Multiple Arteriovenous Fistulas in the Left Lower Limb

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History

A 63-year-old male patient, who has been suffering from venous varicosity of the left lower limb for the past 30 years came to the hospital for a checkup. Physical examinations revealed a mild swelling of the left lower limb with prominent varicosity. An ulcerated area, measuring 3 × 5 cm in size, was visible on the lateral side. A Dual Energy (DE) CT angiography (CTA) was performed to investigate the cause of the varicosity.

Diagnosis

DE CTA images showed four arteriovenous fistulas (AVFs) in the left lower limb (Fig. 1d). Two arterial feeders issued from the distal popliteal artery, right above the bifurcation of the posterior tibial and the fibular arteries. Another two came off the proximal anterior tibial artery. Malformed blood vessels were shown in three areas, and the ulcerated area was fed by two arteries – one from the distal popliteal artery and the other from the proximal anterior tibial artery. Subsequently, the patient was scheduled for an interventional treatment.

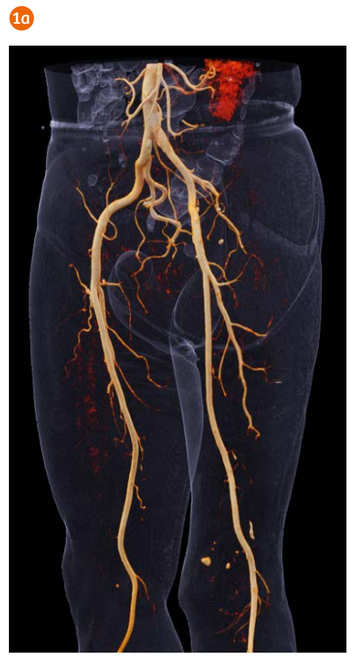
Comments

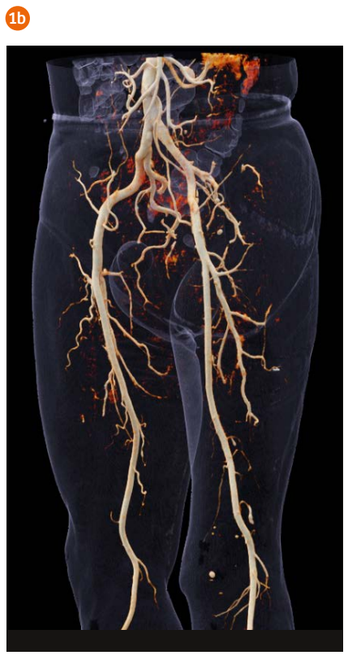
AVFs are anomalously formed by a single vascular channel between an artery and a vein, diverting blood from the normal anatomic capillary beds. Although digital subtraction angiography (DSA) is the gold standard for diagnosing vascular disorders including AVFs, it is invasive and needs to be performed by a specialized team. CTA can serve as the initial imaging study, since it is noninvasive and easily accessible. In this case, DE CTA was performed and the contrast enhancement was compared between the linearly blended images and the images displayed at 45 keV using DE Monoenergetic Plus – an algorithm that performs a regional spatial frequency-based recombination of the high signal at lower energies and the superior noise properties at medium energies to optimize contrast-to-noise ratio (CNR).[1] The contrast of the distal vessels is significantly enhanced at 45 keV, thus depicting small vascular details and providing an important guidance for the interventional treatment. ●

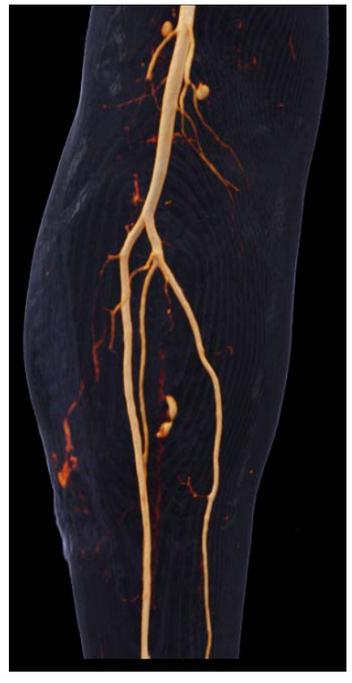
Examination Protocol

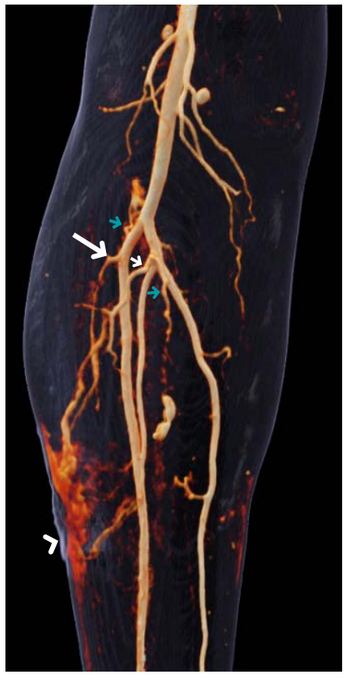
Scanner	SOMATOM Force		
Scan area	Lower extremity	**Rotation time**	0.5 s
Scan mode	Dual Source Dual Energy	**Pitch**	0.6
Scan length	1,116 mm	**Slice collimation**	128 × 0.6 mm
Scan direction	Cranio-caudal	**Slice width**	1.5 mm
Scan time	24 s	**Reconstruction increment**	1.0 mm
Tube voltage	70 / Sn150 kV	**Reconstruction kernel**	Qr40 (ADMIRE 3)
Effective mAs	110 / 37 mAs	**Contrast**	350 mgI/mL
Dose modulation	CARE Dose4D™	**Volume**	60 mL + 50 mL saline
CTDIvol	2.55 mGy	**Flow rate**	5 mL/s
DLP	292 mGy cm	**Start delay**	Bolus tracking in the abdominal aorta @100 HU + 7 s

Reference
[1] Grant KL, Flohr TG, Krauss B, et al. (2014) Assessment of an advanced image-based technique to calculate virtual monoenergetic computed tomographic images from a dual-energy examination to improve contrast-to-noise ratio in examinations using iodinated contrast media. Invest Radiol. 2014 Sep;49(9):586–592.









1 Cinematic VRT images show the runoff (Fig. 1a and Fig. 1b) and the four identified AVFs (arrows) in the left lower limb (Fig. 1c and Fig. 1d). Although the same preset is applied, the small vascular details are more clearly depicted in the images displayed at 45 keV (Fig. 1b and Fig. 1d) than in the linearly blended images (Fig. 1a and Fig. 1c). This is due to a much higher contrast enhancement. The ulcerated area (arrowhead) is fed by two arteries – one from the distal popliteal artery (short white arrow) and another from the proximal anterior tibial artery (long white arrow).