Baroreflex failure syndrome: a rare complication of bilateral carotid body tumor excision

Barorefleks yetersizlik sendromu: İki taraflı karotis cisim tümörü eksizyonunun nadir bir komplikasyonu

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Baroreflex failure syndrome is a rare disorder seen after bilateral carotid body tumor resection. Iatrogenic injuries to the baroreceptor reflex arc cause fluctuations in blood pressure with hypertensive attacks or hypotensive episodes. A 43-year-old woman underwent bilateral carotid body tumor resection with one-week interval for a hypervascular tumor, 78x50x45 mm in size, at the right carotid artery bifurcation and a smaller tumor (50x30x20 mm) in the contralateral neck. Blood pressure of the patient became significantly unstable after excision of the second tumor, with hypertensive attacks up to 220/140 mmHg, accompanied by episodes of severe frontal headache, nausea, vomiting, skin flushing, and synchronous sinus tachycardia of 130 beats/min. Intermittent episodes of hypotension and bradycardia were also noted. The patient was clinically diagnosed as having baroreflex failure syndrome. The symptoms of the patient improved with medical therapy including clonidine, low dose beta-blocker, metoprolol, and a sedative. During 10 months of follow-up, she was generally well with residual episodes of hypertension about twice a month. In patients with bilateral carotid body tumors, unilateral excision of the greater tumor and a conservative approach for the contralateral tumor seem to be a more convenient approach to prevent baroreflex failure.

Key words: Baroreflex; carotid body tumor/surgery; heart rate; hypertension/etiology; postoperative complications.

Barorefleks yetersizlik sendromu, iki taraflı karotis cisim tümörü rezeksizyonundan sonra görülen nadir bir hastalıktır. Baroreseptör refleks sisteminde oluşan iyatrojenik hasar genellikle hipertansif ve hipotansif atakların peşpeşe görüldüğü kan basıncında dönemsel dalgalanmalara yol açar. Kırk üç yaşında kadın hastaya bir hafta arayla, sağ karotis arter bifürkasyonunda hipervasküler bir tümör (78x50x45 mm) ve sol tarafta daha küçük (50x30x20 mm) bir tümör nedeniyle iki taraflı karotis cisim tümörü rezeksizyonu yapıldı. İkinci tümör ameliyatından sonra hastanın kan basıncı belirgin olarak düzensiz seyretmeye başladı. Kan basıncının 220/140 mmHg'ye ve eşzamanlı olarak kalp hızının 130/dakikaya yükseldiği dönemlerde frontal başağrısı, mide bulantısı, kusma ve ciltte sıcaklık görüldü. Ayrıca, aralıklı hipotansiyon atakları ve bradikardi de gözlendi. Hastaya klinik olarak barorefleks yetersizlik sendromu tanısı kondu. Semptomlar klonidin, düşük doz beta-bloker, metoprolol ve sedatif içeren ilaç tedavisiyle belirgin iyileşme gösterdi. On aylık takip sırasında durumu genel olarak iyi seyreden hastada, yaklaşık ayda iki kez olmak üzere hipertansiyon atakları devam etti. İki taraflı karotis cisim tümörü olan hastalarda, barorefleks yetersizlik sendromunun önlenmesi için, daha büyük tümörün tek taraflı eksizyonu ve karşı taraftaki tümörün klinik takibi daha uygun bir yaklaşım görünmektedir.

Anahtar sözcükler: Barorefleks; karotis cisim tümörü/cerrahi; kalp hızı; hipertansiyon/etyoloji; ameliyat sonrası komplikasyon.

Carotid sinus baroreceptors detect and buffer acute changes in blood pressure through alteration of the efferent autonomic tone. Disturbance or injury to this regulatory system can lead to marked lability of arterial response to sympathetic activities.[1] An iatrogenic injury to Hering's nerve, and to the glossopharyngeal, hypoglossal, or vagal nerves can cause denervation of the carotid sinus and deafferentation of the baroreceptor reflex arc.[2,3] Bilateral damage to the carotid sinus baroreceptors during bilateral excision of carotid

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body tumors may lead to baroreflex failure and fluctuations in blood pressure as either hypertensive attacks or hypotensive episodes in the postoperative period. Unilateral excision of the greater tumor and a conservative approach for the contralateral tumor are necessary to avoid baroreflex failure syndrome. We present a case of baroreflex failure syndrome that occurred after excision of bilateral carotid body tumor.

