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## REVIEW

# An update on brain imaging in transient ischemic attack



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### KEYWORDS

Magnetic resonance imaging;  
Transient ischemic attack;  
Diffusion-weighted imaging;  
Brain ischemia;  
Neuroimaging

**Summary** Neuroimaging is critical in the evaluation of patients with transient ischemic attack (TIA) and MRI is the recommended modality to image an ischemic lesion. The presence of a diffusion (DWI) lesion in a patient with transient neurological symptoms confirms the vascular origin of the deficit and is predictive of a high risk of stroke. Refinement of MR studies including high resolution DWI and perfusion imaging using either MRI or CT further improve the detection of ischemic lesions. Rapid etiological work-up includes non-invasive imaging of cervical and intracranial arteries to search for symptomatic stenosis/occlusion associated with an increased risk of stroke.

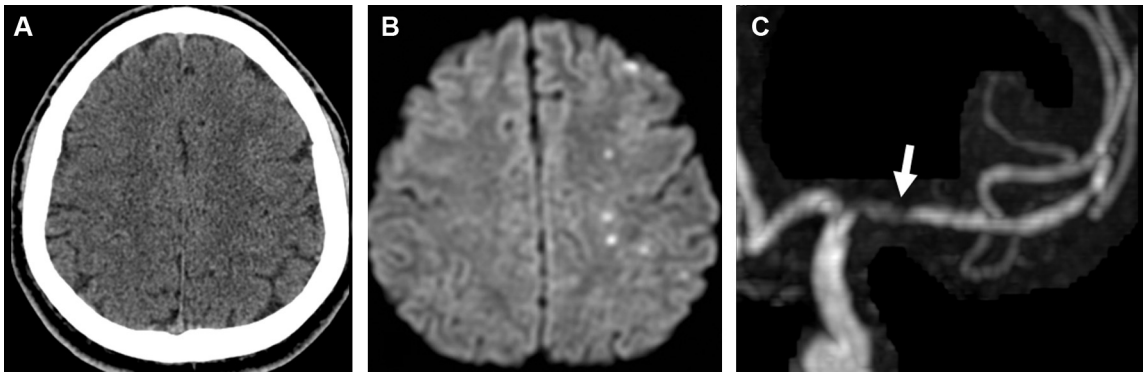
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## Introduction

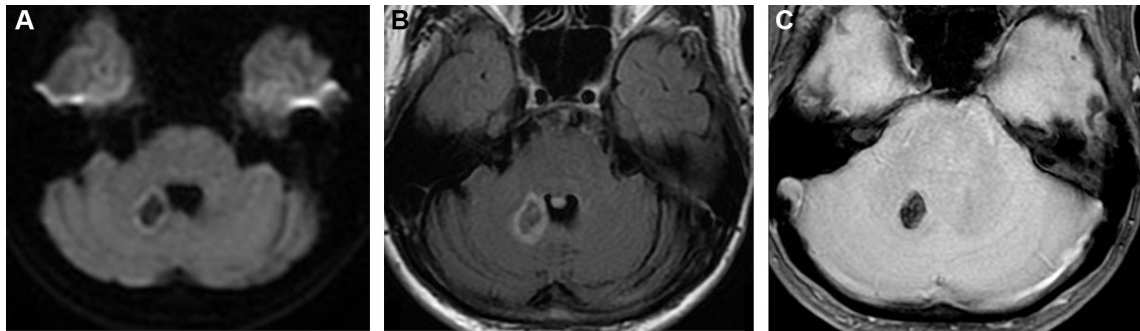
There are nearly 7.5 million transient ischemic attacks (TIAs) worldwide each year. Although health professionals and the general public often consider TIAs as benign, approximately 20% of ischemic strokes are preceded by one or several transient ischemic attacks (TIA) and 10 to 15%

of TIA patients have a stroke within 3 months, with half occurring within 48 hours [1]. TIA offers the unique opportunity to initiate treatment before the onset of permanent disability [2,3]. Rapid diagnosis and treatment of underlying cause are essential to prevent stroke. In 2009, the American Heart Association, the American Stroke Association, and the American Academy of Neurology endorsed a tissue based definition of TIA: "a transient episode of neurological dysfunction caused by focal brain, spinal cord, or retinal ischemia, without acute infarction" [4]. This tissue-based definition has several implications. First, it emphasizes that patients with transient neurological

