Most anomalies of the aortic arch arise due to the persistence of its parts that normally disappear, or due to the disappearance of parts that normally persist. We report a variant of aortic arch branching found on chest computerized tomography in a 75-year old Serbian man who had recurrent hemoptysis and an abnormal chest radiograph representing marked widening of the right superior mediastinum. Computerized tomography revealed a shared origin of the innominate and left common carotid arteries was found. This finding excluded tumor or pulmonary embolism as a cause of hemoptysis. The reason for hemoptysis was anticoagulant therapy which patient had been receiving because of cardiovascular disease. We discuss the relative literature and underline the clinical impact of such a variation.

Key words: aorta, arch, multidetector, computerized tomography

INTRODUCTION

Variations in the branching pattern of the aortic arch range from differences in the distance between origins of different branches to number of branches. The development of the definitive aortic arch and its branches takes place within the first few weeks of fetal life and the final configuration of the aortic arch and its branches is probably related to different growth rates in the various arteries and the associated “migration” and “merging” of the branches. In about 80% of individuals, three branches arise from the aortic arch: the brachiocephalic trunk, left common carotid artery and left subclavian artery. Another 11% of reported cases have a common trunk incorporating the left common carotid artery and the brachiocephalic leaving only two branches originating from the aortic arch. The third most common pattern has the left vertebral artery, a fourth branch of the aortic branch, originating proximal to the left subclavian artery. Other numerous variations of the branching pattern of the aortic arch are found in less than 1% cases.

CASE PRESENTATION

A 75-year-old man came to hospital complaining on mild but recurrent hemoptysis. He had a history of hypertension, abdominal aortic aneurysm and positive familiar anamnesis for cancer. He had a previous cardiovascular disease and was a risk of developing myocardial infarction. Therefore he had been receiving prophylactic anticoagulation therapy. A standard chest radiography revealed widening of the right superior mediastinum and elevation of ipsilateral dome of diaphragm. There was a clinical assumption of him having a superior mediastinal mass and/or pulmonary embolism. Because of this chest radiography finding he underwent a thoracic computerized tomography (CT) firstly to rule out malignancy and pulmonary embolism. CT examination revealed no signs of soft tissue mass neither in the mediastinum nor in the lung, but the reason for an abnormal chest radiograph was a vascular broadening of the superior mediastinum. He had the most common variant of aortic arch anatomy so-called “bovine arch”. Precisely a shared origin of the innominate and left common carotid arteries was found. There was a kinking of the innominate artery, just before its branching, with mild and clinically not significant compression of the superior vena cava. Tortuosity of the widened brachiocephalic trunk was the reason of radiographically seen right superior mediastinum broadening presenting as a pseudotumorous mass. It is most likely that the enlargement of the brachiocephalic trunk in the proximal portion resulted from the confluence of the left common carotid artery.
into the trunk. No other anomalies in the vascular system were observed, and there were no CT signs of pulmonary embolism. This finding excluded possible cause of hemoptysis and the prophylactic anticoagulation turn out to be the reason for this problem.

**DISCUSSION**

“Standard aortic arch” is the most common anatomic appearance in humans and reported to be present in range from 48% to 84%. More than 20 aortic arch configurations have been described. Results from one of the largest studies of the frequency of aortic arch branch variant anatomy in a living patient population (based on MDCT examinations) had shown that the most frequent anatomical variant was a common origin to the brachiocephalic trunk and left common carotid artery (bovine arch) which occurred in 20% of participants. Variations in aortic arch branching pattern occur because there are many changes involved in transformation of the embryonic aortic arch system into the adult arterial pattern. Most anomalies arise due to the persistence of parts of the aortic arches that normally disappear, or due to the disapperance of parts that normally persist. It is thought that the slower growth of the ventral aortic roots between the third and fourth arches allows the left common carotid artery to fuse with the brachiocephalic trunk. The term bovine aortic arch is a misnomer since cattle actually have common brachiocephalic trunk arising from the arch and splitting into two subclavian arteries from which the neck vessels arise, but in clinical practice it is widely accepted. In the past and even nowadays many of the so-called “bovine” aortic arch branching patterns, which are reported in literature, have been identified during dissection. It is known that variants of aortic arch branching can alter the cerebral hemodynamics, which in turn can lead to cerebral abnormalities, or cause other symptoms. Despite that fact, in most of the previous reported cases there might not has been a reason for clinical assumption of those patients having a such congenital anatomic variant. Probably it was clinically silent or it was just regarded as a normal variant and not reported. Thus, a very few direct data are available. Hornick M et al. found an association of this congenital anatomic variant, in which the left common carotid and innominate arteries share a common origin, with thoracic aortic disease. They reported that patients having the thoracic aortic disease in the setting of this aortic arch branching pattern deal with more rapidly expanded aortas (0.29 cm/year) than those who have a “standard aortic arch” (0.09 cm/year). This group has also concluded that radiology reports often overlook a common origin of the left common carotid and innominate arteries, which should not be considered as a normal variant of aortic arch anatomy.

**FIGURE 1.**
CORONAL VIEW IN MEDIASTINAL WINDOW SETTING(A), AND VOLUME RENDERING PICTURE SHOW SHARED ORIGIN OF THE INNOMINATE AND LEFT COMMON CAROTID ARTERY AND THE KINKING OF THE INNOMINATE ARTERY BEFORE THE BRANCHING.
This case shows that clinicians, surgeons and radiologists should be aware of aortic arch variations. Lack of recognition of these variations may cause serious complications during heart and vascular surgeries or any other procedure occurring in the superior mediastinum and the root of the neck. Multidetector CT is a noninvasive and very useful tool in defining anatomic landmarks and relationships, as well as evaluating associated vascular and cardiac anomalies. Thus it might be the modality of choice for establishing the primary diagnosis.

SUMMARY

Aortic arch variations are important to recognize. A case report of a patient with a left common carotid artery originating from the brachiocephalic trunk is presented. Multidetector CT is a noninvasive and very useful tool in defining anatomic landmarks and relationships, as well as evaluating associated vascular and cardiac anomalies. Thus it might be the modality of choice for establishing the primary diagnosis.

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