication of nasogastric tube removal. Arch Phys Med Rehabil 70:702, 1989
23. Lipov EG, Sosis MB: Safe nasogastric tube placement in a patient with a basal skull fracture. Anesthesiology 78: 989, 1993
24. Fletcher SA, Henderson LT, Miner ME, et al: The successful surgical removal of intracranial nasogastric tubes. J Trauma 27:948, 1987
25. Seebacher J, Nozik D, Mathieu A: Inadvertent intracranial introduction of a nasogastric tube, complication of severe maxillofacial trauma. Anesthesiology 42:100, 1975