CERVICAL OSSEOUS CHANGES ASSOCIATED WITH VERTEBRAL ARTERY TORTUOSITY

N. YÜNTEN (1), H. ALPER (1), C. CALLI (1), D. SELCUKI (2), E.-E. USTÜN (1)

(1) Ege University Hospital, Department of Radiology.
(2) Ankara University Hospital, Department of Neurology.

SUMMARY

Vertebral artery tortuosity causing neural foraminal widening is a well described abnormality that should not be confused with other causes of neural foraminal enlargement, particularly on conventional roentgenograms. We, hereby, describe CT features of another cervical osseous change due to the vertebral artery tortuosity, the so called « tubular shaped vertebral artery canal », which is embedded in the vertebral body instead of causing neural foramen enlargement. Catheter and MR angiographic studies have also been performed to confirm the vertebral artery tortuosity causing the osseous changes.

Key-words: Vertebral artery. Tortuosity. CT. MR studies. Angiography.

RÉSUMÉ

Modifications osseuses cervicales associées à la tortuosité de l’artère vertébrale


INTRODUCTION

Tortuosity of the vertebral artery in the cervical region is an uncommon vascular anomaly that can cause bone erosion, leading to a neural foraminal enlargement. Various radiological features of this rare anomaly have been demonstrated by different imaging modalities [1, 3]. In this study, we describe the computed tomographic (CT) appearance of a tubular shaped osseous vertebral artery canal caused by a vertebral artery loop embedded in the body, which, in our opinion, is unique for this rare vascular anomaly.

MATERIALS AND METHODS

CT findings in 7 patients (4 females, 3 males) having cervical osseous changes due to vertebral artery tortuosity are documented. Ages of the patients ranged from 34 to 65 years. Lesions were detected at routine cervical CT examinations in four, at magnetic resonance imaging (MRI) followed by CT examinations in three patients. Osseous changes detected in the CT studies were correlated retrospectively with four view cervical radiograms. Arterial tortuosity was confirmed by catheter angiography in the first case, by MR angiography in the following three cases. CT findings in the subsequent three cases were considered diagnostic for the definition of the anomaly, thus angiographic study was not performed in this group.

CT studies (precontrast n : 7, postcontrast n : 4) were obtained with 3 mm thick contiguous scans from C3-4 to C6-7. MRI studies were performed with a 0.5 Tesla MR system (Vectra, General Electric) consisted of spin-echo TW1, gradient-recalled echo T2W sequences in the sagittal and axial planes. 3D phase contrast MR angiography was obtained in the coronal projection with a flow velocity of 21 cm/sec. in the head-feet direction.
Fig. 1a. – CT scan through the C4 vertebrae corpus shows a tubular erosion of the vertebral body (arrow). The fat planes between the vertebral body and vertebral artery are preserved.

Fig. 1b. – CT scan at the same level at bone window setting demonstrates the tubular osseous defect with a smooth sclerotic margin (arrow).

Fig. 1c. – Left vertebral artery catheter angiography shows tortuosity of the vertebral artery (arrow).

Fig. 2a. – A tubular defect is seen at the corpus of the vertebrae due to tortuosity of the vertebral artery (arrow).

Fig. 2b. – CT scan just below to figure 2a shows normal neural foramina which is mildly narrowed due to degenerative hypertrophic facet changes (arrow).

Fig. 2c. – A coronal 3D PC MRA demonstrates tortuosity at the left vertebral artery (arrow).
Clinical evaluation of the patients presenting various complaints such as vertigo and pain showed no symptomatic correlation with the arterial tortuosity, thus, the vascular anomalies were considered incidental in all.

RESULTS

7 patients had nine vertebral arterial abnormalities which were seen at C4 in all; unilateral at C4 in 5 and a co-existing vertebral abnormality at C6 in 2. CT findings of the osseous erosions in the cervical vertebrae showed smooth, sclerotic margins in all the cases. Two types of defects were documented according to the orientation of the arterial loop. Six of the cases had corpus erosions at the posterolateral aspect of the vertebral body, causing neural foraminal widening (left side n: 5, right side n: 1). Three had a horizontally oriented tubular defect in the body with normal neural foramina (right side n: 2, left side n: 1) (fig. 1, 2, 3). Cervical radiograms showed enlarged neural foramina in the former group, whereas no abnormality was seen in patients having tubular osseous defects. Postcontrast CT scans revealed marked homogenous enhancement of the vertebral artery with preservation of fat planes in the foramina. Angiographic studies confirmed the typical course of the vascular anomaly.

DISCUSSION

Anomalies of origin of the vertebral artery from the aortic arch and other great vessels as well as variations and differences in size are well known. The course of the artery however, is relatively constant after arising from the subclavian artery. Ascending superomedially, it enters the transvers foramen, usually at C6, following an almost a straight course through the foramina up to C2 [1].

Tortuosity of the vertebral artery in its second part coexisting with bone erosions mainly seen as neural foraminal enlargement have been described in a few case reports. This rare anomaly often occurs at the C4-C5 level. The left vertebral artery is affected more than the right while bilateral or multilevel involvement are very uncommon. Radiographs of the cervical spine in oblique projections can demonstrate eccentric neural foraminal widening anterosuperiorly with erosions of the adjacent vertebral body and pedicle. The osseous defect

with sclerotic margins and marked homogenous enhancement of the vertebral artery in the neural foramen on postcontrast scans are CT features described for this anomaly. MR imaging with the spin-echo technique shows the signal void vertebral artery while MR angiography provides a noninvasive method for the demonstration of the vertebral artery tortuosity [1, 3].

It is known that expansion of a foramen or a canal as well as a defect in the bone at the cervical level is highly suggestive of a benign tumor, mainly a neurofibroma or a schwannoma. Congenital absence of a pedicle, infrequently, can be a cause of neural foraminal enlargement. A traumatic false aneurysm or ectasia of the vertebral artery secondary to aortic coarctation have been reported as other vascular causes of foraminal enlargement, which all are very rarely seen. The diagnosis of tortuous vertebral artery can be assessed with various imaging modalities such as CT, MRI, MRA and colour-doppler sonography, which all can establish this benign condition non-invasively [1, 3].

Osseous defects due to anomalous vascular loop in our cases, were easily differentiated from a tumoral mass, an aneurysm or a hypoplastic pedicle by the typical radiological findings. CT clearly displayed the bony changes with smooth, sclerotic margins both in the body, the neural and transvers foramina. Neural foraminal widening occurs when the loop extends posteriorly, eroding the margin of the vertebral body, thus enlarging the foramina anterosuperiorly (fig. 3). Besides these features well described in the literature, CT findings in our 3 cases draw special consideration by demonstrating a different aspect of vertebral artery tortuosity.

The tubular canal like defect in the cervical body hosting the vertebral arterial loop stands out as a unique CT appearance of this anomaly (fig. 1, 2, 3). In other words, the loop causes two types of bony erosions according to its ascending course. A tubular defect is formed when the loop ascends superomedially by affecting the body only, whereas a neural foraminal widening occurs by a posterosuperiorly oriented loop. In our opinion, vertebral artery canal in a cervical body presented as a tubular defect, is a specific CT sign of a tortuous vertebral artery which necessitates no further examination for the differential diagnosis of such an anomaly.

REFERENCES