

Carotid artery dissection: imaging findings on multi-parametric ultrasound

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Section: Cardiovascular

Area of Interest: Arteries / Aorta

Procedure: Diagnostic procedure

Imaging Technique: Ultrasound

Imaging Technique: Ultrasound-Colour Doppler

Imaging Technique: Ultrasound-Power Doppler

Special Focus: Dissection Case Type: Clinical Cases

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Patient: 60 years, male

Clinical History:

A 60-year-old male patient was referred for a follow-up carotid ultrasound after surgical treatment of a type A aortic dissection with Bentall procedure. The dissection was known to be extending to the right common and internal carotid artery.

Imaging Findings:

Transverse B-mode could visualise the intimal flap as an echogenic linear structure floating within the lumen. However, when the ultrasound beam was parallel to the flap's orientation, the latter was not visualised, potentially misleading the examiner. Similarly, due to overwriting artifact caused by inappropriately adjusted colour gain, the flap was occasionally missed, covered by colour flow signals, while with more careful adjustment of parameters, the intimal flap could be detected with this technique as well. The use of power Doppler imaging, colour B-Flow and B-Flow technique increased the technique's sensitivity, accurately visualising the intimal flap in both transverse images and longitudinal images. (Fig.1, 2) The dissection could be seen extending to the internal carotid bulb. (Fig.2) The integration of various flow-detecting techniques like power Doppler technique and B-Flow has the potential to increase the ultrasonographic technique's sensitivity for visualisation of dissection, in the setting of multiparametric ultrasound.

Discussion:

Dissection of the carotid and vertebral arteries is a rare entity with less than 5 new cases per 100.000 of the general population every year. However, it represents an important cause of cerebral ischaemia in young and middle-aged patients. Carotid dissection may either be associated with aortic dissection or may exclusively affect the carotid artery, either caused by trauma or occurring spontaneously. [1] US may be more than 90% sensitive in the diagnosis of carotid dissection, thus being a reliable technique to exclude the presence of this entity. Nevertheless, definite diagnosis and the extent of disease should always be evaluated with a cross-sectional imaging technique such as computed tomography angiography or magnetic resonance angiography. [2, 3] One characteristic but indirect finding of carotid dissection is the detection of a high resistance flow pattern at the initial part of the internal carotid artery, suggestive of distal occlusion or high-grade stenosis. This is explained by the tendency of dissection to affect the distal part of the internal carotid artery, differently to what happens with atherosclerosis. [1] Decreased or reversed

diastolic flow can be visualised in 68% of internal carotid artery dissection. Finally, a normal waveform, low amplitude biphasic pattern or absence of flow in the occluded vessel can also be found during spectral Doppler interrogation. [2, 4, 5] Intramural haematomas of the carotid artery can be occasionally visualised as hypoechoic thickening of the vessel wall. The classic finding of carotid dissection is that of a visible intimal flap dividing the vessel lumen in two parts, but is only rarely found. [1, 6] Furthermore, the absence of calcifications, ulcerations and other findings of atherosclerosis helps differentiating dissection from atherosclerosis. [5] B-flow imaging is a newer vascular ultrasonographic technique which was reported to be more sensitive and specific than classic colour Doppler ultrasonography in the diagnosis of carotid dissection. It was found to more accurately identify intimal flaps and visualise flow within true and false lumens. B-Flow's advantages include the lack of overwriting artifacts, angle dependence and increased sensitivity to slow flow. As a consequence, it can readily and accurately visualise fissures, intimal flaps and slow flow within false lumen in patients with carotid dissection. The intimal flap's movement can also be better appreciated using the cine mode of B-Flow. [7, 8, 9] As a take home message, techniques like power Doppler or B-Flow can be used to increase ultrasound's accuracy for the diagnosis and follow-up of carotid dissection.

