CASE REPORT

PERIOPERATIVE ANESTHETIC MANAGEMENT OF A PATIENT UNDERGOING CAROTID BODY TUMOR REMOVAL: FOCUS ON HEMODYNAMICS

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Abstract

Background: Carotid body tumors (paragangliomas) are uncommon neuroectodermal neoplasms, constituting roughly 1–2% of all head and neck cancers. Their proximity to the carotid vessels and cranial nerves presents considerable perioperative anesthetic problems, especially regarding the danger of hemodynamic instability during tumor manipulation.

Case presentation: We detail the perioperative anesthetic care of a 68-year-old female with a left-sided carotid body tumor, who experienced flushes, palpitations, and headaches. Preoperative imaging confirmed the diagnosis, while the preoperative assessment identified a potentially difficult airway and the need for invasive monitoring. General anesthesia was administered with invasive arterial and central venous monitoring. During tumor dissection, the patient experienced recurring bouts of vagally mediated bradycardia, which resolved upon cessation of manipulation and the administration of atropine and low-dose adrenaline infusion. Hemodynamic stability and sufficient cerebral perfusion were preserved during the surgery. The postoperative recovery was unremarkable, and the patient was discharged on the third day after surgery.

In conclusion: Meticulous hemodynamic monitoring, prompt intervention for vagal reactions, and thorough multidisciplinary collaboration are crucial for the safe administration of anesthesia during carotid body tumor removal.

Key words: *glomus caroticus, glomus caroticus tumor, neck tumors.*

Introduction

Only a small proportion, approximately 1-2%, of the tumors originating from the neuroectodermal tissue are glomus caroticus tumors, which are also known as paragangliomas. These tumors are typically observed as solitary masses, but in 3-10% of the cases, multiple tumors may be present and often in conjunction with other neuroendocrine conditions such as neurofibromatosis type 1, MEN 2, and Von Hippel-Lindau syndrome. (1) Gender and inherited genetic mutations have well-known contributions to the development of glomus caroticus tumors; de novo mutations can also arise at any stage of life. Paragangliomas are most frequently diagnosed in individuals aged 40-60, with a notable predominance in females at a ratio of 4:1. These tumors are classified according to the scale of Shamblin, based on their relationship to the carotid artery in 3 groups (2). Type I tumors are small tumors confined to the carotid bifurcation, with minimal attachment to the carotid vessels, while type II are larger tumors that partially surround the carotid vessels. Type III tumors are large, encasing tumors that significantly involve the carotid arteries, making their resection and extirpation very challenging. Symptomatology and clinical presentation in these cases is largely determined by the anatomical location of the tumor. Lesions which involve the middle ear are most commonly associated with pulsatile tinnitus, conductive hearing loss, aural fullness, otorrhea or otorrhagia, and the presence of a bluish-red mass visible through the tympanic membrane. In contrast, tumors affecting cranial nerves typically present with facial nerve paralysis, dysphonia, significant sensorineural hearing loss, and otalgia. In general, neurological symptoms are manifested subsequently after occurrence of otologic symptoms (3,4) On the other hand, rare functional CBT may produce neuroendocrine secretions causing catecholamine-related symptoms, such as palpitations, headaches, hypertension, tachycardia, or flushing (5). When considering carotid body tumors, surgical resection of the tumor remains the treatment of choice, which is usually considered a definitive therapy (6). However, the surgical procedure by itself is complex and risky due to the close proximity of the tumor to significant neurovascular structures and great vessels in the neck, leading to significant surgical and anesthetic risks such as major blood loss, airway compromise, or hemodynamic instability due to carotid body stimulation which can arise during the surgical intervention. Managing cases of carotid body tumors could be very challenging to both the surgeon and the anesthetist, as the tumor is highly vascular and the cranial nerves IX, X, XI, and XII in the carotid sheath are close. (7). Therefore, a perioperative rise in blood pressure coupled with the vascular nature of the tumor could result in massive blood loss. This case report is presented to bring to the fore the anesthetic challenges encountered during the perioperative management and the steps taken to overcome them. Adequate preoperative evaluation, including assessment of potential airway difficulties, is essential, as neck masses may distort normal anatomy and increase the risk of difficult intubation. Cardiovascular assessment should focus on identifying hypertension, arrhythmias, or signs suggestive of possible catecholamine secretion. Also, routine laboratory testing, coagulation studies, and detailed imaging such as CT or MRI determine the extent of vascular involvement and guide perioperative planning, playing a crucial role in planning safe anesthetic management.

