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Case Report

Dexmedetomidine and magnesium sulphate as the anaesthetic adjuncts for intraoperative management for resection of pheochromocytoma

Gentle Sunder Shrestha, Sachit Sharma Rupakhetee, Sunil Pathak, Pragya Acharya, Bashu Dev Parajuli, Anil Shrestha

Tribhuvan University Teaching Hospital, Institute of Medicine, Maharajgunj, Kathmandu 44600, Nepal

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Abstract

Pheochromocytoma, a tumour arising from adrenal medulla or other ganglia of sympathetic nervous system is notorious for secreting catecholamines. This form of the tumour is a major challenge to anaesthesia team as acute changes in blood pressure and heart rate usually occurs due to the release of catecholamines from the tumour site before tumour resection and cessation of the same after resection leading to hemodynamic instability intraoperatively. Better hemodynamic stability is desired during this form of tumour resection as acute fluctuations in blood pressure may lead to severe intracranial or cardiovascular events. Dexmedetomidine and magnesium sulphate were used as anaesthetic adjuncts to achieve good hemodynamic stability in a 35 years old female who presented with the history of headaches, palpitation and sweating on and off since last 2 years. The use of these agents allowed us to obtain an acceptable level of hemodynamic stability along with the help of other agents such as inotropes, vasopressors, vasodilators and antihypertensive agents. Dexmedetomidine and magnesium sulphate were used before resection of the tumour in our case and stopped thereafter. These agents may be an excellent option as anaesthetic adjuncts to obtain greater hemodynamic stability during resection of pheochromocytoma.

Keywords: anaesthetic management; dexmedetomidine; magnesium sulphate; pheochromocytoma.

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Corresponding Author: Dr Sachit Sharma Rupakhetee, MBBS
MD Resident, Department of Anaesthesiology,
Tribhuvan University Teaching Hospital, Institute Of Medicine,
Maharajgunj, Kathmandu, Nepal,
Email: sachitrupakhetee@gmail.com

Introduction

A pheochromocytoma is a rare form of tumour arising from the chromaffin cells of adrenal medulla or from other paraganglia of sympathetic nervous system.[1] Patients present with a variety of symptoms due to the production of excessive amounts of norepinephrine, epinephrine and dopamine into the circulation leading to hypertension usually severe and unresponsive to conventional therapy, episodic symptoms of palpitation, tachycardia, panic attack and feelings of doom. Surgical resection is the definitive management of these tumours. The anaesthetic management of these tumours has been to abolish the effect of excess catecholamines responsible for producing hemodynamic instability. Since dexmedetomidine (DEX) decreases the amount of norepinephrine available at axon terminals of sympathetic postganglionic neurones by activation of α2-adrenoceptors, its use may diminish the contribution of the sympathetic nervous system making it a good option for controlling the rise in blood pressure (BP) and heart rate (HR) intraoperatively for different forms of surgeries. Magnesium sulphate ($MgSO_4$) also has been used as an anaesthetic adjunct to control the rise in BP and HR in different forms of surgeries. Here we discuss the possible role of magnesium sulphate and dexmedetomidine used in combination to achieve hemodynamic stability as anaesthetic adjuncts in a 35 years old female who had undergone resection of pheochromocytoma.

Case Description

A 35 years old female, weighing 50 kgs, presented to our institute with the history of headache, palpitation and sweating on and off since last 2 years. Her past medical history was insignificant with no functional limitations. Her blood pressure was 120/70 mm Hg with the heart rate of 84/minute. Her ECG and echocardiography were normal. Her thyroid function test was normal. Abdominal CT scan revealed left adrenal mass suggestive of pheochromocytoma. Both her 24 hours urine vanillylmandelic acid and metanephrine were raised with the levels of 40.2 mg and more than 2500 µgm respectively. She was put on Amlodipine 5 mg daily, Prazosin 5 mg 8 hourly and Propranolol 10 mg 6 hourly for 2 weeks for optimisation.

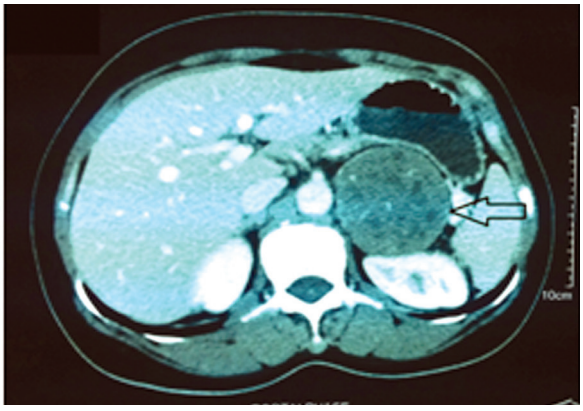

Figure 1. CT scan of the abdomen showing well defined heterogeneously enhancing soft tissue density in left suprarenal region suggestive of the adrenal tumour (indicated by arrow).

