Endoleak After Endovascular Aneurysm Repair

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History

A 77-year-old male patient, with a history of coronary artery bypass grafting and hypertension, had undergone endovascular aortic aneurysm repair (EVAR) in 2012. Four years later, the EVAR had been extended into the left internal and external iliac artery, due to a distal type I endoleak. In a recent routine follow-up, a dynamic abdominal CT angiography (CTA) was requested to rule out a suspected endoleak.

Diagnosis

The dynamic CTA images revealed a hyperdensity in the infrarenal AAA sac, as well as a lumbar feeding artery, characterizing a type II endoleak. A severe stenosis of the proximal left renal artery is also seen.

Comments

EVAR is a percutaneously performed procedure to repair an AAA using synthetic graft and stents. An endoleak is defined as a leak into the aneurysm sac after endovascular repair. A type II endoleak is the most common but least serious of five different types. The leak is characterized by a retrograde flow to the aneurysm sac from arterial branches such as the lumbar artery. Although it does not require immediate treatment, lifelong follow-up is necessary. For appropriate patient management, it is not only important to detect the endoleak but also to define its source, i.e. the feeding artery. The challenge of a standard CTA is the lack of dynamic information. The best imaging phase and the combination of imaging phases remain a matter of debate. While an acquisition in the arterial phase is suitable for defining the source of the endoleak, it may miss the visualization of the endoleaks that have a delayed filling. Scanning in a delayed phase will not properly show the feeding artery due to diminished arterial opacification. An additional invasive angiogram may then be needed.

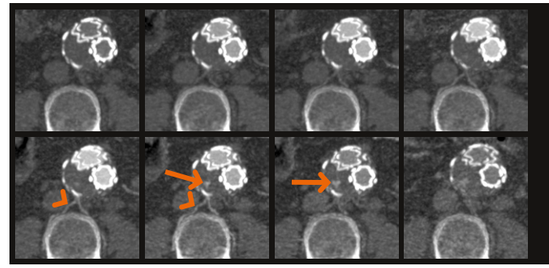
In this case, a dynamic CTA was performed using Adaptive 4D Spiral scanning. It shows that the endoleak is best seen 26 seconds after the beginning of the scan, which is 10 seconds after the peak arterial enhancement. A lumbar artery as the source of the endoleak is also clearly demonstrated, using the fused temporal maximum intensity projection (MIP) images. As dynamic CTA requires multiple scans and may result in an increased radiation dose compared to a single or dual-phase CTA, it can be used as an imaging strategy in cases where standard CTA does not clearly define the source of an endoleak, or if an endoleak is not shown but suspected due to an increasing or non-diminishing size of the aneurysm sac. Additionally, lower kV and mAs settings for each time point acquisition, as well as longer scan intervals after the arterial enhancement peak, should be applied to improve contrast-to-noise ratio (CNR) and to reduce radiation dose. ●

Examination Protocol

Scanner	SOMATOM Edge Plus		
Scan area	Abdomen/pelvis	**Rotation time**	0.28 s
Scan mode	Adaptive 4D Spiral	**Slice collimation**	128 × 0.6 mm
Scan length	282.4 mm	**Slice width**	1.5 mm
Scan direction	Shuttle	**Reconstruction increment**	0.8 mm
Scan time	30.5 s*	**Reconstruction kernel**	Br32
Tube voltage	80 kV	**Contrast**	320 mgL/mL
Effective mAs	110 mAs	**Volume**	90 mL + 40 mL saline
Dose modulation	CARE Dose4D™	**Flow rate**	5 mL/s
CTDIvol	35.8 mGy	**Start delay**	Bolus tracking in left atrium
DLP	1035.1 mGy cm		

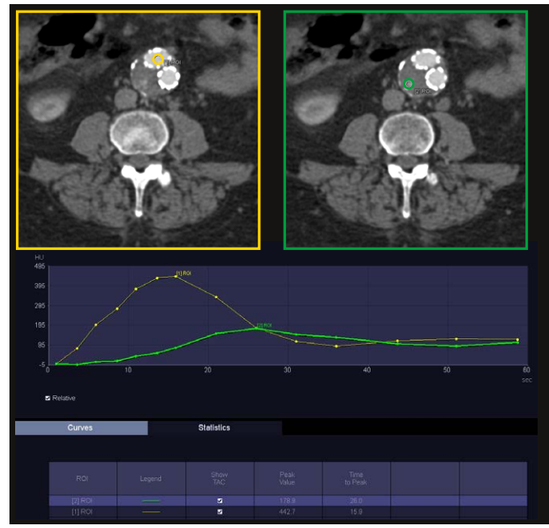
*7 acquisitions at an interval of 2.5 seconds for the first 15 seconds, followed by 4 acquisitions at an interval of 5 seconds, and 3 acquisitions at an interval of 7 seconds in a total scan duration of 58 s.

1



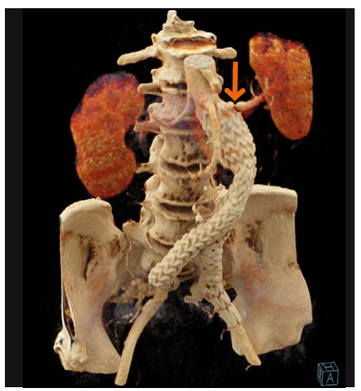
1 MIP images (9 mm) selected at time points of 0-5-10-12-16-20-26 and 35 seconds post scan start show an endoleak contrast blush (arrow) and the feeding lumbar artery (arrowhead).

2



2 Time attenuation curves (TAC) of the stent lumen (ROI1, in yellow) and the endoleak blush (ROI 2, in green) demonstrate the peak enhancement (ROI 1: 16 s, ROI 2: 26 s) and the washout of the contrast. Note that a standard CTA acquired at the aortic peak enhancement would have been too early to optimally visualize the endoleak. Ensuring the correct timing for a second late scan would also be difficult without prior knowledge of the washout dynamics of the endoleak.

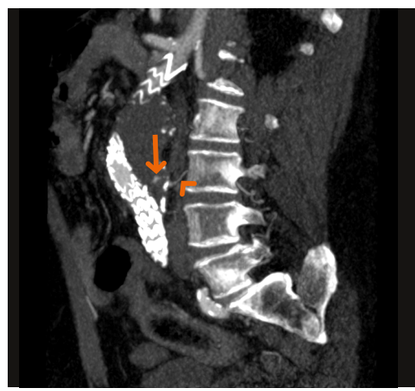
3a



3b

3 Cinematic VRT images show the stent configuration in its complete length within a scan range of 28 cm (a), as well as the endoleak (b, arrow) and the feeding lumbar artery (b, arrowhead) in a zoomed sagittal view. A severe stenosis in the proximal left renal artery (a, arrow) is also seen.

4



4 A sagittal view of temporal MIP fused with 12 time points around the peak enhancement shows the endoleak (arrow) and the feeding lumbar artery (arrowhead).