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Case Report

Anaesthetic management of occipitocervical stabilization and C1–C3 decompression in a patient with intradural cervical tumor and prior stroke: A case report

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Abstract

Upper cervical spinal surgeries pose significant anaesthetic challenges due to proximity to the brainstem, potential for spinal cord compromise, and the need for advanced airway management. These challenges are further compounded in patients with underlying neurological or pulmonary comorbidities. We report the anaesthetic management of a 64-year-old male with a history of cerebrovascular accident (CVA), chronic smoking, and newly diagnosed hypertension, who presented with a C1–C3 intradural spinal tumor and underwent occipitocervical stabilization and decompression. This case emphasizes key considerations including airway assessment, respiratory optimization, hemodynamic stability, intraoperative neuromonitoring, and perioperative temperature and fluid management. Total intravenous anaesthesia (TIVA) with propofol and dexmedetomidine enabled reliable motor and somatosensory evoked potential monitoring. A multidisciplinary approach, along with meticulous intraoperative repositioning from prone to lateral, was critical to minimize the risk of neurological and airway complications.

Keywords: Intradural cervical spinal tumor, Occipitocervical stabilization, C1–C3 decompression, Difficult airway management, Anaesthesia for neuromonitoring, Total intravenous anaesthesia (TIVA).

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1. Introduction

Tumors at the craniocervical junction, particularly those affecting the C1–C3 spinal levels, are rare but clinically significant due to the high density of neurovascular structures in the region. Anaesthetic management of patients undergoing surgery in this area requires careful consideration of airway control, positioning, and the potential for neurological deterioration. These tumors can compress the spinal cord and brainstem, leading to complex perioperative challenges, especially in maintaining spinal cord perfusion and avoiding secondary injury during airway manipulation and surgical positioning.[1,2] Additional complexity arises in patients with previous cerebrovascular events and compromised pulmonary reserve, where the risk of perioperative stroke and respiratory failure is heightened.[3,4] This case report presents a multidisciplinary anaesthetic approach to managing such a patient scheduled for occipitocervical stabilization and decompression of a suspected intradural tumor compressing the cervical spinal cord.

2. Case Presentation

A 64-year-old male with a known history of CVA 16 years ago presented with progressive neck pain, mild left-sided limb weakness, and recent onset of heaviness in voice over the preceding week. The patient had a residual left-sided angle of mouth deviation from the prior stroke but no facial weakness. Neurological examination revealed motor power of 0/5 in the left upper limb, 3/5 in the right upper limb, and 4/5 in both lower limbs, along with brisk deep tendon reflexes and hypoesthesia. His respiratory effort was suboptimal, with a single breath count of seven and breath-holding time of

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twelve seconds. The patient was a chronic smoker and had recently been diagnosed with hypertension, for which he was on tablet Olmesartan 20 mg once daily.

On airway examination, the patient had adequate mouth opening, a Mallampati classification of Class III, restricted neck extension, a thyromental distance greater than 6.5 cm, and no missing teeth or dentures. Pulmonary function testing revealed moderate irreversible obstructive airway disease with a component of restriction. Arterial blood gas analysis was within normal limits. Transthoracic echocardiography showed a normal ejection fraction of 60% with no regional wall motion abnormalities. Preoperative optimization included the use of incentive spirometry to improve pulmonary reserve and reduce the risk of postoperative atelectasis. Respiratory clearance was obtained, and the patient was deemed fit for surgery from a pulmonary perspective. The patient had abstained from smoking for two weeks preoperatively.

Cervical spine MRI revealed a C1–C3 ventrolateral lesion, isointense on T1-weighted imaging, hyperintense on T2-weighted imaging, and contrast-enhancing, causing posterior spinal cord displacement (**Figure 1**). Differential diagnoses included hemangioblastoma and schwannoma. Preoperative embolization was attempted but abandoned due to unidentifiable feeding vessels. CT angiography showed a chronic right basal ganglia infarct without significant vessel stenosis.

