Anaesthesia for excision of vestibular schwannomas

BY NINA HJELDE AND JOE SEBASTIAN

The 'shared airway' relationship between ENT surgeons and anaesthetists is well documented. But ENT surgery and anaesthesia interact in numerous other ways, particularly in complex skull base surgery. What do our anaesthetic colleagues want us to know about vestibular schwannoma excision from the other side of the operating room? **Nina Hjelde** and **Joe Sebastian** offer their wisdom on anaesthetic perspectives of this complex skull base operation.

Preoperative assessment

Typically, vestibular schwannoma patients will be in their fourth decade, some substantially older, with comorbidities expected of their age group. A small minority of patients are those with neurofibromatosis type 2; a multisystemic disease strongly associated with bilateral vestibular schwannomas. Key anaesthetic concerns include pulmonary fibrosis, cardiomyopathies, renal artery stenosis, phaechromocytomas and previous neurosurgery.

Larger tumours of the cerebellopontine angle can occasionally affect the lower cranial nerves, resulting in a compromised gag reflex and risk subsequent aspiration pneumonitis. Obstruction of the fourth ventricle outflow can lead to hydrocephalus with fluctuations in consciousness. Urgent swallow assessment and placement of a nasogastric tube may be required.

Intraoperative considerations

Neuroanaesthesia

Surgery often involves a joint procedure between ENT and neurosurgical skull base teams. Anaesthetic priorities in neurosurgery focus on optimising intracranial physiology to maximise oxygen delivery whilst reducing bleeding, brain oedema and unique complications such as venous air embolism. The concept of 'hypotensive anaesthesia' is often followed in ENT surgery as an aid to minimising bleeding, yet this is sometimes contradictory to the neurosurgical requirements which desire maintenance of adequate cerebral perfusion pressure. Monitoring such as arterial lines are multifunctional in order to optimise ventilatory parameters (such as avoidance of hypercarbia which causes cerebral vasodilation), to allow continuous BP monitoring and to avoid the skin pressure effects of a BP cuff continuously inflating/deflating.

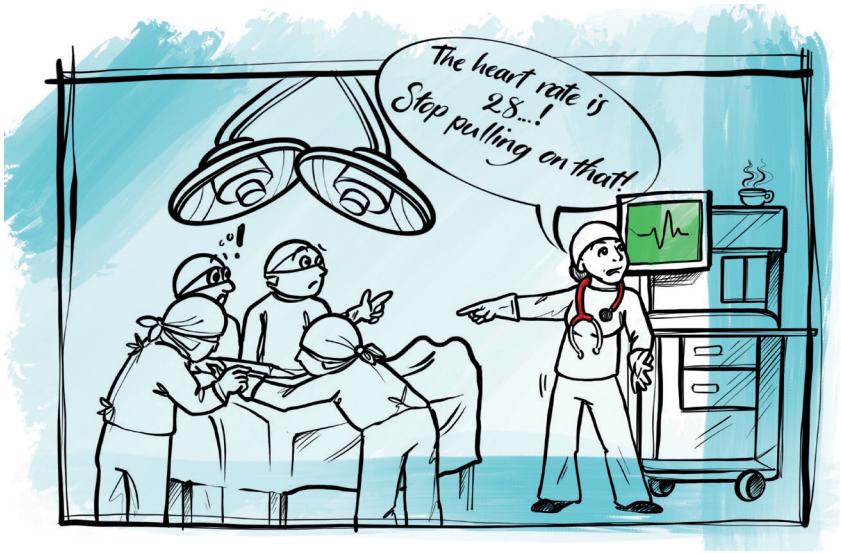

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Figure 1: The trigeminocardiac reflex can trigger sudden and overwhelming autonomic activity leading to dangerous arrhythmias.

Figure 1 illustrates that surgical stimulation around the brainstem (especially involving the trigeminal nerve root) can cause cardiovascular instability; typically, hypertension with bradycardia. Immediate cessation of surgical manipulation usually prevents dangerous bradycardias, or progression to asystole. Occasionally use of antimuscarinic agents such as glycopyrrolate or atropine are required. The former is often preferred as glycopyrrolate has a lower blood-brain-barrier penetrance, avoiding the adverse features of central cholinergic syndrome.