Differential Diagnosis List: Carotid dissection as an extension of aortic type A dissection., Carotid dissection with intimal flap, Carotid intramural haematoma, Carotid atherosclerosis

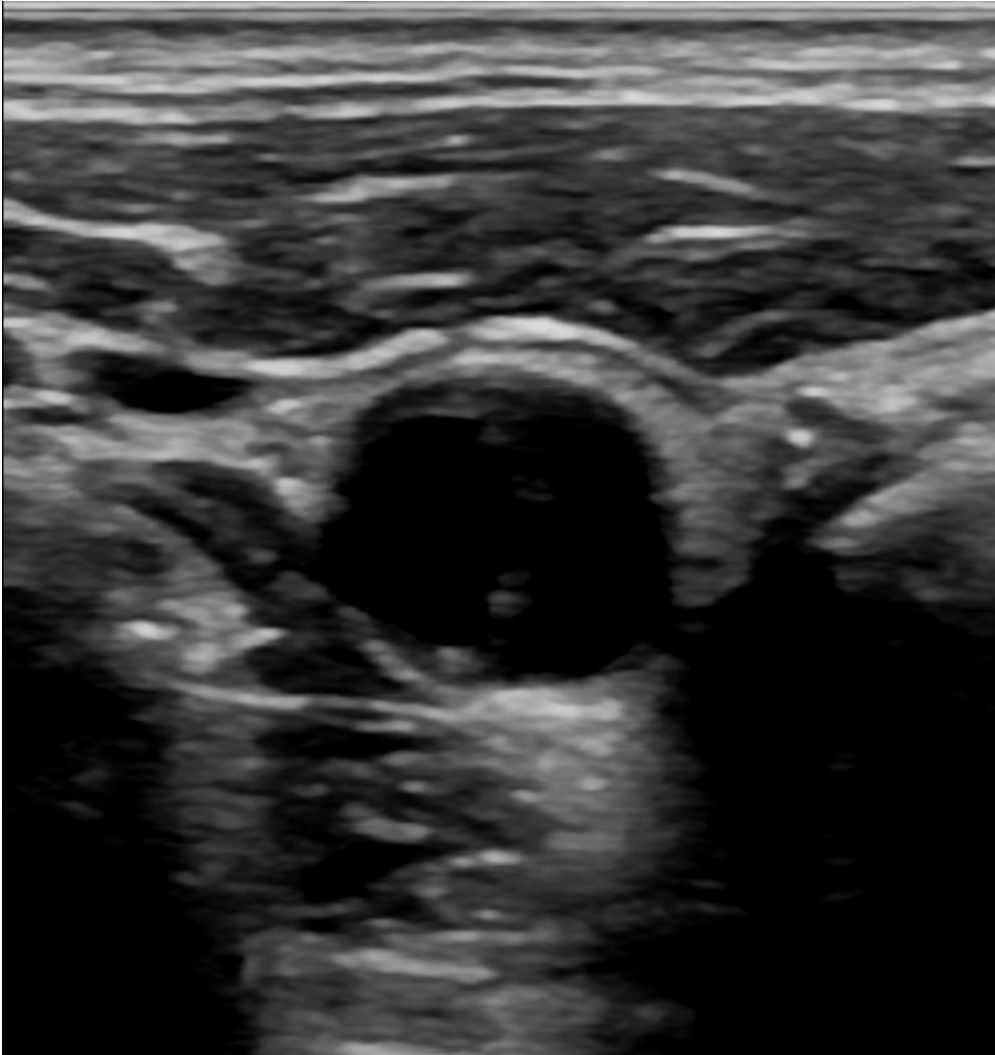
Final Diagnosis: Carotid dissection as an extension of aortic type A dissection.

