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The Intraoperative Diagnosis of a Tracheoesophageal Fistula in an Adult

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TRACHEOESOPHAGEAL fistula (TEF) is a rare diagnosis in adults. Herein is reported the case of a TEF diagnosed by the anesthesiologist after uneventful induction of general anesthesia for elective abdominal surgery.

Case Report

A 61-yr-old woman (weight, 121 kg) presented to the operating room for closure of an abdominal wound. Her history was notable for morbid obesity and restrictive lung disease, necessitating numerous therapeutic bronchoscopies for correction of atelectasis. The patient did not have symptoms of recurrent aspiration. She was not specifically questioned about coughing associated with food intake.

Approximately 6 months before the current procedure, she underwent a complex revision of a previously failed gastric bypass. She had a difficult postoperative course complicated by infarction of her gastric remnant, the development of multiple enteroentero- and enterocutaneous fistulae, and several episodes of sepsis. She was in the hospital with a nasogastric tube in place for several months.

Approximately 3 months before the current procedure, she underwent a 9-h operation, during which multiple fistulae were taken down and intestinal continuity was restored. Anesthetic during this surgery was notable for a leak around the endotracheal tube (ETT) after placement of a 7.0 cuffed tube. This leak disappeared after reintubation with an 8.0 cuffed ETT.

The current case began with an uneventful intravenous induction of anesthesia with fentanyl, propofol, and succinylcholine. A 7.0 ETT was placed *via* direct laryngoscopy without difficulty. The ETT cuff was inflated and bilateral breath sounds were confirmed. The tube was taped in place, an esophageal stethoscope was inserted, and mechanical ventilation was started, using 50% nitrous oxide (N₂O) and desflurane in oxygen.

After 5-10 min, as the effects of succinylcholine wore off, a gurgling

sound was noted around her airway at end-inspiration with each respiratory cycle. Assuming a poor seal by the ETT, 2 ml air was added to the cuff; however, the leak persisted. Repeat laryngoscopy confirmed that the ETT cuff was entirely below the vocal cords. Particularly notable was the finding that removal of the esophageal stethoscope before repeat laryngoscopy resulted in an increase in the intensity of the gurgling sound. A presumptive diagnosis of TEF was made.

A brief fiberoptic evaluation of the patient's airway (through the ETT) failed to reveal any defects in the tracheal wall. A gastroenterologist was not available to endoscopically examine the patient's esophagus during the anesthetic. Postoperatively, an esophagram showed a tracheoesophageal fistula at the level of the carina.

Esophagoscopy and bronchoscopy revealed this lesion to taper from an approximately 0.6-cm lesion in the anterolateral esophagus to a pinhole defect in the tracheal wall.

Discussion

Grant *et al.*¹ reported the case of a 15-yr-old undergoing hiatal hernia repair and pyloromyotomy, in whom the diagnosis of TEF was previously suspected. The presence of TEF was suggested intraoperatively by gastric distention, which increased with each positive-pressure ventilation and which was abolished by advancing the ETT to just above the carina.

Saldanha *et al.*² reported the case of a 34-yr-old scheduled for right lower lobectomy for bronchiectasis. Esophageal and gastric distention associated with positive-pressure ventilation suggested the presence of a bronchoesophageal fistula. Surgery was deferred, the fistulous tract was confirmed by radiologic contrast study, and the patient subsequently underwent lobectomy and division of the fistula.

Kovitz *et al.*³ reported the diagnosis of TEF in an intensive care unit patient who experienced gastric distention while undergoing positive-pressure ventilation. This led to a sampling of gases from the stomach, ventilator, and room air, which suggested gastric gases came from the ventilator; the diagnosis of TEF was confirmed at esophagoscopy.

This is the first case report of a TEF diagnosed intraoperatively on the basis of an audible air leak.

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CASE REPORTS

The most likely mechanism for creation of the TEF was erosion of the patient's nasogastric tube through the anterior esophageal wall into the trachea. The finding that the defect was larger on the esophageal side than on the tracheal side makes bronchoscopy an unlikely cause. None of the other common causes of TEF in adults (radiation therapy, trauma, corrosive burn, malignancy, congenital defect, or tuberculosis) apply to this patient.

There are several causes of air leak after tracheal intubation, most of which are easily verifiable. The most common are inadequate depth of ETT insertion (with the ETT cuff straddling the vocal cords), inadequate cuff inflation, and inadvertent placement of an esophageal stethoscope or nasogastric tube into the trachea.

Exclusion of these causes, in the presence of an increased leak associated with removal of the esophageal stethoscope, led to a presumptive diagnosis of TEF. This diagnosis was confirmed postoperatively. During di-

rected questioning postoperatively, the patient admitted to a history of coughing when drinking fluids (especially carbonated beverages).

Despite several weeks of keeping the patient as *non per os* and providing nutrition *via* a feeding tube, the fistula failed to close. Subsequently, the patient underwent esophagoscopy and injection of the fistula with a fibrin sealant. Her coughing immediately ceased, and she remains asymptomatic.

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The Changes in Bispectral Index during a Hypovolemic Cardiac Arrest

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ANESTHESIOLOGISTS for many years have sought to monitor brain function during surgery to assist in proper administration of sedative-hypnotic agents and to detect early signs of inadequate cerebral perfusion. A processed electroencephalographic device (Aspect Medical Systems, Natick, MA) newly approved by the Food and Drug Administration produces a unitless scale from 0 to 100 that correlates with a patient's hypnotic state.¹ At the top of the scale (100), a patient is awake and responsive. As hypnotics

are administered, the scale (Bispectral Index, BIS) decreases in a dose-related fashion. Generally, free recall is lost at 70 and consciousness is lost at 60.² As the Index approaches 0, burst suppression becomes more prominent as electroencephalographic activity is lost.

We describe a patient in whom this monitor was used for titration of anesthetic agents for a tricuspid valve replacement, during which she had transient hypovolemic cardiac arrest. The BIS and hemodynamics were stored real-time into a laptop computer. This case report shows the potential value of BIS monitoring, not only for intraoperative drug titration, but also as a sign of return of cerebral function after an intraoperative threat to neurologic integrity. It was possible to track how the patient was responding to resuscitation.

Case Report

The patient was a 22-yr-old woman scheduled for tricuspid valve replacement. She had undergone closure of a ventricular septal defect

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