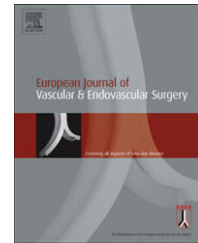




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# Extracranial and Transcranial Ultrasound Assessment in Patients with Suspected Positional 'Vertebrobasilar Ischaemia'

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## KEYWORDS

Transcranial Doppler;  
Rotational;  
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**Abstract** *Objectives:* A diagnosis of 'positional' vertebrobasilar ischaemia is considered in patients presenting with dizziness/vertigo during lateral neck rotation/extension and is attributed to bony 'nipping' of the vertebral artery (VA). This study reviewed our experience with extracranial and transcranial ultrasound to determine whether a diagnosis of 'positional' vertebrobasilar ischaemia was associated with any changes in flow in the extracranial VA and the P1 segment of the posterior cerebral artery (PCA) during head turning.

*Methods:* A retrospective case note review was undertaken in 46 patients with an accessible window for transcranial Doppler who had undergone extracranial and transcranial assessment of flow velocity and flow directionality in the VA and PCA while the head was moved into positions that normally triggered the patient's symptoms.

*Results:* Positional 'vertebrobasilar symptoms' were triggered by lateral head rotation in 35 patients (76%), while 11 (24%) developed symptoms following neck extension. Only one patient was found to have a significant carotid stenosis (symptoms unchanged following carotid endarterectomy) and none had significant disease in the extracranial VAs. None of the patients exhibited any change in extracranial VA flow during head turning/extension and none had reversal of flow either. Similarly, there was no change observed in the PCA flow characteristics during head turning. The majority of patients (74%) were subsequently referred to the Ear, Nose and Throat (ENT) department, and 94% of the patients noted an improvement in symptoms following entry into a vestibular rehabilitation programme.

*Conclusions:* A diagnosis of 'positional' vertebrobasilar ischaemia should be made with extreme caution and only after a specialist assessment in a Balance Centre.

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The vertebral arteries (VAs) arise from the subclavian arteries and pass posterosuperiorly between longus colli and scalenus anterior before passing superiorly through the foramen in the transverse process of the sixth cervical vertebra. The VAs then ascend via the transverse foramina of the upper cervical vertebrae to the level of C2, where they pass posterolaterally around the posterior arch of C1 before passing between the atlas and occiput. Having pierced the dura at the level of the foramen magnum, the VAs meet at the level of the medulla/pons to become the basilar artery (BA). There are, therefore, a number of points where the VA can be compressed by bony/soft-tissue structures, either as a consequence of an anatomical anomaly or because of a degenerative change.

It has become almost conventional to consider a diagnosis of 'positional' vertebrobasilar ischaemia in patients who present with dizziness/vertigo or faintness where these symptoms are specifically associated with either lateral neck rotation or extension. It is generally assumed that these patients have 'nipping' of the extracranial VAs sufficient to cause haemodynamical compromise and the onset of posterior fossa symptoms. Not surprisingly, patients may be labelled as having suffered vertebrobasilar transient ischaemic attacks (TIAs), often without further investigation.

Technological developments in ultrasound imaging now mean that it is possible to insonate and image the extracranial and basal intracranial circulation to ascertain whether these patients display any change in flow patterns in the VA/posterior cerebral artery (PCA) vessels during head rotation and extension. A failure to elicit any change in flow haemodynamics would render any diagnosis of positional 'vertebrobasilar ischaemia' extremely unlikely.

## Materials and methods

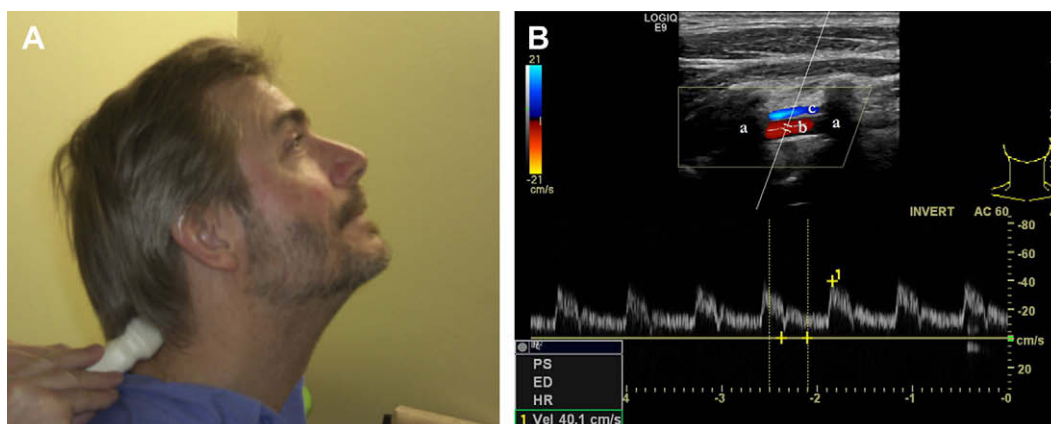
Since 2000, a standardised ultrasound protocol has been employed in patients referred to the Vascular Unit with suspected positional vertebrobasilar ischaemia and a retrospective audit was undertaken of the findings in 46 patients

presenting between January 2000 and July 2007 (and who had an accessible temporal window for transcranial Doppler ultrasound). Each had been referred with a diagnosis of suspected positional vertebrobasilar ischaemia. The Leicestershire, Northamptonshire and Rutland Research Ethics Committee advised that this study did not fall under the remit of the NHS Research Ethics Committee as it was an audit/service evaluation.

## Extracranial Duplex examination of the carotid and vertebral arteries

This was performed using a Philips HDI 5000 Duplex scanner with a 7–4 MHz linear array transducer, with the patient lying in a supine position in a darkened, quiet room. The extracranial carotid arteries were assessed in order to exclude any haemodynamically significant lesion (>70%), while also excluding abnormal low-velocity or high-resistance flow that may indicate a dissection or distal siphon disease. The proximal VAs were then imaged, as were the intervertebral segments of the extracranial VAs and assessed for the presence of stenosis >50%, tortuosity, patency, direction of flow, asymmetry of size or flow characteristics, such as high-resistance flow or increased systolic rise time.

The patient was then placed in a sitting position with the head in a neutral position, looking directly ahead. The extracranial VAs were re-imaged and the best intervertebral segment of this vessel selected for imaging (always above C6). The flow patterns were monitored during a variety of head movements (Fig. 1A) starting with the right VA. The head was first rotated to the left and then to the right. Second, the head was extended and then rotated to the left/right. Third, the head was maximally flexed and then rotated from left to right. Finally, the patient was asked to position his/her head in any other position that normally triggered the symptoms. A similar protocol was then carried out on the left VA. Any change in flow velocity or directionality in the intervertebral segment of the VA was documented (Fig. 1B).



**Figure 1** (A) Insonation of an intervertebral segment of the right VA while the head is extended using colour Duplex ultrasound. (B) Flow velocity and directionality in an intervertebral section of the VA is monitored at baseline and then when the head is moved into extension, rotation, etc. Key: (a) acoustic shadow caused by transverse processes of cervical vertebrae, (b) vertebral artery, (c) vertebral vein. The cursor is placed over the intervertebral segment of the VA to obtain a waveform.

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