References:

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Figure 1

a



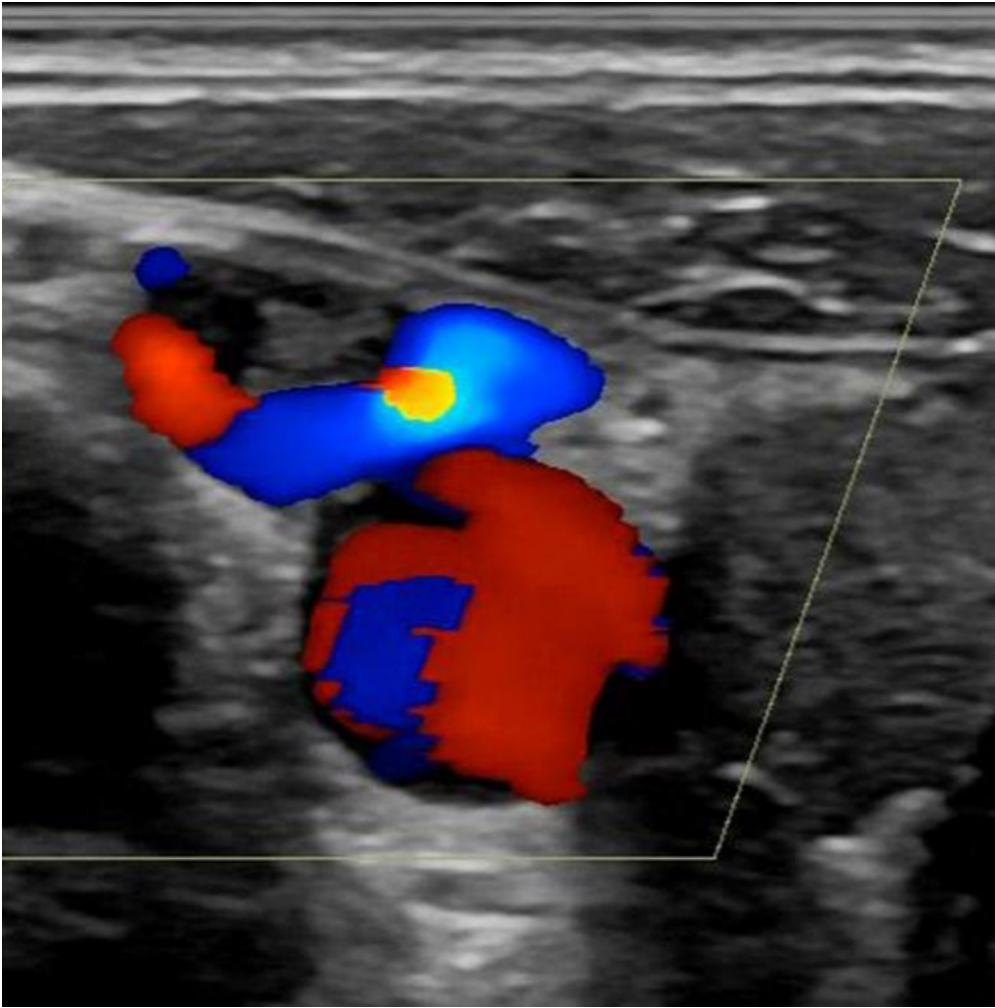
Description: B-mode image adequately visualising the intimal flap within the common carotid artery lumen. **Origin:** Department of Radiology, AHEPA University Hospital

