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Case Report

Intraoperative Anesthetic Management in an Asymptomatic and Biochemically Silent Pheochromocytoma

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Abstract

Pheochromocytomas are tumors that originate from the chromaffin tissue of the adrenal medulla and commonly produce catecholamines. The diagnosis is typically established by the measurement of catecholamines or their metabolites in urine or plasma and tumors are localized with the use of radiographic and scintigraphic studies. Pheochromocytomas can occur in asymptomatic patients and the preferred treatment is surgical removal of the tumor. These chromaffin tissue tumors are not uncommon in anesthetic practice and have varied manifestations. The perioperative management of these tumors has improved remarkably over the yearsin conjunction with the evolution of surgical techniques (laparotomy to laparoscopic techniques and now to robotic approaches.). Majority of the patients present with normal clinical and biochemical parameters in the preoperative period, the incidence of hypertension being only 50 %. Even though patients may be clinically asymptomatic, surveillance and proper preoperative evaluation is important, as surgery for associated tumors may precipitate a hypertensive crisis and result in severe complications. We report an intraoperative anesthetic management of 32-year-old female with a left adrenal mass (pheochromocytoma) and left ovarian cyst. Throughout her entire course of treatment she was asymptomatic with normal blood pressure readings. Her biochemical screening was unremarkable. She underwent open surgical resection of the adrenal mass with confirmation of pheochromocytoma on histology. Pheochromocytoma represents very significant challenges to the anesthesiologist's especially when undiagnosed. This case illustrates how paucity of literature on perioperative preparation of clinically and biochemically silent Pheochromocytomas led to serious intraoperative complications even in an asymptomatic, biochemically negative patient.

Keywords: ***Pheochromocytoma, Anesthesia.***

Introduction

Pheochromocytoma (PCC) is a rare tumor that can form in chromaffin cells in the adrenal glands. The tumor can cause the adrenal glands to make too much of the hormones norepinephrine (noradrenaline) and epinephrine (adrenaline). Approximately 80 to 85% of catecholamine-producing tumors originate from the adrenal medulla, and these are called pheochromocytomas. About 15 to 20% derive from the sympathetic paravertebral ganglia and are known as catecholamine-secreting paragangliomas. Among patients with hypertension in the outpatient setting, the prevalence of catecholamine-producing tumors is estimated to be 0.2% to 0.6% [1]. The adrenal medulla normally secretes about 80% epinephrine, but the tumors of the adrenal medulla predominantly secrete more norepinephrine than epinephrine [2]. The elevated catecholamines can give rise to symptoms including sustained or paroxysmal hypertension, headaches, palpitations, tremors, diaphoresis, dyspnea, anxiety, chest pain, nausea, vomiting, and paresthesia. A diagnosis is usually established by measuring the levels of metanephrines in the urine or blood [3] .Clinically silent pheochromocytomas are usually detected on routine screening of patients. Computed tomography (CT) or magnetic resonance

imaging (MRI) is used for tumor localization. The tumor can also present as an asymptomatic adrenal incidentaloma, identified radio graphically. We present here the anesthetic management of hypertensive crisis in aasymptomatic and biochemically silent pheochromocytoma.

Case presentation

A 32-year-old female with a left adrenal mass. The patient was clinically asymptomatic and had a normal biochemical profile with respect to urinary VMA and plasma catecholamines. Due to lack of availability in our setup and cost constraints, metanephrine levels could not be done. As there were no clear guidelines for preoperative preparation of biochemically negative cases, we decided to take up the patient without pharmacological preparation. The patient was posted for open mass excision under general anesthesia (GA). Patient was thin lean build with BMI of approximately 22. She has no co morbidities. Patient has abdominal pain since few months. She went to a local doctor who advised USG abdomen pelvis which showed ovarian cyst with some lesion near upper pole of left kidney. Her CT abdomen showed B/L ovarian cyst with heterogeneously enhancing mass in left supra renal region measuring 58.8 mm x 59.1 mm abutting the spleen, tail of pancreas and upper pole of left kidney with maintaining intervening fat planes without significant lymphadenopathy as shown in figure.1. Patient was advised workup for possiblepheochromocytoma (PCC). All biochemical markers for PCC were negative. Routine investigation advised and preoperative blood investigation tabulated in **Table 1**.