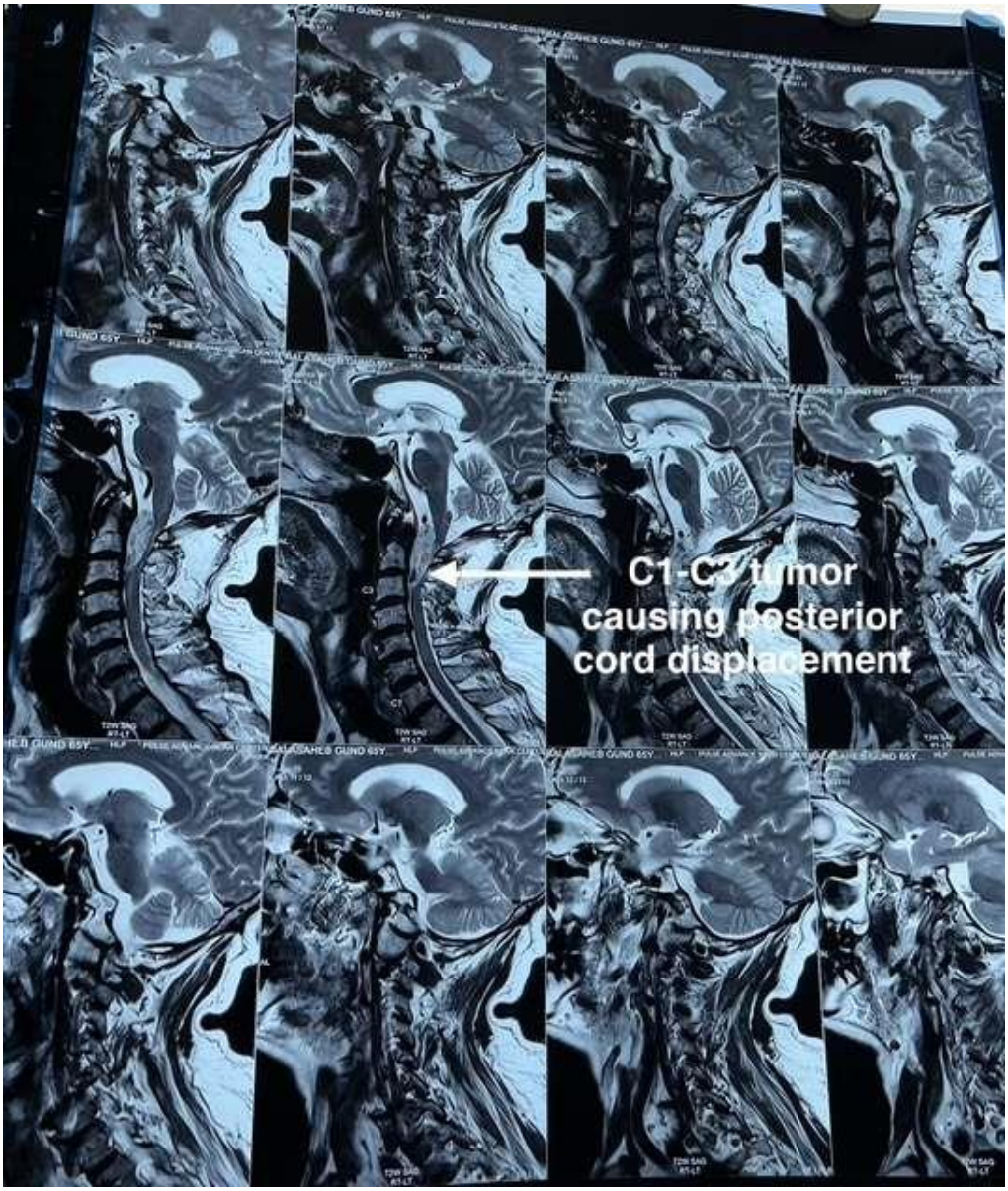

Figure 1: MRI cervical spine showing tumor

3. Anaesthetic Management

In the operating room, standard ASA monitors were applied, including electrocardiography, non-invasive blood pressure, pulse oximetry, end-tidal CO_2, capnography, entropy for depth of anaesthesia, and temperature monitoring. Two peripheral intravenous lines were secured using 18G and 20G cannulas. Invasive blood pressure monitoring was established via a right radial artery cannula inserted using the Seldinger technique under strict aseptic precautions. Central venous access was obtained through the right internal jugular vein under ultrasound guidance, as the left internal jugular vein was unsuitable due to the anticipated left lateral decubitus position for tumor excision and restricted neck mobility complicating cannulation. Stroke volume variation (SVV) and pulse pressure variation (PPV) were utilized to guide intraoperative fluid management and maintain hemodynamic stability.