b



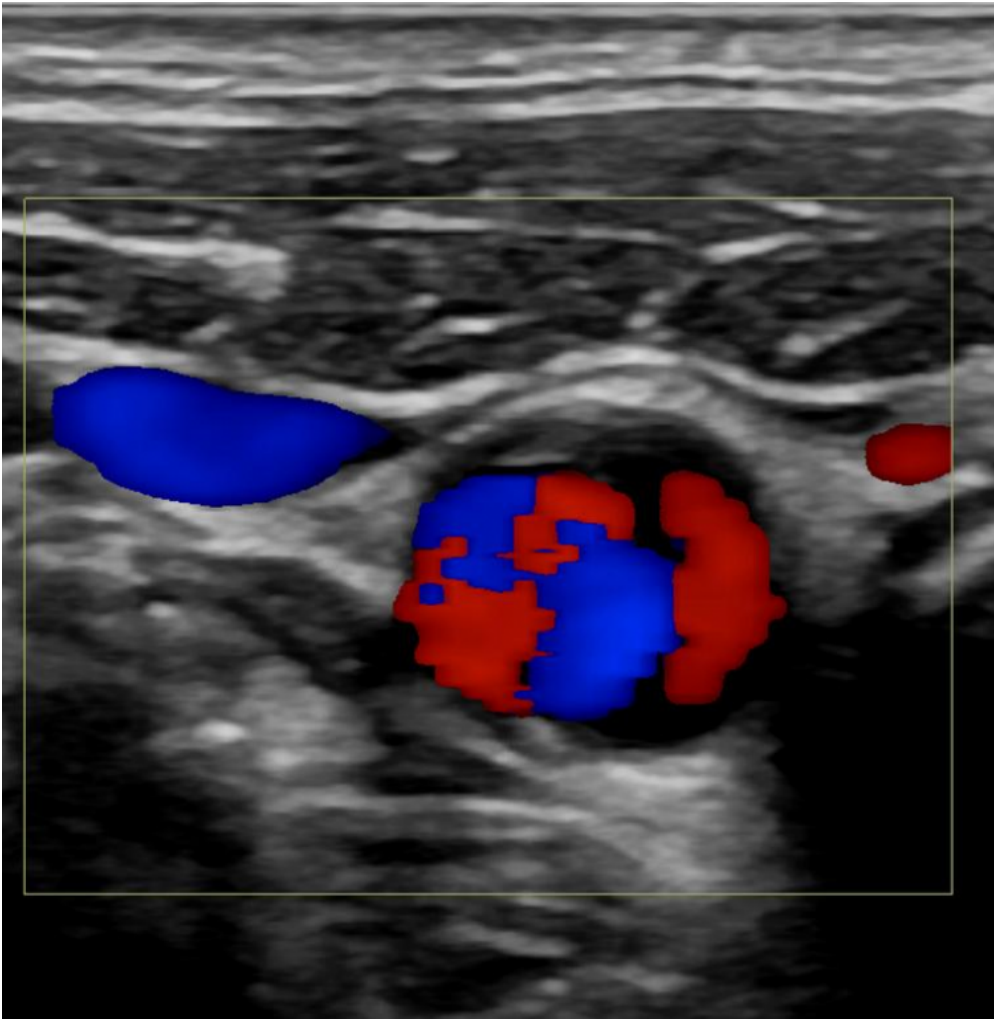
Description: A different B-mode image failed to visualise the intimal flap due to its orientation in relation with the ultrasound beam. **Origin:** Department of Radiology, AHEPA University Hospital

c



Description: Colour Doppler image showing blood flow signals filling the entire lumen, covering the intimal flap due to overwriting artifact. **Origin:** Department of Radiology, AHEPA University Hospital

