 

PERIOPERATIVE MANAGEMENT

# Coronary Bypass Surgery in the Presence of Metastatic Pheochromocytoma

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**ABSTRACT The hemodynamic management of a patient with a pheochromocytoma presents special challenges due to the episodic release of catecholamines from the tumor, which threatens to provoke a hypertensive crisis. We present a patient with metastatic pheochromocytoma (bone, lung, lymph nodes) who underwent successful coronary artery bypass graft (CABG) surgery following premedication with phenoxybenzamine and metyrosine as well as the use of intraoperative phentolamine for the management of a hypertensive crisis in the operating room.** doi: 10.1111/jocs.12533 *(J Card Surg 2015;30:419–420)*

Pheochromocytoma is a rare catecholamine-secreting neuroendocrine tumor of the adrenal medulla or sympathetic ganglia.[1] If the tumor is removed in its entirety, surgery may be curative; otherwise medical management consists of a combination of adrenergic and calcium channel blockers to control blood pressure and prevent tachycardia, as well as metyrosine to reduce catecholamine synthesis.[2] Surgery for a patient with a pheochromocytoma is particularly high risk due to the provocation of catecholamine release by the physical stresses of anesthetic induction, endotracheal intubation, skin incision, and potential tumor manipulation. Precautions must be taken to ensure safe surgical management and prevention of a hypertensive crisis. We present the management of a patient with metastatic pheochromocytoma in need of coronary artery bypass graft (CABG) surgery.

## PATIENT PROFILE

The proposal to report this case was evaluated by the Boca Raton Regional Hospital Research Committee, which determined that this research endeavor was exempt from review by the institutional review board. Permission was granted to publish this case report.

A 58-year-old male was referred for CABG surgery with worsening shortness of breath symptoms. He had known metastatic pheochromocytoma for more than 10 years, having previously undergone resection of the primary right peri-renal tumor, as well as subsequent chemotherapy and radiation for multiple sites of metastasis including pulmonary nodules, mediastinal lymph nodes, and bone (spine, ribs, right femur). His metastatic disease had been radiographically stable for two years. He had early onset cardiovascular disease, including a previous myocardial infarction (MI), and multiple percutaneous coronary intervention (PCI) procedures with stents in the right, left anterior descending (LAD), diagonal and circumflex coronary arteries. Now two years since his most recent PCI treatment, the patient had developed recurrent shortness of breath and angina symptoms. His ejection fraction had decreased from 50% to 30%. Despite aggressive antiplatelet and lipid-lowering therapy, a repeat coronary angiogram revealed 60% in-stent restenosis of the LAD stents, as well as 70% left main ostial stenosis. The risk of repeat PCI was felt to be prohibitively high. Therefore, the patient agreed to undergo CABG, despite the potential risks with surgery.

The patient was medically optimized in the preoperative period for one week with the administration of phenoxybenzamine 10 mg bid (a nonselective alpha-adrenergic blocker), metyrosine 250 mg daily (an inhibitor of catecholamine synthesis), and carvedilol 25 mg bid (an alpha- and beta-adrenergic blocker). In the operating room, anesthesia induction was performed with etomidate, fentanyl, rocuronium, and inhaled isoflurane. Following endotracheal intubation, the patient's blood pressure climbed to 180/80 mmHg.

**Conflict of interest:** The authors acknowledge no conflict of interest in the submission.

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The hypertensive crisis was averted with additional fentanyl boluses and three boluses of 1 mg phentolamine (a short-acting alpha antagonist). The blood pressure subsequently stabilized before the sternotomy was performed. Bone metastasis and profuse bleeding was evident in the manubrium, which was controlled with gelfoam and bone wax. Mediastinal lymph nodes were evident but not biopsied at the time of surgery, in order to prevent unnecessary tumor manipulation. On-pump CABG was chosen, in contrast to off-pump surgery, to help facilitate hemodynamic management during surgery. The remainder of the operation was performed without incident, with the left mammary grafted to the LAD, and saphenous vein grafted to a circumflex branch. The patient was weaned from cardiopulmonary bypass easily with low dose norepinephrine. Cardiac function was excellent, and the vasopressor support was weaned within several hours of the operation. By the morning after surgery, the patient was extubated, and his preoperative blood pressure medications were slowly reintroduced. The patient was discharged from the hospital five days after surgery following an uneventful postoperative course. Now 12 months later, the patient continues to do well, with patent grafts noted on recent computed tomography imaging.

## DISCUSSION

Pheochromocytoma is an uncommon tumor originating from neural-crest cells that leads to early cardiovascular disease and severe hypertension secondary to chronic catecholamine excess. Pheochromocytoma may be successfully cured with surgical resection, but 5% to 10% of patients present with metastatic disease.[2] In the absence of a surgical cure, medical management for patients with metastatic pheochromocytoma is achieved through the control of the catecholamine-mediated manifestations of the disease. The standard of care includes alpha- and beta-adrenergic blockers to prevent vasoconstriction and tachycardia, respectively, with the addition of calcium channel blockers and metyrosine.[2] Our patient underwent resection of the primary tumor; however, metastases remained, necessitating chemotherapy and radiation.

Surgery presents a unique challenge for the pheochromocytoma patient. The stress of an operation threatens to provoke catecholamine release from adrenal tissue which may in turn provoke a hypertensive crisis. Particularly risky intraoperative periods include anesthetic induction, intubation, skin incision, and any tumor manipulation.[1] A hypertensive crisis triggered by anesthetic induction during surgery in the setting of an undiagnosed pheochromocytoma has a mortality risk that approaches 80%.[3] The goal of preoperative medical optimization is to adequately control hypertension and inhibit catecholamine production via adrenergic receptor blockers, calcium channel blockers, and metyrosine.[2] The risk of perioperative mortality during a pheochromocytoma operation can be reduced from 45% to approximately 3% with the judicious use of these treatments.[1] The presence of severe coronary artery disease makes adrenergic blockade even more imperative since even small fluctuations in blood pressure can adversely shift the myocardial supply-demand balance and cause ischemia.[4] Intraoperatively, the anesthesiologist must be prepared to manage a hypertensive crisis using phentolamine, a short-acting alpha antagonist. Even valuable antihypertensive medications like nitroprusside can be ineffective in patients with pheochromocytoma.[3] Because tumor manipulation provokes catecholamine release, we did not biopsy mediastinal lymph nodes at the time of surgery.

A few cases in the literature have described the hemodynamic challenges of performing CABG in a patient undergoing pheochromocytoma resection concurrently.[4–5] To our knowledge, however, no reports exist of a patient surviving surgical coronary revascularization with metastatic pheochromocytoma. In addition to reducing catecholamine production with metyrosine, we believe the preoperative administration of phenoxybenzamine, an irreversible alpha receptor blocker, helped in the care of our patient to minimize the severity of intraoperative blood pressure fluctuation. Phenoxybenzamine is likely more safe and effective for preoperative blood pressure control for a patient with pheochromocytoma undergoing CABG, as compared to calcium channel blocker therapy such as nicardipine.[5]

This case demonstrates that cardiac surgery is feasible for a patient with metastatic pheochromocytoma, with appropriate preoperative medical optimization and careful intraoperative hemodynamic management.

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