

## Case 8057

### Occlusion or Near-Occlusion of the ICA?

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**Section:** Cardiovascular

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**Patient:** 84 year(s), female

## Clinical History

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An 84-year-old woman presented to the ER with dysarthria, left hemianopsia and hemiplegia. Head CT excluded a haemorrhagic stroke.

Although at B-Mode US the right ICA appeared to be completely filled with echogenic thrombus, Color and Power Doppler evaluation showed a string of flow within it, diagnostic of near-occlusion.

## Imaging Findings

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An 84-year-old woman was brought to the ER due to sudden loss of consciousness while standing, followed by a fall with head trauma. Family members who witnessed the episode stated that she regained consciousness soon after the fall but was drowsy ever since.

Physical examination revealed a frontal head wound, dysarthria, left hemianopsia and hemiplegia. Pulse was rhythmic and arterial tension was normal.

Head CT, performed without contrast administration, revealed no signs of recent intracranial haemorrhage.

The patient was admitted to the Neurology Department with the diagnosis of ischemic cerebral infarction, and was treated accordingly.

Doppler Ultrasound was performed the following day. On the B mode examination, echogenic material seemed to fill the whole lumen of the right internal carotid artery, starting at its emergence and extending along the full length of observable vessel. This finding suggested the presence of total occlusion due to an intraluminal thrombus (Figs. 1 and 2). Colour and Power Doppler US evaluation, though, revealed a narrow and irregular flowpath within the thrombus. This finding is

known as "trickle flow" or "string sign" and is diagnostic of near-occlusion (Figs. 3 and 4). Pulse Wave (PW) Doppler analysis showed high-flow-resistance spectral morphology and low peak systolic velocity in the right common carotid artery. Spectral morphology and flow velocities were normal in the left common carotid artery (Figs. 5 and 6). Despite the near-occlusion of the right internal carotid artery, right subclavian artery maintained normal flow velocity and direction (Fig. 7).

## Discussion

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Internal carotid artery (ICA) occlusion is most commonly caused by atherosclerosis. Dissection and fibromuscular dysplasia are much less frequent causes.

On US, ICA occlusion presents as echogenic material completely filling the arterial lumen accompanied by absence of arterial pulsations or flow at Colour, Power and PW Doppler interrogation. Other findings include a characteristic to-and-fro" flow pattern at the point of occlusion, known as thud flow", seen at Colour and PW Doppler imaging and damped resistive flow in the common carotid artery (CCA) at PW Doppler imaging, known as externalization of the CCA.

Near occlusion typically presents with a string sign" or trickle flow" at both Colour and Power Doppler imaging. The advantages of Power over Colour Doppler in this particular clinical setting are not unanimous.

The distinction between occlusion and near occlusion is of extreme importance because patients with near occlusion may be treated with endarterectomy, while total occlusion precludes it.

To avoid false-positive diagnosis of total occlusion, optimisation of Doppler parameters is of utmost importance. It involves:

- . Using a low frequency (< 7 MHz) transducer;
- . Obtaining the best possible views of the ICA, in both longitudinal and transverse planes, with adequate box size and steering;
- . Lowering the pulse repetition frequency to values as low as possible, preferably below 15 cm/sec;
- . Lowering the low frequency filter to avoid missing low frequency signals;
- . Increasing Colour and PW gain settings to the point of visible background noise;
- . Increasing Colour threshold to over 80%;
- . Increasing the sample volume gate to 2.5 mm or more.

Doubtful cases may require alternative imaging modalities, such as catheter or CT angiography.

## Final Diagnosis

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Near-occlusion of the right internal carotid artery

## Figures

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**Figure 1 B Mode US**





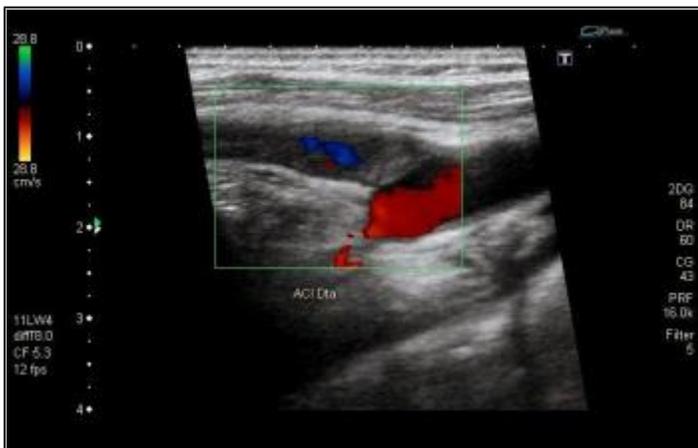
B Mode examination of the carotid arteries revealed echogenic material filling the lumen of the right internal carotid artery, not associated with caliber reduction.

**Figure 2 B Mode US**



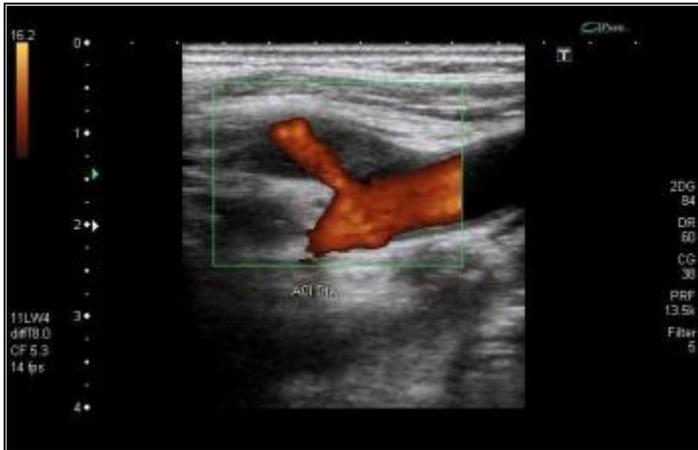
Intraluminal filling of the right internal carotid artery with echogenic material, here seen in a transverse plane.

