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Challenges of Anaesthesia for Excision of Parasagittal Meningioma in a Diabetic Hypertensive: What are the Lessons?

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Case Report

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Abstract

Parasagittal meningioma complicated by diabetes mellitus and hypertension is a challenging disease. We present the case of a 55-year-old known diabetic hypertensive who presented to us on referral with a diagnosis of intracranial meningioma for neurosurgical care. He was worked up and successfully underwent a craniotomy and total tumor excision. Histology was in agreement with our preoperative concerns. The anesthetic challenges in the management of the patient are discussed.

Keywords: Diabetes; Hypertensive; Anaesthesia

Abbreviations: ASA: American Society of Anesthesiologist; MRI: Magnetic Resonance Imaging; ETT: Endotracheal Tube; CT: Computerized Tomography.

Introduction

Meningiomas are tumours of the arachnoid mater and tend to arise adjacent to the major venous sinuses, commonly parasagittally [1,2]. Most are benign and can be successfully removed [3]. Clinical manifestations of meningiomas reflect the space occupying nature of the lesion and occur due to compression of brain structures [4]. Thirteen percent of surgical patients with intercurrent medical illnesses presenting for anesthesia suffer from diabetes mellitus [5]. The anesthetic management should incorporate principles to contain the challenges inherent in the management of such patients thus ensuring blood glucose [6] and blood pressure control to reduce perioperative morbidity and mortality [7].

Case Presentation

A 55-year-old retired male Engineer; known diabetic hypertensive for 4 years was referred to our facility on account of progressive left lower limb weakness of gradual onset about 6 years before presentation with associated headaches, jacksonian seizures and projectile vomiting. He has an intact higher cerebral function. Muscle power was graded 3/5 on the left lower limb and 4/5 in the right lower limb. Other systems were essentially normal. He was admitted; brain Computerized Tomography (CT) revealed a giant right parasagittal tumor probably Meningioma; Fasting blood sugar was 13.5 mmol/l. He was commenced on dexamethasone 4 mg 12 hourly the endocrinology team commenced him on oral glibenclamide (Daonil) 5 mg daily, and Metformin 1gm 12 hourly while the cardiology team paced him on amlodipine 10mg daily. Patient was found to have a poor glycemic and BP control necessitating the introduction of insulin and losartan and postponement of the surgery twice.

Anesthetic Management

His airway assessment was Mallampati 11 and his physical status according to the American Society of Anesthesiologist (ASA) classification was class 111. Relevant aspects of anesthesia and perioperative care were explained to the patient and an informed consent obtained. Four units of whole blood was typed and cross matched for intraoperative use. An infusion of a mixture of 10 mmol KCl and 10 units of Humulin R in 500 ml of 10% dextrose (GIK) was commenced on the morning of surgery and blood sugar strictly monitored with a glucometer.

On arrival in the theatre, patient's identity was confirmed. Standard routine monitors were attached and capnograph calibrated. His baseline vital signs were pulse rate 90 beats/minute, BP 145/90 mmHg and SPO_2 100% on room air. Patient had 2 IV lines (one central and the other peripheral) and an arterial line. Intravenous atropine 0.6 mg and dexamethasone 8 mg were administered before the induction of anesthesia.

Following preoxygenation with 100% oxygen, intravenous fentanyl 250 micrograms and thiopentone 250 mg were administered as induction agents. At the loss of the eyelash reflex, intravenous suxamethonium (100 mg) was administered. The trachea was intubated with a size 8 mm cuffed armored tube and correct placement confirmed with capnograph tracing and chest auscultation. Automated intermittent positive pressure ventilation was instituted. Anesthesia was maintained with 100% oxygen and 0.8 to 1.2% isoflurane vapor. A total fresh gas flow of 4 liters per minute was administered. Muscle relaxation was maintained by an initial bolus of intravenous pancronium bromide 6 mg followed by 4 additional boluses of 2 mg each. The blood pressure and pulse rate were recorded every 5 minutes till the end of the surgical procedure. Core temperature was monitored with nasopharyngeal temperature probe while the peripheral temperature was monitored with axillary probe. Foleys urethral catheter was passed for monitoring of hourly urine output. Intravenous ceftriaxone 1 gram and metronidazole 500 mg were administered.

