Case Reports and Reviews

Case Report

The Hemodynamic-Stabilizing Properties of Dexmedetomidine on Adrenalectomy For Pheochromocytoma: A Case Report

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Abstract

Pheochromocytoma is a catecholamine-secreting neuroendocrine tumor and represents a challenge to the anesthesiologist. Without adequate preoperative preparation, excessive catecholamine release can result in life-threatening cardiovascular complications. To control blood pressure during the surgery, an infusion of sodium nitroprusside and dexmedetomidine was administered. Dexmedetomidine helps prevent hemodynamic instability during the tumor resection and was a way of interrupting the catecholamine release.

This report attempts to address the preoperative and intraoperative issues in managing these challenging tumors with an emphasis on other therapeutic options to control the adrenergic crisis during the surgery.

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Introduction

Pheochromocytoma is a rare neoplasm of chromaffin cells that synthesize catecholamines. Naranjo The classic triad of symptoms includes hypertension, headache, and sweating. Some hereditary conditions may be associated, such as multiple endocrine neoplasia type 2 (MEN2)(1). The patient should be evaluated for the existence of target organ lesions resulting from excess catecholamine secretion, myocardial infarction, cardiomyopathy, arrhythmias, and heart failure. Neumann Currently, surgery is the only curative treatment available, but it comes with risks such as hypertensive and hypotensive crises caused by the tumoral release of catecholamines during anesthetic induction and tumor manipulation [1].

Preoperative management is a key component of patient care to minimize the physiological impact of catecholamines, with the goals being the control of hypertension (including the prevention of intraoperative hypertensive crisis) and the reversal of hypovolemia [2]. Several approaches to pharmacologic preparation have been proposed; however, no randomized trials have been conducted to compare the efficacy of these various techniques, and there is no universally accepted method of preoperative blood pressure control [3]. According to current recommendations, adrenergic blockade should be started 7-14 days before surgery [1]. However, according to Lentschener et al, based on the findings that high preoperative systolic blood pressure is not predictive of perioperative hemodynamic instability, only patients with hypertension-induced organ dysfunction require systolic blood pressure normalization before surgery [4].

This article provides an evidence-based update on anesthetic management for a pheochromocytoma resection and describes the assessment and therapeutic options to control blood pressure in the perioperative period.

Case report

A 69-year-old, female patient, BMI 26, medical history of hypertension, headache, palpitations, sweating, and diabetes, with multiple hospitalizations. A computed tomography scan revealed an 8 cm tumor on the left adrenal gland compatible with pheochromocytoma. Preoperative preparation consisted of doxazosin and atenolol. Admitted for preoperative optimization and adrenalectomy. The intraoperative monitoring consisted of electrocardiography, pulse oximeter, end-tidal CO_2, invasive blood pressure, and central venous pressure. The arterial catheter was inserted into the left radial artery and connected to the FloTrac/ Vigileo system.

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An 18G thoracic epidural catheter was placed in the T8-9 interspace with an 18G Tuohy needle. Epidural analgesia was performed with a bolus dose (Ropivacaine 0.2%, 15ml, morphine 2 mg). Anesthetic induction with sufentanil, lidocaine, propofol, and rocuronium. Maintenance of anesthesia was done with 2.5% sevoflurane. Despite the smooth intubation of the trachea, the patient had a significant hypertensive peak (systolic blood pressure up to 300mmHg). During the intraoperative period, she presented intense pressure lability, with blood pressure rapidly varying from 50-260 mmHg, titrated noradrenaline, and nitroprusside. Intraoperative infusion of dexmedetomidine was then started, 0.7mcg/kg over 10min followed by a continuous infusion of 0.4 mcg/kg/h, with better hemodynamic control being observed. After clamping the effluent vein, sudden hypotension occurred. A fluid bolus was administered, vasodilators were rapidly discontinued, norepinephrine infusion was started and dexmedetomidine was stopped. Anesthetic-surgical time of 5h, removal of the entire tumor, and no invasion of adjacent structures identified. Fluid management was goal-guided through hemodynamic parameters and also by urinary output and blood gas analysis. We Infused 2750 ml of heated balanced crystalloid (about 10 ml/kg/h). In the end, she presented hemodynamic stability and absence of markers of poor perfusion, being referred to the ICU extubated and without complaints. In the intensive care unit, invasive pressures and blood glucose were monitored, inotropes were tapered off and she recovered well.

