CASE REPORT

Reversed internal jugular vein flow as a sign of brachiocephalic vein obstruction

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Abstract

The value of colour Doppler sonography is well known in the assessment of venous disease, including obstruction/occlusion from thrombosis. Central venous disease, however, can be more difficult to directly assess than disease in peripheral veins. Accordingly, there is significant value not only in the direct signs of venous disease, but also in the indirect signs. We report a case of reversed internal jugular vein flow in a patient with left arm swelling as a sign of brachiocephalic vein obstruction.

Keywords: colour Doppler sonography, reversed internal jugular vein flow, vein obstruction, venous thrombosis, brachiocephalic.

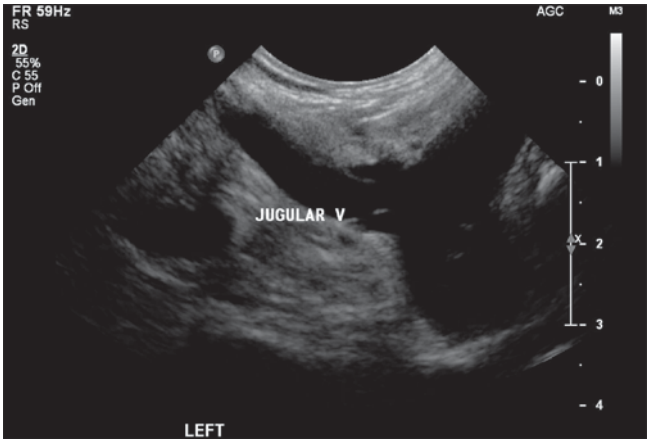

Fig. 1a: The left internal jugular vein, with no internal thrombus.

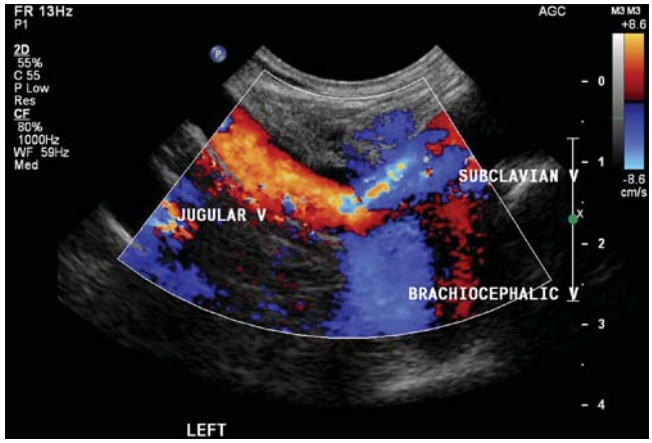

Fig. 1b: Colour Doppler demonstrating retrograde flow in the left internal jugular vein.

Case report

A 63-year-old man was referred to our department for investigation of recent left arm swelling. He was recently diagnosed with a relapse in diffuse large B-cell lymphoma, having previously been treated for Hodgkin's disease.

A recent PICC line had been inserted into the left basilic vein to assist with long-term antibiotic therapy for an infection involving the soft tissues of the back. At the time of the study, the patient was experiencing left upper arm swelling, associated with mild discomfort.

The patient proceeded to an ultrasound assessment of the left upper arm veins, using a Philips (Amsterdam, Netherlands) iU22 ultrasound system.

On assessment, flow within the left internal jugular vein was reversed, with loss of normal respiratory phasic variation and cardiac pulsatility, and there was increased reverse flow upon arm augmentation. The left internal jugular vein, however, was patent and compressible with no internal thrombus seen. Normal flow was seen within the right internal jugular vein.

The left subclavian and axillary veins were patent and compressible, with no internal thrombus, however these vessels also demonstrated loss of normal respiratory phasicity and cardiac pulsatility. The left basilic and brachial veins were patent and compressible, with no internal echoes to suggest thrombosis. A short segment of the left cephalic vein demonstrated internal echoes and was non-compressible, in keeping with thrombosis (this was at the level of the mid-humerus and did not extend to the junction with the subclavian vein).