The patient was positioned and cradled on Mayfield horse shoe head rest. Intravenous 20% mannitol 200ml and furosemide 20 mg was given before the bone flap was raised. Analgesia was supplemented intermittently with boluses of fentanyl 50 micrograms.

The arterial oxygen saturation was between 98% and 100%. The ECG showed normal sinus rhythm. Intraoperative vital sign was a pulse rate of 90-110 beats/minute while systolic and diastolic blood pressure ranged between 100-160 mmHg and 60-100 mmHg respectively. End tidal carbon dioxide ($EtCO_2$) was between 2.6 kPa and 4 kPa. Core temperature was between 36.6 ^{0}C and 37.1°C while the peripheral temperature was between 34 and 37.2°C. Blood sugar estimation ranged from 8.2 mmol/l to 9.6 mmol/l. Findings at craniotomy included a firm, well circumscribed grey right parasagittal tumor measuring 6 cm by 6 cm by 7 cm with sagittal sinus attachment. Estimated total intraoperative blood loss was 1800 ml. The patient was transfused with 2 units of blood.

At the end of the procedure which lasted 7 hours isoflurane was turned off; throat pack removed; oropharynx cleared of secretions and residual neuromuscular blockade reversed with neostigmine 2.5 mg and glycopyrrolate 0.4 mg. The patient was extubated and transferred to the ICU awake with SPO_2 100% on room air; pulse rate 92 beats/minute and BP 140/85 mmHg.

Post-Operative Management

In the ICU, Oxygen was administered via nasal prongs with vital signs as follows: pulse rate 90 beats/minute; BP 140/85 mmHg and SPO_2 100%. The vital signs were recorded in real time. The Glasgow coma score was 15. GIK infusion at 100 ml per hour was continued with 0.9% normal saline 1 litre 8 hourly through the other intravenous line.

Postoperative analgesia was provided with parenteral paracetamol and tramadol for 72 hours and thereafter paracetamol orally for 5 days. Other postoperative treatment regimen included dexamethasone 4 mg intravenously 8 hourly for the 1st 48 hours and 2 mg 12 hourly thereafter. Intravenous ceftriaxone l gram daily and metronidazole 500 mg 8 hourly, and IV Omeprazole 40 mg daily for 5 days. Random blood sugar, clotting profile and serum electrolyte, urea, and creatinine done on the 1st postoperative day were normal except bicarbonate that was 19 mmol/l. Total fluid inputs was 3,000 mls in the 1st 24 hours, and output was 810 ml. Then patient suddenly started passing large quantities of very dilute urine 8,000 ml over a 24-hour period with Specific gravity-1,000 to1,002) on the 2nd postoperative day. A diagnosis of diabetes insipidus was made and patient started on hourly and 4 hourly urine output and

specific gravity monitoring respectively. Subcutaneous desmopresin 0.5 microgram 12 hourly was commenced with good result. The urine output was corrected within 48 hours. He was started on a normal diet 36 hours after surgery; insulin regimen changed to oral hypoglycaemic agents with blood sugar level at 6 mmol/l. He was transferred to the surgical ward on the 5th postoperative day and was also commenced on oral artesunate following a positive malaria parasitemia on blood film. Histological report showed a WHO grade I meningioma.

Discussion

Meningiomas are solid tumors that are usually firmly attached by a broad base to the dura [1-6] accounting for between 15 to 20% of primary intracranial tumours [1].

The tumor location, growth rate and raised ICP may be responsible for its clinical manifestations [8]. The index patient had hemiparesis due to the tumor mass effect on the motor area. The progressive involvement of the pyramidal system may also explain the hypertonia and brisk reflexes of the lower limbs.

Emejulu and colleagues reported that CT scan is a dependable tool in the diagnosis of space occupying lesions [9] but Magnetic resonance imaging (MRI) where available is the gold standard. Both imaging modalities where employed in the course of the management of the index patient. Vomiting secondary to intracranial hypertension may give rise to electrolyte imbalance and dehydration. Preoperative estimation of electrolyte, urea and creatinine is therefore indicated. Serum electrolytes, urea and creatinine assess the renal function in longstanding diabetes mellitus.