A high-risk informed consent was obtained preoperatively, highlighting the neurological, respiratory, and hemodynamic risks associated with high cervical spine surgery. Cross-matched blood and blood products were arranged pre-emptively due to the risk of intraoperative haemorrhage from the highly vascular tumor. Premedication included intravenous midazolam 1 mg and fentanyl 2 µg/kg. General anaesthesia was induced with intravenous propofol 2 mg/kg and rocuronium 1 mg/kg. Given the restricted cervical extension and anticipated difficult airway, tracheal intubation was performed using a video laryngoscope, successfully placing a size 8.0 mm cuffed endotracheal tube.

Following intubation, a nasogastric tube was inserted to facilitate postoperative feeding and gastric decompression. Anaesthesia maintenance was achieved using intravenous propofol and dexmedetomidine infusions to facilitate neuromonitoring. This total intravenous anaesthesia (TIVA) approach was chosen because propofol provides stable hypnosis with rapid titratability, while dexmedetomidine offers analgesia, anxiolysis, and sympatholysis without suppressing evoked potentials. Unlike opioids or high-dose volatile agents, this combination preserves motor evoked potential (MEP) and somatosensory evoked potential (SSEP) signal quality and reduces intraoperative hypertensive surges.

Sevoflurane was limited to a MAC ≤0.8 and administered only during periods when critical neuromonitoring was not required, as higher concentrations cause significant (>50%) suppression of MEP signals. Neuromonitoring alerts were defined as a >50% reduction in MEP amplitude or >10% latency increase in SSEPs. Upon such alerts, the intervention protocol involved ruling out anaesthetic suppression, increasing mean arterial pressure (MAP) to >80–85 mmHg, correcting hypothermia or anaemia, and notifying the surgical team to evaluate potential mechanical factors.

Muscle relaxants were withheld after intubation to preserve MEP and SSEP integrity. Depth of anaesthesia was continuously guided using entropy monitoring. The patient was initially positioned prone using a Mayfield head clamp for laminectomy and facetectomy, followed by repositioning to the left lateral decubitus position for tumor excision (**Figure 2**). All pressure points were carefully padded, and cervical precautions were strictly observed during repositioning. Airway pressures in the prone position ranged between 18–22 cm H_2O, and ventilation was maintained with pressure-controlled mode to ensure normocapnia.

Hemodynamic support was provided with a noradrenaline infusion at 0.02–0.05 µg/kg/min to maintain MAP between 75 and 85 mmHg, optimizing spinal cord perfusion while respecting cerebral autoregulation in this post-stroke patient. This balance avoided hypotension, which could risk spinal cord ischemia, and excessive hypertension, which could precipitate recurrent stroke or bleeding. Intraoperative hypertensive surges were managed with intermittent propofol boluses.

Intraoperative arterial blood gases remained within normal limits. Estimated blood loss was approximately 700 mL and was managed with crystalloids and transfusion of one unit of packed red blood cells. SVV was maintained between 10–13% and PPV below 13%, guiding goal-directed fluid therapy. Balanced crystalloids were preferred over colloids to reduce renal and coagulation risks, particularly given the patient's history of stroke, where haemodilution could compromise cerebral oxygenation. As preoperative embolization was not feasible, backup plans for uncontrolled bleeding included activation of the massive transfusion protocol, use of cell salvage, rapid infusion systems, and surgical standby for urgent haemostasis.

Core temperature was maintained between 36 and 37°C using warming blankets, underbody air warmers, fluid warming via Hotline, and controlled ambient operating room temperature. Throughout the 10-hour procedure, the patient remained hemodynamically stable with preserved ventilation and oxygenation.

Following completion of surgery, the patient was electively ventilated and shifted to the neurosurgical intensive care unit for observation and respiratory support. Extubation was performed the following day after confirming adequate recovery of neuromuscular function, stable hemodynamics, and sufficient respiratory effort. In the ICU, neurological checks (motor power, cranial nerve function, speech assessment) were performed hourly for the first 6 hours and every 4 hours thereafter to detect delayed deficits. Multimodal analgesia included IV paracetamol, low-dose dexmedetomidine infusion, and intermittent tramadol, avoiding opioids such as morphine that carry a higher risk of respiratory depression in patients with poor pulmonary reserve. The postoperative period remained uneventful, and no new neurological deficits were noted.

