Endoleak and stent-graft occlusion after endovascular aneurysm repair

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History

A 59-year-old female patient, with a history of hypertension and diabetes (type II), had been diagnosed with an abdominal aortic aneurysm (AAA) and had undergone endovascular aneurysm repair (EVAR) three months ago. The patient came back to the hospital complaining of progressive, intermittent claudication of the left lower limb. An ultrasound examination revealed an occluded left iliac stent-graft, however, with good distal blood flow into the left lower limb. The patient was admitted for further treatment. A dual energy (DE) CT angiography (CTA) was performed to further evaluate the patency of the stent-graft and to rule out potential endoleaks.

Diagnosis

CTA images showed a bifurcated aortic stent-graft in the aneurysm sac and both common iliac arteries (CIA). The CIA protheses appeared to be twisted – the left prosthetic leg was attached posteriorly to the right iliac artery and patent, whilst the right prosthetic leg was attached anteriorly to the left iliac artery and occluded. An endoleak (Type III) was visualized posteriorly at the proximal end of the left iliac prosthesis (L3 level), coursing left-posteriorly along the aneurysmal sac, extending behind the occluded left iliac prosthesis and finally feeding the left external iliac artery (LEIA). The contrast enhancement of the right lower limb arteries appeared to be shallow, presumably due to the delay in acquisition timing. There were no signs of stenoses or thrombi. Subsequently, the patient was scheduled for endovascular recanalization and repair.

Comments

EVAR is performed to replace open surgeries for patients with AAA. The prostheses act as a bypass channel for blood flow through the aneurysm, preventing its enlargement and rupture. Regular follow-up imaging is necessary for all EVAR patients to assure the patency of the prostheses, as well as to rule out potential endoleaks. These occur in approximately 25% of the EVAR patients. Once an endoleak is identified, it is critical to determine the endoleak type for patient management. A type III endoleak is considered a high pressure leak and requires urgent treatment due to the high risk of sac rupture. CTA can precisely illustrate the site and the type of endoleaks and is the modality of choice. [1]

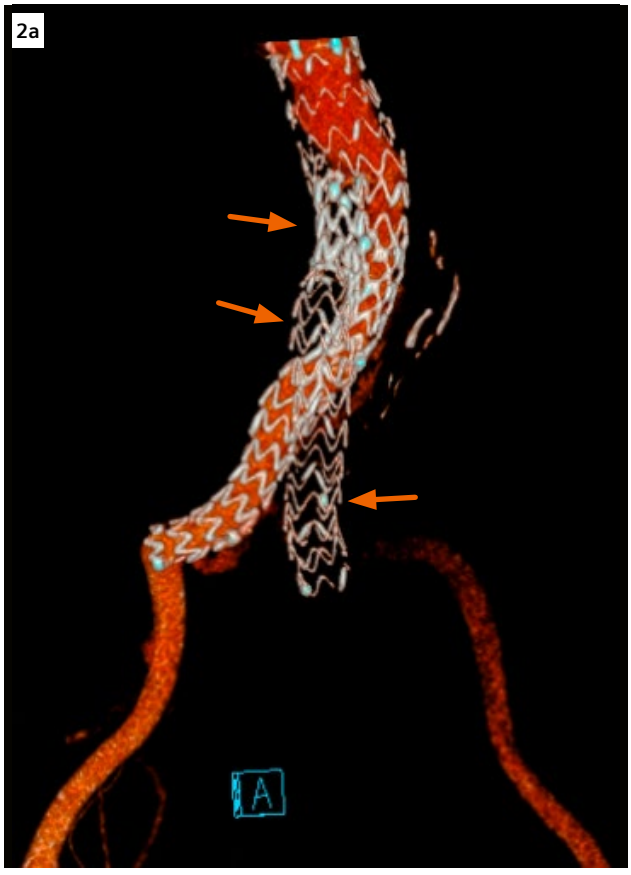
This case presents a rare EVAR complication – a complete occlusion of the left iliac prosthesis and a concurrent endoleak salvaging the blood flow in the left leg. A dual energy (DE) CTA mode is performed which applies a special filter technique, Selective Photon Shield, enabling significant separation of energy spectrums at 80 and 140 kV settings. The attenuation measurements acquired at these two kV settings can be calculated to display images at lower keV levels to significantly enhance the contrast, using "*syngo*. CT DE Monoenergetic Plus". The same image data can also be used to generate iodine images showing contrast enhancement, as well as virtual non-contrast (VNC) images simulating native scan, using "*syngo*. CT DE Virtual Unenhanced". These two types of image presentation help physicians differentiate hyperdensities, for example, the contrast enhanced endoleak and the calcification of the aneurysmal wall. The bone structures can be removed using "*syngo*. CT DE Direct Angio" to show non-obscured vasculature. All these applications are performed in an automated workflow. Advanced techniques, such as cinematic volume rendering technique (cVRT), are also applied to enable a lifelike, three-dimensional demonstration of the anatomical details facilitating an easy and straightforward communication. ●