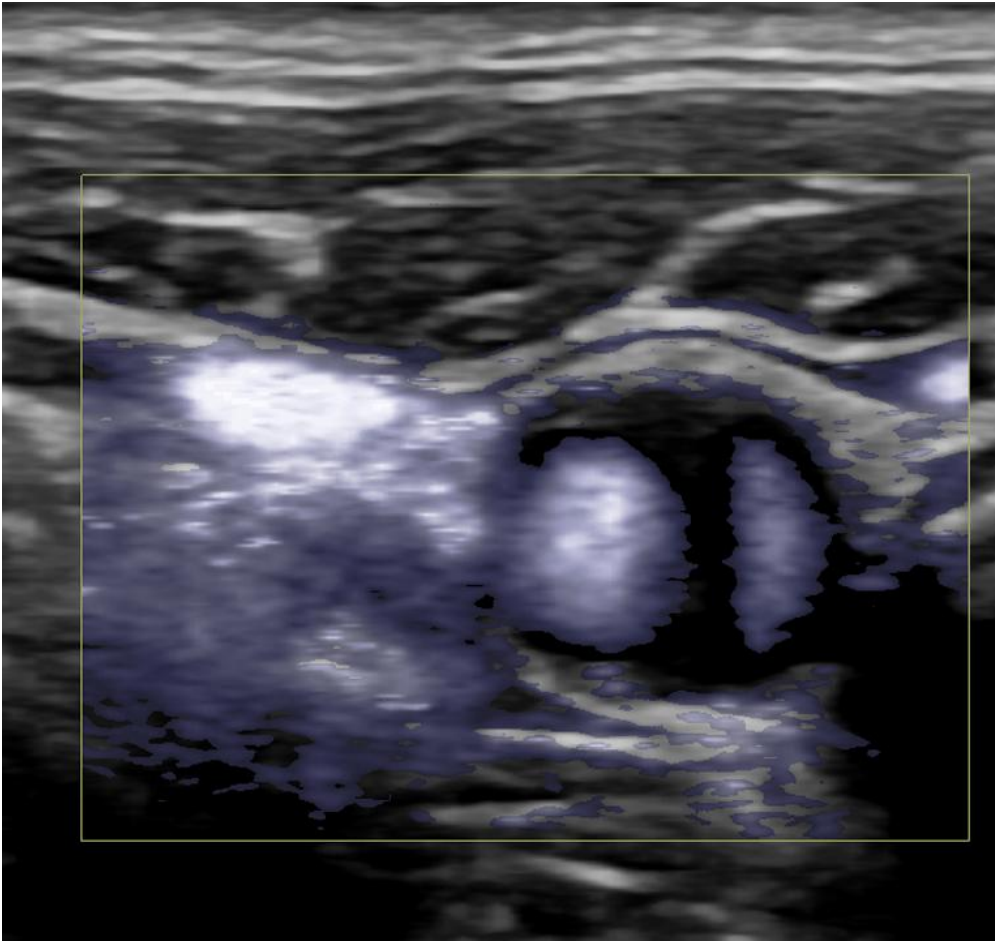
d



Description: Colour Doppler image with careful adjustment of colour gain detected the intimal flap.

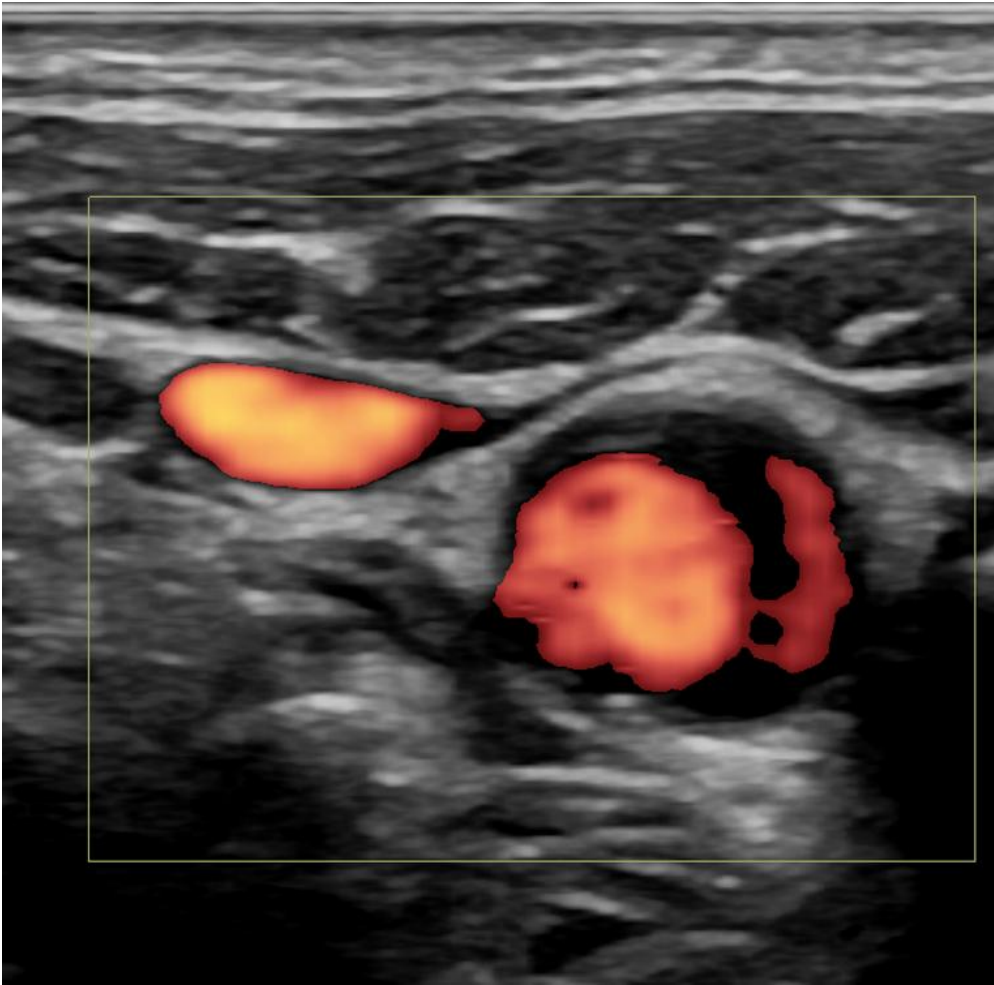
Origin: Department of Radiology, AHEPA University Hospital

