Preoperative evaluation of neurosurgical patients

Smita Bapat

Astri MV Luoma

Abstract

Neurosurgery encompasses a wide range of established intracranial and spinal procedures as well as rapidly advancing techniques in areas such as functional neurosurgery, interventional radiology and magnetic resonance imaging (MRI). This article focuses on the required preoperative preparation of neurosurgical patients. Intracranial and spinal surgery are associated with significant morbidity (23.6% and 11.2%, respectively), with overall 30-day mortality around 0.4–2.3% for intracranial surgery. Preoperative assessment must consider the surgical procedure being undertaken, pathology and its presentation, as well as patient-related factors that can be optimized prior to surgery. It also allows preoperative risk stratification and shared decision-making, informed consent and appropriate planning of perioperative care. Careful documentation of preoperative neurological status is essential for postoperative assessment and management. A thorough understanding of the impact of surgery and anaesthesia on intracranial physiology is also required. This ensures high quality, safe care and excellent patient experience.

Keywords Craniotomy; functional neurosurgery; neurosurgical patients; neurovascular surgery; pituitary surgery; preoperative assessment; raised intracranial pressure; spinal surgery

Royal College of Anaesthetists CPD Matrix: 1F01, 2A03, 2F01, 3F00

Learning objectives

After reading this article, you should be able to:

- identify the signs and symptoms of raised intracranial pressure preoperatively
- assess and optimize the risks associated with the surgical procedure and underlying pathology
- plan appropriate perioperative care for these patients

Neurosurgery encompasses a wide range of established intracranial and spinal procedures as well as rapidly advancing techniques in areas such as functional neurosurgery, interventional radiology and magnetic resonance imaging. In the UK, approximately 80,000 neurosurgical procedures are performed per year. This article focuses on the required preoperative preparation of neurosurgical patients. Discussion of specific pathology or surgical processes is beyond the scope of this article.

Both intracranial and spinal surgery are associated with significant morbidity (23.6% and 11.2% respectively), with overall estimated 30-day mortality risk around 0.4% increasing to 2.3% for intracranial surgery. A thorough understanding of the impact of surgery and anaesthesia on intracranial physiology is required. Preoperative assessment must consider the neurosurgical procedure being undertaken, the pathology and its presentation, as well as patient related factors that can be optimized prior to surgery. A difficult airway is encountered more frequently in these patients, which necessitates comprehensive examination and planning of airway management. Careful documentation of preoperative neurological status is essential for postoperative assessment and management.

Smita Bapat *MB ChB FRCA is a Locum Consultant Neuroanaesthetist at the National Hospital for Neurology and Neurosurgery, London, UK. Conflicts of interest: none.*

Astri M V Luoma *MB ChB FRCA is a Consultant Neuroanaesthetist at the National Hospital for Neurology and Neurosurgery, London, UK. Conflicts of interest: none.*

Preoperative assessment

For elective neurosurgical patients, this should follow a multidisciplinary process prior to admission and include planning of postoperative rehabilitation and social needs.

Preoperative assessment should follow the standard anaesthetic format as recommended by both the Association of Anaesthetists of Great Britain and Ireland (AAGBI) and Royal College of Anaesthetists (RCoA), with particular focus on:

History: focus must be on the presenting neurosurgical complaint and current medications. Obtaining an accurate history may prove challenging; patient presentation ranges from fully alert and orientated to comatose. A collateral history can be obtained from the family, carers, referring hospital or medical notes. The type and location of any lesion along with presenting signs and symptoms should be noted, in particular any features of raised intracranial pressure (see Box 1) or focal neurology. Comorbidities should also be considered (e.g. sodium imbalance, hypertension or hyperglycaemia). National guidelines for management of elderly and obese patients should be followed where indicated.

Examination: a complete neurological assessment must be documented preoperatively including the Glasgow Coma Scale (GCS), examination of the peripheral and central nervous system, and pupillary size and reactivity. The GCS, and importantly its components, is a useful tool for evaluating the patient's gross neurological status and may indicate the urgency of surgery. A rapid decline in GCS suggests progression of the underlying neurological condition or a new cerebral event and may warrant new or further investigations. In certain circumstances, e.g. traumatic brain injury (TBI), a GCS of 8 or less is an indication for urgent airway management. Intubation and mechanical ventilation protects against aspiration of gastric contents and allows control of ventilation helping to prevent secondary brain injury. Further examination should be systems-based; cardiorespiratory compromise is not uncommon in the acute patient or those presenting for pituitary or spinal surgery.

