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Case Report

Usefulness of Multidetector Row CT for Comprehensive Preoperative Evaluation of Neck Arteriovenous Malformation: Insight From a Patient With Angiography and Surgery Comparison

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Abstract

Neck arteriovenous malformation (AVM) is an uncommon high flow vascular lesion. In the past, because of limitations in magnetic resonance imaging and sonography, invasive angiography was usually necessary for diagnosis and surgical planning. Here, we present a 33-year-old woman with neck AVM. Multidetector row computed tomography (MDCT) provided comprehensive preoperative information, including the anatomic location, feeding artery and draining veins of the lesion. This report demonstrates that MDCT has evolved into a mature technology that can be an alternative tool and probably a new paradigm in the diagnosis of and surgical planning for AVMs. (*Tzu Chi Med J* 2010;22(3):157–159)

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1. Case report

A 33-year-old woman had a red macule over the lateral right side of her neck at birth. The macule later enlarged and gradually turned blue. Spontaneous bleeding of the enlarged mass had occurred during pregnancy several years previously and was controlled by external compression. She came to our outpatient department where a physical examination disclosed a movable, pulsatile mass over the lateral right side of her neck. Arteriovenous malformation (AVM) was impressed.

Multidetector row computed tomography (MDCT) (Brilliance 40; Philips Medical Systems, Best, The Netherlands) with a computed tomography cervicocranial pan-angiography protocol was used for preoperative evaluation (1). Technical parameters included a collimation of 40×0.625 mm, tube voltage of 120 kV, effective tube current of 250 mAs per section, slice thickness of 0.67 mm, rotation time of 0.5 seconds, and scan area from the calvaria to the trachea bifurcation (Fig. 1). Contrast administration was in accordance with the "contrast-covering time" concept to ensure coverage during the scan time (2,3).

The dose-length product of the examination was 983.3 mGy×cm, which corresponds to an effective dose of 3.04 mSv [4].

A review of the source images showed that MDCT clearly delineated the nidus of the AVM, an engorged feeding artery from the proximal right occipital artery of the right external carotid artery and four veins draining into the right external jugular vein (Figs. 2 and 3). With the dedicated CT workstation, the information was provided as comprehensive post-processing images to facilitate angiography and surgical planning. Right external carotid arteriography showing the nidus of the AVM and the feeding artery was precisely compatible with the MDCT findings (Figs. 2 and 3). Preoperative transarterial embolization with glue was subsequently performed. During the delicate excisional surgery, the plastic surgeon also found the identical feeding artery and draining veins (Fig. 3).

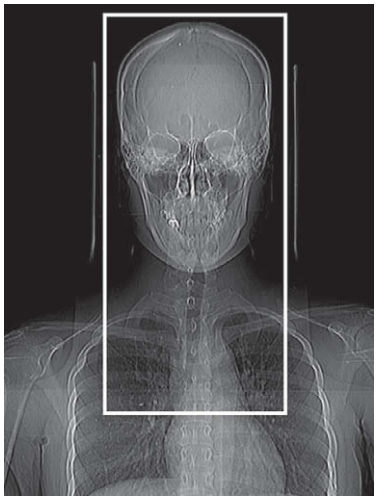

Fig. 1 — Pilot film and scan range of computed tomography cervico-cranial pan-angiography. Scout topographic image shows the scan area (white box), which was from the calvaria to the trachea bifurcation.

2. Discussion

According to our present case, MDCT can be used as a first-line noninvasive modality for comprehensive preoperative evaluation of neck AVMs. MDCT delineates the vascular anatomy, and is completely compatible with angiographic and even surgical findings. Thus, MDCT can provide sufficient information for surgery and can be the sole imaging tool in preoperative evaluation of neck AVMs. The use of invasive angiography is only indicated for transarterial embolization to reduce perioperative bleeding.

AVMs arise from an abnormal connection between the arterial and venous systems. Presenting symptoms of AVMs include congestive heart failure, embolism, pain, bleeding, and ulceration. On physical examination, the lesions may appear blue and feel warm with pulsation and throbbing because of the increased blood flow [5]. The most effective treatment for AVMs is transarterial embolization with subsequent surgical resection [6].

Previously, diagnosis was based on a combination of clinical features with imaging studies. In the literature, AVMs have mostly been evaluated by sonography or magnetic resonance imaging [5,7]. However, sonography is unable to provide a panoramic view of the lesion, and magnetic resonance imaging is limited by its spatial resolution. Thus, invasive angiography may be necessary for therapeutic planning [7,8]. As an invasive modality, diagnostic carotid angiography has minimal but inevitable complications, including minor stroke and transient ischemic attack [9]. The recent improvements in MDCT data acquisition and the maturation of contrast medium injection skills have made comprehensive evaluation of many difficult cardiovascular diseases possible, such as with neonatal coronary artery [10], prosthetic devices [11] and whole body arterial evaluation [3]. MDCT has become the primary modality for evaluating complex and delicate anatomy in cardiovascular diseases.