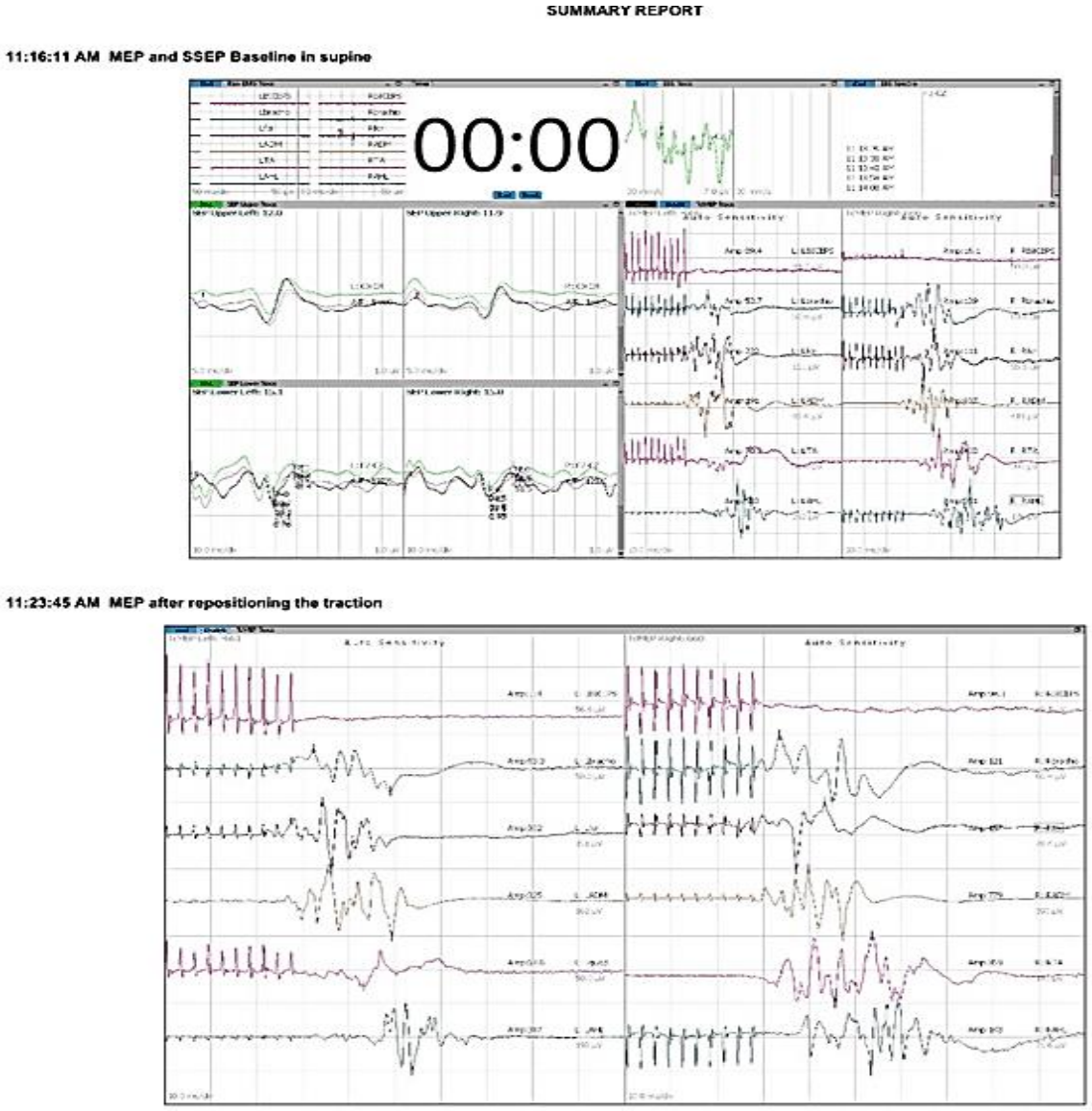

Figure 2: SSEP and MEP

4. Discussion

Anaesthetic management of upper cervical spinal surgery presents unique challenges owing to the close proximity of the lesion to the brainstem and spinal cord, potential airway difficulties, hemodynamic instability, and the need for precise neuromonitoring.[1,3,4] These challenges are magnified in patients with significant comorbidities, as in this case of a 64-year-old male with a history of cerebrovascular accident, chronic obstructive airway disease, and recent-onset neurological deterioration.