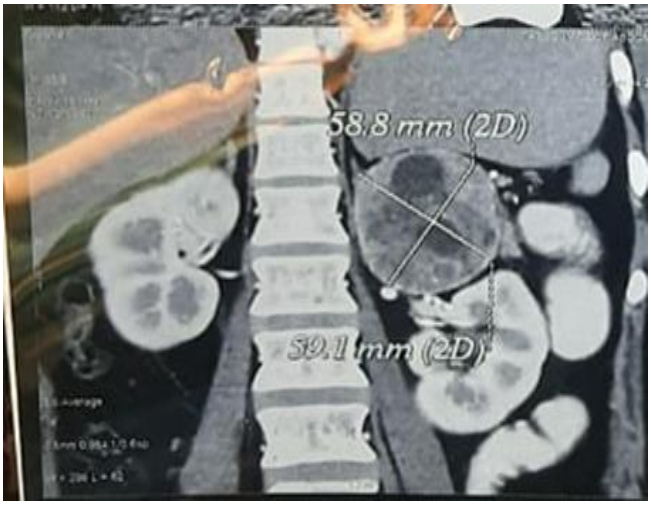


Figure 1: CT scan showing Left Adrenal Mass 58.8 x 59.1 mm

Patient was planned for mass resection. Pre-anaesthesia evaluation was done and patient was accepted as ASA grade 1 status. Two units of blood were asked to be arranged and kept for surgery. Case was discussed with operating Onco-surgeon, after a detailed conversation possibility of pheochromocytoma (PCC) was not ruled out. We kept all infusions pumps ready and loaded including Labetalol, Nitro-glycerine, and noradrenalin. Along with ampoules of adrenalin and vasopressin on standby. After proper consent patient was shifted to operating room, connected to monitor, her blood pressure was 109/68 mmgh, pulse of 77 beats per minute and Spo2 98 percent on room air. 16 G i.v cannulae was place in both arms, and a fluid bolus of 1 litre was pushed before induction. Premedication was started with inj midazolam 2 mg, along with glycopyrollate 0.2mg. Induction was done with propofol 80 mg and vecuronium 6mg i.v; a 7.5 mm cuffed endotracheal tube was placed in Trachea fixed at 22 cms. Patient was connected to automatic anaesthesia delivering machine and put on Volume controlled mode. Post intubation blood pressure was 112/83 mmHg with pulse of 90 per minute, anaesthesia was maintained with oxygen and isoflurane and analgesia with diclofenac, tramadol and paracetamol. Patient was handed over to surgical team with stable vitals. Patient was placed on left lateral position. On Surgical incision patient was stable, while reaching towards tumour site, as soon as the surgeon touched the mass, patient's blood pressure suddenly shoots to 220/125 mmgh, I alerted surgeon about the sudden rise in pulse and blood pressure pointing towards confirmation of PCC.

While dissecting mass was highly vascular with strong adhesions with surrounding tissues as shown in figure 2 & 3. While ligating a large tumor vein patient's blood pressure came down to SBP 180 from 220 mmhg..While DBP remained around 120 mmhg despite being on maximum doses of both labetalol and NTG. Meanwhile urologist also joined the operating team. Main artery supplying the tumour was ligated after informing anaesthesiologist...but to a surprise the blood pressure still remained on higher levels. While the dissection was going on smoothly with minimum handling of tumour during mobilisation, patient's heart rate suddenly started to decrease and BP measured 60 /30 mmHg. I immediately gave atropine 1 mg i.v followed by 12 mg Mephentimene while I stopped both infusions immediately and asked my technician to load adrenaline injection. Within around 10 seconds time patient had flat ECG line and no spot pleatue. I started giving chest compression and pushed 1 mg adrenalin i.v. after approximately 30 seconds patients heart rate came around 130 with blood pressure 160/100, I started noradrenalin infusion. after around 10 minutes patients vitals became stable with heart rate of around 90 and blood pressure of 130/90 mmhg . Upon discussing, the operating surgeon said that he ligated a insignificant blood vessel and suddenly heart rate and blood pressure dropped drastically. I asked surgeons to proceed with surgery which was completed without any further problems; one unit of packed red cells (PRBC's) was transfused intra operatively. Surgery took around 6 hours to get completed. Intraoperative hemodynamic changes are shown in Graph 1 & 2. Tumor of size approximately 6x6x6 cms removed as shown in figure.4 and sent for histopathological examination. Patient was not extubated and was shifted to surgical intensive care unit on noradrenalline support with blood pressure 110/70 mmgh. Next day patient was extubated and noradrenalline tapered and stopped. Patient was shifted to room on 2nd post-operative day. Pathological report came positive for pheochromocytoma

