Argon Gas Embolism During Pediatric Liver Resection: A Case Report

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Introduction

The argon beam coagulator (ABC) is often used for hemostasis during and after surgery on parenchymatous organs. In experienced hands, ABC is considered to be a relatively safe tool. However, “the possibility that the flow of argon gas onto bleeding tissue may cause venous gas embolism” is an important safety consideration (1). It is known that when ABC systems are used in closed cavities, such as in laparoscopic procedures, there is risk of argon gas embolism caused by intra-abdominal over-pressurization (2,3). Systemic gas embolism has been reported with ABC use during hepatic surgeries in the adult population, more often over-pressurization (2,3). Systemic gas embolism has been reported with ABC use during hepatic surgeries in the adult population, more often over-pressurization (2,3). Systemic gas embolism has been reported with ABC use during hepatic surgeries in the adult population, more often over-pressurization (2,3). Systemic gas embolism has been reported with ABC use during hepatic surgeries in the adult population, more often over-pressurization (2,3).

Case Report

A 20 month, 10.7kg, ASA III male with the diagnosis of hepatoblastoma was scheduled for liver resection.

PMH included a full term delivery, previously healthy male with liver carcinoma with pulmonary metastasis who had undergone recent chemotherapy.

Previous surgical procedures were limited to a liver biopsy and port placement at an outside hospital.

Patient was taken to the operating room and induced through a pre-existing subclavian port and his airway was secured via endotracheal tube without any difficulty. Additional intravenous access was obtained and a radial arterial line was placed.

At approximately 2.5 hours into the procedure, a sudden drop in end-tidal carbon dioxide and oxygen saturation were noted. The surgeons were notified and confirmed no apparent entry for air embolus and the event was quickly treated with 100% ventilation, fluid boluses and time. The hypoxia, hypotension, and drop in end-tidal carbon dioxide were consistent with an apparent embolism, most likely related to the ABC in use by the surgeons.

Objective:

- Air Embolism

- Call for help. Notify surgeon.
- Compress jugular veins
- Perform Valsalva on patient using hand ventilation
- Lower surgical site below level of heart (if possible)
- Check for open venous lines or air in tubing
- Flood wound with irrigation
- Stop source of air entry
- Left-side down once source controlled
- Close all pressurized gas sources (laparoscope, endoscope)
- Oxygen to 100%.
- To force air through lock, even if not in cardiac arrest
- Chest compressions: 100/min; to force air through lock, even if not in cardiac arrest
- Vasopressors (epinephrine, norepinephrine)
- Transesophageal echocardiography (if available and/or diagnosis unclear)

ABC is a mode of noncontact electrosurgical coagulation produced by a jet of inert argon gas encompassing an electrofulguration arc, which results in a fine spray of electrical current and uniform coagulation of tissue surfaces, clearing the field of pooled blood.

• Argon gas is 17 times less soluble than CO2 and is absorbed slowly from the bloodstream and for this reason argon-rich emboli may pass into the systemic circulation.
• The pediatric population also commonly have undiagnosed intracardiac communications, which can cause immediate gas bubbles in the left heart chambers.
• Important that pediatric anesthesia caregivers are aware of the potential life-threatening complications of ABC. Caution is necessary in the use of ABC during liver surgery and care should be taken to maintain the lowest possible gas flow rate.
• Intraoperative TEE monitoring may also be useful for early detection of argon gas embolism during hepatic liver resections, especially in the pediatric population.
• It is probably safer to avoid the use of nitrous oxide when the use of ABC is planned, as with any procedure with a high risk of venous gas embolism.
• Pediatric anesthesia caregivers need to be aware of this serious and life-threatening complication during pediatric hepatic surgery and be prepared to recognize and treat the complication if it occurs.

References