Introduction

Pheochromocytoma is a rare tumor of chromaffin cells producing catecholamines. It presents with vague nonspecific symptoms which are often attributed to co-existing disease. This patient was diagnosed in the anesthetic room due to swinging hypertension to hypotension on induction of anesthetic for tissue aortic valve replacement (AVR) and bypass graft. The heart disease in combination with uncontrolled catecholamine boluses from the pheochromocytoma posed a diagnostic problem, being often attributed to common/co-existing pathology. The blood pressure instability on anesthetic required precise control, multidisciplinary input, and awareness of possible diagnosis as a routine intervention for hypotension may have been fatal in view of underlying cardiac pathology.

Case Report

A 77-year-old male was incidentally diagnosed with pheochromocytoma after severe instability at anesthetic induction for cardiac surgery. The plan was for coronary artery bypass grafting and AVR for severe aortic stenosis.

Two weeks of intermittent chest pain associated with dizziness worse on exertion and sudden standing was followed by severe central chest pain waking him from sleep with elevated Troponin T: 139 ng/L (n <17 ng/L) and electrocardiogram (ECG) changes suggestive of non-ST-elevation myocardial infarction. Angiogram was carried out, and referral for surgery was made.

Five-year history of a headache and dizziness was treated as migraine by his GP with topiramate. Other comorbidities were diabetes mellitus (Type 2), hypertension, and medically managed prostate malignancy. The GP had recently stopped anti-hypertensives due to dizzy spells and hypotension.

A 10-day coronary care unit admission preceded transfer for surgery. His preoperative observation chart demonstrates labile blood pressure (BP) taken over the day ranging from 104/50 to 190/100 mmHg, with a stable heart rate of 60 bpm. During this time, he was treated with beta-blockers and Angiotensin-converting enzyme-inhibitor for acute coronary syndrome.

Abstract

A 77-year-old man was admitted for aortic valve replacement and combined coronary bypass grafting. Grossly, labile arterial pressures were demonstrated on anesthetic induction prompting cancellation and Intensive Care Unit transfer. Urine analysis identified high normetadrenaline/creatinine ratio, plasma metanephrine, and plasma normetanephrine. A left adrenal lesion on computed tomography scan collectively indicated pheochromocytoma. Laparoscopic adrenalectomy was prioritized at multidisciplinary team before cardiac surgery. Vague symptoms of pheochromocytoma pose a diagnostic problem, being often attributed to common/co-existing pathology. The blood pressure instability on anesthetic required precise control, multidisciplinary input, and awareness of possible diagnosis as a routine intervention for hypotension may have been fatal in view of underlying cardiac pathology.

Keywords: Aortic valve replacement, coronary artery disease, induction of anesthesia, multi-disciplinary team meeting, pheochromocytoma, uncontrolled blood pressure, unexpected diagnosis

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Preoperative investigations

Transthoracic echo showed normal left ventricular (LV) size with 40% ejection fraction and elevated filling pressures. The aortic valve showed severe calcific aortic stenosis (area 0.84 cm$^2$; peak gradient 64.64 mmHg; peak velocity 402 cm/s); and mild aortic regurgitation.

ECG suggested LV hypertrophy as per the Cornell voltage criteria\(^1\) with left axis deviation.

Coronary angiogram identified proximal left anterior descending (LAD) artery stenosis (80%), with further mild atheroma in the left main stem, circumflex, and right coronary artery.

Carotid Doppler scanning showed carotid stenosis of 50% and 70% on the right and left, respectively.

Anesthetic proceedings

Initial BP in the anesthetic room was 144/73 mmHg. Induction was performed using 3 mg Midazolam, 250 mcg Fentanyl, and 50 mg Propofol. Isoflurane was started at MAC: 1 and 8 mg of Pancuronium given. BP rose immediately, reaching 290/160 mmHg at 3 min postinduction. Despite attempts to control BP with titrated boluses of Fentanyl up to 1 mg, propofol up to 200 mg, and Isoflurane, the patient remained uncontrollably hypertensive. Possible errors in drawing up the induction medications were quickly excluded after checking the empty vials carefully. After several minutes of established hypertension, a sudden drop to 70/35 mmHg occurred.

A diagnosis of pheochromocytoma was considered. An endocrinologist and anesthetist with significant experience of pheochromocytomas were urgently contacted. Hypertension was managed by titrating glyceryl trinitrate and sodium nitroprusside (SNP) infusions initially. 8 mmols magnesium sulfate were also given. Propofol infusion was maintained. Hypotension was managed with fluid boluses, Trendelenburg position of the operating table and a single bolus of Metaraminol 0.5 mg given when absolutely essential (systolic of 60 mmHg). BP remained uncontrolled.

The cardiovascular instability and possible diagnosis of pheochromocytoma prompted the cancellation of surgery. The patient was transferred to ITU and stabilization with alpha-blockade (NG Phenoxybenzamine 20 mg tds) was instituted on a background infusion of SNP.

The patient remained an inpatient during the investigation for pheochromocytoma.

Investigation results

Of note, all urinary and blood tests for catecholamine metabolites were sent before administration of any iatrogenic catecholamine.

An immediate urinary normetadrenaline/creatinine ratio was high at 5.40umol/mmol creat (normal range 0.00–0.350 umol/mmol creat), considered highly suspicious of pheochromocytoma.

Plasma metanephrine was dramatically elevated at 4,110pmol/L (range 80–510 pmol/L) with a plasma normetanephrine >25,000 pmol/L (range 120–1180 pmol/L).

