ANAESTHESIA FOR INTRAOPERATIVE MRI

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Why?
Surgical Accuracy
• Real time feedback
• Accounts for brain shift and changes in anatomy
• Optimizes removal of lesion
• Identifies complications early
• Reduces likelihood of further surgery
• Reduces length of hospital stay?
Factors contributing to “Brain Shift”

• Anaesthesia
• Positioning
• Hydration
• Opening the cranium
• Lesion resection
What?

- Low grade glioma
- Transphenoidal hypophysectomy
- Epilepsy surgery
The Royal Prince Alfred Hospital Experience 20/9/2007 – 30/6/2013

- Tumour resection 149
- Transphenoidal hypophysectomy 97
- Redo tumour resection 33
- Temporal lobectomy (epilepsy surgery) 13
- Redo transphenoidal hypophysectomy 2
- Third ventricle colloid cyst 2
- Syrinx 2
- Corpus callostomy (epilepsy surgery) 2
- Abscess 1
- Transoral resection of odontoid process 1
- Insertion of Rickham reservoir 1
The Setup Options

• Dedicated MRI theatre within existing operating suite
• Dedicated MRI theatre remote to operating suite
• MRI scanner adjacent to standard operating theatre
• MRI scanner remote to operating suite
• Portable MRI scanner
Dedicated MRI theatre
Polestar portable MRI scanner
The Dedicated MRI Theatre within the Existing Operating Suite

- 1.5 Tesla
- Very expensive
- No ferrous objects may enter the MRI theatre
- Staff and patient safety issues
- Can not be offered to all patients
- Must have adjacent “standard” anaesthetic room for patient preparation and induction
- Limits anaesthetic equipment options
- Forces adaptation of standard anaesthetic equipment
- Makes management of intraoperative emergencies difficult
- Titanium operating instruments
- Excellent image quality
Portable MRI Scanner – “Polestar”

• 0.5 Tesla
• Cheaper option
• Minimises staff and patient safety issues
• Can be offered to all patients?
• Patient preparation and induction may be done in the operating room
• No (or minimal) adaptation of anaesthetic equipment required
• Easier to manage an intraoperative emergency
• Normal operating instruments maybe used
• Poor intraoperative MRI images/limited modes
Screening and Education – Patients and Staff

• Checklists
• Restricted access
• Ferromagnetic devices
• Ferrous implants
  – Pacemakers and defibrillators
  – Clips
  – Foreign bodies
Screening and Education – patients and Staff
The Preanaesthetic Consultation

- Ferrous implants
- ECG monitoring
- Gadolinium Dimeglumine
- Body habitus – 200kg
The Preanaesthetic Consultation
Preparation, Equipment and Monitoring

- Cables, intravenous lines, arterial lines and airway tubing needs to be of adequate length.
Preparation, Equipment and Monitoring
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• Coiling must not occur
Preparation, Equipment and Monitoring

• Cables, intravenous lines, arterial lines and airway tubing needs to be of an adequate length.
• Coiling must not occur.
• Skin to skin contact must be avoided with adequate insulation.
Preparation, Equipment and Monitoring

• Cables, intravenous lines, arterial lines and airway tubing needs to be an adequate length
• Coiling must not occur
• Skin to skin contact must be avoided with adequate insulation
• Ear plugs
Checklist Before Entering OT-16

1. Ear plugs
2. Arms insulated from body
3. No metal objects in sheets
4. Monitoring leads
   a. Not looped
   b. Separated from patient
5. No ferromagnetic items
   a. Anaesthetic machine draw
   b. Anaesthetic machine top, IV pole, etc
   c. Drug trolley draws
Preparation, Equipment and Monitoring

• MRI safe – device is completely non-magnetic, non-electrically conductive and non-resonance frequency reactive
• MRI conditional – device may contain magnetic, electrically conductive or resonance frequency reactive components, but may operate safely in proximity to an MRI
• MRI unsafe
Preparation, Equipment and Monitoring
Preparation, Equipment and Monitoring

- Ventilators and anaesthetic machines
- IV poles
- Gas cylinders
- Laryngoscopes
- Endotracheal tubes
- Physiological monitors
ECG

- Unreliable due to distortion
- Mimics hyperkalaemia +/- ischaemia
- Non-ferrous electrodes
- Carbon fibre leads
- Place limb leads close together
- Position the line between the limb and leg electrodes parallel to the magnetic field flux lines
- Maintain a small area between electrodes
- Twist or braid the ECG leads
- Position the electrodes near the centre of the MRI
- Insulate the leads from the patient’s skin
Other

• Pulse oximetry – fibreoptic
• Non-invasive blood pressure
• Invasive blood pressure
• Peripheral nerve stimulation
• Temperature – fluoroptic
Emergencies

- Develop – define activities and use of equipment
- Implement
- Practice