Power Doppler Scanning in the Diagnosis of Carotid Body Tumors

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The aim of this work was to show contribution of power Doppler imaging in the diagnosis of the carotid body tumors. Six patients with a nontender mass beneath the mandibular angle were evaluated with gray scale and power Doppler sonography. Well-defined, solid, weakly hyperechoic masses were noted on gray scale sonography in the carotid bifurcation. Power Doppler sonography showed abundant flow, characterized as an intense blush, throughout the entire tumor in all patients. We believe that invasive and expensive diagnostic modalities are not necessary to evaluate carotid body tumors. Gray scale sonography and power Doppler imaging are sufficient for primary diagnosis of carotid body tumors. KEY WORDS: Paraganglioma; Power Doppler ultrasonography; Carotid body.

Nonchromaffin paragangliomas are very rare tumors. They arise from chemoreceptor cells at multiple sites throughout the body, specifically the jugular, tympanic, vagal and aortic glomus, and retroperitoneal regions. Carotid body tumors, also known as chemodectomas, are a subtype of extraadrenal paraganglioma. They are slow-growing, usually benign tumors with malignancy occurring in about 6% of tumors. They tend to be hypervascular and arise predominantly in intimate contact with vital structures, making their excision a surgical challenge. Sonography is the screening method of choice, followed by angiography, determines the diagnosis. In this study, we attempted to show the power Doppler imaging findings in carotid body tumors.

MATERIAL AND METHODS

Six patients (three men and three women) between the ages of 25 and 65 years with nontender mass beneath the mandibular angle were referred to the radiology department. The lesions were located on the right side in four cases and on the left in two cases.
All patients were evaluated with gray scale and power Doppler sonography. Additionally, three preoperative diagnostic DSA examinations, two CT scans, two MR imaging examinations, and two 2D time of flight MR angiography were performed in these patients. The patients were placed in a supine position with the neck in retroflexion during the gray scale and Doppler sonographic examinations.

Both sonographic examinations were performed with Toshiba SSA 270 A equipment (Toshiba, Tustin, CA) using 7.5 MHz linear transducer. CT examinations were performed with Hitachi W 450 (Hitachi, Tokyo, Japan), MR imaging with an AIRIS 0.3 T magnet (Hitachi), and angiography with Opescope 50 N (Shimadzu, Tokyo, Japan).

The patients were operated on and the diagnosis was confirmed with histopathologic examination.

RESULTS

The most common complaint was a swelling in the anterolateral region of the neck. Using B-mode imaging, the swellings appeared as well-defined, solid, weakly hyperechoic homogeneous masses in the carotid bifurcation. We found broadening of the bifurcation with shifting of the internal carotid artery posteriorly and laterally and of the external carotid artery anteriorly and medially (Fig. 1). The smallest lesion was 2 cm and the largest was 6 cm in maximum dimension. Power Doppler sonography showed abundant flow, characterized as intense blush, throughout the tumors, mainly in small blood vessels. This appearance mimicked slightly the capillary phase images of the angiogram. The external and internal carotid arteries were noted to surround the highly vascularized tumor (Fig. 2).

DSA examinations showed a well-defined hypervascular tumor with a dense blush in the capillary phase situated in the arterial bifurcation (Fig. 3). CT and MR imaging examinations showed densely enhanced tumor at a widened carotid bifurcation. On MR images, the lesions were of intermediate intensity on T1-weighted images and slightly hyperintense on T2-weighted images. The mass compressed the internal and external carotid arteries (Fig. 4). Widening of the carotid bifurcation also was identified on 2D time of flight MR angiography (Fig. 5).

DISCUSSION

Although carotid body tumors are rare, they should always be considered in the differential diagnosis of a neck mass. Early clinical detection of carotid paragangliomas is difficult since these lesions often occur sporadically, and the patients remain symptom-free until the tumor becomes noticeable. Lymphadenopathy, carotid artery aneurysm, branchial cleft cyst, vagal paraganglioma, and neurogenic and salivary gland tumors should also be considered in the differential diagnosis.

Ultrasonography is the first radiologic method in the diagnosis of these lesions. The diagnostic possibility of a chemodectoma has to be considered when a solid, slightly heterogeneous mass is detected within the carotid bifurcation. In addition to its location, the presence of profuse vascularization leads to diagnosis of carotid body tumor. Doppler sonographic analysis of the mass to evaluate intratumoral blood flow is helpful in differentiating chemodectomas from other solid, nonhypervascular masses. It is not included with the other masses in this study. However, it was reported that low-resistance flow pattern in masses located in the bifurcation was very important in the diagnosis of carotid body tumors. Power Doppler sonographic examination performed after gray scale sonography demonstrated the intratumoral increased vasculature as an intense tumor blushing pattern. The appearances mimicked slightly the angiographic pattern, which is virtually pathognomonic. Power Doppler sonography, which is essentially angle independent and free of aliasing, extends the dynamic range of the Doppler scale down to the noise threshold. It can assess local vascularity, slow flow, and blood volume. Therefore, power Doppler sonography has an increased sensitivity to flow in small vessels and slow flow. Consequently, in the
diagnosis of carotid body tumors, DSA may be omitted owing to its invasiveness. However, angiography can also be used in the preoperative tumor embolization with polyvinyl alcohol particles or prior to early ligation of the external carotid artery. Embolization allows complete surgical excision and increases the effect of postoperative radiotherapy in patients with carotid body tumors.

CT and MR imaging are useful in evaluating multiple lesions and accurately localizing them. MR imaging can also show some large intratumoral vessels. MR angiography may be useful to demonstrate flow within vessels, and it provides a familiar imaging display for surgical planning. Splaying of the carotid bifurcation is useful in demonstrating carotid space lesions. In our two cases, MR angiography showed the splaying carotid bifurcation. CT scanning, MR imaging, and MR angiography all may be used in demonstrating carotid body tumor and intratumoral vasculature. However, these modalities are expensive and require the use of contrast medium.
In conclusion, the localization of the tumor within the carotid bifurcation, splaying of the bifurcation, and profuse vascularity are important in the diagnosis of carotid body tumors. Invasive and expensive diagnostic modalities such as CT, MR imaging, and DSA are not necessary to evaluate this tumor. Gray scale ultrasonography and power Doppler imaging are noninvasive and inexpensive modalities of choice for the primary diagnosis of carotid body tumors.

REFERENCES