Scavenging system obstruction: A cause of raised PEEP during a magnetic resonance-guided neurosurgical procedure

Obstrucción en el sistema de drenaje: una causa de aumento en la PEEP en Neurocirugía guiada por Resonancia Magnética

Dear Director,

A 48-year-old man was scheduled for a temporal lobe tumor resection. The use of intraoperative magnetic resonance imaging (MRI) was required, needing special equipment including the anesthetic machine (Aestiva 5 MRI, Datex-Ohmeda, GE Healthcare, Madison, USA). After a total intravenous anesthesia induction and orotracheal intubation the patient was ventilated with volume control modality (tidal volume 550 mL, respiratory rate 12, PEEP 6 and 1:2 inspiration/expiration ratio) ensuring normocapnia and normoxegenation controlled by arterial blood gas. Before opening the dura mater, the PEEP level suddenly rose up to 10 cm H₂O (980.6 Pa), with an increase in both peak and mean airway pressures (Fig. 1, left). Simultaneously an increase of brain tension was observed in the surgical field.

We ruled out a respiratory or endotracheal tube malfunction because there was a lack of abnormalities in pulmonary auscultation, capnography, pulse oximetry or hemodynamics. Our main suspect at that moment was a dysfunction in the anesthetic station. We excluded an inspiratory or expiratory valve malfunction because of the absence of rebreathing and other abnormalities in the shape of the capnography curve. Decreasing the fresh gas flow from 6 to 3 L min⁻¹ and changing to manual ventilation solved the air trapping. After checking all the connections between the patient and the machine and a correct aspiration from the central system, we observed a partial obstruction in one of the holes of the AGSS tube close to the anesthetic machine. The disconnection of the tube solved the problem (Fig. 1, right), confirming our hypothesis of an incident with the scavenging system.

The brain tension was relieved and a successful tumor resection performed. The patient was extubated in the operation room and discharged home 5 days after the surgery without neurologic sequelae.

All anesthetic machines require a security system to allow a proper scavenging system. In Aestiva 5 MRI machine the security system for avoiding an over-pressure consists on two orifices in the AGSS tube to make sure that a proper gas aspiration happens. In this case the combination of a relative high fresh gas flow and a damaged AGSS tube may have played a role in the critical incident.

Figure 1  Airway pressure curves and anesthetic gas scavenging system (AGSS) of the anesthetic machine for magnetic resonance imaging. A rise in PEEP level with the AGSS connected to the anesthetic machine (left) and a decrease to baseline after disconnecting the tube (right).
An erroneous use and a failure of the system are the two main reasons of incidences with anesthetic machine, being a lack of familiarity to the system and connections accidents some examples. In this specific case, the Aestiva 5 MRI anesthetic machine just allows manual test as part of the checking, being unable to detect problems due to a damaged AGSS. Anesthesiologists, used to high-standard-anesthetics stations, should be especially aware of non-automatic self-test anesthetic devices such as those designed for anesthesia delivery in the MRI environment.

Anesthesia for MRI is a high risk procedure representing a challenge for the anesthesiologist. Several issues have to be considered, such as the use of a specific anesthetic machine, standard monitoring, and trained personnel to guarantee the maximum patient safety. In this case, an early diagnosis and treatment of increased PEEP due to malfunction of the AGSS prevented potential serious complications.

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Bibliografía


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