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**Figure 1** Thirty-two-year-old man presenting with fever and seizures. Normal CT-scan. (A). Small focal hyperintensities in left frontal lobe on DWI. (B). Proximal stenosis left middle cerebral artery on TOF-MR angiography (C).



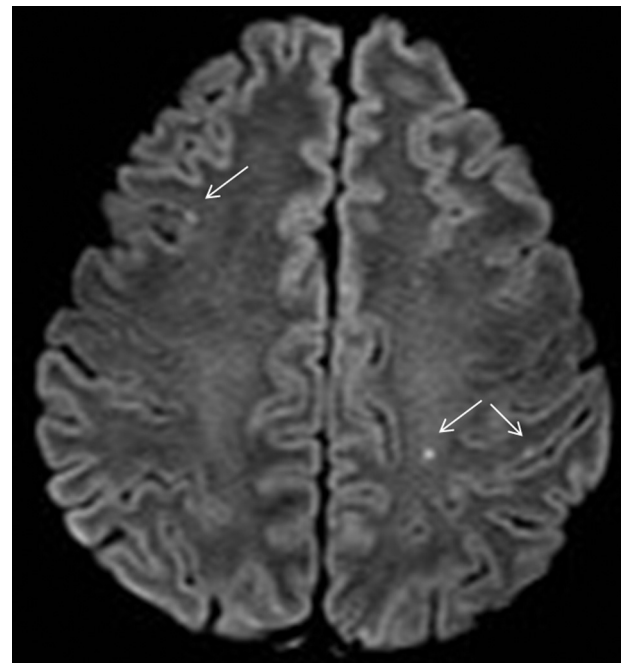
**Figure 2** Sixty-five-year-old man presenting with cerebellar syndrome and hypotonia of the 4 limbs lasting less than 2 hours. 1.5-Tesla MRI performed 4 hours after the onset of symptoms demonstrating right cerebellar hematoma, hypointense with a hyperintense rim on DWI (A) and FLAIR (B), with marked hypointensity on T2\*-weighted sequence (C).

symptoms may have acute brain infarction. Second, brain imaging becomes a critical tool in the evaluation of patients presenting transient neurological symptoms of presumed ischemic mechanism. In this review, we will highlight the role of brain magnetic resonance imaging (MRI), the preferred and most sensitive modality in patients with transient deficit. MRI should include diffusion-weighted imaging (DWI) and should be completed within 24 hours of TIA onset [4]; the relevance of its use is 3-fold:

- the presence of a recent ischemic lesion confirms that the mechanism of transient clinical event is ischemic in origin;
- the location and distribution have diagnostic value in relation to the stroke mechanism;
- finally, an acute ischemic lesion on DWI is a strong predictor of stroke [5,6]. Of note, through this document, we will be using the classic time-based definition of a TIA i.e. a sudden, focal neurological deficit of presumed vascular origin lasting less than 24 hours.

### Brain imaging for the diagnosis of TIA

The clinical diagnosis of TIA is difficult because it is mainly based on the clinical history, since neurological signs resolve quickly [7,8]. So, after having ruled out a brain haemorrhage, the first goal of brain imaging is to help distinguish



**Figure 3** Fifty-five-year-old woman presenting with transient (10 min) right hand paresia, lasting 10 minutes. MRI performed 10 hours after the onset of symptoms. Small hyperintensities in left and right hemispheres (arrows) on DWI. Etiological work-up: atrial fibrillation.

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