Tension-Type Headache and Migraine: Two Points on a Continuum?

Bert B. Vargas, MD

Corresponding author
Bert B. Vargas, MD
Center for Neurosciences, 2450 East River Road, Tucson, AZ 85718, USA.
E-mail: bvargas@neurotucson.com

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The question of whether tension-type headache (TTH) and migraine represent two points on a continuum has been debated for decades. Skeptics of the continuum model support their view by noting that the characteristics of these two headaches and the demographics of the individuals who suffer from them are undeniably distinct. In the clinical setting, however, these disorders exhibit more similarities than differences. TTH and migraine may exhibit similar associated features (even within the constraints of diagnostic criteria), respond effectively to similar medications, share similar demographics among certain age groups, and may each have genetic influences. These findings suggest that TTH and migraine may be more intimately related than would be suggested by their diagnostic criteria.

Introduction

Although migraine and tension-type headache (TTH) are distinct disorders by definition, at times they may be difficult to distinguish and are occasionally separated only by nuance. Clinicians frequently encounter patients who do not definitively meet the criteria for TTH or migraine. They are often faced with the difficult task of fitting a headache patient into a criteria-based diagnosis, armed only with a list of subjective complaints (eg, pain severity) and varying degrees of associated features, such as photophobia, phonophobia, and cutaneous allodynia. This task is complicated further if the patient has difficulty recalling specific details such as headache frequency, duration, time-to-peak severity, distribution (unilateral vs bilateral), and the presence of cranial autonomic symptoms. Many times, these seemingly small details have a significant impact on making the correct diagnosis.

Whether TTH and migraine are examples of two truly distinct entities with their own pathophysiologies and natural histories or whether they represent opposite ends of a continuum has been the subject of debate for decades [1]. Much of what we have come to believe regarding the characteristics of these two disorders argues that they are undeniably different. The similarities that argue in favor of the continuum model are often thought to be the product of an artifactual association between the two, given the high prevalence of TTH in the general population and among migraineurs [2].

A Brief History of Classification

The earliest difficulties in differentiating TTH and migraine were due to the lack of an adequate classification system by which to define the two; however, centuries of astute observations began to support the notion that not all headaches were alike. Although Aretaeus of Cappodocia is often credited with discovering migraine in the second century AD and Galen with the first use of the word *migraine*, it was Tissot who made clear distinctions between migraine and common headache in 1783, ascribing migraine to a supraorbital neuralgia "provoked by reflexes from the stomach, gallbladder, or uterus" [3]. As these two disorders became more clearly differentiated phenotypically, it was hypothesized that they were the result of two very different pathophysiologies. Despite the popularity of vascular theories for migraine as proposed by individuals such as DuBois, Reymond, and Darwin, and the thinking that TTH was a disorder of muscle contraction, it was Thomas Willis who first proposed that TTH and migraine were actually two points on a continuum [4]. Arguments favoring a continuum model surfaced again in the mid-1980s [5] but were seemingly contradicted in 1988 when the International Headache Society established criteria that differentiated the two as separate disorders with clearly different features [6••]. Since that time, and after the publication of two editions of the International Classification of Headache Disorders (ICHD), these two disorders remain unmistakably distinct on paper. Confounding this distinction, however, is that in the clinical setting these two disorders may present with numerous phenotypic permutations, many of which overlap. Also troubling is the relatively frequent comorbidity of TTH and migraine, compelling many to argue

that tension headache is simply a mild form of migraine and thus supporting the continuum model.

Although the ICHD has been argued to be the most significant and important breakthrough in headache medicine over the past 50 years [7], it has also been argued that it has created artificial distinctions that do not address the common clinical conundrum of patients who appear to fall within a nebulous "gray zone" [8]. The current classification system was born out of the knowledge that only with a reliable set of criteria by which to classify numerous headache phenotypes would it be possible to provide relevance from scientific breakthroughs to specific populations of patients. Additionally, such a classification allows specific headache subtypes to be studied, and patients to be able to attach a name to their disorder [7]. Unfortunately, an unavoidable artifact that occurs with the establishment of a specific set of criteria is being either too broad or too specific.