Case presentation

We present a 68-year-old female patient, 62 kg in weight and 165 cm in height, on chronic antihypertensive therapy, whose laboratory findings and hemostasis tests were within normal ranges. She was admitted to our department for thoracic and vascular surgery with a left-sided neck tumor and symptoms such as flushing, headaches, and palpitations. Preoperatively, the diagnosis was confirmed by contrast-enhanced CT of the neck region. Before induction, her vital parameters were monitored; her blood pressure was 130/70 mmHg, heart rate 60/min, and saturation 98% while spontaneously breathing room air. Proper premedication, aimed at achieving anxiolysis, hemodynamic stability, and attenuation of stress response, is equally important and contributes significantly to minimizing intraoperative cardiovascular instability while enhancing overall anesthetic safety. After preoxygenation for 3 minutes with 8L/min oxygen, the patient was premedicated with 2mg Midazolam i.v, 0.1mcg Fentanyl and inducted to general anesthesia with 100 mg Propofol. Inhalational anesthesia was maintained with continuous use of sevoflurane and adequate muscular relaxation with rocuronium. The patient presented with a difficult airway, leading to a difficult intubation. The patient was intubated with video laryngoscope and an ETT number 7 was placed. An arterial line was placed in the right radial artery and invasive blood pressure was monitored continuously. A central venous line was inserted in the right internal jugular vein to provide reliable venous access for vasoactive drugs and continuous monitoring of central venous pressure (CVP). CVP measurements offered valuable insight into the patient's intravascular volume status and right-sided cardiac filling pressures during the procedure. After induction and intubation, the patient had stable vital parameters, with a slight decrease in blood pressure, which was 100/65 mmHg, no change in heart rate, with oxygen saturation of 100%. The stability of parameters was maintained throughout the whole surgical intervention, and they were in the range of 100-130 mmHg for systolic pressure and 60-80 mmHg for diastolic, while maintaining adequate MAP above 70 mmHg. The heart rate was in the range of 35-80 beats per minute, and blood oxygenation was 99-100%, with monitored capnography that showed $ETCO_2$ from 32 to 36. Intraoperatively, we administered an ampoule of Dexamethasone 8mg i.v, with adequate gastroprotective therapy with Famotidine 20mg and Metoclopramide 10 mg. Due to vagal stimulation during surgery, the patient necessitated intermittent administration of atropine ampoules, in accordance with the patient's heart rate values. Episodes of bradycardia occurred intraoperatively. The bradycardia that occurred during tumor manipulation resolved when the manipulation or handling was discontinued, but hemodynamic insufficiency responded well to intravenous atropine, adrenaline, and intravenous fluids. Continuous infusion of adrenaline at a dose of 0.01 mg prevented sudden hemodynamic disturbances in the patient. Non-opioid multimodal analgesia was provided with acetaminophen 1 g iv. Fluid replacement was with 1500 ml NaCl 0.9%. After three hours of surgery, the patient awoke and was transferred to the recovery room, in good condition and pain-free. Postoperative pain management was conducted with nonsteroid analgesics, antibiotics,

gastroprotective therapy, and anticoagulant therapy. The postoperative period was uneventful, and after 3 days, the patient was discharged from the hospital.

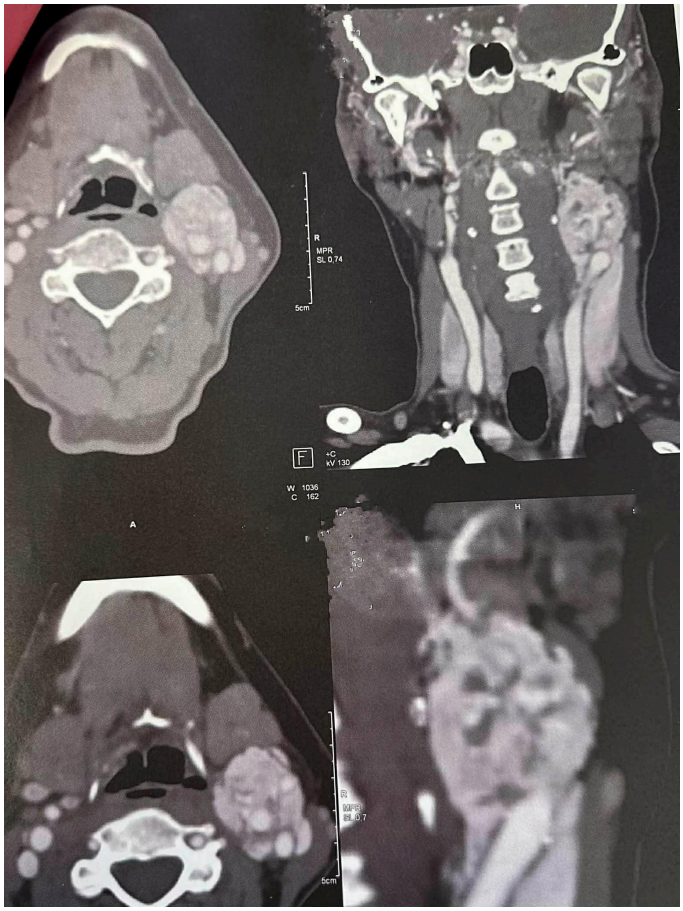

Figure 1. Contrast-enhanced CT scan of the neck demonstrating a well-defined, intensely enhancing hypervascular mass located at the left carotid bifurcation, situated between the external and internal carotid arteries. The lesion measures approximately 32 × 29 × 52 mm and produces characteristic splaying of the carotid vessels ("lyre sign"), consistent with the appearance of a carotid body paraganglioma.