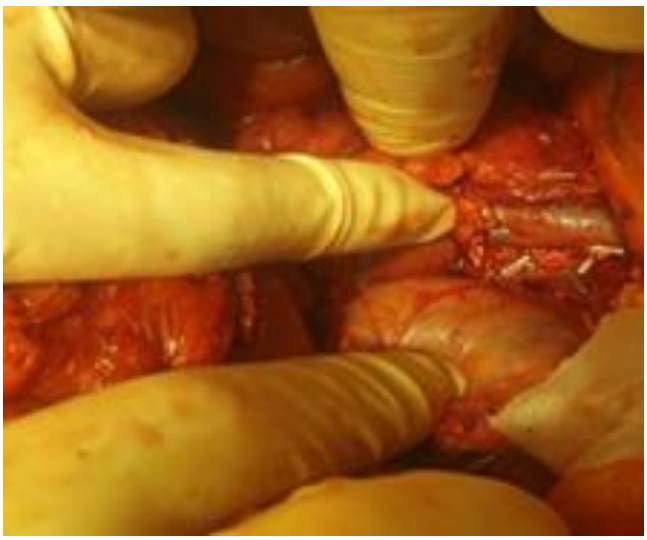


Fig 2

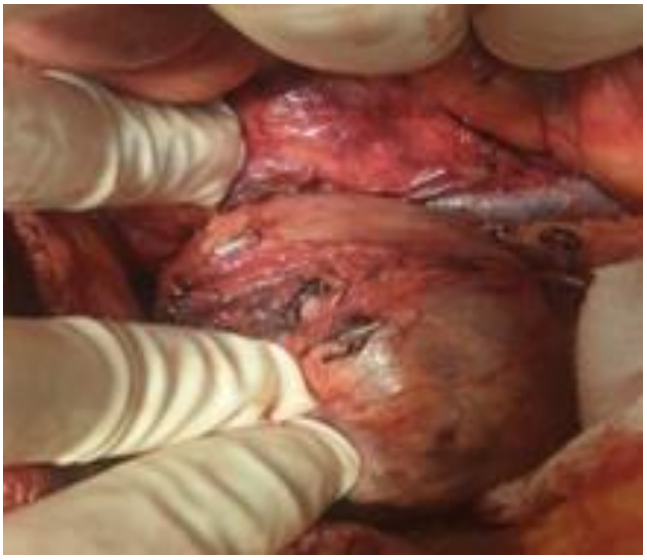


Fig 3

Figure 2 & 3: Showing Adrenal Mass with blood vessel.

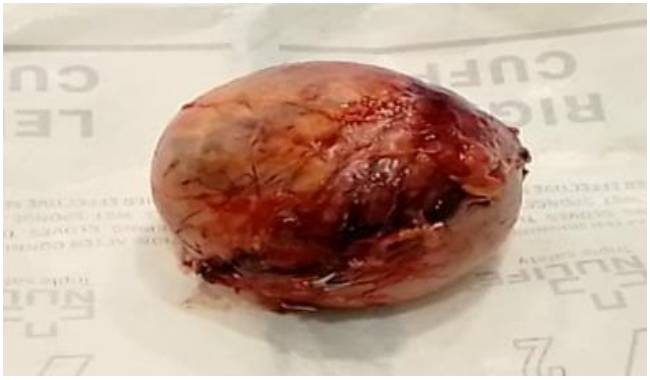
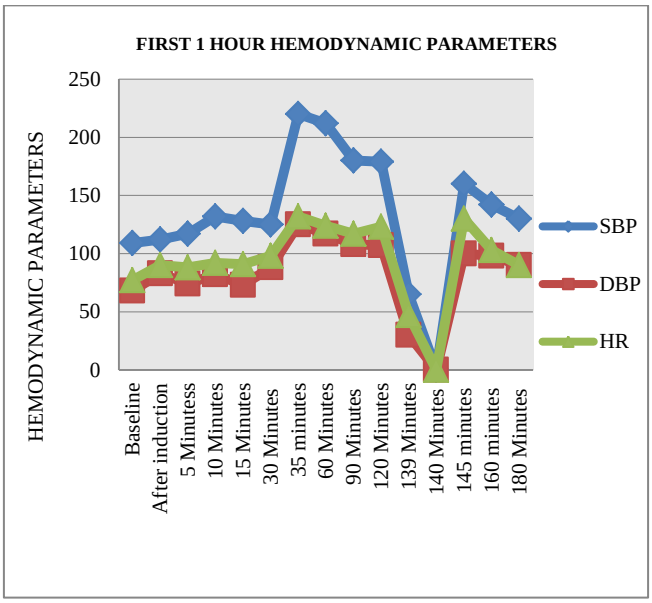
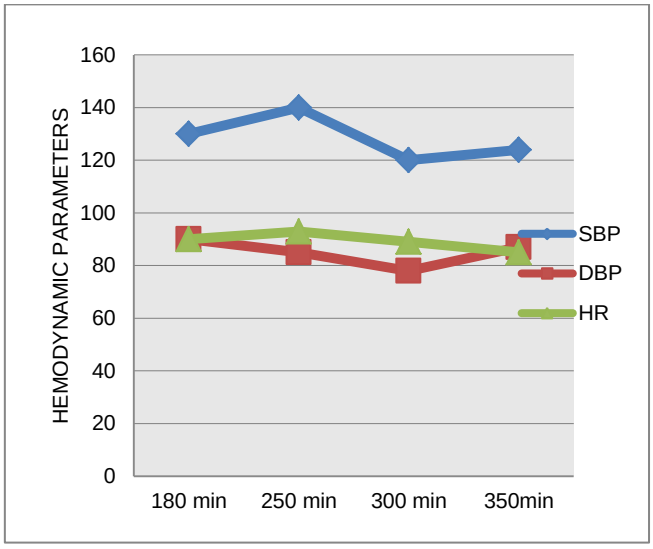


Figure 4: Pheochromocytoma after excision measuring size 6 x 6 x 6 cm



Graph 1: Hemodynamic changes in 1stto 3rdhour of surgery.