Preoperative control of intracranial hypertension and correction of co-morbid conditions improves surgical outcome. Measures should be taken to reduce the intracranial pressure and this can be achieved by reducing the cerebral blood volume or the brain tissue volume. Hypoxia and hypercarbia can also exacerbate ICP and this can be avoided by ensuring a patent airway and adequate ventilation. The efficacy of steroids in reducing the edema associated with tumor is widely documented [10-13]. Administration of steroid for 48hrs before an elective surgical procedure has the potential to reduce edema formation and improve the clinical condition by the time of craniotomy [10]. Steroids are usually administered intraoperatively and postoperatively to maintain the effects achieved by preoperative treatment. The above measures were put to good use in the management of the index patient.

The reduction in brain volume can also be achieved by maintaining high serum osmolality. This forms the basis for the use of intravenous mannitol for acute reduction of brain volume [8,10]. Furosemide, a loop diuretic is slower in onset and less reliable than mannitol but its action appears synergistic. Our patient benefitted from the use of both agents.

McAnulty, Robertshaw and colleagues admitted that poor neurologic outcome has been associated with hyperglycemia after anaesthesia [6,7] and the perioperative morbidity and mortality of a diabetic is related to this. On the other hand, good diabetic control has been shown to reduce perioperative morbidity and mortality [9]. We were conscious of these in the management of this patient (hence the multidisciplinary approach to his care from the outset). Propofol and thiopentone were used as part of the anesthetic management of the patient. Thiopentone decreases cerebral metabolic rate ($CMRO_2$), CBF and ICP [12]. The effect of propofol on $CMRO_2$ and CBF is similar to that of thiopentone but recovery from propofol is faster with no hang-over effect [12,13]. Propofol also protects more effectively against the pressor response to intubation which makes it the drug of choice in neuroanaesthesia [13]. Ketamine is not popular in neurosurgery because it causes increase in CBF and ICP and is therefore contraindicated in patients with raised intracranial pressure hence it was not used in the index patient.

Attenuation of pressor response to laryngoscopy is strongly indicated in neurosurgical operations. Fentanyl inhibits the pituitary-adrenal response to surgery in man and has been found to be effective in attenuating stress response to laryngoscopy and endotracheal intubation [14]. Lignocaine in a dose of 1.5 mg/kg has been shown to attenuate the rise in ICP [15]. Propranolol may be administered intravenously in the preinduction period in a dose of 0.01-0.03 mg/kg to maintain cardiovascular stability. During the induction period particularly at intubation esmolol, an ultra-short acting beta blocker with relative cardioselectivity may be preferred to propranolol which has a longer duration of action. Beta blockers are effective in blunting both hypertensive and tachycardic responses to stressful stimuli such as laryngoscopy [16].

An endotracheal tube (ETT) with adequate diameter should be used to reduce airway resistance. Berwick and

colleagues advised that kinking of the ETT is common in head and neck surgery and may lead to carbon dioxide retention and hypoxemia so a non-kinkable armored tube should be preferred [17]. Packing the oropharynx with moistened gauze prevents trickling of secretions down the airway because a slow cuff deflation may occur during prolonged surgery. These measures were employed in this patient.

Monitors are essential and were employed to monitor critical parameters in real time. Surgical stress causes a profound catabolic response. Not only is there an increase in the secretion of catecholamines, glucagon and cortisol, there is also a decrease in the sensitivity to insulin [7]. Frequent intraoperative glucose monitoring is therefore indicated to facilitate accurate titration of glucose and insulin dosages to meet these needs.

Blood loss may be challenging in neurosurgery and should preferably be replaced promptly since large volume of crystalloids predisposes the patient to cerebral oedema [9].

Conclusion

Surgical excision of meningioma in a hypertensive diabetic offers a considerable challenge to both the anesthetist and neurosurgeon, hence a strict perioperative homeostasis are essential for a good outcome

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