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Review Article

Transient Ischemic Attack with Emphasis on Visual Manifestations

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Abstract

A transient ischemic attack (TIA) is defined as a brief episode of neurological dysfunction resulting from cerebral, spinal, or retinal ischemia without infarction. TIAs are clinically significant in that they serve as a warning sign for impending stroke, as approximately 15% of patients suffer from stroke within the first 90 days. Clinical features of TIA vary widely, depending on the location of the occlusive event. Visual symptoms are often the initial presenting sign of a TIA, necessitating the accurate detection and referral by optometrists and ophthalmologists to forestall morbidity or mortality secondary to ischemic injury.

Keywords: *Transient Ischemic Attack (TIA); Transient Monocular Blindness (TMB); Diffusion Weighted Magnetic Resonance Imaging (DW-MRI); Carotid Artery Disease; Lacunar Vessels*

Introduction

A transient ischemic attack (TIA) is defined as a brief episode of neurological dysfunction resulting from cerebral, spinal, or retinal ischemia without infarction [1-3]. This definition was revised in 2009 and endorsed by the American Heart Association (AHA) and the American Stroke Association (ASA) from the previous, time-based definition of a transient episode of focal, neurological symptoms of vascular origin lasting less than 24 hours [1-3]. The revision was necessary in that recent advancement utilizing diffusion weighted magnetic resonance imaging (DW-MRI) revealed that up to half of all patients with symptoms lasting less than 24 hours actually presented with small cerebral infarction [1,3]. As such, a tissue-based definition was implemented.

TIAs are clinically significant in that they serve as a warning sign for impending infarction, or stroke, as approximately 15% of patients suffer from stroke within the first 90 days following a TIA [1,4]. Of the 90-day stroke risk, the greatest occurrence is during the first two days [4,5]. Similarly, 15 - 30% of ischemic strokes are preceded by a TIA [3,6]. Emergent and appropriate care of patients with TIA may significantly reduce the risk of subsequent stroke or cardiac events [3]. These statistical findings emphasize the importance of prompt identification and referral of these patients by health care practitioners to reduce the morbidity and mortality. While both ischemic stroke and TIA are markers of reduced blood flow, TIAs offer an opportunity to initiate treatment that may forestall the onset of permanent infarction and disability [1-4].

Incidence and Risk Factors

The precise incidence of TIA is difficult to establish and likely underestimated due to the fleeting nature of the symptoms and the variability in diagnostic criteria [1]. The overall incidence is thought to be 200,000 to 500,000 cases per year, and in a telephone survey 2 - 3% of patients reported having been diagnosed with TIA [7].

TIAs are most common in the elderly population with existing vascular disease [6]. Risk factors include both modifiable and non-modifiable factors. Five of the modifiable risk factors account for 82% of strokes and TIAs, emphasizing the importance of counseling these patients on lifestyle changes. The most important risk factor is hypertension [8]. Decreasing salt intake with other dietary changes, as well as exercise and limited alcohol use may significantly reduce blood pressure and profoundly reduce stroke risk following a TIA [8]. The remaining, top modifiable risk factors include smoking, diet, obesity, and sedentary lifestyle [8]. Diabetes mellitus and dyslipidemia are also noteworthy risk factors associated with both TIA and stroke [6,8].

TIAs in children have not been thoroughly investigated, as they are rare occurrences. However, it was found that approximately 4% of children with TIA also had subsequent stroke on initial evaluation [5]. The risk factors for TIA in children differ from those associated with adult TIAs, and more commonly result from arteriopathy, congenital heart disease, autoimmune disease, sickle cell anemia, and thrombophilia [5]. Though TIA symptoms are significantly more common in adults, it should not be discounted in children.

Pathophysiology

TIAs occur in a similar fashion to ischemic strokes, in that blood flow to the brain, retina, or spinal cord is reduced and results in neurological symptoms. There are two, primary types of vessels affected by this blood flow reduction [3,9]. The first of these are the large vessels. Traditionally, TIAs were thought to result from transitory embolic phenomenon of either cardiac origin or atherosclerosis of intracranial or extracranial arteries traveling to the cerebral blood supply and clearing within minutes or hours [3,9]. Researchers have also described a second category of 'lacunar TIAs,' which affects the much smaller, perforator vessels in the brain [9]. Occlusion of these perforating arteries causes transient ischemia with restoration of blood flow resulting from spontaneous lysis, collateral circulation, or passage of the occluding thrombus [3].

In patients with TIA secondary to large vessel abnormalities, specifically carotid artery atherosclerotic disease, the distributions of these atherosclerotic lesions are variable among ethnicities, producing a difference in outcomes [2]. For example, atherosclerotic lesions in Caucasians are often confined to the extracranial vessels, while Asians will exhibit intracranial atherosclerosis. This is significant in that those with intracranial artery stenosis have a 12 - 15% risk of increased stroke recurrence when compared to extracranial disease, even with prompt medical therapy [2]. It is also of note that intracranial artery occlusive lesions, in general, are more common than extracranial. As such, it is important for prompt evaluation and treatment of those patients with combination TIA and intracranial artery lesions [2].