Discussion

Pheochromocytomas account for less than 1% of all adult cases of hypertension. Although they are a rare cause of hypertension, they must be detected because they are potentially fatal and one of the few truly curable forms of hypertension [5].

During the perioperative period, a pheochromocytoma crisis can develop into a potentially fatal scenario, characterized by increased bleeding, myocardial infarction, cardiomyopathy, arrhythmias, and even cardiogenic shock. The gold standard pharmacological treatment is alpha antagonists [6]. Doxazosin is a more specific short-acting and competitive alpha-1 antagonist with a long duration of action and does not have reflex tachycardia as an adverse effect [3].

Careful planning and meticulous anesthetic management, in addition to close communication with the surgical team, are essential [3]. In the intraoperative period, rapid hemodynamic changes may occur due to the release of catecholamines, preload changes due to vessel compression, or increased bleeding [2].

According to Challis et al, perioperative management is more important than preoperative hypotensive drug administration for achieving good clinical outcomes because meticulous blood pressure monitoring, administration of vasoactive and antiarrhythmic drugs, and careful fluid management are the main blood pressure control measures that truly improve patient outcomes [1]. Although early surgical ligation of the adrenal vein is recommended to reduce intraoperative hemodynamic instability, high increases in catecholamine levels may still occur in large tumors [7].

All agents that cause catecholamine or histamine release should be avoided [3].

Intraoperative hypertension management includes increasing anesthesia depth and rapidly administering vasodilators such as sodium nitroprusside and nitroglycerin. An ultrashort-acting beta blocker infusion could be effective as an adjunct to heart rate control [3].

There are a few reports of the use of dexmedetomidine as an anesthetic adjuvant for the resection of pheochromocytoma.

Dexmedetomidine is a shorter-acting highly selective central alpha 2 agonist that acts at G protein-coupled adrenergic receptors by inhibiting the secretion of norepinephrine at presynaptic adrenergic nerve endings [8].

Intravenous dexmedetomidine infusion has a rapid distribution phase with a distribution half-life of approximately 6 minutes. It has high protein binding, hepatic metabolism with extensive liver biotransformation. Severe hepatic impairment may require dose reduction [9].

Dexmedetomidine reduces blood pressure and heart rate, sympathetic response to intubation, perioperative oxygen consumption (beneficial effect against myocardial ischemia perioperative), anesthetic requirements, and enhances postoperative analgesia. Moreover, reduce plasma levels of catecholamines, the incidence of tachyarrhythmias, and possible inhibition of the inflammatory response [10].

After starting dexmedetomidine in a continuous infusion, lower pressure lability with lower intraoperative variability of systolic blood pressure, in addition to better control of heart rate was observed. Given the usual hemodynamic instability during pheochromocytoma resection, we believe that dexmedetomidine contributed to hemodynamic stability by limiting catecholamine cardiac effects.

Dexmedetomidine was a successful method of achieving safe anesthesia. However, the optimal intraoperative dosing has yet to be determined, and more research in this setting is required [11].

Short episodes of hypotension may occur before adrenal vein clamping during pheochromocytoma resection. The treatment of hypertensive spikes may outlast the brief surgical stimulus, such as tumor removal, and the shorter catecholamine effect, which results in hypotension. In these cases, adequate volume replacement and low doses of direct-acting alpha agonists are used as treatment [7].

Hyperglycemia is common as a result of catecholamine excess, and as indicated, insulin infusion therapy should be used regularly in these patients [3].

In conclusion, anesthetic management in the surgical resection of pheochromocytoma is challenging. An adequate preoperative multidisciplinary approach is necessary to reduce the physiological impact of catecholamine release. Intraoperative infusion of dexmedetomidine proved to be effective as an adjuvant to attenuate the sympathetic autonomic response and pressure lability.

Declaration of interest

The authors declare no conflicts of interest.

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Author contributions

All the authors reviewed the case and reviewed the literature. All authors read and approved the final manuscript.

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