A careful assessment of the patient's airway should be carried out to allow appropriate planning, in particular for those presenting for cervical spine surgery. Underlying medical conditions

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Features of raised ICP

Signs and symptoms of raised ICP

- Headache
- Vomiting
- Papilloedema
- Unilateral/bilateral papillary dilatation
- Cranial nerve II or VI palsy
- Drowsiness/loss of consciousness
- Absent brainstem reflexes
- Abnormal respiration
- Arterial hypertension
- Bradycardia

Radiological signs indicating raised ICP

CT/MRI scans

- Mass
- Hydrocephalus
- Cerebral oedema
- Midline shift
- Obliteration of cerebrospinal fluid cisterns
- Effacement of ventricles and cortical sulci

Box 1

such as ankylosing spondylitis and rheumatoid arthritis are associated with increased difficulty with tracheal intubation. Findings and a perioperative plan must be clearly documented.

Stability of the patient's cervical spine should be noted, and the impact of airway management on the spinal cord assessed. It is useful to seek a neurosurgical opinion and review available neuroradiological imaging.

Investigations

Preoperative testing should follow national guidelines and be directed by surgical procedure, clinical status and co-morbidities. All patients undergoing surgery in the 'sitting position' require a bubble echocardiogram to exclude a patent foramen ovale.

Neuroradiological imaging should be reviewed; this will provide information on location, size, vascularity and proximity of the lesion to vital structures. Any potential difficulty with the airway may also be assessed, along with spinal cord compression.

Co-morbidities and drug therapy in neurosurgery

Multiple co-morbidity is common and should be managed according to existing guidelines with referral to the appropriate medical team for further optimization when indicated.

Cardiovascular disease

Hypertension: hypertension is common in the elderly and baseline blood pressure should be noted. The cerebral vascular autoregulation curve shifts to the right in hypertension and a higher intraoperative blood pressure may be required to maintain cerebral [and other organ] perfusion. The patient may also be intentionally hypertensed in an emergency, e.g. TBI or delayed cerebral ischaemia (DCI) to ensure maintenance of cerebral perfusion. Parameters should be noted. The AAGBI and British Hypertension Society have just published joint guidelines on preoperative management of hypertension in elective surgery.

Antihypertensives – Angiotensin converting enzyme inhibitors (ACEIs) or angiotensin II receptor blockers (ARBs) administered on the day of surgery are associated with more frequent episodes of intraoperative hypotension. However, there is no difference in other outcomes including MI, stroke, renal failure or death, and it is suggested that continuation of these drugs is reasonable. A decision to discontinue antihypertensives preoperatively should be balanced with the risks associated with postoperative hypertension in the neurosurgical patient.

Cardiomyopathy: cardiomyopathy may occur in isolation or as a systemic manifestation of several neurosurgical disease processes, e.g. subarachnoid haemorrhage, acromegaly or Cushing's disease.

Antiplatelet and anticoagulant drugs: use of antiplatelet and target specific oral anticoagulants is increasing for conditions such as atrial fibrillation (AF), coronary stents or stroke. Optimal perioperative management must balance the risk of a thrombotic event and the risk of haemorrhage associated with the procedure. Bridging therapy with unfractionated or low molecular weight heparin may be appropriate in patients at moderate or high risk of thrombosis but should only be initiated following discussion with neurosurgeons, cardiologists and haematologists. CHA_2DS_2-VASc scores are used to determine the risk of thrombosis in AF. Planning should include the timing of re-anticoagulation.

There may be a need to reverse the effects of antiplatelet agents and anticoagulants in emergency surgery. Knowledge of the last known dose and time of administration is required, and it is advisable to seek haematological guidance and follow local guidelines.

Glycaemic control

Hyperglycaemia is common and may coexist in the neurosurgical population as a consequence of corticosteroid therapy or brain injury. A recent retrospective study demonstrated that patients with preoperative hyperglycaemia have greater complication and mortality rates, and an increased length of hospital stay.[1] Episodes of hypoglycaemia must also be avoided. Diabetic control should be optimized (aiming HbA1c of <69 mmol/L) preoperatively to improve patient outcome. In those undergoing emergency surgery, a blood glucose target of 6–10 mmol/L is recommended.

Fluid and electrolyte disturbances

Neurosurgical patients are at high risk of developing fluid and electrolyte disturbances. Reasons include a decreased conscious level, vomiting, bulbar dysfunction, poor oral intake, drug therapy and hormonal imbalance. Hyperosmolar therapy (mannitol or hypertonic saline) may also be administered to control a raised ICP in emergencies with resultant fluid and electrolyte abnormalities.

The central nervous system plays a major role in sodium and water homoeostasis and so disturbances are common following brain injury (see Table 1). Patients who have previously undergone pituitary surgery may have chronic diabetes insipidus.

Polypharmacy as well as multiple co-morbidities also contribute, and hyponatraemia may be a marker of increased surgical risk.

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