Rev Bras Anestesiol. 2015;xxx(xx):xxx–xxx

REVISTA BRASILEIRA DE ANESTESIOLOGIA
Official Publication of the Brazilian Society of Anesthesiology
www.sba.com.br

CLINICAL INFORMATION

Intractable intraoperative brain herniation secondary to tension pneumocephalus: a rare life-threatening complication during drainage of subdural empyema

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Received 25 December 2014; accepted 28 January 2015

KEYWORDS
Intraoperative brain herniation;
Tension pneumocephalus;
Hydrogen peroxide;
Brain amputation

Abstract Tension pneumocephalus is rare but has been well documented following trauma and neurosurgical procedures. It is a surgical emergency as it can lead to neurological deterioration, brainstem herniation and death. Unlike previous cases where tension pneumocephalus developed postoperatively, we describe a case of intraoperative tension pneumocephalus leading to sudden, massive open brain herniation out of the craniotomy site. The possible causative factors are outlined. It is imperative to rapidly identify possible causes of acute intraoperative brain herniation, including tension pneumocephalus, and institute appropriate measures to minimize neurological damage.

PALAVRAS-CHAVE
Herniação cerebral no intraoperatório;
Pneumoencéfalo de tensão

Herniação cerebral intratável secundária a pneumoencéfalo de tensão no intraoperatório: uma complicação rara com risco para a vida durante a drenagem de empiema subdural

Resumo O pneumoencéfalo de tensão é raro, mas foi bem documentado após trauma e procedimentos neurocirúrgicos. Trata-se de uma emergência cirúrgica porque pode levar à deterioração neurológica, herniação do tronco cerebral e morte. Ao contrário de casos anteriores nos quais o pneumoencéfalo de tensão se desenvolveu no pós-operatório, descrevemos um caso de pneumoencéfalo de tensão desenvolvido no período intraoperatório levando a uma

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http://dx.doi.org/10.1016/j.bjane.2015.01.005

Please cite this article in press as: Foo LL, et al. Intractable intraoperative brain herniation secondary to tension pneumocephalus: a rare life-threatening complication during drainage of subdural empyema. Rev Bras Anestesiol. 2015. http://dx.doi.org/10.1016/j.bjane.2015.01.005

herniação cerebral súbita, maciça e aberta para fora do local da craniotomia. Os possíveis fatores causais são destacados. É imperativo identificar rapidamente as possíveis causas da herniação cerebral aguda no intraoperatório, incluindo o pneumoencéfalo de tensão, e instituir medidas apropriadas para minimizar os danos neurológicos.

Introduction

Tension pneumocephalus is rare but well documented, with studies showing an incidence of 2.5–16%[1] since it was first described in 1962. Most cases occur postoperatively and present with neurological deterioration. To our knowledge this is the first such case report of intraoperative tension pneumocephalus which presented with immediate consequences – massive brain herniation from the operative site. Anaesthetic and surgical considerations in the management of tension pneumocephalus and intraoperative brain herniation are outlined.

Case report

A 27 year-old female presented with right sided weakness and blurring of vision. CT scan showed a left parietal tumour and she underwent craniotomy and excision. She recovered well and was discharged with persistent right sided weakness.

Three weeks later, she presented again with wound breakdown and pus discharge from the craniotomy site. CT (Fig. 1) revealed a subdural empyema in both frontal regions measuring 1.3 cm in depth with post-surgical encephalomalacic changes in the left parasagittal region. She was posted for an emergency craniectomy and wound debridement.

Figure 1 Preoperative CT scan.

Pre-operatively, she was afebrile with GCS of 15/15. Her baseline blood pressure (BP) was 115/75 mmHg and heart rate was 105 beats per minute (bpm). In the operating theatre, under standard monitoring, induction of anaesthesia proceeded with intravenous fentanyl 2 mcg/kg and IV propofol 2.5 mg/kg. Muscle paralysis was achieved with IV rocuronium 1 mg/kg. Her airway was secured with a size 7.5 cm cuffed PVC endotracheal tube and she was positioned supine with her head on a horseshoe headrest. We maintained general anaesthesia with Sevoflurane in oxygen: air (FiO_2 of 0.5).

Her previous incision wound over the frontal area was opened and bone flap removed. Slough and pus discharge was noted on the brain surface. The wound was debrided and then irrigated with approximately 10 mL of 3% hydrogen peroxide mixed with normal saline in a bulb syringe. Upon completion of irrigation, profound brain herniation occurred through the operative site. It happened acutely and wound closure was impossible. There was no obvious bleeding seen.

Physiological parameters prior to herniation were all within normal range (BP: 100/50 mmHg; HR: 95–115 bpm, saturation: 99–100%, end tidal CO_2: 33–36 mmHg). Minimum Alveolar Concentration had been maintained at 0.9. She had been given intermittent boluses of rocuronium for muscle relaxation. Analgesia was achieved with intravenous morphine 4 mg and an IV alfentanil 1 mg bolus was given during the incident. During acute brain herniation, transient hypotension and tachycardia were observed which resolved with a fluid bolus.

Immediate measures to decrease brain bulk included hyperventilation to decrease the $PaCO_2$ to 30–35 mmHg and administration of intravenous mannitol (0.5 g/kg). IV phenytoin 1 g was given for seizure prophylaxis. The head position was checked to ensure the neck veins were not compressed. However, the brain herniation persisted. The surgeon then proceeded with amputation of the herniated brain for decompression and closure.

An urgent CT brain post-operation showed left parietal brain herniation and cerebral oedema of herniated brain and part of the left parietal lobe. Extensive subdural pneumocephalus was seen in both frontal regions (Fig. 2). A new subdural collection was also noted in the left parieto-temporo-occipital region.

She was cerebral protected post-operatively and another wound debridement and burr hole was done two days later for persistent discharge and the presence of extensive subdural pneumocephalus from CT scan.

Despite the profound intraoperative open brain herniation and brain amputation, the patient had a reasonably good neurological outcome with expressive aphasia.

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