Migraine and Tension-Type Headache: Differentiating Two Common Problems

It has been said that disease does not exist as an all or none phenomenon, but as a continuum that leads us to question not whether an individual has a disease, but "how much" of a particular disease a patient has [9]. This notion seems particularly applicable to TTH and migraine, especially if TTH truly represents a mild form of migraine. Although the criteria for TTH and migraine are clearly different, it can be argued that there exists a gray zone between the two where the differences become less distinct. Therein lays the definition of a continuum: two entities that are ostensibly distinct, but are differentiated by elements that vary by minute enough degrees to make absolute distinction impossible. The fact that 44% of individuals with migraine were found to be misdiagnosed as having TTH at some point in their lives suggests that the practical application of ICHD criteria may be more difficult than expected [10••]. Another possibility, however, is that there exists a population of individuals who do in fact meet criteria for TTH early on, but progressively develop new or worsening features, essentially morphing into migraineurs.

The following factors support the thinking that TTH and migraine may be more intimately related than originally thought: 1) weather changes, stress, and menstruation are cited as the most common triggers for both TTH sufferers and migraineurs [11]; and 2) voxel-based morphometric analysis demonstrates decreased gray matter in the anterior cingulate, insular cortices, and the dorsal rostral pons in both migraine and chronic TTH [12•,13•]. These similarities, however, pale in comparison to the numerous differences that have become accepted as key defining features separating TTH from migraine, which are highlighted in the following text alongside the data that seem to contradict the dogma regarding these two disorders.

Refuting Arguments Against the Continuum Theory

The defining characteristics of migraine and TTH have been frequently described in the literature in an effort to differentiate the two disorders. Among these characteristics, there are several commonly accepted differences (which are reflected in their respective ICHD criteria). These include the "featureless" nature of TTH versus the numerous features associated with migraine, the familial association and the presence of known genetic markers in migraine (which are as of yet absent in TTH), and response of migraine to triptans that does occur in TTH [14,15]. These features argue for the differentiation between the two. Lastly, numerous epidemiological data seem to argue against the continuum model. However, a review of the literature behind these differences portrays a much different story.

Associated features

The classic depiction of TTH is that of a bilateral band-like pressing or tightening pain without associated features [8,14]. In clinical practice, however, it is common to encounter patients who present with headache features more commonly associated with migraine. The ICHD criteria for TTH allow for the presence of some associated features in either photophobia or phonophobia [6••]. The diagnosis of probable TTH allows for even more latitude because it allows for the potential for other associated features contingent upon the headache phenotype not meeting criteria for migraine [6••].

Although commonly associated with migraine, the presence of throbbing or pulsating pain is far from specific. Sixty-one percent of migraineurs report nonpulsatile pain and nearly half (43%–45%) of TTH sufferers describe their headaches as throbbing [16,17]. TTH sufferers experienced the classic pressing or tightening pain only 51% of the time [17] compared with 21% of migraineurs [16]. Migraine is also commonly thought to be unilateral; however, it occurs in a unilateral distribution in only 54% of cases [17] with side-locked unilaterality in only a minority (21%) of cases [18]. Migraine is reported as bilateral almost as frequently as TTH, occurring between 38% and 50% of the time [19,20]. Despite its "classic" bilateral distribution, TTH is found to be bilateral in only 56% of cases [17], with 13% of sufferers reporting unilateral tension headache that is side-locked [18]. Finally, severity worsened with activity does not appear to be specific to migraine as it has been noted in both 59% to 66% of migraineurs and 32% of TTH sufferers [16,17].

Genetics

It has been asserted that "the genetics of headache is the genetics of migraine" [8] and that the familial heritability among migraineurs and known biologic markers found in familial hemiplegic migraine (FHM) help to set it apart from TTH [14]. Mutations in the Cav2.1 (P/Q)

type voltage-gated channel *CACNA1A* gene mapped to chromosome 19 in FHM [21], mutations in *ATP1A2* gene in FHM-II [22], and mutations in the voltage-gated sodium channel gene *SCN1A* in FHM-III [23•] have no correlates in TTH.

The results from a population-based study of Danish twins, however, support a genetic component to TTH [24•]. This study suggested that there may be a genetic link in TTH sufferers as high concordance rates were noted in twins identified as not having TTH, as well as those who suffer from frequent episodic TTH [24•]. The data obtained from this study indicated that co-occurrence of migraine was associated with increased prevalence of frequent episodic and chronic TTH, suggesting a relationship between the two disorders [24•].

