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Case Report

Delayed Recovery of a Prolonged Total IntraVenous Anesthesia Procedure with Risks of Malignant Hyperthermia

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Abstract

Background: Spinal Cord Ependymoma (SCE) is an intramedullary tumor that requires surgical intervention. Total Intravenous Anesthesia (TIVA) is indicated for such neurosurgery cases. The pharmacodynamics and pharmacokinetics of each drug used must be factored to safely extubate and maintain the airway postoperatively.

Case: A 57-year-old male with a history of pulmonary hypertension presented to the hospital with complaints of gait difficulty and sensory deficits secondary to SCE. The patient was scheduled for surgery, and the decision was made to do TIVA due to a family history of Malignant Hyperthermia. Three continuous IV drips were placed: propofol, titrated between 125-300 mcg/kg/min, ketamine at 5 mcg/kg/min, and sufentanil at 0.3 mcg/kg/hr. The patient required a phenylephrine infusion at 35 mcg/min to maintain hemodynamics, which had to be titrated up to 75mcg near the 11-hour point due to severe hypotension. Following extubation, the patient was placed on an oral airway with a simple O2 mask in place. He was noted to have snoring respirations with oxygen desaturating to the low 80's. A jaw thrust was done, and he was placed on a non-rebreather mask. Due to a fixed obtunded state, a hasty decision to re-intubate was made without proper revaluation and communication between providers. The patient was then re-extubated 1.5 hours later with minimal post-op complications.

Conclusion: This case illustrates the challenges of prolonged TIVA in the assessment of safely extubating patients while maintaining the airway in the postoperative period.

Keywords: Spinal Cord Ependymoma (SCE); Total Intravenous Anesthesia (TIVA); Airway

Introduction

Spinal Cord Ependymoma (SCE) is a rare, slow-growing intramedullary low-grade tumor that presents with non-specific symptoms including back pain, paresthesias, and gait ataxia progressing over the course of years. SCE originates from ependymal cells that line the ventricular system and are non-capsulated with regular borders [2]. Complete surgical resection has been established as first-line treatment and can be curative. Total Intravenous Anesthesia (TIVA) is typically reserved for patients with a potential risk for malignant hyperthermia (MH) and for measurement of somatosensory and motor-evoked potentials [4]. TIVA is also recommended in neurosurgery cases to limit increased intracranial volume due to the neuro-protective effect of propofol in improving cerebral perfusion pressure and mean arterial pressure (MAP) [7]. The context sensitive half-lives of medications for the maintenance of procedures are factored into account to determine the rates and amounts given. A medication's half-life is defined as the time required for the drug plasma concentration to decline by 50%

[3]. Propofol has a rapid onset with a terminal half-life around 4-7 hours [3]. Ketamine is typically given intravenously, with a duration of action lasting 10-15 minutes and a 45 minute context sensitive half-life. Sufentanil has a 50 minute context sensitive half-life, while phenylephrine's half-life is 5 minutes [3]. From a patient perspective, the total body weight (TBW) and ideal body weight (IBW) also play a critical role in drug administration, particularly in morbid obese patients. Dosing scalars are implemented to account for changes in the patient's body composition and subsequent cardiac output. These physiological changes in blood volume, regional blood flow, and cardiac output affect the peak plasma concentration and elimination half-life of many pharmacological agents. The medications potential for overdosing and causing dangerous side effects like respiratory depression narrows the therapeutic window. IBW is defined as the ideal weight associated with a maximum life-expectancy for a given height. The calculated value tends to be lower than the lean body weight (LBW) which can lead to underdosing of medications. Similarly, if based on TBW, this can lead to an overdose, especially in morbidly obese patients [8].

Case Presentation

A 57 year old male is scheduled for a thoracic spinal ependymoma resection in ambulatory surgery center. Patient's vitals stable in Pre-op: Wt: 78.3 kg; Ht: 5'8, BMI: 26.30 PMHx: Pulmonary Hypertension, Hypertension, Gastroesophageal Reflux Disease, Tobacco Abuse, History of Postoperative Nausea and Vomiting PSHx: Nasal Reconstruction, Debulking of Forehead flap FHx: 1st-degree relative for Malignant Hyperthermia, Asthma, COPD, Cancer, Early death in mother (unknown etiology) Meds: Meloxicam, Lisinopril, Albuterol, Gabapentin, Methocarbamol, Sildenafil Pre-op ROS: Negative except mentioned above Airway: Normal His intraoperative anesthetic care included TIVA without the use of volatile anesthetics due to the family history of MH. Somatosensory and motor evoked potentials were set up and calibrated. The anesthesia start time was 0727 and the infusions were set up immediately following induction at 0750. As shown in table 1, four continuous IV drips were set up: propofol, ketamine, sufentanil, and phenylephrine. Propofol was titrated up to 300 mcg/kg/min and stopped 1 hour before the end of the procedure. Ketamine was stopped about 1.5 hours prior to extubation. Phenylephrine was titrated up to 50 mcg/min, but later increased to 75 mcg/min towards the end of the procedure due to severe hypotension. Subsequently, the patient was stopped on the phenylephrine drip and was started on a norepinephrine drip, of which he received 205 mcg prior to extubation. After 11 hours and 8 minutes, procedure time was called at 1835. The patient was extubated in the room and transferred to SICU for further management with an oral airway and a simple O2 mask in place. He was noted to have snoring respirations and started desaturating to low 80's. A jaw thrust was done by a bedside nurse, and he was placed on a non-rebreather mask. His oxygen saturation started to improve slightly, and the surgeon was called to assess the patient. Due to a fixed obtunded state, a hasty decision to re-intubate was made without proper re-evaluation and communication between providers for primary airway protection. The patient was then re-extubated about 1.5 hours later in the SICU and presented with minimal post-op complications.

