

Venous Air Embolism During Endoscopic Third Ventriculostomy

Abstract

Neuroendoscopic procedures are increasingly performed nowadays due to the significant technological improvement of endoscopic instrumentation. It carries various advantages such as speed, simplicity, avoidance of implants, and no brain dissection or retraction. Although considered to be safe, it is associated with a host of complications. We hereby report a case of venous air embolism in an infant who was undergoing endoscopic third ventriculostomy. The complication occurred at the completion of surgery when surgeons were withdrawing the endoscope. The successful management of this uncommon event is being discussed.

Keywords: Complications, neuroendoscopy, pediatric patient, venous air embolism

Introduction

The significant technological advancement of endoscopic instrumentation is causing increasing use of neuroendoscopic procedures in recent years.^[1] Endoscopic third ventriculostomy (ETV) is the most common neuroendoscopic procedure performed.^[2] Although considered to be safe and less invasive, a wide array of complications such as infection, hemorrhage, hemodynamic alterations, electrolyte disturbances, and hypothermia can still occur even in experienced hands. The complication rate in pediatric patients is 8.1%.^[3] We hereby report a case of venous air embolism (VAE) in an infant while undergoing ETV.

Case Report

An 8-month-old male infant weighing 8 kg was scheduled to undergo ETV for noncommunicating hydrocephalus. There was history of progressive increase in size of head. There were no signs of raised intracranial pressure. Perinatal and past history was nonsignificant. The hematological and biochemical investigations were within normal limits. After adequate fasting of 4 h for clear liquids, he was taken up for surgery. Atropine 400 mcg was given per orally 30 min prior to surgery. In the operating room, monitors (electrocardiograph, noninvasive blood pressure, and oxygen saturation) were attached, and induction

of anesthesia was done with sevoflurane in oxygen followed by injection fentanyl 15 mcg. Rocuronium 6 mg was administered to facilitate oral endotracheal intubation. Maintenance of anesthesia was done with 40% oxygen in nitrous oxide, sevoflurane, and fentanyl. ETV was done through burr hole in the right frontal bone. Normal saline was used as an irrigant, and its flow rate was continuously monitored. During removal of the endoscope, one of the bridging veins got torn. A sudden fall in EtCO₂ from 35 to 22 mmHg was noticed within few seconds of the removal of endoscope. Bleeding due to the sheared vein was controlled expeditiously, and the site was flushed with saline. The heart rate increased from 130 to 159 bpm, but the blood pressure was stable at 82/50 mmHg. Nitrous oxide was switched off, and the patient was ventilated with 100% oxygen. Surgeons were informed of the complication, and intravenous fluid boluses were administered. The patient remained hemodynamically stable and maintained oxygen saturation. However, EtCO₂ remained low for 12–15 min. After spontaneous respiratory efforts, neuromuscular blockade was reversed with atropine and neostigmine and trachea extubated. The patient was shifted to neurosurgical Intensive Care Unit and monitored closely for 24 h which was uneventful.

Discussion

VAE is not uncommon in neurosurgical patients but the incidences during ETV are

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few. Our patient exhibited sudden and sustained fall of 13 mmHg of EtCO₂, which persisted for around 15 min. All the probable causes of fall in end-tidal carbon dioxide were ruled out. Although bleeding occurred (estimated blood loss around 50 ml), but it was slight and did not lead to hypotension. We speculate various causes of VAE during ETV. First, in hydrocephalus, the veins are dilated and stretched, hence are more prone for injury by the endoscope. Second, the size of the head was quite big which caused the level of operative site slightly higher than the heart level unintentionally. Everyone inch rise in head decreases venous pressure by 2 mmHg and create a negative pressure gradient. It could have aggravated the chances of air embolism. Third, a small amount of air enters via burr hole and endoscope sheath and it might expand the use of nitrous oxide. Last but not the least, hypovolemia due to less fluid intake could have facilitated air entrapment.

VAE is a potential complication during surgery performed in sitting position. Pediatric and adult age groups are equally prone for it.^[4] In neuroendoscopy too, few incidences are reported in the literature. Fabregas *et al.* reported 4% incidence in their case series.^[5] Ganjoo *et al.* witnessed single episode of VAE in 298 patients who underwent neuroendoscopic procedures during 7-year period.^[6] Singh *et al.* also found single case of VAE of 223 patients who underwent neuroendoscopic surgery. It occurred while creating a burr hole and responded to conservative management.^[7] Kida *et al.* reported a case VAE in an adult patient while endoscopic manipulation and it lasted for 15 min and responded to conservative management.^[8]

While dealing with neuroendoscopic procedures, one should be aware of potential complications. Close monitoring and vigilance are of utmost importance for quick recognition

of the complications; efficient and timely management can avert the life-threatening risks.

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Conflicts of interest

There are no conflicts of interest.

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