e



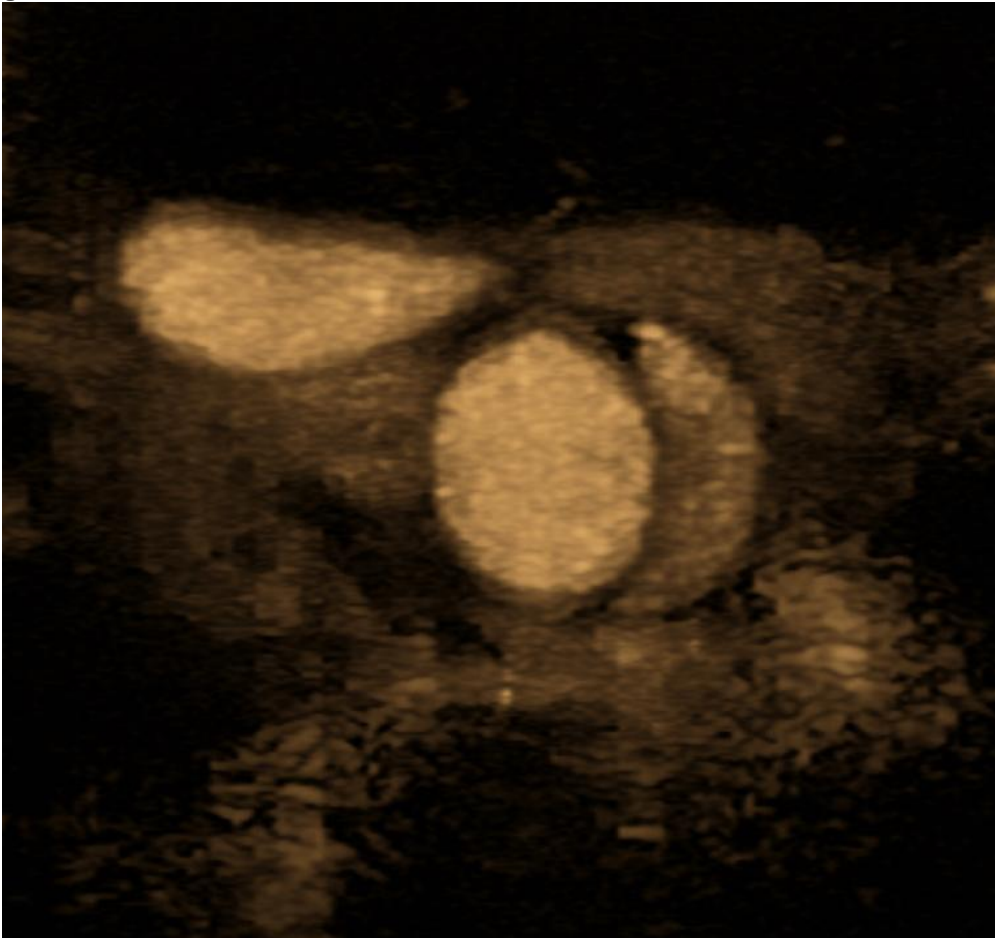
Description: Colour B-Flow image accurately detecting the flow within the true and false lumen, highlighting the intimal flap. **Origin:** Department of Radiology, AHEPA University Hospital