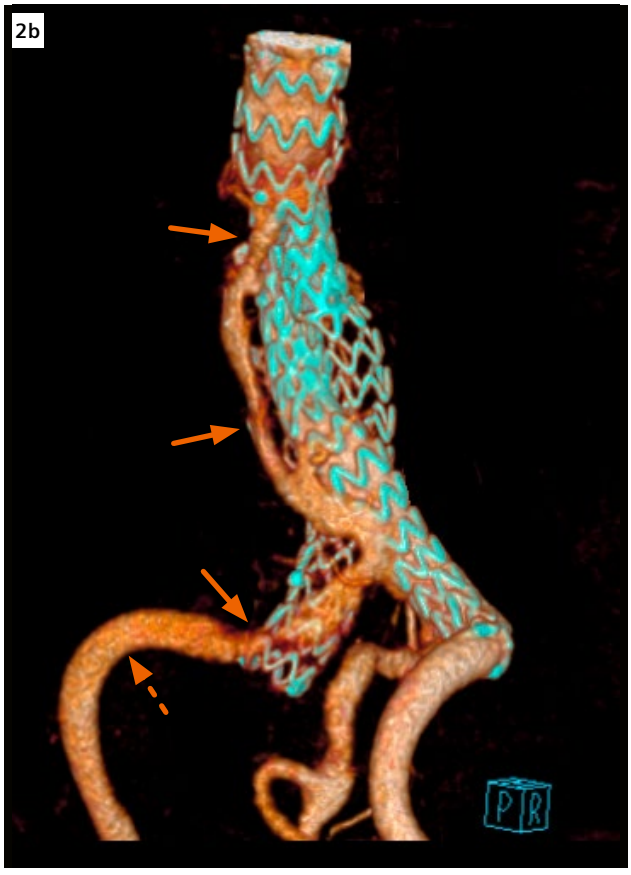
References

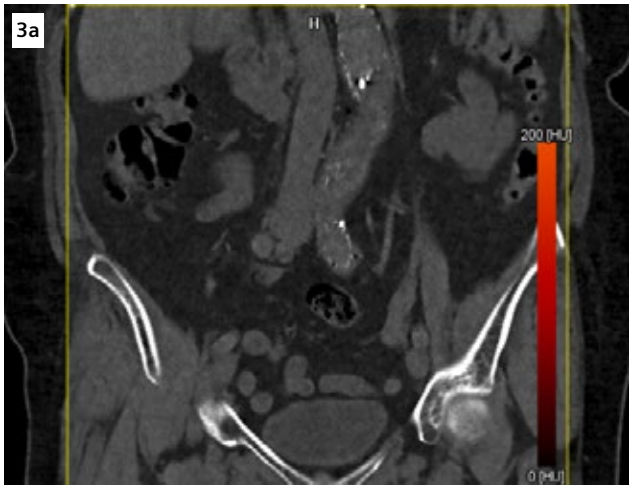
[1] T.W. Kassem, Follow up CT angiography post EVAR: Endoleaks detection, classification and management planning, The Egyptian Journal of Radiology and Nuclear Medicine 48 (2017) 621–626.

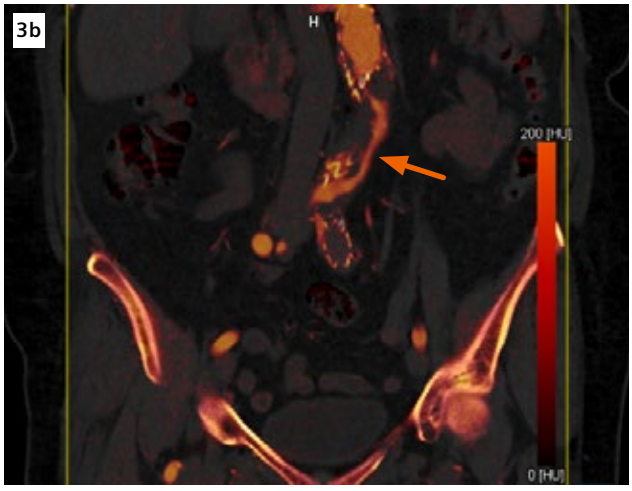
1 A cVRT image shows an infra-renal AAA (arrow) before EVAR. Both common iliac arteries are dilated.

2 cVRT images show a left-anterior view (Fig. 2a) and a right-posterior view (Fig. 2b) of the twisted iliac prostheses. The left iliac prosthesis is occluded showing no blood flow within (arrow, Fig. 2a), and the LEIA (dotted arrow, Fig. 2b) is fed by a type III endoleak (arrows, Fig. 2b).









3 A VNC image (Fig. 3a) and an iodine/VNC fused image (Fig. 3b) clearly show the contrast enhanced endoleak (arrow, Fig. 3b).

4 A MIP image shows an overview of the runoff CTA. The left iliac prosthesis shows no contrast within; however, the distal arteries in the left lower limb are well-opacified. The contrast of the arteries in the right lower limb appears to be shallow, presumably due to the delay in acquisition timing.

Examination Protocol

Scanner	**SOMATOM Definition Flash**
Scan area	Runoff
Scan mode	Dual Source Dual Energy
Scan length	884 mm
Scan direction	Cranio-caudal
Scan time	51.7 s
Tube voltage	80 / Sn140 kV
Effective mAs	195 / 82 mAs
Dose modulation	CARE Dose4D
$CTDI_{vol}$	7.8 mGy
DLP	831 mGy cm
Rotation time	0.5 s
Pitch	0.33
Slice collimation	64 x 0.6 mm
Slice width	1.0 mm
Reconstruction increment	0.4 mm
Reconstruction kernel	I26f
Contrast	370 mg/mL
Volume	80 mL + 50 mL saline
Flow rate	5 mL/s
Start delay	Bolus tracking with 100 HU at the descending aorta + 5 s delay

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