



Learning From Others:

Anesthesia
Quality Institute
ANESTHESIA INCIDENT
REPORTING SYSTEM (AIRS)

A Case Report From the Anesthesia Incident Reporting System

Detailed review of unusual cases is a cornerstone of anesthesiology education. Each month, the AQI-AIRS Steering Committee will abstract a case and provide a detailed discussion based on a submission to the national Anesthesia Incident Reporting System. Feedback regarding this item can be sent by email to r.dutton@asahq.org. Report incidents to www.aqiairs.org.

Case 2012-8: Blowing Bubbles

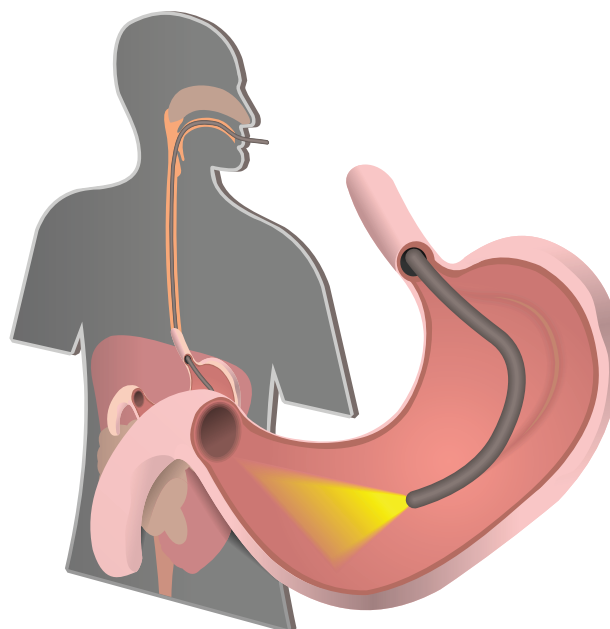
An 80-year-old woman presented for endoscopic retrograde cholangio-pancreatography (ERCP) for relief of gallstone pancreatitis. She had experienced one week of increasing abdominal pain, but no fever, chills or hemodynamic instability. General anesthesia was induced with propofol and lidocaine, and the trachea was intubated following administration of succinylcholine. The patient was turned semi-prone for the procedure. Blood pressure remained stable at 110/70 and HR at 75 for the next hour. During removal of gallstones, EtCO₂ dropped suddenly from 35 to 5 mmHg. Pulse oximeter perfusion index fell immediately from 9 to 0.2, and noninvasive blood pressure and carotid pulse were unobtainable.

The patient was immediately turned supine. CPR was initiated and epinephrine was administered. After two minutes of CPR, the patient was pulseless with a narrow complex electrical heart rate of 32. CPR was continued and further epinephrine and calcium chloride were given. Arterial and central venous access were obtained, and vasopressin and sodium bicarbonate were administered. Heart rate increased and perfusion gradually returned over the next 10 minutes.

Transesophageal echocardiography (TEE) demonstrated a small amount of residual air in the apex of the right ventricle. Subsequent abdominal CT scan showed air in the biliary tree as well. The patient was transferred to the intensive care unit and maintained on 100 percent oxygen for four hours. Sedation was reversed at 12 hours, emergence was uneventful, and the patient made a full neurologic recovery.

Discussion

Endoscopic surgery is increasing steadily in volume and complexity. Anesthesia team participation in routine endoscopy is controversial,¹ but value increases with sicker patients and longer and more technically challenging procedures. ERCP represents a particular challenge because of competition for the airway, patient position (usually prone or semi-prone), longer duration, and concomitant use of fluoroscopy. Endoscopy suites are usually small and more cluttered than traditional O.R.s and may be remotely located. Necessary anesthesia equipment is harder to find, and the endoscopists and nurses are not as familiar with anesthesia issues as surgeons and nurses in the O.R.



Review of cases submitted to AIRS in the past eight months reveals a disproportionately high number of incidents associated with less traditional operating environments, including the radiology and GI suites. Several events have been reported from ERCP cases, including difficulties with airway management, an unusual reaction to medication and three cardiac arrests. Venous air embolus was suspected in one other case and was certainly the cause of arrest in this patient.

Pressurized air is used during endoscopy to distend the GI tract and allow anatomic visualization. Instrumentation of the biliary tract and laceration of the duodenal mucosa during ERCP can create false passages, allowing air to move from the duodenum to the circulation. The incidence of asymptomatic air entrapment is unknown, but if too much air reaches the right ventricle a “vapor lock” can occur, leading to sudden and complete loss of cardiac output. Systemic or paradoxical embolization to the cerebral circulation can occur through a patent foramen ovale, through right-to-left shunts, or by a large enough embolus that air transits the pulmonary circulation more rapidly than it can be cleared. Cerebral air embolus may present with hypertension, decreased level of consciousness and focal neurologic symptoms even before circulatory deterioration.

Numerous case reports in the GI and anesthesia literature have described this phenomenon;^{2,5} PubMed search of “ERCP and air embolus” yields multiple hits, including the first report of a patient death, in 1997.² A 2009 review article collected 13 cases from the world literature.³ A subsequent review one year later increased this number to 19,⁴ and a paper dated May 2012 referenced 21 cases, suggesting that this is a rapidly emerging complication.⁵ Numerous fatalities have been reported, and outcome appears to be especially grim when cerebral embolization occurs.

Recommendations

Primary prevention of air embolus may not be possible, as the disruption of duodenal mucosa is happening at the microscopic level. Risk of air embolus is thought to be increased in patients who have had previous biliary procedures and in those with more extensive inflammation and scarring. Awareness of risk and vigilance for hemodynamic instability are recommended. Early detection of air entrapment might be possible with precordial Doppler technology, and use of carbon dioxide rather than air for distention might reduce the risk for symptomatic embolization. It is possible that positive pressure as opposed to spontaneous ventilation might also decrease risk, which would be an argument for general anesthesia in these patients.

Once symptoms of air embolus have been recognized, the ERCP should be immediately terminated. Hemodynamic support with fluids and pressors should be initiated. Specific recommendations for management include positioning the patient head down and turned to the left side (to trap remaining air in the apex of the right ventricle), aspirating air from the heart through a central catheter, and maintaining the patient on 100 percent oxygen to facilitate clearance of nitrogen bubbles. Hyperbaric oxygen therapy will shrink bubbles faster and may improve watershed perfusion of ischemic brain tissue, but hard evidence of benefit is lacking.

Conclusion

Advancing procedural technology can create new and unexpected risks for patients. This is especially true today with the increasing number and diversity of anesthetizing locations outside of the operating room. The range of procedures and patients in these areas is expanding rapidly and norms for monitoring, anesthesia type and patient selection are in the process of evolution. Vigilant monitoring, suspicion for risk, and the ability to rescue patients from distress are required for anesthesia practice in these new venues – maybe more so than in the main O.R.

References:

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3. Bisceglia M, Simeone A, Forlano R, Andriulli A, Pilotto A. Fatal systemic venous air embolism during endoscopic retrograde cholangiopancreatography. *Adv Anat Pathol*. 2009;16(4):255-262.
4. Finsterer J, Stollberger C, Bastovansky A. Cardiac and cerebral air embolism from endoscopic retrograde cholangiopancreatography. *Eur J Gastroenterol Hepatol*. 2010; 22(10):1157-1162.
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