On the morning of surgery, she was premedicated with Diazepam 5 mg. Other medications were continued. Her baseline blood pressure was 110/70 mm Hg and heart rate was 76/minute. In the operating room, an arterial line was placed in the left radial artery and an epidural catheter was placed at T10-11 level. DEX 1µg/kg was administered over 10 minutes followed by 0.7- 1µg/kg/hr. Magnesium sulphate was administered 2 gram over 30 minutes followed by 1 gram per hour. The patient was induced with propofol, fentanyl and lidocaine and intubated after administering vecuronium. Intubation was uneventful. Bupivacaine 0.25% 8 ml was administered for epidural activation. Blood pressure and heart rate increased during surgical incision. The patient was put on sodium nitroprusside infusion of 0.5 to 2 µg/kg/min and intermittent boluses of glyceryl trinitrate 100µg and Esmolol 20 mg were administered to control the blood pressure surge. Following ligation of venous pedicles, blood pressure dropped to 80/50 mm Hg. All the vasodilators, dexmedetomidine and magnesium sulphate were stopped and the patient was administered noradrenaline 0.1 to 0.3 µg/kg/min to maintain blood pressure. Adjustment of dosage of Neuromuscular blocker was done based on Train of Four monitoring. The patient was successfully extubated. Noradrenaline was gradually tapered and stopped 6 hours after surgery. The patient was discharged home after 4 days. The histopathology of the resected specimen, later on, confirmed the mass as pheochromocytoma.

Discussion

Pheochromocytoma and paragangliomas are catecholamine-secreting tumours that present particular perioperative challenges owing to severe hypertension and its consequences.[2] Preoperative optimisation of the BP and HR of the patient were done in our case with 2 weeks of alpha and beta blockade.

Magnesium is a vasodilator and inhibits catecholamine release as well as catecholamine receptors and also functions as an endogenous calcium antagonist.[3] MgSO4 has a duration of action of around 30 mins and the same for dexmedetomidine infusion is 5-8 mins. Since both these agents were stopped after ligation of venous pedicles and shortly before resection, MgSO4 may have some role in causing post resection hypotension as compared to dexmedetomidine because of its prolonged duration of action. One major problem that may arise with the use of $MgSo_4$ is that it may accentuate the action of nondepolarizing neuromuscular blockers by decreasing the sensitivity of endplate and excitability of muscle fibres. Although magnesium may increase the duration of neuromuscular blockade, this effect can be accommodated with careful neuromuscular monitoring and adjusted dosing of intraoperative neuromuscular blockers.[4] In our case, however, magnesium sulphate was stopped after resection of the tumour, titration and

adjustment of dosage of neuromuscular blocking agents were done based on train-of-four monitoring, therefore, no problems as such was encountered during extubation and recovery.

In addition to magnesium sulphate, dexmedetomidine which is a short acting, central alpha-2 receptor agonist attenuates sympathetic response to stresses such as intubation and extubation.[5] Use of it resulted in effective preoperative sedation and also helped to achieve significant intraoperative hemodynamic control at the same time reducing requirements of anaesthetic agents and promoting postoperative analgesia. Dexmedetomidine may enhance intraoperative hemodynamic stability and stress response control through activation of presynaptic alpha-2 receptors, reducing norepinephrine release.[6]

In another context, a combination of Dexmedetomidine and $MgSO_4$ did not result in the elimination of the need to administer esmolol, GTN and sodium nitroprusside to control BP surge during tumour manipulations; it reflects the fact that these agents alone are not sufficient to provide hemodynamic stability during the resection of this type of tumour. It seems possible that, with larger doses of $MgSO_4$ or Dexmedetomidine that result in higher plasma levels of these drugs, we could have reduced the dosage of esmolol, GTN and sodium nitroprusside for additional BP control during tumour manipulation. Caution should be exercised when giving very large doses of Dexmedetomidine as a rapid infusion, as healthy adult volunteers[7] and paediatric patient[8] have shown increases in BP in response to high-dose Dexmedetomidine.

Because of its physiologic effects, magnesium is an attractive option for catecholamine blockade in patients undergoing tumour resection.[9]

Thus, using dexmedetomidine and $MgSO_4$ as anaesthetic adjuncts from the start of surgery before tumour manipulation in our case, conferred greater hemodynamic stability intraoperatively although more randomised clinical trials are necessary to establish definite role and importance of these agents during resection of pheochromocytoma.

Conflict of interest: The authors declare no competing interests.

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