One of the foremost anaesthetic concerns was airway management. Restricted neck extension, Mallampati Class III airway, and the risk of cord compression during manipulation required a careful and gentle intubation strategy. The use of a video laryngoscope minimized cervical spine movement and allowed successful tracheal intubation without compromising neurological status. Difficult airways are well-documented in patients undergoing cervical spine surgery and are associated with increased risk of secondary cord injury if improperly managed.[5,6]

Respiratory status posed another critical challenge. Preoperative pulmonary function testing revealed moderate irreversible obstructive and restrictive changes. The patient also demonstrated reduced breath-holding time and low single breath count, reflecting compromised pulmonary reserve. These findings, common in chronic smokers and those with restrictive lung disease, significantly increase the risk of postoperative respiratory complications, warranting elective postoperative ventilation.[2]

Hemodynamic control was of paramount importance given the patient's previous CVA and the location of the tumor near the medulla. Maintaining an adequate mean arterial pressure to ensure spinal cord perfusion while avoiding hypertensive surges that could risk re-bleeding or exacerbation of prior cerebrovascular insult required continuous monitoring.[9] Adequate perfusion pressure has

been correlated with improved neurological outcomes in spinal cord surgeries.

Another distinct challenge in this case was the requirement for intraoperative neuromonitoring using motor evoked potentials (MEPs) and somatosensory evoked potentials (SSEPs). These modalities demand the avoidance of neuromuscular blocking agents following induction and necessitate the limitation of volatile anaesthetics to preserve the integrity of neurophysiological signals. To meet these criteria, the anaesthetic plan was tailored using continuous infusions of propofol and dexmedetomidine, with entropy monitoring guiding anaesthetic depth to ensure adequate hypnosis without suppressing evoked potentials. Total intravenous anaesthesia (TIVA) with these agents is well established as the preferred approach for surgeries involving neuromonitoring.[7,8]

In addition, tumor vascularity raised concerns about potential intraoperative haemorrhage. Although digital subtraction angiography was attempted to facilitate preoperative embolization, no definitive feeding vessel was identified, and the surgery proceeded without embolic protection. When feasible, preoperative embolization can significantly reduce blood loss during resection of highly vascular spinal tumors.

Surgical positioning further added to the procedural complexity. The patient required intraoperative repositioning from prone (for laminectomy and facetectomy) to left lateral decubitus (for tumor excision), demanding close coordination among the anaesthesia and surgical teams. This transition carried a risk of airway displacement, spinal cord injury, and pressure-related complications. Positioning-related adverse events are well-documented, particularly in patients with cervical pathology, and can lead to poor neurological outcomes if not managed with strict vigilance.

When managing cervical spine surgery in patients with a history of stroke, careful anaesthetic planning is essential to minimize perioperative risks. In this case, the use of total intravenous anaesthesia (TIVA) tailored for neuromonitoring, adherence to strict mean arterial pressure (MAP) targets, and planned postoperative ventilation contributed to a stable intraoperative course and favourable outcome. These measures are particularly relevant, as previous studies have reported perioperative stroke recurrence or respiratory complications in up to 10–15% of similar high-risk patients, emphasizing the importance of an individualized, multidisciplinary approach to care.[4,9]

5. Conclusion

This case illustrates the complexity of anaesthetic management in upper cervical spine surgery for intradural tumors in patients with significant comorbidities. A multidisciplinary approach, incorporating careful airway planning, neuromonitoring-compatible anaesthesia, and vigilant hemodynamic and respiratory management, is essential for optimizing outcomes. These strategies are particularly critical in high-risk patients, offering valuable lessons for anaesthetic practice in similar cases.

6. Ethical Considerations and Data Documentation

All intraoperative photographs, MRI labels, and waveform data were obtained with explicit informed consent for publication.

7. Source of Funding

None.

8. Conflict of Interest

None.

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