Usefulness of Doppler ultrasound in ischemic “vertigo plus”

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Abstract

Vertigo is an illusion of a moving environment. Ischemic “vertigo plus” has additional focal neurological symptoms which are sometimes discrete. Before an initial Doppler examination it is possible to analyze voice, audition, gait, and wave of the hands during history taking.

A patient presenting vertigo plus has to be considered as an emergency case (Stroke Unit).

The following pathologies may present with symptoms of “vertigo plus”: (1) Latero-medullar infarction: vertigo and a nasal voice; (2) Infarction in the posterior inferior cerebellar artery (PICA) territory—vertigo and severe ataxia and/or clumsiness of one hand; (3) Progressive infarction of the brainstem with fluctuating symptoms as vertigo, diplopia, and transient hemiparesis; (4) Infarction in the distribution of the anterior inferior cerebellar artery (AICA)—vertigo with unilateral hearing problems in 50% of the cases.

With condition (1) and (2) Doppler Ultrasound (DUS) is likely to find a distal obstruction of the ipsilateral vertebral artery, with (3) and (4) a basilar artery stenosis or occlusion can be suspected and detected by DUS.

In conclusion, DUS is useful in vertigo plus, especially when the hospital does not have immediate access to magnetic resonance with angio. Anyway, DUS can yield additional intracranial and cervical hemodynamic information, even after this technique.

Keywords: Vertigo, Vertebrobasilar stroke, Emergency, Doppler ultrasound, Transcranial Doppler sonography.
Definition of vertigo

Illusion of a moving environment (mainly rotation of the objects). An isolated vertigo is in 95% of patients of a peripheral vestibular origin [1].

Ischemic “vertigo plus” has focal neurological symptoms which can be discrete.

Diagnosis

During the first contact and history, the following functions may be disturbed indicating “vertigo plus”: voice, audition, gait and wave of the hands.

Any patient presenting with a focal neurological sign and vertigo has to be considered as an emergency case (Stroke Unit).

Types of "vertigo plus"

Four types of vertebrobasilar infarctions with possible “vertigo plus” are described below, concerning underlying vascular pathology and the clinical usefulness of Doppler ultrasound (DUS) [2].

Lateral medullary infarction:
Lateral medullary infarction, also called Wallenberg syndrome: vertigo with at least a recently appearing nasal voice.
Pathology: Atheroma of 1 to 4 small branches coming from the fourth segment of the vertebral artery (V4), stenosis or dissection involving V3-V4 [1, 3]. DUS can be normal or detect a V4 stenosis, but it does not distinguish a dissection from a stenosis. A cervical MRI allows to assess the presence of a dissection. The main risk is a bronchopneumonia due to disturbed swallowing.

Posterior inferior cerebellar artery infarction:
Posterior inferior cerebellar artery (PICA) infarction: vertigo (horizontal nystagmus) often associated with a severe ataxia and/or a clumsiness of one hand.
Pathology: Atheromatous stenosis in 50%, involving the PICA, the V4 segment of the vertebral artery (VA) or, more rarely, its origin [2, 3]. Cardioembolic causes represent half of these cases.
DUS can be normal or detect a V4 stenosis. When present, a proximal stenosis can be identified by extracranial DUS, suggested by increased velocities or by indirect signs on the waveform of the distal VA, such as a systolic notch sign or a slow systolic ascending time.
The main risk is a progressive coma occurring in 25% of cases on the second or third day, needing neurosurgical treatment for space occupying edema.

Progressive infarction of the brainstem:
Progressive infarction of the brainstem due to a thrombosis of the basilar artery, characterized by fluctuating or progressive symptoms.
The main symptoms and signs are intermittent vertigo in 75% of the cases, diplopia, and transient unilateral or bilateral paresis.
An early diagnosis of a basilar artery stenosis by DUS is needed and can reveal a segmental increase of velocities with transoccipital insonation. An intraarterial angiography is useful to confirm basilar artery stenosis, offering the possibility of interventional treatment and thrombolysis.
The prognosis is very poor without treatment (death in 80% of the cases).

Infarction in the distribution of the anterior inferior cerebellar artery:
Vertigo with unilateral hearing loss or pulsatile tinnitus will occur in 50% of the cases.

It is due to an occlusion of a branch of the anterior inferior cerebellar artery (AICA), a main branch of the basilar artery. Sometimes the cause is an atheroma of the basilar artery wall, rarely a significant basilar artery stenosis [3].
DUS is often normal. It is an exception to find a basilar artery stenosis.
The prognosis is in general good.

Isolated vertigo

An isolated vertigo has mainly a peripheral vestibular cause. An ischemic cause is exceptional, eventually being caused by an atheroma involving the median branch of the PICA, a small vessel which cannot be detected by DUS. In this case, the clinical head trust test is normal; this negative result excludes a vestibular neuritis.

Conclusion

In the emergency room, DUS is very useful after a CT scanning, when the hospital centre does not provide access to immediate MRI. Otherwise an MRI with angiography (MRA) is the best diagnostic method for a patient with acute onset of “vertigo plus”. In such a setting intracranial DUS can add hemodynamic information, and extracranial DUS can be used to precisely quantify extracranial carotid or vertebral artery stenosis.

Abbreviations

AICA: Anterior inferior cerebellar artery; DUS: Doppler ultrasound; MRA: MRI with angiography; PICA: Posterior inferior cerebellar artery; VA: vertebral artery (VA)
Competing interests

The authors declare no conflict of interest.

References