**Figure 3 Colour Doppler US**



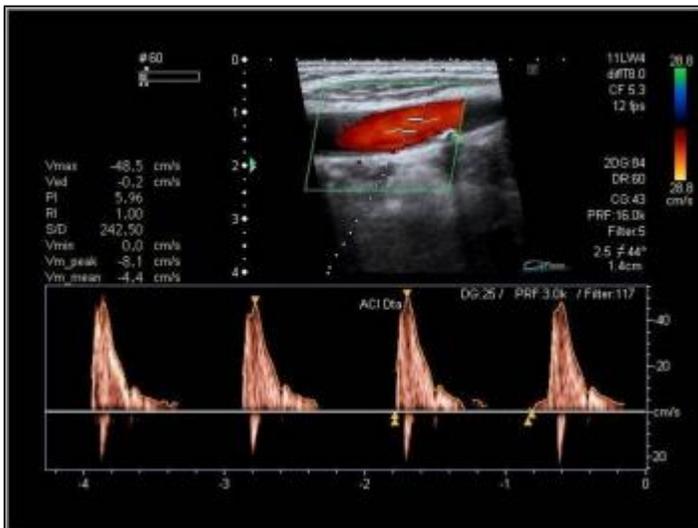
Colour Doppler evaluation revealed the "string sign" or "trickle flow", characteristic of near occlusion.

**Figure 4 Power Doppler US**



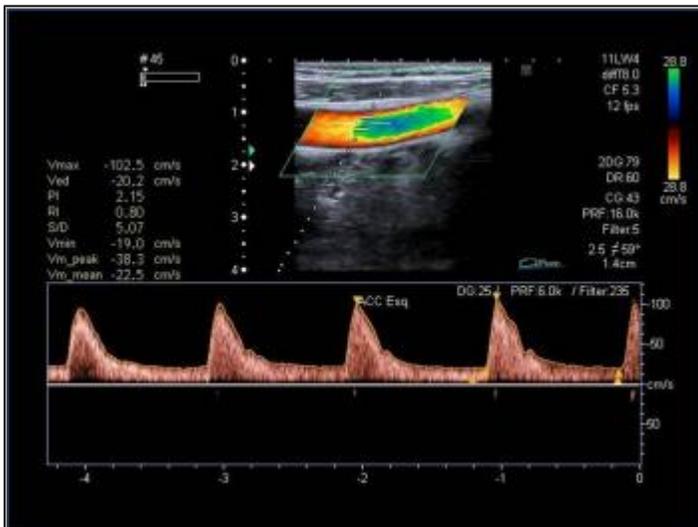
"Trickle flow" as seen on power Doppler US.

**Figure 5 Spectral Doppler US**



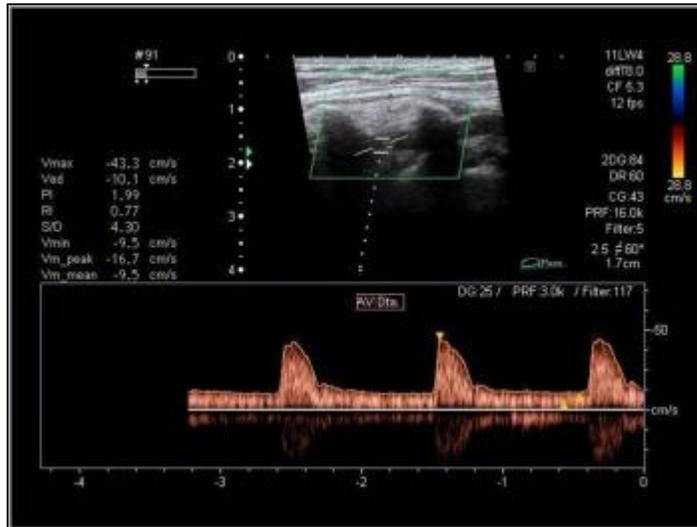
Right common carotid artery showed a high-flow-resistance spectral morphology, with zero flow in the end-diastole. Note peak systolic velocity of only 48 cm/s.

**Figure 6 Spectral Doppler US**



Flow velocities were considerably higher (103 cm/s) in the contralateral common carotid artery, with preserved low-flow-resistance spectral morphology.

**Figure 7 Spectral Doppler US**



Despite the pre-occlusive stenosis of the right internal carotid artery, flow was not reversed and velocities were normal in the homolateral vertebral artery.

## MeSH

### **Carotid Stenosis** [C14.907.137.230]

Narrowing or stricture of the internal, common, or external carotid artery, most often as a result of atherosclerotic plaque formation. Ulcerations may form in atherosclerotic plaques and induce thrombus formation. Platelet or cholesterol emboli may arise from stenotic carotid lesions and induce a transient ischemic attack (ISCHEMIC ATTACK, TRANSIENT) or CEREBROVASCULAR ACCIDENT. Emboli which travel to the eye may manifest as AMAUROSIS FUGAX (temporary blindness). (From Adams et al., Principles of Neurology, 6th ed, pp822-3)

## References

- [1] Tahmasebpour HR (2005) Sonographic Examination of the Carotid Arteries. BSc, RDMS et al; RadioGraphics 25:15611575
- [2] Zwiebel, Pellerito (2005) Introduction to Vascular Ultrasonography. Elsevier Saunders; 5th Edition

## Citation

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