Intraoperative Medication	Induction Amount	Infusion Rate	Total Amount Received
Propofol	600	125 <-> 300 mcg/kg/min	11,427 mg
Ketamine	-	5 mcg/kg/min	204 mg
Sufentanil	8 mcg	0.3 mcgikg/hr	473 mcg
Phenylephrine	-	35 <-> 75 mcg/min	26,939 mg
Norepinephrine	-	-	205 mcg
Lidocaine	80 mg	-	80 mg
Rocuronium	30 mg	-	30 mg

Table 1: Total Intraoperative Medications Amounts Received.

Discussion

This case highlights the significant concerns when making the decision to re-intubate a patient who has undergone prolonged TIVA. Waking up patients under these circumstances has proven to be challenging with a family history of MH. Differential diagnoses to consider for prolonged sedation include renal or hepatic impairment, excess lipophilicity from obesity, miscalculated doses to TBW or IBW, and myocardial depression. Lab values to focus on in PACU are pH, lactate, creatine kinase, triglyceride levels, and EKGs to test for Brugada-type changes focusing on sodium conduction.

In a randomized controlled study, patients who only received analgesia to satisfy minimum alveolar concentrations had a decreased ICU length of stay with decreased mechanical ventilation requirements compared to those who received both analgesia and sedation [5]. Extubating a patient is assessed by the clinician based upon physical exam findings including eye opening, purposeful movement, end tidal anesthetic concentration below a predetermined level, reversal of neuromuscular blockade, and the laryngeal stimulation test [4]. A prolonged extubation time is defined by the end of skin closure to extubation lasting longer than 15 minutes. Other factors that contribute towards prolonged extubation are old age, male gender, and prolonged duration of neuromuscular relaxants as seen in this case. Elderly patients have a decrease in volume of distribution and clearance rate, therefore requiring smaller doses for efficient responses. Previous studies have found that the male gender may have prolonged recovery from anesthesia, likely due to the lack of abundance of female sex hormones, estrogen and progesterone, playing a key role in neuroprotection and improving central nervous system functions. In 2007, progesterone was found to be a glio-active factor by enhancing remyelination [5]. Postoperative anesthetic care is crucial to maintain proper ventilation and oxygenation. In this particular case, the patient had consistent intraoperative hypotension along with continuous phenylephrine and norepinephrine drips. Close monitoring and proper communication between the PACU nurses, the surgeons, and the anesthesiologists was crucial to patient care. Despite the patient's desaturating vitals, using non-invasive methods to deliver oxygen as alternatives to intubation should have been utilized, and subsequently, the providers could have avoided reintubation. The clinical judgement made by the staff to re-intubate the patient and proceed to invasive methods poses a serious threat to patient outcomes, especially when other modalities of ventilation have not been tried first.

Conclusion

Due to the risk of volatile anesthetics inducing severe reactions, TIVA remains the anesthetic choice for neurosurgery cases and for patients with a family history of MH. When a patient continues to be obtunded postoperatively, careful observation and monitoring is required to avoid any aspiration in an unsecured airway. Avoiding reintubation in the PACU by using alternative modalities such as positive pressure ventilation or laryngeal mask airways should be considered. Additional quality management research and evidence-based protocols are necessary to establish proper extubation criteria for prolonged TIVA cases while factoring in context sensitive half-lives of medications contributing to postoperative complications.

Bibliography

1. Barzin M and Maleki I. "Incidence of Vertebral Hemangioma on Spinal Magnetic Resonance Imaging in Northern Iran". *Pakistan Journal of Biological Sciences* 12.6 (2009): 542-544.

2. Celano E., *et al*. "Spinal cord ependymoma: a review of the literature and case series of ten patients". *Journal of Neuro-Oncology* 128.3 (2016): 377-386.

3. Gepts E., *et al*. "Linearity of Pharmacokinetics and Model Estimation of Sufentanil". *Anesthesiology* 83.6 (1995): 1194-1204.

4. Nimmo A., *et al*. "Guidelines for the safe practice of total intravenous anaesthesia (TIVA)". *Anaesthesia* 74.2 (2018): 211-224.

5. Misal U., *et al*. "Delayed recovery from anesthesia: A postgraduate educational review". *Anesthesia: Essays and Researches* 10.2 (2016): 164.

6. Phan K., *et al*. "Anesthesia Duration as an Independent Risk Factor for Early Postoperative Complications in Adults Undergoing Elective ACDF". *Global Spine Journal* 7.8 (2017): 727-734.

7. Zuleta-Alarcón A., *et al*. "Total intravenous anaesthesia versus inhaled anaesthetics in neurosurgery". *Colombian Journal of Anesthesiology* 43 (2015): 9-14.

8. Ingrande J and H J M Lemmens. "Dose Adjustment of Anaesthetics in the Morbidly Obese". *OUP Academic, BJA: British Journal of Anaesthesia* 105.1 (2010).