f



Description: Power Doppler image accurately detecting the flow within the true and false lumen, highlighting the intimal flap. **Origin:** Department of Radiology, AHEPA University Hospital

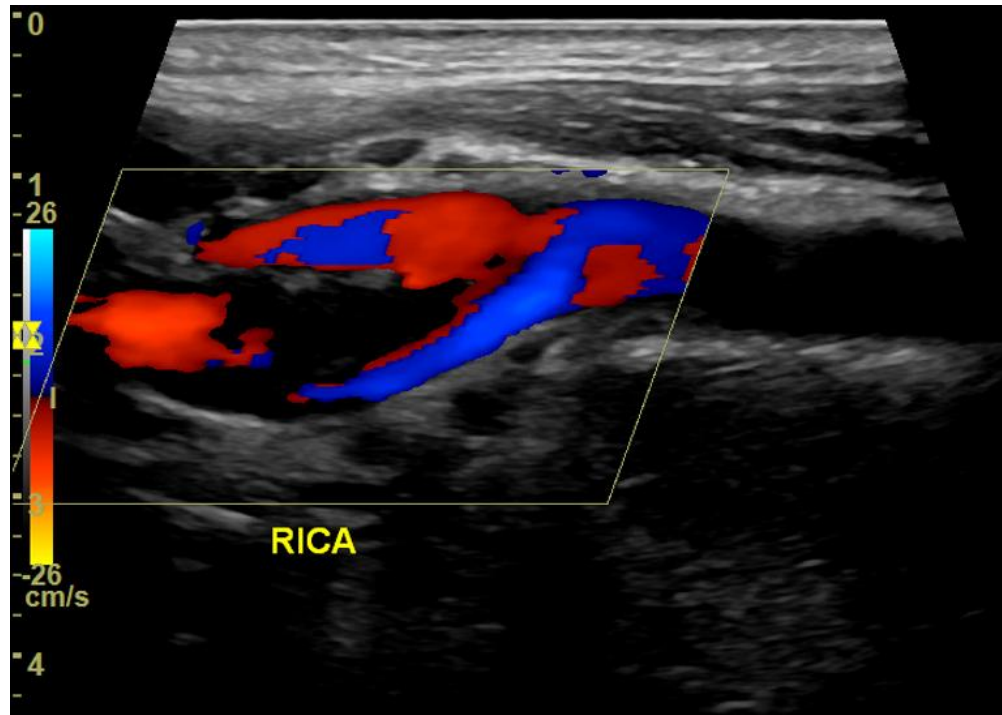
g



Description: B-Flow image accurately detecting the flow within the true and false lumen, delineating the intimal flap. **Origin:** Department of Radiology, AHEPA University Hospital