Overall, these findings were suggestive of occlusion or severe stenosis (intrinsic or extrinsic) of the proximal left brachiocephalic vein. The normal flow in the right internal jugular vein did not suggest extension of the occlusive/stenotic process to involve the superior vena cava. Therefore, a CT scan was recommended for further assessment.

Accordingly, the patient underwent a CT scan of the neck and chest. There was near complete collapse of the left brachiocephalic vein as it passed just posterior to the left sternoclavicular joint.

The cause of this collapse was due to external compression by a combination of degenerative changes at the costosternal joints, mild soft-tissue thickening surrounding the left sternoclavicular joint, and an ectatic thoracic aorta. Collateral vessels were also noted in the posterior neck musculature.

Fig. 2a: Loss of normal respiratory phasicity and cardiac pulsatility in the left internal jugular vein.

Fig. 2b: Normal phasic and normal directional venous flow in the right internal jugular vein.

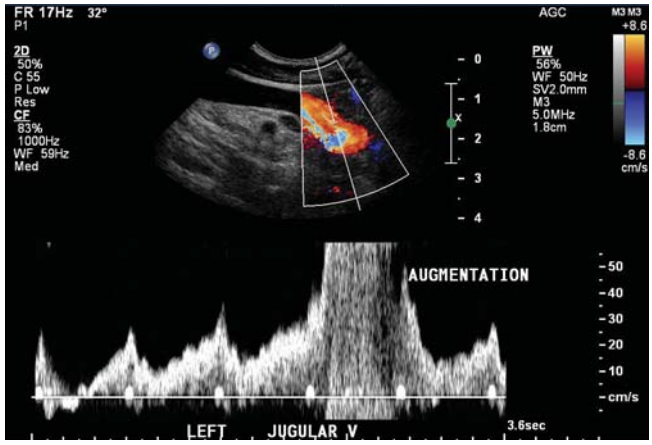

Fig. 3: Increased reversed flow in the left internal jugular vein upon augmentation.

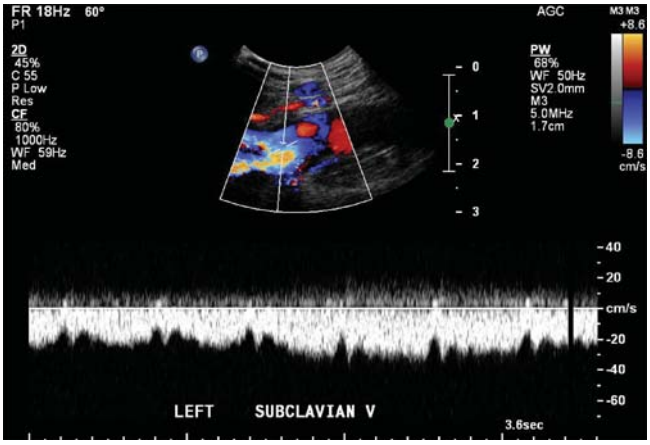

Fig. 4a: Blunted phasicity in the left subclavian vein.

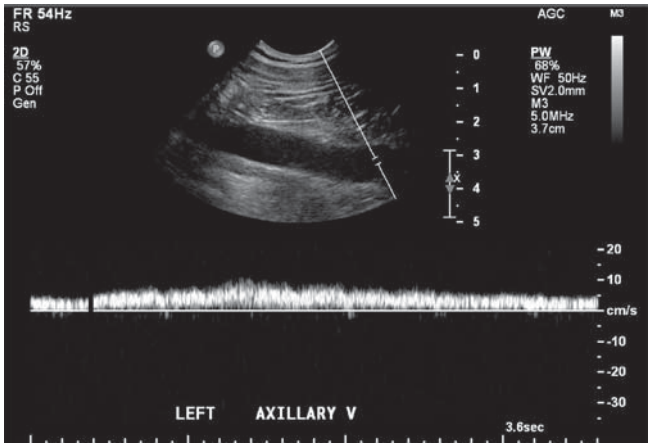

Fig. 4b: Blunted phasicity in the left axillary vein.

Discussion

Doppler examination is the screening technique of choice in evaluating upper extremity venous thrombosis. Colour Doppler sonography is accurate, with reported sensitivities of ~78–100% and specificities of ~82–100%[1].

