Airway Management in Patients with Large Defects of the Anterior Skull Base: A Case Report and Literature Review

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ABSTRACT

Objectives: Tension pneumocephalus (TP) is a rare but serious complication that can occur after neurosurgery and other procedures involving the skull base. It can also be exacerbated during times of resuscitation. We describe a case where TP developed after mask induction prior to anterior skull base repair and propose alternative options for perioperative airway management.

Study Design: Case report and literature review.

Methods: The electronic record of a patient who developed TP after anterior skull base surgery was reviewed and the relevant aspects of the case are described. A search of Ovid and PubMed databases and a manual review of article bibliographies was completed.

Results: A female patient was noted to have pneumocephalus on postoperative day 2 following frontal bone resection of a metastatic breast tumor and frontal sinus cranialization. After failed conservative management, the patient was taken back to the operating room. On induction of anesthesia, positive pressure mask ventilation resulted in significant worsening of the pneumocephalus requiring emergent evacuation prior to the definitive surgical procedure. The patient ultimately did well postoperatively and recovered without any long-term neurological compromise.

Conclusion: Positive pressure mask ventilation can produce or worsen pneumocephalus in patients with defects of the anterior skull base. Alternative techniques such as rapid sequence induction or tracheostomy should be considered in these patients.

INTRODUCTION

- Anterior skull base surgery is a common cause of pneumocephalus, which occurs via a fistulous communication between the sinonasal cavity and the extradural or subdural space.
- Tension pneumocephalus (TP) is a space-occupying lesion that can lead to transtentorial herniation and severe neurologic disability or death.1
- Clinical signs of TP: headache, dizziness, behavioral changes, focal and global neurologic deficits, otorrhea or rhinorrhea
- Two well-known mechanisms for the development of TP: "Ball-valve": Increased pressure (due to sneezing, coughing, or mask ventilation) forces air past the fistulous covering and traps air intracranially.
- "Inverted bottle": Loss of CSF (due to lumbar drainage, otorrhea/rhinorrhea), loss of brain matter, and steroids and dehydration of brain matter to lower ICP lead to intracranial dead space that is replaced with air.
- Simple pneumocephalus can be managed conservatively, but TP requires surgical decompression.
- TP can be exacerbated during times of resuscitation with mask ventilation as illustrated in this case report.2-3
- Alternative methods for perioperative airway management should be considered in such cases.

METHODS AND MATERIALS

The electronic record of our patient was reviewed and the relevant aspects of the case are described. A search of Ovid and PubMed databases and a manual review of article bibliographies was completed.

DISCUSSION

- The rate of TP after anterior skull base surgery has been recorded to range from 1-7%.1
- TP has been reported following mask ventilation in a few cases2-4, and Gil, et al. (2003) described TP as a contraindication to such a maneuver.
- Airway diversion techniques, such as nasal packing and nasopharyngeal airway are commonly practiced in the prevention of TP.5
- Prolonged intubation and tracheostomy were previously thought to have aided in the prevention of TP, but Gil, et al. (2003) showed a similar complication rate of TP without use of such airway diversion techniques.
- Clevens, et al. (1999) reported 2 cases of TP that were relieved with tracheostomy.
- In our case, prophylactic tracheostomy may have been appropriate to ensure avoidance of upper airway pressure perioperatively.
- Rapid sequence intubation (RSI) could also be performed with negligible upper airway pressure. Preoxygenation may be done with high flow 100% oxygen or even a laryngeal mask airway (LMA) after induction with neuromuscular blocking agents.

CASE REPORT

- 34 y.o. female with metastatic breast cancer to the frontal bone underwent tumor resection by neurosurgery, requiring frontal sinus cranialization.
- Tumor extended intradurally, and the dura was replaced by suturable Duragen.
- Two contiguous sites of the frontal intersinus septum were obliterated and patched with fat. The cavity was filled with saline prior to close.
- POD #2 patient complained of headache and increased pain over her bicornal incision and had decreased level of consciousness.
- Repeat head CT showed TP with scalp and subarachnoid air (Fig. 1). Lumbar drain was clamped and high flow supplemental O2 via nasal cannula was started.
- Patient continued to have increased pneumocephalus requiring needle decompression.
- OTO-HNS was consulted for repair of a possible paranasal-intracranial communication.
- Prior to intubation, the patient received mask ventilation resulting in the development of a sizeable amount of subcutaneous scalp air and exacerbation of her TP.
- The TP was relieved with emergent removal of the staples and ligature of multiple galeal sutures from her prior incision.
- Patient was hemodynamically stable throughout.
- Sinonasal-intracranial communication was repaired transcranially and endoscopically (Fig. 2).
- Patient tolerated the procedure well and no long-term effects were noted on follow-up outpatient visit.

REFERENCES