CONCLUSION

Because of its simplicity and relative accuracy (to a $V_o/V_T$ of 0.70), the calculated $V_o/V_T$ can become a routine measurement in all cases of patients requiring respiratory assistance where there are facilities for measuring arterial blood gases, thus permitting more frequent evaluation of the patients' respiratory status.

Inadvertent Intracranial Introduction of a Nasogastric Tube, a Complication of Severe Maxillofacial Trauma

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The purpose of this communication is to alert anesthesiologists and physicians caring for severely traumatized patients with maxillofacial injuries of a possible hazard associated with nasogastric intubation.

REPORT OF A CASE

A 17-year-old girl was admitted to the emergency ward of the Massachusetts General Hospital with multiple injuries resulting from a car accident. On arrival, she was restless and incoherent. She was bleeding from the mouth and nose. Physical examination revealed a nasal fracture and a frontal hematoma with multiple facial lacerations. Both eyelids were edematous, but the pupils were found to be symmetrically dilated, and responsive to light. No other injuries were documented. Vital signs were stable, with a blood pressure of 130/80 torr and a pulse of 88/minute. The hemoglobin was 37 per cent. A #14 French peripheral intravenous line and a #16 French central venous pressure catheter were inserted, and blood sampled. A plastic #18 nasogastric (Salem-Sump) tube was passed via the left nostril and connected to continuous suction, without checking by standard procedures to determine whether the tube was properly placed. Mannitol, 25 g, and dexamethasone, 8 mg, were given intravenously.

During subsequent physical examinations by specialists in general, oral, plastic, and neurosurgery, the patient's state suddenly deteriorated; right hemiparesis developed, and the right pupil dilated. Radiographic examination of the skull was performed, but before the results were available, the patient was taken to the operating room for emergency craniotomy.

On arrival to the operating room, the patient had short bouts of restlessness, alternating with episodes of shallow respirations. The patient resisted attempts at direct laryngoscopy for orotracheal intubation. A #7 French Portex nasotracheal tube was passed blindly into the trachea without difficulty. The patient was paralyzed and anesthetized.

Radiographs of the skull showing the nasogastric tube crossing the cribiform plate and the dura and curving within the cerebral cavity (fig. 1) arrived in the operating room at the start of the operation. Suction had been discontinued prior to transfer to the operating room. The tube was removed from the nose immediately, and grey gelatinous matter was found adherent to the tip and within the lumen of the tube. A right temporal craniectomy revealed a small subdural hematoma, extensive contusion, and cerebral edema. A wide bifrontal craniectomy was then performed for cerebral decompression. It was observed that the patient had sustained multiple bilateral comminuted
fractures of the anterior fossa and frontal sinuses extending to the floor of the cavities. Operation was complicated by massive arterial bleeding, and extensive cerebral edema necessitating resection of both frontal lobes. A sudden cardiac arrest was treated vigorously but unsuccessfully.

**DISCUSSION**

Insertion of nasotracheal and nasogastric tubes through the noses of patients with severe maxillofacial trauma carries special risks. These patients may have nasal, orbital floor, zygomatic, maxillary, and palatal fractures. They often have associated fractures of the cervical spine or the frontal ethmoid, sphenoid, or cribiform areas or base of the skull, with or without cerebrospinal fluid leaks. Because the presence of blood and soft tissue edema in the sinuses interferes with the clarity of radiographs, the extent of fracture displacement often cannot be assessed prior to operation. Furthermore, laminography of the skull, a more informative but time-consuming technique, is often not possible.

In addition, traumatically induced disruption of the normal anatomy of the area may make it impossible or hazardous to pass any tube through the nose into the oropharynx. In the case reported, cerebral insertion of the nasogastric tube may be responsible for additional brain injury, and may have contributed to the intracranial bleeding. Bacterial flora from the nasopharynx may be inadvertently introduced intracranially, increasing the risk of infection. The presence of the brain-like matter suctioned from the tube may delude physicians into thinking that the tube is in the proper place. In this case, insertion of the nasotracheal tube, although successful, may not have been an appropriate choice.

Another complication of blind nasotracheal intubation in patients with maxillofacial trauma is the passage of the tube through the nose, into the maxillary antrum, then through the floor of the orbit into the fat pad of the eye, with or without damage to the eye. At times, patients with maxillofacial trauma do not have a noticeable cerebrospinal fluid leak prior to
Massive Swelling of the Head and Neck

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Macroglossia has recently been added to the list of possible complications of anesthesia for neurosurgery in the sitting position, the explanation being that there is bilateral occlusion of the lingual vein from the pressure of the endotracheal tube and oral airway on the tongue with the head in the extreme flexed position. This is a case report of massive swelling of the head, neck, and tongue which occurred after prolonged neurosurgery in the sitting position.

REPORT OF A CASE

A 21-year-old Caucasian man was admitted to the hospital with a history of loss of consciousness, headaches, and visual disturbances. Investigations revealed an arteriovenous malformation of the left parieto-occipital region. A month later the patient underwent craniotomy with ablation of the arterial feeders of the malformation. Anesthesia was induced with sodium thiopental. Following administration of succinylcholine, the trachea was intubated easily with a 34 anode tube, and a medium-sized plastic oral airway was inserted. Anesthesia was maintained for 13 hours with nitrous oxide, oxygen, halothane, d-tubocurarine, and hyperventilation. A posterior-fossa craniotomy was performed with the patient in the sitting position with the back up 20 degrees, the head held in a Gardner clamp. The immediate postoperative period was uneventful. However, the patient developed right-sided weakness, and arteriography revealed incomplete removal of the arteriovenous malformation.

The patient returned for a second operation a month later. The same anesthetic technique was used, with the addition of prolonged hypotension (mean pressure 55 mm Hg) with the patient in the same body position. Towards the end of the 14-hour procedure, swelling of the brain was noted. Despite intravenous administration of steroids and mannitol, the swelling was too great to allow replacement of the bone flap. At the end of anesthesia, some swelling of the tongue and lips was noted, though it was thought not to be significant enough to embarrass respiration. However, after extubation of the trachea the patient evidenced immediate respiratory distress. Ventilation