Case Report

The Use of Sevoflurane in the Management of Hypertensive Crisis Occurred During Pheochromocytoma Resection: Case Report and Review of the Literature

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Abstract

Pheochromocytoma is a rare catecholamine producing tumor. Perioperative anesthetic management for the resection of pheochromocytoma is a challenging issue to anesthesiologist because of its potential for hypertensive crisis. We report anesthetic management of a case of pheochromocytoma resection using combination of sodium nitroprusside and sevoflurane, and present a review of the literature.

ABBREVIATIONS

NIBP: Non-Invasive Blood Pressure; HR: Heart Rate; IBP: Invasive Blood Pressure; CVP: Central Venous Pressure

INTRODUCTION

Pheochromocytoma is a catecholamine secreting tumor which could be difficult to manage during anesthesia because of its potential for serious hemodynamic instability. In patients undergoing pheochromocytoma removal, intraoperative increase in arterial pressure has been known to be largely associated with direct manipulation of the tumor [1]. Different anesthetic agents and techniques are recommended for intraoperative hemodynamic management, especially during manipulation of the tumor. Presently, improvement in anesthetic care, availability of potent and fast acting vasoactive drugs and anesthetic agents resulted in a mortality rate close to zero in most series [1]. We would like to report a case of pheochromocytoma resection in which serious intraoperative hypertensive responses were adequately controlled by increasing anesthetic depth with sevoflurane in the presence of continuous administration of sodium nitroprusside.

CASE PRESENTATION

A 43 year-old female presented with a 4 years history of palpitation, intermittent flushing and hypertension. She had been on thiazide-valsartan and amlodipin therapy for one year. An abdominal computerized tomography revealed a right adrenal mass of 8x7 cm in diameter. Plasma catecholamines and urinary catecholamine metabolites were found to be elevated approximately three times than normal upper limits. A metaiodobenzylguanidine (MIBG) scan was not performed since there was no doubt about the biochemical and radiological diagnosis. The patient was referred to surgery after 7 day duration of phenoxybenzamine treatment (a dose of 20 mg per day was commenced on, and gradually increased to 60 mg per day). Informed consent was taken from the patient before surgery.

The patient was pre medicated administrating intravenous 2 mg midazolam. Upon arrival in the operating room, non-invasive blood pressure (NIBP) was 150/90 mmHg and heart rate 75 beats per minute. The intraoperative monitoring consisted of electrocardiography, heart rate (HR), pulse oximeter, ends tidal CO₂, invasive blood pressure (IBP), central venous pressure...
General anesthesia was induced with 2.5 mg/kg propofol, 1 mg/kg remifentanil, 1 mg/kg lidocaine, 0.1 mg vecuronium, and maintained with remifentanil infusion (0.5-1 mcg/kg/min) and sevoflurane 2-4%. At time of laparotomy, IBP increased and nitroprusside sodium infusion of 1 mcg/kg/min was commenced on. However, during manipulation of the tumor, IBP raised abruptly. This increase was controlled by increasing the concentration of sevoflurane to 4% (Figure 1). When IBP returned to the baseline value, the concentration of sevoflurane was decreased to 2%. A second hypertensive response occurred before adrenal vein ligation and it was controlled by the same strategy. After the resection was completed, nitroprusside administration was stopped and the arterial blood pressure remained in the normal range until the end of the surgery. CVP was around 10-12 mm Hg during surgery. The patient was uneventfully extubated and transferred to surgical department. The postoperative course was uneventful, and histopathological examination confirmed pheochromocytoma.

DISCUSSION

Pheochromocytoma is associated with a challenging and fluctuating clinical course during anesthesia and surgery. The main objectives in the perioperative management of these patients are to control the blood pressure, heart rate and arrhythmias. Preoperative α blockade, intraoperative vasodilators and increasing the depth of anesthesia are the measures taken to prevent wide swings in haemodynamic changes [2].