Discussion

Despite the fact that cervical ultrasound is the first diagnostic tool usually applied in cases where the existence of carotid body tumors is suspected, a comprehensive patient history, physical examination, and adequate imaging techniques also must be considered in the diagnostic algorithm (7). Several radiologic modalities, including computerized tomography (CT), magnetic resonance imaging (MRI), angiography, and magnetic resonance angiography, are available to determine the existence of carotid body tumors (7). High resolution and contrast-enhanced computed tomography is a preferred diagnostic modality because it is considered superior in demonstrating the extent of the disease and possible tumor erosion of the skull base (7).

Removing the carotid body tumors through surgery brings specific anesthetic perioperative challenges because of the tumor's proximity to the nerves and great blood vessels, as well as the possibility of catecholamine release due to tumor manipulation and resection, which can cause significant hemodynamic disturbances. The risk of intraoperative hemorrhage represents a central anesthetic and surgical concern during carotid body tumor resection because tumors are hypervascular, receiving extensive arterial supply from branches of the carotid artery that significantly increases the risk of bleeding upon dissection. The anesthetic strategy must incorporate volume optimization, readiness for prompt transfusion, and the capacity for rapid titration of vasoactive agents. Similar considerations have been discussed in the Macedonian Journal of Anesthesia, where the management of hormonally active tumors has been shown to require careful preoperative optimization and vigilant intraoperative hemodynamic control.(12) General anesthesia is the most preferred modality for CBT removal, as it allows optimal control of airway, ventilation, and hemodynamics throughout the procedure (8). Since surgery occurs at the place of bifurcation of the carotid artery, anesthesiologists must ensure maintaining optimal hemodynamics, adequate MAP, and cerebral perfusion pressure in order to prevent cerebral hypoperfusion and brain injury (9). This procedure was implemented in our case report and resulted in a favorable outcome due to maintaining optimal hemodynamics. Continuous intraoperative monitoring and hemodynamic optimization are necessary for stable cerebral perfusion and the absence of any postoperative neurological deficits. Continuous cervical plexus block could be considered as another alternative anesthetic modality, which might have many advantages, but also disadvantages when compared to general anesthesia. Faster postoperative recovery and a shorter in-hospital stay as far as hemodynamic stability was observed as one of the benefits of choosing cervical plexus block over general anesthesia when performing a CBT removal (10). Performing this surgical intervention with cervical block as a sole anesthetic technique could sometimes be disadvantageous due to unsecured airway and possible hypoxia related to loss of consciousness due to hypoperfussion and hemodynamic instability. Regardless of the type of anesthesia, continuous invasive hemodynamic monitoring via arterial line and central venous line placement has become a mainstay and a standard of care in this type of surgeries since both can guide the anesthesiologist when tailoring fluid and vasoactive medication administration in case of sudden episodes of hypotension, hypertension, tachycardia or bradycardia. Likely due to tumor manipulation, several episodes of bradycardia were observed in our case, which were well managed and resolved by giving an intermittent injection of atropine and a continuous infusion of adrenaline intraoperatively. Recently, mild hypothermia has been recognized and considered as a beneficial intervention during surgery because of hypothermia-related reduced cerebral metabolic rates and consumption of oxygen (11). In our case report, hypothermia was not used as a particular intervention. Postoperative intensive monitoring ensures prompt detection of cardiovascular and neurological complications and their adequate and on-time resolution. With detailed preoperative assessment and intraoperative vigilance, the anesthetic management of CBT removal can be safely accomplished without any unfavorable outcomes.

Conclusion

Carotid body tumor removal surgery requires invasive and close monitoring of the hemodynamics with vigilant and complex anesthetic management. Maintaining systemic hemodynamics within the normal ranges as well as cerebral perfusion preservation are crucially important and the main goals in order to diminish complications arising from tumor removal. With careful consideration of the risks, anticipation of unfavorable intraoperative events, planning and collaboration among a multidisciplinary team, the adequate anesthetic management can significantly reduce the occurrence of complications and help achieve successful surgical outcomes during carotid body tumor removal.

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