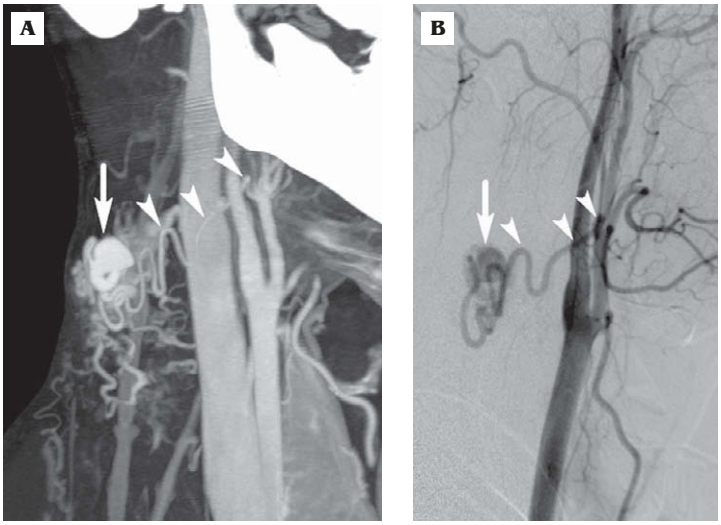

Fig. 2 — Arterial anatomy of the neck arteriovenous malformation. (A) Oblique sagittal maximum intensity projection image on multidetector row computed tomography clearly delineates the nidus of the arteriovenous malformation (arrow) and an engorged feeding artery (arrowheads) from the proximal right occipital artery of the right external carotid artery. The findings were compatible with the digital subtraction angiography and surgical findings. (B) Right anterior oblique projection on right carotid arteriography shows the nidus (arrow) and feeding artery (arrowheads).

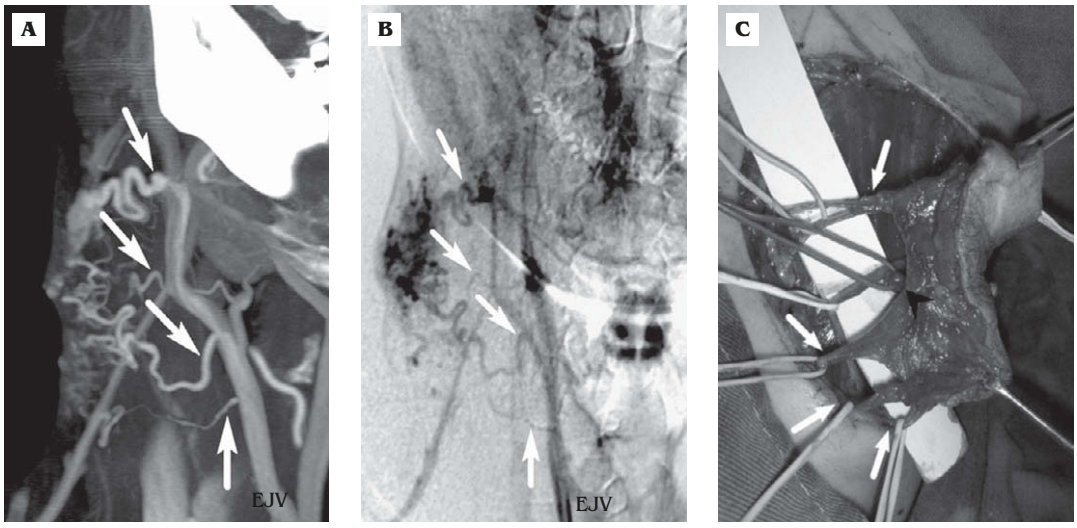

Fig. 3 — Venous anatomy of the neck arteriovenous malformation. (A) Oblique sagittal maximum intensity projection image on multidetector row computed tomography demonstrates four veins (arrows) draining from the arteriovenous malformation into the right external jugular vein (EJV). The finding was compatible with digital subtraction angiography and surgical findings. (B) Right anterior oblique projection on right carotid angiography during the venous phase shows the four veins (arrows) draining into the right EJV. (C) Photography of the surgical findings. The four draining veins (arrows) are marked by blue vascular loops, the arteries (arrowhead) by red vascular loops, and the nerve by a white vascular loop.

In many respects, it has replaced conventional catheter angiography (3,10,11).

In our case, with precise protocol setting, contrast injection, scan-injection synchronization, and a meticulous post-processing technique, MDCT was shown to have excellent ability in the preoperative evaluation of neck AVMs. With a single scan and low-dose protocol, all the detailed information required by surgeons can be acquired, including arterial and venous anatomy, the nidus of the AVM, and the involved area and depth. MDCT can help surgeons assess neck AVMs preoperatively and can thus facilitate the surgery.

To the best of our knowledge, the present case is the first reported case of neck AVM evaluated by MDCT angiography which was compared with invasive angiography and surgery. The findings from these three procedures were identical. With three-dimensional reconstructed images, MDCT provides comprehensive evaluation by defining the gross total anatomy and the relationship of the mass to important structures in the neck, as well as detailed information about feeding and draining vessels. Thus, MDCT is potentially a new paradigm for the diagnosis of and treatment planning for AVMs.

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