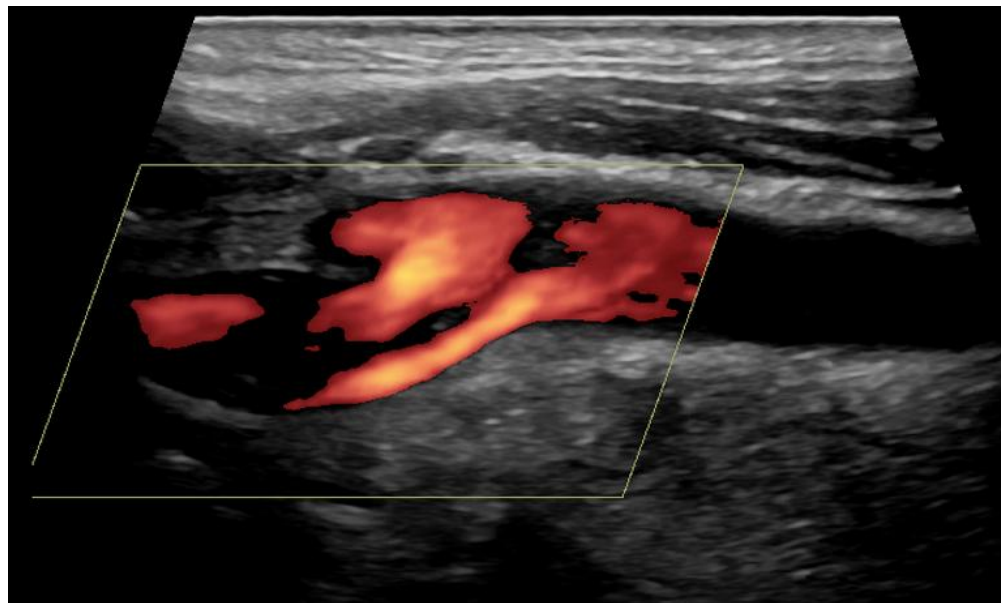
Figure 2

a



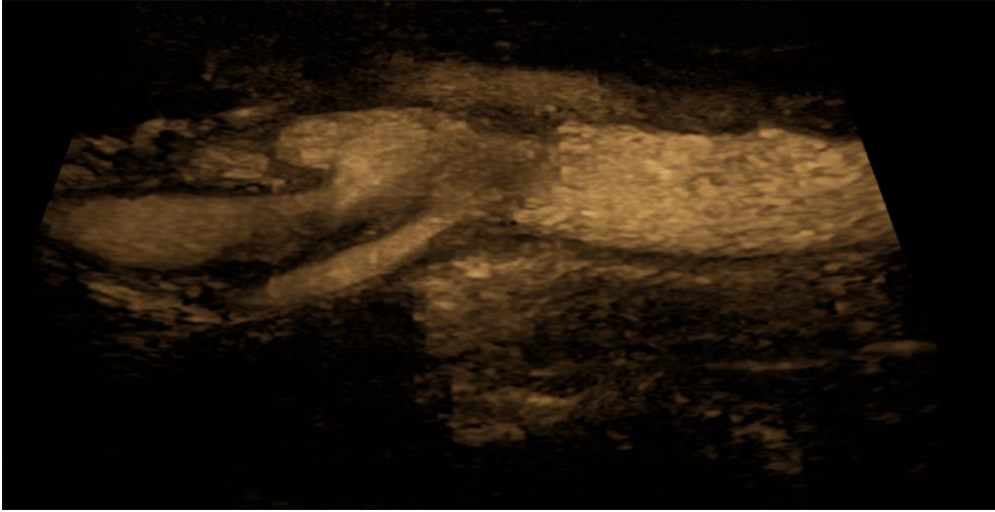
Description: Colour Doppler image showing the extension of dissection to the carotid bulb. **Origin:** Department of Radiology, AHEPA University Hospital

b



Description: Power Doppler image confirming colour Doppler findings. **Origin:** Department of Radiology, AHEPA University Hospital

c



Description: B-Flow image confirming colour Doppler findings and showing improved filling of the blood vessels with blood flow signals. **Origin:** Department of Radiology, AHEPA University Hospital