Graph 2 Hemodynamic changes in remaining of surgery.

Discussion

Our patient demonstrated an asymptomatic pheochromocytoma that was biochemically negative. The diagnosis of pheochromocytoma was ultimately made with the combination of follow-up imaging and lab work. Medications, anesthetic agents, pregnancy, and surgery can precipitate hypertensive crisis or shock, even in asymptomatic patients [4].

In general, a CT scan with contrast-enhancement and MRI are used to localize pheochromocytomas [5]. The Endocrine Society Guidelines recommend CT rather than MRI as the initial imaging modality for most patients, due to excellent spacial resolution in the thorax, abdomen, and pelvis [1]. In roughly half of the cases, the tumor was discovered incidentally by imaging that was not part of a diagnostic workup for abnormal blood pressure readings [6].

Catecholamines are produced mainly by the chromaffincells of the adrenalmedulla and the postganglionicfibers of the sympatheticnervoussystem. Catecholamine's - nor-epinephrine, epinephrine, and dopamine – act through ubiquitously expressed G-protein coupled adrenergic receptors and play important roles in practically every aspect of human physiology. Norepinephrine signals through α1, α2, and β1 receptors, while epinephrine will primarily stimulate only β1 and β2 receptors. At normal levels, dopamine does not have much of an effect on any of the adrenergic receptors; however, as plasma concentrations increase (ex: dopamine-secreting tumor), dopamine can stimulate both α and β receptors [7].

α1-adrenergic receptors are found primarily on smooth muscle tissue including peripheral (coronary, cerebral, renal, etc.) arteries and veins, causing vasoconstriction upon stimulation. This increases systemic pressure and reduces organ perfusion.

β1-adrenergic receptors can be stimulated by both norepinephrine and epinephrine. The positive inotropic effect of β1 activation in cardiomyocytes is significantly more pronounced than one, induced by α1 stimulation.Stimulation of β1 receptors will also result in release of renin, which will increase mean arterial blood pressure by converting angiotensinogen to angiotensin I. β2-adrenergic receptors are stimulated mainly by epinephrine and will induce vasodilation of muscular arteries, as well as increase norepinephrine release from the sympathetic ganglia [7].

Dopamine will target D1 and D2 dopaminergic receptors. Activation of D1 receptors results in vasodilation of the renal arteries, while D2 activation will inhibit norepinephrine secretion from sympathetic nerve terminals and have a mild negative

inotropic effect on the heart. The signaling net result would explain the clinical phenomenon of lack of hypertension and palpitations in patients with dopamine-secreting pheochromocytomas. On the other hand, pharmacologically high levels of dopamine will stimulate α and β1 receptors causing vasoconstriction and increased heart rate [7].

The differential diagnosis of intraoperatve hypertensive crisis is broad and may be divided into neurological, endocrine, and renal causes. Cardiac manifestations of phaeochromocytoma include left ventricular hypertrophy and diastolic dysfunction, tachyarrhythmias, and systolic heart failure.

Conclusion

Pheochromocytoma is a tumor of the chromaffin cells in the adrenal medulla and sympathetic paraganglia, which synthesizes and secretes catecholamines. Norepinephrine, epinephrine, and dopamine all act on their target receptors, which causes a physiological change in the body. Handeling tumor during surgery may stimulate chromaffin cells to relese high circulating levels of catecholamines, that can lead to severe hypertension crisis and can have devastating effects on multiple body systems (cardiovascular, cerebrovascular, etc.), and can lead to death if untreated. So, before takeing up these cases, anesthesiologist must be well prepared with all necessary medications like antihypertensives and antiarrhythmics (nitroglycerin, sodium nitroprusside, phentolamine, esmolol, xylocard, and amiodarone).

Ethics approval and consent to

Capital Hospital Meerut UP.

List of abbreviations

CT: Computerized Tomography
MRI: Magnetic Resonance Imaging
VMA: Vanillylmandelic Acid

Conflicts of Interest

No conflict of interest

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Authors' contributions

Omar N. main Anesthesiologist. Shahid M Chief operating surgeon, Bashir M. Lab Diagnosis. Imran s. Manuscript writing. Vipin k Urologist. Palak Manuscript writer.

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