

Visual claudicatio: diagnosis with 64-slice computed tomography

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Abstract We present a case of a 78-year-old male referred presented to our institution with amaurosis fugax after walking 20 steps (“visual claudicatio”). Duplex ultrasound was not able to visualize the carotid arteries. Multislice computed tomography (Sensation 64 Cardiac, Siemens, Germany) of the cerebro-vascular circulation was performed from its origin at the level of the aortic arch to the circle of Willis. The investigation demonstrated a complete occlusion of both common carotid arteries at their origin and a severe origo stenosis of both vertebral arteries. An important collateral circulation of the vertebral arteries through the minor vessels of the neck was also displayed. Both comunicans posterior arteries were small but patent. The intra-cranial arteries

were patent. Multislice CT of the cerebro-vascular circulation is an optimal tool for a comprehensive evaluation when duplex ultrasound fails.

Keywords 64-slice CT · CT angiography · Carotid artery stenosis · Diagnosis

1 Introduction

Stroke (brain attack) represents one of the most serious causes of mortality and morbidity in the United States and throughout the world. Each year, 150,000 patients die as a direct result of a cerebro-vascular accident (CVA), while 600,000 patients experience the morbidity of aphasia, blindness, or paralysis. Among patients with stroke, extra-cranial carotid disease represents the cause of approximately one half of cases. The goals of carotid imaging can be described as early detection, clinical staging, surgical road mapping, and postoperative therapeutic surveillance. The gold standard for the study of carotid and vertebral arteries is conventional digital subtraction angiography (DSA). Non invasive techniques, such as duplex-ultrasound, computed tomography (CT), and magnetic resonance imaging allow to study segments of the cerebro-vascular circulation. The introduction on multislice CT, especially with the latest 64-row equipments, significantly improved scan range, scan speed and image quality [1, 2].

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2 Case description

A 78-year-old male was referred to our institution because of amaurosis fugax after walking 20 steps (“visual claudicatio”). A previous carotid ultrasound was not able to visualize the carotid arteries in their usual anatomical location. Therefore, it was decided to proceed with a contrast-enhanced multislice CT (Sensation 64 Cardiac, Siemens, Germany) of the cerebro-vascular circulation from its origin at the level of the aortic arch to the circle of Willis.

The scan parameters for 64-slice CT Coronary Angiography were: individual detector width 0.6 mm, gantry rotation time 330 ms, effective temporal resolution 165 ms (with single segment reconstruction algorithm), kV 120, eff. mAs 180, pitch factor 1, scan direction cranio-caudal. The acquisition time takes from 12–15 s [3–6].

A bolus of 60–80 ml contrast material with high iodine concentration (350–400 mg of Iodine per ml) is injected through the brachial vein with a flow rate of 4–5 ml/s. A test bolus or a bolus-tracking technique may be used to synchronize the arrival of contrast in the coronary arteries with the initiation of the scan. Bolus tracking technique is more reliable and allows to reduce the volume of contrast material [3–6].

The resulting images (Fig. 1) demonstrated a complete occlusion of both common carotid arteries at their origin and a severe origo stenosis of both vertebral arteries. An important collateral circulation of the vertebral arteries through the minor vessels of the neck was also displayed. Both comunicans posterior arteries were small but patent. The intra-cranial arteries were patent. The plain CT scan of the brain showed only a lacunar lesion in the left internal capsule. The patient is on follow-up and no immediate treatment option has been planned.

3 Discussion

Acute ischemic neurologic symptoms are related to small-vessel disease of the intracranial perforating arteries, thromboembolism from atherosclerotic disease in the supraaortic arteries, and cardiac embolism [7]. The most common source

of thromboembolism is atherosclerotic disease of the carotid bifurcation.

However, atherosclerotic lesions in the aorta, the origin of the supraaortic arteries, the common carotid artery (CCA), the internal carotid artery (ICA) distal to the bifurcation, and the vertebrobasilar circulation can cause transient ischemic attack or ischemic stroke due to thromboembolism [8, 9]. In the evaluation of patients with cerebro-vascular disease, complete vascular imaging from the aorta to the circle of Willis must be performed before therapeutic decision making can be undertaken.

There are three well known criteria for the quantification of carotid artery stenosis and they are all based on longitudinal assessment of the carotid bifurcation [10]. These three criteria are: the North American Symptomatic Carotid Endarterectomy Trial (NASCET), the European Carotid Surgery Trialists (ECST), and the Common Carotid (CC).