Ocular Manifestations of TIA

Clinical features of TIA vary depending on the location of the occlusive event. Visual symptoms are often the initial presenting signs of a TIA, making optometrists' and ophthalmologists' awareness crucial to the evaluation and referral of these patients. These symptoms most commonly are described as transient monocular blindness (TMB), isolated binocular blindness (IBB), homonymous lateral hemianopia (HLH), flashing lights or bilateral positive visual phenomena (BPVP), and finally transient diplopia [10-14].

TMB in particular is suggestive of an ischemic etiology, as approximately 25% of these cases are due to TIA involving the anterior cerebral circulation. About 50,000 new cases of TMB occur per year, arising from retinal ischemia secondary to internal carotid artery stenosis [11,13,15]. In fact, of the 20 - 30% of TMB patients with carotid stenosis, half of them had advanced findings of 80 - 94% stenosis, supporting early treatment in these patients with carotid end arterectomy [11]. Despite the significant degree of carotid occlusion, TMB patients have better prognosis and lower risk of hemispheric stroke [10,11]. The reason for this is not well understood, but is thought to be due to excellent collateral circulation. It can also be due to the increased sensitivity of retinal cells when compared to brain cells, and that a small embolic phenomenon in the retina would elicit more symptoms than the same size embolus in the brain [11].

Since there is no gold standard or diagnostic test for TIA, evaluation is based primarily on patient history. This led to a study investigating patterns of TMB that may predict vascular events [10]. Volkers., *et al*. concluded that crescendo attacks, downward visual field loss,

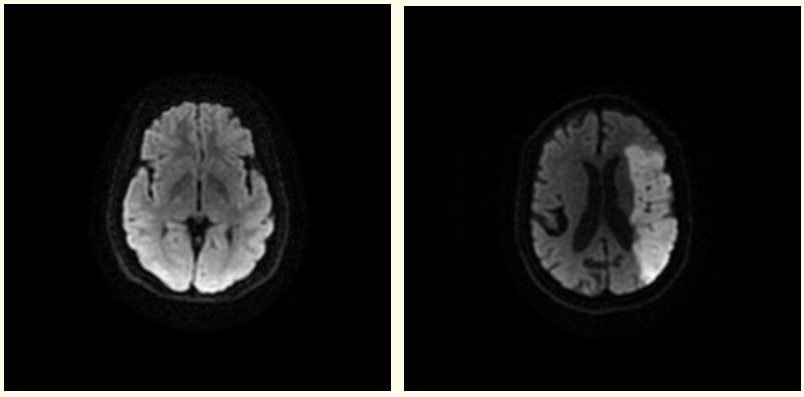
and upward visual field resolution correlated with an increase in vascular events. More importantly, involvement of the peripheral field vs. central field was most significantly associated with vascular disease, making careful history taking an imperative skill in the evaluation of TIA with visual symptoms [10].

While TMB is indicative of carotid occlusive disease of the anterior circulation, TIA presenting with IBB coincides instead with disruption of the vertebrobasilar circulation and resultant ischemia of the visual cortex. This is more commonly a result of cardiac emboli that reaches the posterior cerebral artery via vertebrobasilar arteries [14]. These visual episodes are also transient, lasting minutes, and may also be accompanied by diplopia or flashing, multi-colored lights [12-14].

Treatment and Management

Patients with acute TIA require rapid referral to exclude minor ischemic stroke as well as identification and treatment of risk factors to further prevent the high risk of impending stroke associated with TIA. Urgency for referral is based on extent and severity of risk factors and TIA symptoms. The ABCD2 score for estimating risk of stroke is a helpful clinical tool in distinguishing high-risk patients from lower risk groups [9]. Using variables such as age, blood pressure at time of presentation, clinical features, duration, and presence or absence of diabetes, the clinician may evaluate each case using a point scale, where 4 points or more warrants a more expeditious evaluation within 24 hours. Less than a 4 point score would still require prompt evaluation, but on an outpatient basis within one week of the initial onset [6,7].

Patients are evaluated initially using DW-MRI to identify the presence or absence of tissue infarction and therefore to distinguish between a true TIA from ischemic stroke [1,3,16]. In one study, 35 - 67% of patients with suspected TIA actually had restricted diffusion on MRI, suggesting stroke as the diagnosis [3]. Single, large lesions on DW-MRI greater than or equal to 15mm were indicative of atrial fibrillation as the underlying cause for cerebral damage [16].



A. **B.**

Figure 1: DWI-MRI of two patients presenting with TIA symptoms. *A. The first patient had no abnormalities on DWI-MRI, consistent with TIA. B. This patient demonstrated restricted diffusion on DWI, consistent with a left middle cerebral artery territory infarction.*

In cases of minor stroke or high risk TIA, treatment should be implemented immediately to forestall permanent injury or disability. Several studies have concluded that combined clopidogrel and aspirin therapy initially is more effective than aspirin alone in treatment of these cases and was helpful in reducing the overall risk of stroke recurrence [6,17-19]. Laboratory work up and cardiac tests may be helpful in cases where an underlying systemic cause is not known.

Conclusion

This review emphasizes the importance for patient and practitioner awareness on signs and symptoms of TIA. Those patients, especially with a significant number of risk factors, should be educated that while these symptoms may be transitory in nature, they pose a substantial risk for impending stroke. Eye care practitioners may be the initial examiners of such patients, and should understand the necessity of expeditious evaluation to prevent the risk of permanent disability or death.

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