Response to triptans

The increased responsiveness to triptans for acute attacks in migraineurs compared with TTH sufferers has also been used to argue for the lack of a relationship between the two disorders. Although some evidence exists for the use of sumatriptan for acute attacks in TTH, one study investigated TTH with comorbid migraine [25] and another study did not discuss whether the triptan-responsive TTH sufferers also experienced comorbid migraine [26]. The study investigating triptan responsiveness for pure TTH showed no effect and has been used to suggest that TTH and migraine are distinct not only phenotypically but physiologically, thus refuting the continuum model. Unfortunately, this logic is faulty in that it only supports a difference between the two extremes, not the headaches within the intermediate gray zone where the two overlap. Again, referring to the definition of continuum, the two extremes are clearly different in character, but it is the data points that lie in between that are differentiated only by minute degrees. Regardless, adequate controlled clinical trials regarding the efficacy of triptans in episodic TTH have not been performed [25].

Aside from triptans, there are numerous other therapeutic interventions for migraine that also appear to be useful in TTH. Specifically, aspirin, amitriptyline, NSAIDs, and biofeedback appear to be useful in both disorders [5].

It is unclear why TTH and migraine would each respond robustly to so many similar abortive and prophylactic medications and not with triptans. This observation suggests that perhaps triptans become more effective as the physiology of the headache changes, involving the additional neuronal pathways that result in the expression of migraine features such as nausea, photophobia, phonophobia, and the search for solitude.

Epidemiological differences

A clear epidemiological difference between TTH and migraine exists as the yearly prevalence of TTH is 74% [27] compared with 12% for migraine [10••]. Additionally, there is a significant difference in the sex distribution of TTH and migraine as the yearly prevalence of migraine among men and women is 5.6% and 17.1%, respectively [10••], compared with 63% and 86% for TTH [27]. When taking into account the frequently comorbid existence of TTH in migraineurs, there is not a significantly increased prevalence of TTH in migraine sufferers [2,28]. The same study noted that TTH in migraineurs does not differ from TTH in nonmigraineurs except for attacks that are more frequent and more severe [28]. It is asserted that these observations support the view that the two disorders are distinct and represent only a noncausal "relationship" [2].

It is evident, though, that TTH in migraine does not fully mimic TTH in the nonmigraineur and that could arguably suggest a phenotypic change that occurs as the threshold for developing migraine is approached. Another interpretation of these data is that the two disorders lie on a unidirectional continuum, such that worsening TTH features that blur into probable TTH, then probable migraine, and then finally into migraine.

With regard to the difference between prevalence among men and women, prior to age 12 and after age 60, the ratio of female to male migraineurs when extrapolated from data from the American Migraine Prevalence and Prevention study begins to resemble the ratio of female to male TTH sufferers. The reason for the increase in prevalence in women after menarche and before menopause remains uncertain, but one possibility is that transient estrogen levels (and specifically estrogen withdrawal) alters vascular tone, leaving women more susceptible to headache [29]. Possibly the same susceptibility for vascular instability may make it easier for women to progress from TTH to migraine. Furthermore, it is misleading to argue that the difference in gender ratios between TTH and migraine supports the existence of two distinct disorders—especially without taking into account the changes in prevalence over time. The same misguided logic could be used to argue that the differences in gender ratios between migraine at age 10 and migraine at age 30 represent two clinically distinct entities and not the natural history of the progression of migraine, and this is clearly not the case.

Conclusions

A large body of evidence supports the existence of numerous overlapping features between migraine and TTH. This, along with the existence of headache phenotypes that do not clearly meet criteria for either TTH or migraine, suggests that these two disorders exist on a continuum and that the expression of migraine may be the result of triggers that propel TTH sufferers beyond a particular threshold. Arguments against the continuum model only illustrate the obvious differences between TTH and migraine but do not address the hypothesis

that migraine may reflect a physiologic evolution from episodic TTH as severity worsens, central sensitization occurs, and additional neuronal pathways are incorporated. Migraine appears to be the result of a sensitized nervous system that can no longer adapt to the degree of sensory input leading to a loss of its ability to effectively mediate nociceptive input [1].

Regarding the expression and features of TTH and migraine, evaluation of the data rather than simple acceptance of the dogma would seem to argue that these two disorders do not represent neighbors or even cousins, but rather the same individual at different stages of life and directly influenced by the environment to which they are exposed.

Disclosure

No potential conflict of interest relevant to this article was reported.

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