CASE REPORT

A 43-year-old woman presented to the outpatient clinic of our hospital with a complaint of bilateral, painless swelling in the cervical region, of more than two-year history. The lesions progressed within the past year. Her blood pressure was normal and she did not have an evident health problem in the past. There was a family history of carotid body tumor. On physical examination, she had an elastic, painless, and mobile mass in the right jugulodigastric area, and a smaller one on the contralateral side. Fine needle aspiration of the tumor on the left that was performed by an otolaryngologist demonstrated paraganglioma cells, despite the high risk for bleeding in such tumors with hypervascularity. Digital subtraction angiography confirmed the presence of a hypervascular tumor, 78 x 50 x 45 mm in size, at the right carotid bifurcation (Fig. 1) and a similar one (50 x 30 x 20 mm) in the contralateral neck. The patient was referred to our cardiovascular surgery clinic for surgical intervention.

The tumor on the right side was resected first without an injury to the artery or the vagus, hypoglossal or glossopharyngeal nerves (Fig. 2). Postoperative blood pressure and heart rate were 128/68 mmHg and 84 beats per minute, respectively. One week later, excision of the contralateral tumor was performed uneventfully. However, blood pressure of the patient became significantly unstable after excision of the second tumor, with hypertensive attacks up to 220/140 mmHg, accompanied by episodes of severe frontal headache, nausea, vomiting, skin flushing, and synchronous sinus tachycardia of 130 beats/min. Intermittent episodes of hypotension with drowsiness were also noted. The heart rate varied between 90 and 120 beats/min between episodes of hypertension. She was also anxious and emotionally labile.

No metabolic or neurological condition was found for the cause of hypertensive episodes and related symptoms. Blood and urine tests for catecholamine levels, ultrasonography of adrenal glands and renal arteries, and cerebral computed tomography did not show any abnormality. There was no ischemic finding on the electrocardiogram. The patient was clinically diagnosed as having baroreflex failure syndrome after resection of bilateral carotid body tumor. Analysis of baroreflex sensitivity was not available. Medical therapy was instituted including 0.2 mg clonidine, a low-dose beta-blocker, 50 mg/day metoprolol to regulate blood pressure and to prevent hypertensive attacks, and oral diazepam. The symptoms improved but did not totally resolve. The patient was discharged 14 days after surgery in a favorable condition. During 10 months of follow-up, she was generally well with episodes of hypertension about twice a month despite hypertensive therapy.

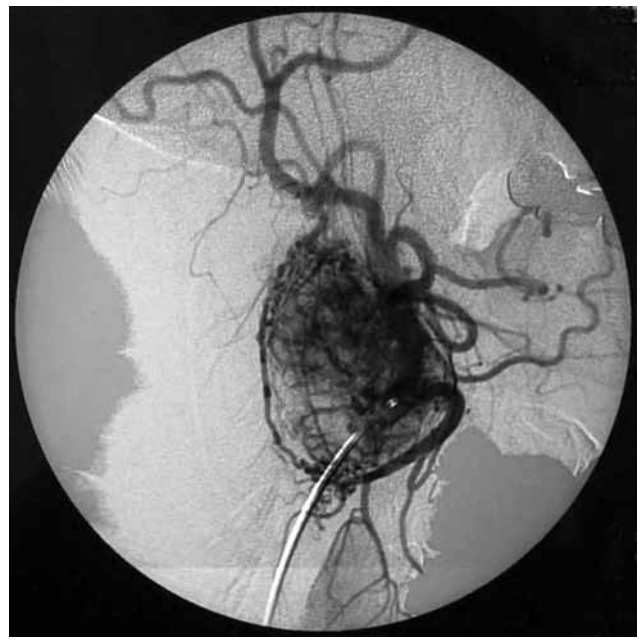

Figure 1. Digital subtraction angiography shows a giant carotid body tumor with increased hypervascularity.

Figure 2. Macroscopic view of the tumor.

DISCUSSION

Baroreflex failure syndrome is a rare disorder after resection of bilateral carotid body tumors, resulting from iatrogenic injury to innervation of carotid sinus baroreceptors. Acute phase of this morbidity is characterized by relapsing episodes of hypertensive attacks immediately after surgery, associated with synchronous sinus tachycardia and hypotension. Patients usually complain of intractable frontal headache, dizziness, tachycardia, diaphoresis, nausea, vomiting, and skin flushing when the blood pressure rises. These symptoms may last about 30 minutes. Episodic marked hypotension and bradycardia can also develop when the blood pressure falls down. Emotional lability is frequently associated with clinical manifestations and causes discomfort in daily activities.[3] These changes are usually more dramatic if tonic inhibition is removed suddenly during surgical resection of carotid body tumors.