Issues related to prolonged surgery

Emphasis should be made on venous thrombo-embolism (VTE) prophylaxis and temperature control. Patients should be treated as high risk for VTE with mechanical prophylaxis and pharmacological agents, the latter started after a minimum of 24 hours. Inadvertent perioperative

BOX 1: KEY ISSUES TO HIGHLIGHT TO THE ANAESTHETIST:

- Bleeding risk and blood product requirements
- Postop ventilatory and aspiration concerns related to neurological state
- Degree of brainstem involvement with likelihood of CVS instability
- Nerve monitoring requirements (alters timing and choice of muscle relaxant)
- Positioning

"Inadvertent perioperative hypothermia is associated with significant adverse outcomes such as increased surgical site infection, increased risk of cardiac events and coagulopathy"

hypothermia is associated with significant adverse outcomes such as increased surgical site infection, increased risk of cardiac events and coagulopathy. In our experience however, these patients can tend towards hyperthermia so temperature should be closely monitored, and appropriate body-warming deployed. Accurate input/output is essential to prevent fluid overload which is recognised to be associated with adverse medical and surgical outcomes. Consent should include a urinary catheter.

Positions include park-bench (for the retrosigmoid approach typically performed by the neurosurgical team) or supine (for the trans-labyrinthine approach which tends to be a joint procedure). Pressure areas must be actively sought out and well-padded, especially in patients with a low BMI. Our centre utilises special pressure-relieving mattresses.

For park-bench positioning, the head is often pinned in place with the Mayfield clamp by the neurosurgeons. This must be communicated to the anaesthetist as it is a stimulating aspect of the operation. A bolus of sedation or analgesia is needed to avoid hypertensive spikes, and head support is required.

Choice of anaesthetic agents

Choice of anaesthetic in neurosurgical cases is dictated by the need for prompt postoperative assessment of neurological function in the face of prolonged anaesthetic drug exposure. We prioritise use of drugs with fast off-set to facilitate this. Our centre typically chooses a combination of gas and remifentanil infusion to keep the patient asleep. Desflurane is chosen due to a lower fat tissue solubility resulting in less build up in fat tissues during prolonged surgery (especially important in the obese) with a faster and smoother wake-up.

Minimising use of muscle relaxants is advantageous to allow early and accurate facial nerve monitoring. Relaxants are used in a small dose at induction to create optimal intubating conditions but continued perioperative tube tolerance can be facilitated by the use of opiates. Remifentanil is a strong opiate which is broken down quickly in the plasma with negligible systemic absorption, giving it a fast onset/offset time. These properties make it ideal for uptitration during stimulating periods (eg. bone cutting) to fend off adverse cardiovascular events. Ensuring smooth extubation with minimal coughing and straining forms the cornerstone of neuroanaesthesia as we strive to minimise haemorrhage risk.

Postoperative care

Close monitoring of neurological status is required as the risk of deterioration is highest during the immediate six hours following intracranial surgery. Postoperative nausea and vomiting (PONV) may be triggered by vestibular manipulation; to boost our usual agents, our strategy is to apply hyoscine patches preoperatively with regular anti-emetics postoperatively. In our centre, preoperative courses of intratympanic gentamicin are a standard therapy which significantly shorten the postoperative recovery period due to a reduction in PONV and dizziness.

Oral analgesics tend to be sufficient although non-steroidal anti-inflammatories should be avoided for the first 24 hours due to anti-platelet effects. Infiltration of local anaesthetic is not advisable due to potential anaesthesia of the brain stem and cranial nerves. Should a fat graft have been harvested intraoperatively, it is our centre's experience that the area should be well infiltrated with local anaesthetic with insertion of a wound drain as the pressure effects from subsequent haematoma formation have been associated with severe pain.

In conclusion

The anaesthetic management of these complex cases involved meticulous attention to detail, including safe positioning, understanding neuroanaesthesia principles and appreciating the need to facilitate prompt postoperative assessment of neurological function.

FURTHER READING

Riley C, Andrzejowski J. Inadvertent perioperative hypothermia. *Bja Educ* 2018;**18(8)**:227-33.

Kelly KP, Janssens MC, Ross J, Horn EH. Controversy of non-steroidal anti-inflammatory drugs and intracranial surgery: Et ne nos inducas in tentationem? *Br J Anaesth* 2011;**107**:302-5.

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AUTHORS

Nina Hjelde,

ST4 Anaesthetic trainee, Salford Royal NHS Foundation Trust, Manchester, UK.

Joseph Sebastian, BSc MBBS MRCP FRCA,

Consultant Neuroanaesthetist, Salford Royal NHS Foundation Trust, Manchester, UK.

Twitter: @neuro_gasman

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