The advantage of CT in these settings is that virtually any plane and projection can be generated and any method can be applied also in unfavourable conditions.

CT angiography can be considered as a non-invasive gold standard for the evaluation of cerebro-vascular diseases.

CT angiography is not limited by plane constraints and therefore could always perform the adequate cross-sectional plane [11]. Current criteria for stenosis assessment are based on the historical gold standard of conventional angiography [12, 13]. For the assessment of the degree of stenosis in the coronary arteries QCA (i.e. quantitative coronary angiography) represents the clinical gold standard. However, more accurate (and more invasive) methods are available, such as intravascular ultrasound (IVUS) [14]. IVUS allows cross-sectional imaging of coronary artery lumen and, when available, is the actual gold standard for coronary wall and lumen assessment. Intra-arterial technique is rarely used for the assessment of carotid arteries and almost never for clinical purposes. This is also due the easier accessibility of carotid arteries by other non-invasive techniques.

In analogy with IVUS, CT angiography has the potential to provide reliable cross-sectional

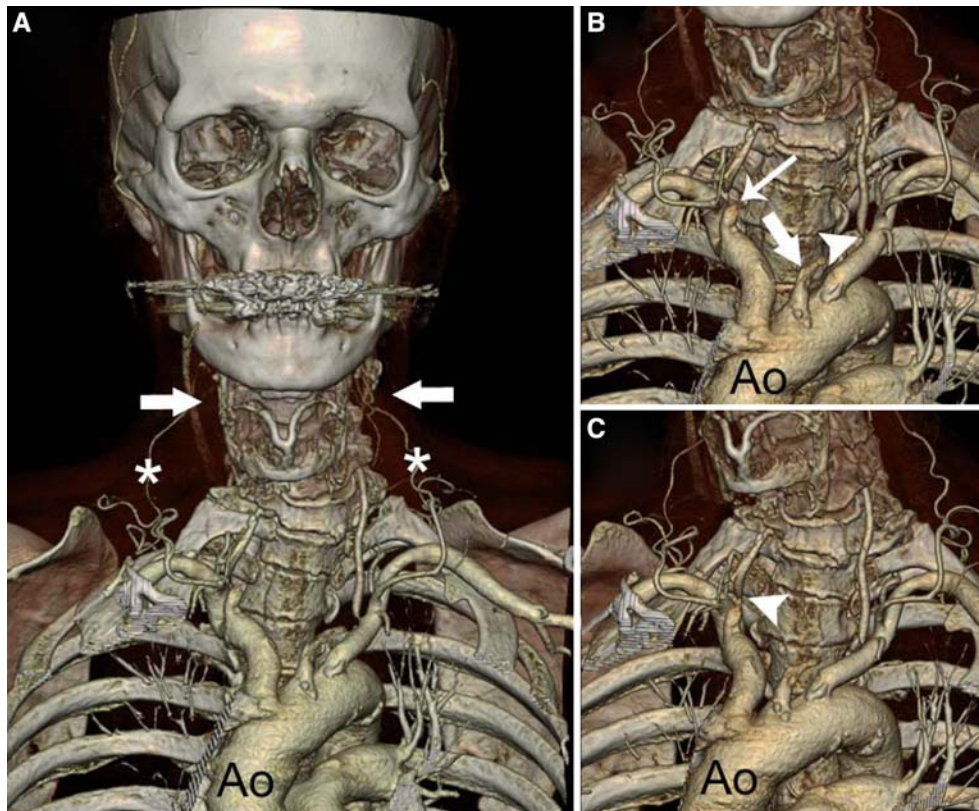


Fig. 1 Three-dimensional volume rendering of the multi-slice CT dataset. The three-dimensional volume rendering of the entire dataset (**A**) shows the origin of the supra-aortic arteries at the level of the aortic arch (Ao) in standard configuration, the absence of carotid arteries in the region of the neck on both sides (arrows), and the presence of evident collateral circulation (asterisks) through the thyro-

cervical trunks. A magnified view performed with slightly different angles at the level of the origin of the supra-aortic arteries (**B** and **C**) shows the occlusion of the right (**B**—thin arrow) and left common carotid artery (**B**—thick arrow), and the severe stenosis of the left (**B**—arrowhead) and right vertebral artery (**C**—arrowhead)

imaging of carotid plaques for the evaluation of vessel lumen and wall.

4 Conclusion

Multislice CT is a reliable and non-invasive tool for the assessment of vascular diseases that affects the branches of the aortic arch, especially when the first line tools (i.e. duplex ultrasound) are not able to provide reliable information.

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