Clinical symptoms in baroreflex failure syndrome develop because of unopposed sympathetic activation in response to physical and emotional stress.[2] The pathophysiologic feature of this syndrome is the lack of tonic inhibitory effect of baroreceptors on sympathetic activity and negative feedback of emotional lability leading to episodes of severe hypertension and tachycardia. The symptoms are more predominant in the early period of surgery. Clinically, the patients may even be at risk for life-threatening intracranial hemorrhage because of hypertensive crises.[4] Therefore, precise control of blood pressure is very important to avoid associated morbidities and mortality.

In the differential diagnosis of baroreflex failure, adrenal tumors such as pheochromocytoma, hyperthyroidism, renal artery stenosis, and neurological pathologies should be excluded. The diagnosis is confirmed by measuring baroreceptor sensitivity using a noninvasive method known as the transfer function.[5] The technique involves simultaneous beat-to-beat recording of the R-R interval and systolic arterial pressure variability. These two recordings are then used in a spectral analysis using an autoregressive algorithm to show baroreceptor sensitivity.[6]

Macroscopically, a carotid body tumor is encapsulated, elastic in consistency, and closely associated with the carotid arteries. The differential diagnosis of carotid body tumors includes other causes of neck masses such as lymphomas, metastatic tumors, carotid artery aneurysms, thyroid lesions, salivary gland tumors, and branchial cleft cysts. Percutaneous needle biopsy or incisional biopsy of carotid body tumors should be avoided because these interventions may cause intractable bleeding, pseudoaneurysm formation, and carotid artery thrombosis.[7] Duplex scanning with color flow imaging, magnetic resonance imaging, or computed tomography angiography provide diagnostic information about this hypervascular tumor of the neck region.

Despite the well-circumscribed nature of these tumors, there is no true capsule. As the tumor grows, the carotid arteries and their bifurcation are progressively embedded and distorted by the tumor. Local invasive nature of the tumor may cause invasion of the adventitia of the carotid arteries. Shamblin et al.[8] classified these tumors into three anatomical groups: group I consists of relatively small tumors, which are minimally attached to the carotid vessels and easily resected surgically; group II consists of larger tumors with moderate attachments to the carotid vessel arteries where surgical excision may be possible by using a temporary intraluminal carotid artery shunt; group III tumors are very large, completely encase the carotid arteries and often require arterial resection and graft interposition. Our intraoperative findings confirmed increased vascularity and pathologic characteristics of this tumor. Careful dissection is necessary because of firm adherence of the tumor to the carotid arteries. Enhanced surgical experience is also an obligation to avoid intraoperative bleedings and carotid artery injuries. Surgical resection and outcome would be much easier and safe if these giant tumors can be diagnosed in their early period of growth.

Treatment of baroreceptor failure is based on regulation of blood pressure and improvement of emotional volatility, both of which are not easy to achieve. Despite medical therapy, variability in blood pressure and associated symptoms may persist, but less frequent with time, as in our case. This suggests that the compensatory ability of other baroreceptors other than those of the carotid sinus have limited importance in control of blood pressure in humans.[9] It has been reported that clonidine, a centrally and peripherally acting alpha-agonist, reduces the frequency and severity of unremitting hypertensive attacks.[2] Low-dose steroids are also effective to improve the symptoms of hypotensive episodes. Anxiolytic therapy with benzodiazepines and avoidance of stressful conditions or stimuli are helpful. Finally, surgical resection is indicated in carotid body tumors. While unilateral excision of tumors less than 5 cm is safe, morbidity in-

creases for tumors larger than 5 cm and for those with bilateral involvement. Thus, unilateral excision of the greater tumor and a conservative approach with close surveillance of the size of the contralateral tumor are recommended to prevent baroreflex failure.[7,10]

In conclusion, when a cervical mass is detected at the carotid artery bifurcation, carotid body tumors should be in the mind, and radiological evaluation is necessary. Percutaneous needle aspiration is not recommended because of increased vascularity of the tumor. Baroreflex failure syndrome can be avoided through early diagnosis and early follow-up of contralateral tumor size. This may obviate sequential resection which is closely linked to the development of baroreceptor failure.

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