Anesthetic challenges during neurosurgical procedures using Intraoperative Magnetic Resonance Imaging Systems (IMRIS), literature review and case report.

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Case Description

Induction of anesthesia took place in an induction room separate from the OR. After standard induction of anesthesia the patient was successfully intubated. Two peripheral IV’s, an arterial line, and a foley catheter were placed. The patient was moved to an MRI compatible bed and into the OR.

The patient was placed in the prone position and her head was pinned and positioned to a head holder already attached to the surgical bed, to assure immobility. This proved to be a challenge since pinning was performed when the patient was already in the prone position and the head holder differs from the Mayfield head holder used in a regular OR.

Anesthesia maintenance consisted of isoflurane and rocuronium and remifentanil infusions. The site was opened and tumor located. The IMRIS, a Siemens Espree MRI (1.5 Tesla of power) model was used to verify tumor location and size three times. Before each scan equipment counts were taken and the patient was wrapped in a sterile protective covering.

The surgery was completed without complications and the patient was returned to supine position. After emergence the patient was transferred to the post-anesthetic care unit in stable condition and discharged four days later.

Discussion

IMRIS generates high resolution images of the brain, increasing the extent of resection of gliomas. The use of IMRIS allows immediate detection of brain shifts and location of brain lesions, reducing operative and recovery time and risks as well as the need for repeat surgery. Despite these surgical advantages, the special OR bed set up and the presence of an electromagnetic field associated with IMRIS can complicate anesthetic management.

In IMRIS the patient must be moved to the prone position prior to the head pinning because the head holder is already attached to the surgical bed for convenience. The fixation device in IMRIS differs from that in a typical OR because it is limited to angular, as opposed to lateral displacement (see figures 1 and 2). This complicates airway management of the patient for the anesthesia provider and places the patient at risk for eye injury.

The presence of a magnetic field requires special safety and equipment considerations by the anesthesiologist. Magnetic objects within the electromagnetic field will be attracted to the magnet at high speeds, potentially injuring the patient and equipment. Metal electrocardiogram (ECG) leads and non-MRI compatible pulse oximeters and wires may overheat with exposure to the scanner, placing the patient at risk for severe thermal injury. The scanner and protective covering prevent patient access during the scan. If an airway complication such as extubation occurs it takes 20-30 seconds to remove the MRI scanner and plastic covers and gain access to the patient airway. It should be noted that in the case of an emergency situation the doors to the surgical suite can be unlocked only after the MRI has been fully removed and secured in the storage bay, a process that takes at least 90 seconds.

The electromagnetic field can produce monitoring interference to pulse oximetry and ECG tracing. Patient temperature cannot be monitored during the scan.

Safe and uncomplicated anesthetic management of a patient in the prone position during an IMRIS case is very feasible with comprehensive training of the anesthesiologists and proper equipment management and selection.

By visualizing and evaluating target tissues throughout the operation, the surgeon can make more informed decisions about procedure course based on patient condition.

This case study details the anesthetic management of a patient undergoing a craniotomy in the prone position using IMRIS, followed by a description of the most common and critical potential anesthetic complications.

The patient was a 30-year-old woman diagnosed with a recurrent left parietal glioma. The operation taking place was a repeat left parietal craniotomy for near-total resection of the brain tumor using IMRIS.