Traditionally, it is recommended that all patients with pheochromocytoma should receive adequate pre-operative α blockade, and this strategy has been suggested to reduce the peri-operative complication rates to less than 3% [3,4]. However, preoperative hypertension treatment has not proven to be useful [1,5]. The patients undergoing pheochromocytoma removal with normal or increased preoperative arterial pressures have not any significant differences in the outcome [6]. Phenoxybenzamine has been the most commonly used α blocker for preoperative control of hypertension, however currently it is not regarded as the best drug for this purpose. Phenoxybenzamine, an irreversible blocker of α1 and α2 adrenoceptors, has a half-life of 24 h. It produces significant postural hypotension and reflex tachycardia due to the blockade of α2 receptors. Its long duration of action has been suggested to contribute to the hypotension following tumor removal [1]. The patient in the present case received preoperative phenoxybenzamine treatment which was prescribed by endocrinologists before referral to surgery. The patient did well, however it might not be the best adequate drug currently. Selective α antagonists such as terazosin and prazosin have shorter duration of action and therefore could minimally potentiate the hypotension, which follows a decrease in catecholamine levels [1,5]. A β blocker may be used for preoperative control of tachyarrhythmias. However, β blockers should never be commenced on without previous blocking α receptor-mediated vasoostriction, because the loss of β adrenergic-mediated vasodilatation in a patient with unopposed catecholamine-induced vasoconstriction can result in serious hypertension [4]. A variety of calcium channel blockers [1], clonidine, dexametomidine [7], labetalol [8], and magnesium sulfate [9] have also been suggested to prepare the patients for surgery.

The induction of anesthesia, intubation, skin incision, and surgical manipulation of the tumor can lead to life-threatening adrenergic crisis [1]. Direct manipulation of the tumor, both in open and laparoscopic resection, is one of the most important factors for intraoperative hypertension. Surgical handling of the tumor may be associated with a 25% incidence of dangerous hypertensive attacks even in properly prepared patients [10]. Several other factors associated with increased risk of intraoperative hemodynamic instability were described, including a tumor size larger than 4 cm [11] as in the present case.

During the surgical manipulation, brisk hypertensive episodes can be controlled by nitroprusside, nitroglycerine, nicardipine, fenoldopam or labetalol [12]. In a recent literature review, it has been stated that up to 3 different antihypertensive medications were used simultaneously to treat hypertensive crisis in the reported cases [12]. Nitrates followed by β blockers were given most frequently [12]. Our choice was sodium nitroprusside in the present case. Its onset of action is immediate and recovery occurs within a few minutes. It has been commonly used as a first-line drug to treat intraoperative hypertension in patients undergoing pheochromocytoma surgery [5,13]. In the other hand, nitroprusside may cause complications such as, methemoglobinemia, cyanide toxicity and the patient may also develop tachyphylaxis.

The intraoperative hypertensive responses can be limited by increasing anesthetic depth [13]. Sevoflurane has low solubility in blood and fat, leading that it is an anesthetic agent with which the level of anesthesia can be easily altered [2]. It does not sensitize the myocardium to catecholamines, and is one of the preferable inhalational agents in pheochromocytoma surgery. In our case, we decided to begin with the elevation of sevoflurane concentration even if we already had the nitroprusside infusion installed in order to take the advantage of prevention of potential side effects of nitroprusside. Intraoperative hypertensive events which occurred during surgical handling of the tumor were rapidly controlled by adjusting the
sevoflurane concentration and increasing anesthetic depth. Khetarpal et al used dexmedetomidine infusion and increased sevoflurane concentration to control hypertensive crisis during pheochromocytoma surgery [2].

Fentanyl, remifentanil, and propofol are intravenous anesthetics that maybe used to blunt sympathetic response during anesthesia [14]. Remifentanil is an ultra-short acting opioid. It acts through binding μ-receptors and causes bradycardia and hypotension. Remifentanil infusion, decrease the hemodynamic response during pheochromocytoma resection [14].

It has long been suggested to restore blood volume with an assumption that patients with pheochromocytoma are hypovolemic. Presently, however, it is known that intra and postoperative hypotension is the consequence of vasodilation after tumor removal, and not because of hypovolemia [1]. Furthermore, fluid infusion does not change the outcome in patients undergoing pheochromocytoma surgery [15]. A total of 2000 ml of fluid infusion was given to our patient and central venous pressure was within normal range during surgery. The patient did not experience hypotension after tumor removal.

Preoperative preparation and management of the hypertensive episodes are main issues of the anesthetic management in pheochromocytoma resection surgery. Increasing the sevoflurane dose can be used as a first line treatment of hypertensive episodes during surgery.

REFERENCES