There are several direct and indirect signs of disease of the upper extremity veins. Direct signs include: visualisation of thrombus, venous non-compressibility, scarring or an adjacent compressing mass on grey-scale images. Colour imaging may show cessation of flow with complete occlusion, or turbulent flow with focally elevated velocities in partial occlusion. Indirect signs include: dampening of waveforms, decreased velocities and loss of transmitted pulsatility and respiratory phasicity peripheral to a stenosis. Asymmetry in waveforms on bilateral examination aids in identifying the location of stenoses[2].

The normal spectral Doppler waveforms in the upper extremity veins are characterised by two phasic variations in amplitude. Cardiac pulsatility is seen as choppy and sometimes demonstrates a biphasic flow pattern, with a peak forward flow during mid diastole, whereas the flow slows or reverses as the tricuspid valve closes. Respiratory variation can be prominent in the upper extremity veins, with increased flow during inspiration and decreased flow on expiration. Loss of the normal biphasic pattern and development of a nonpulsatile signal strongly suggest central venous disease (e.g., thrombosis, stenosis, or extrinsic compression). Some authors have found absent or reduced cardiac pulsatility to be a more sensitive marker of unilateral venous occlusion than asymmetric respiratory phasicity[1,2].

The internal jugular veins are large vessels, relatively easily evaluated with ultrasonography, and due to their proximity to the heart, usually have pulsatile waveforms. As described above, waveform alteration (e.g. monophasic, flattened or dampened flow in the jugular vein) or waveform asymmetry may indicate more central (brachiocephalic/SVC) thrombosis or obstruction that is difficult to visualise directly[1–3]. Both these internal jugular waveform findings (of dampened flow and asymmetry) were evident in this particular case to indicate brachiocephalic vein occlusion.

Identification of the collateral venous routes can provide further evidence of a suspected occlusion. The

colour Doppler finding of retrograde jugular venous flow (such as in this case) has been reported as a sign of brachiocephalic vein occlusion[4].

Central venous stenosis can also manifest in haemodialysis patients without previous central venous catheterisation. In haemodialysis patients with polytetrafluorethylene grafts, central venous stenosis has been reported in up to 29% of cases, and is thought to develop from the high-pressure turbulent flow caused by the arteriovenous fistula. In this context, retrograde internal jugular venous flow has also been reported[5–7].

In summary, spectral analysis of flow in the internal jugular and subclavian veins can provide indirect evidence of more central pathology. These findings should be sought in patients with unexplained arm oedema and/or pain, in whom the likelihood of disease is high. Confirmation with CT scan is useful.

References

1 Chin EE, Zimmerman PT, Grant EG. Sonographic Evaluation of Upper Extremity Deep Venous Thrombosis. *J Ultrasound Med* 2005; 24: 829–38.

2 Nazarian GK, Foshager MC. Color Doppler Sonography of the Thoracic Inlet Veins. *Radiographics* 1995; 15: 1357–71.

3 Middleton WD, Kurtz AB, Hertzberg BS. Chapter 10: Neck and Chest, and Chapter 11: Extremities. In: Ultrasound: the requisites. Second edition. Missouri: Mosby; 2004. pp 244–301.

4 Conkbayir I, Men S, Yanik B, Hekimolu B. Color Doppler sonographic finding of retrograde jugular venous flow as a sign of innominate vein occlusion. *J Clin Ultrasound* 2002; 30: 392–98.

5 Hartmann A, Mast H, Stapf C, Koch H, Marx P. Peripheral hemodialysis shunt with intracranial venous congestion. *Stroke* 2001; 32: 2945–46.

6 Lumsden AB, MacDonald MJ, Isiklar H, Martin LG, Kikeri D, Harker LA, Allen RC. Central venous stenosis in the hemodialysis patient: incidence and efficacy of endovascular treatment. *Cardiovasc Surg* 1997; 5: 504–9.

7 Oguzkurt L, Tercan F, Yıldırım S, Torun D. Central venous stenosis in haemodialysis patients without a previous history of catheter placement. *Eur J Radiol* 2005; 55: 237–42.