Computed tomography (CT) thorax, abdomen and pelvis showed a complex 4.5 cm lesion in the left adrenal [Figures 2 and 3]. The heterogeneous nature with flecks of calcification was not characteristic of adrenal adenoma and with the biochemistry above this finding was diagnostic of pheochromocytoma.\(^2\)

Nuclear medicine scanning with iodine-131-metiodobenzylguanidine demonstrated no evidence of metastases or extra-adrenal pheochromocytoma [Figure 4].

Surgical planning

MDT discussion with cardiac and endocrine anesthetists, physicians and surgeons, concluded that intervention for the catecholamine-secreting tumor would occur first, followed by a stabilization period and cardiac surgery.

Planned laparoscopic adrenalectomy was performed, and the patient made an uneventful postoperative recovery.

Two weeks later, it was decided to proceed with cardiac surgery after anesthetic re-assessment. The patient was anaesthetized without a problem. Bypass was through
LAD was grafted using the left internal mammary artery. The aorta was opened, valve excised, annulus decalcified, and a 22 Soprano Armonia valve inserted. Bypass was weaned with a small dose of adrenaline.

Postoperatively, right-sided limb weakness developed and CT scan confirmed periventricular small vessel ischemic change with no large acute infarct. Antiplatelet agents were given and his symptoms almost entirely resolved by discharge. The patient remained in hospital for 11 days postoperatively, with planned follow-up by the vascular and stroke teams due to his carotid disease.

At 6-week postoperative clinic, he was functionally well and mobilizing 800yards despite residual mild weakness of the right hand. His echo showed a well seated prosthetic aortic valve with 35% ejection fraction.

**Discussion**

Pheochromocytoma is a rare catecholamine-producing tumor of chromaffin cells. The estimated incidence is 2–8 per 1 million persons per year. Autopsy series reveal prevalence figures of 0.2% suggesting that up to 50% pheochromocytomas are undetected during life.\(^1\) It can affect all ages with a mean diagnostic age of 40 years.\(^2\)

Clinical features may be vague, posing a diagnostic problem, and include abdominal pain, hypertension, headache, anxiety, sweating, palpitations, syncope, nausea, and vomiting. Patients may experience paradoxical response to beta-blockade and ischemic cardiac pain in the absence of coronary disease due to coronary spasm. Some patients are persistently hypertensive with resultant symptoms; others report intermittent attacks occurring at the time of secretion. Catecholamine crises may be precipitated by anesthetic induction, trauma, exercise, childbirth, and diagnostic procedures among others.\(^3\)

This patient’s preadmission symptoms including headaches and significant hypertension were likely due to catecholamine release and may have highlighted the underlying pathology; however, had been attributed to more common, co-existing disease.

A cardiac surgical patient with unpredictable catecholamine release during anesthesia and surgery poses an unusual and difficult clinical problem. Cardiac surgery requires precise control of haemodynamics to permit bypass, myocardial and organ protection and return to a normal loaded heart as circulatory support is withdrawn.

Our case study demonstrates an unusual presentation and a multidisciplinary approach in managing this complex situation.

Perioperative hypotension at induction of anesthesia in patients with aortic stenosis is not uncommon due to physiological changes with vasodilatation. A high index of suspicion was required to recognize the possible diagnosis and proceed appropriately.
Induction hypotension is commonly managed with iatrogenic catecholamines, which would have been detrimental and perhaps fatal in this patient. With an already high systemic vascular resistance and existing coronary artery disease, the administration of further catecholamines would increase peripheral vascular resistance resulting in a struggling left ventricle with acute heart failure.

Intentional vasodilatation using infusions of short-acting agents enabled control to be gained before further myocardial damage occurred. Rapid conversion to oral/nasogastric phenoxybenzamine provided background peripheral blockade of the effects of excess catecholamines.

Following resolution of the acute crisis, a multidisciplinary approach was employed to evaluate risk for the complex surgeries required. The decision of priority was challenging given his critical coronary artery disease, severe aortic stenosis, and significant carotid disease as well as the risk of a further catecholamine crisis at the time of surgery.

The MDT felt that managing the pheochromocytoma first would be safer, with the assistance of an anesthetic team with extensive endocrinology experience. After the successful intervention, his cardiac disease was tackled, safe in the knowledge that any instability would not be due to aberrant catecholamine release.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.

References
1. Boland GW, Blake MA, Hahn PF, Mayo-Smith WW. Incidental adrenal lesions: Principles, techniques, and algorithms for imaging characterization. Radiology 2008;249:756-76.
2. Casale PN, Devereux RB, Alonso DR, Campo E, Kligfield P. Improved sex-specific criteria of left ventricular hypertrophy for clinical and computer interpretation of electrocardiograms: Validation with autopsy findings. Circulation 1987;75:565-72.
3. Joynt KE, Moslehi JJ, Baughman KL. Paragangliomas: Etiology, presentation, and management. Cardiol Rev 2009;17:159-64.
4. Krishnappa R, Chikaraddi SB, Arun HN, Deshmane V. Pheochromocytoma in Indian patients: A retrospective study. Indian J Cancer 2012;49:188-93.
5. Scholten A, Cisco RM, Vriens MR, Cohen JK, Mittmaker EJ, Liu C, et al. Pheochromocytoma crisis is not a surgical emergency. J Clin Endocrinol Metab 2013;98:581-91.