

# Migraine, Tension-type Headache, and Transformed Migraine

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Migraine and tension-type headache (TTH) are highly prevalent primary headaches that remain underdiagnosed and undertreated in clinical practice. The similarities and differences between migraine and TTH may impose diagnostic challenges as well as management difficulties. In addition, the possibility of migraine chronification or transformation in daily or near-daily headache raises the potential level of interaction between pathophysiologic mechanisms of TTH and migraine. The continuum concept is a possible key to the understanding of this association. Future studies are necessary to clarify epidemiology, pathophysiology, and management of these two most prevalent headaches.

## Introduction

Migraine, tension-type headache (TTH), and transformed (chronic) migraine (TM) are common and debilitating disorders. The prevalence may vary worldwide, but population-based studies in adults, applying the International Headache Classification in its revised criteria [1], estimate general headache prevalence approaching 46%, migraine reaching 11%, TTH affecting nearly 42% [2], and chronic daily headache reaching 3% (with an estimated prevalence of 2% for transformed/chronic migraine) [3]. According to the World Health Organization, headache disorders are among the 10 most disabling conditions for men and women, and among the five most disabling conditions for women [4•].

## The Diagnostic Challenge

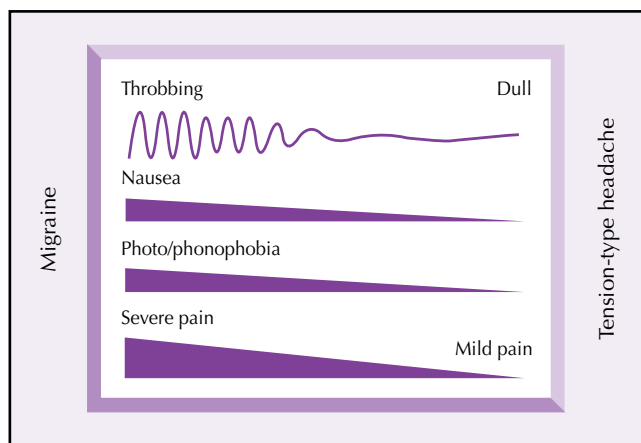
Differentiating a TTH attack from a mild to moderate migraine headache attack, the most common episodic headache types, has long been recognized as a common clinical

diagnostic challenge. The misdiagnosis of migraine as TTH and vice versa has potentially significant consequences because it may preclude patients with disabling headaches from receiving appropriate treatment, and therefore, increase the burden. Several aspects may complicate diagnosis: 1) poor description and/or presentation of associated symptoms; 2) the concomitant presence of more than one headache type; and 3) when one or more associated features of one specific headache type are present in the other.

The concept of a continuum spectrum between migraine and TTH was initially proposed by Waters in 1973 and has been debated more intensively for more than two decades [5]. Its understanding is essential to the understanding of the possible migraine-TTH bridge. One pole is migraine headache, with its characteristics of throbbing head pain, unilateral location, moderate to severe or severe intensity, and associated symptoms of nausea, vomiting, photophobia, and phonophobia; TTH is the other pole of the spectrum, with its features of dull head pain, pressing or tightening quality, bilateral location, mild or moderate severity, and less associated symptoms, with the absence of more than one among those accompanying a migraine attack. In between lies a wide range of clinical pictures, including combinations of one feature or another (Fig. 1). This concept had the support of John Graham, who suggested that migraine sufferers had mechanistically related big headaches (phenotypic migraine); TTHs are considered small headaches (phenotypic TTH) [6].

The classification system for headache disorders has improved substantially in the past years, but we are still far from the ideal. The possibility of a continuum concept with opposed poles has not been adequately addressed in the classification attempts, which were first published in 1964, followed by the first edition of the International Headache Society (IHS) diagnostic criteria, published in 1988 [7]. This was revised and improved more recently, in the second edition, published in 2004 [1].

Headaches that do not fulfill migraine or TTH criteria but have characteristics of one or another type were diagnosed in the 1988 edition as a “migrainous disorder.” However, it has been changed to probable migraine or probable TTH in the second edition (2004) [1], although



**Figure 1.** Features of the continuum between migraine and tension-type headache.

an overlap of features still exists because a migraine attack missing features of criteria D (nausea and/or vomiting, photophobia and/or phonophobia) may be diagnosed as both probable migraine or probable TTH. A trend toward lumping headache types, including migraine and TTH, together under the label of “mixed” headache has been observed in daily clinical practice, but better definition on diagnosis and treatment of this headache type is lacking.

TTH diagnosis according to the IHS criteria is based mainly on negative characteristics, whereas migraine is based on positive symptoms. Defining TTH or migraine has to do with the presence (migraine) or the absence (TTH) of specific features, such as photophobia and phonophobia, aggravation by routine activity, nausea and/or vomiting, pulsating or throbbing pain quality, and unilateral location (Table 1). The lack of distinctive features of TTH may contribute to its misdiagnosis as migraine, especially in a mild to moderate attack commonly seen in patients undergoing preventive treatment. Health care providers confronted with a patient who meets some but not all of the diagnostic criteria for more distinct and defined headache types, such as migraine, may fall back on the less specific TTH diagnosis. TTH patients need suffer only mild to moderate headache to meet IHS criteria, whereas patients must suffer a number of clear-cut typical associated symptoms in addition to a moderate to severe headache in order to fulfill the IHS criteria for migraine. Therefore, TTH may be less underdiagnosed than migraine.

Increased muscle contraction or tenderness in the head and neck, although not included as a differentiating characteristic of TTH in the IHS diagnostic system, is often thought to be a unique feature of TTH, given its hypothesized muscular etiology. On the other hand, it is commonly thought that migraine is not accompanied by muscle tension or neck pain, but this has not been proven true. Increased resting muscle tension and muscle contraction during the headache attack itself may be greater in migraineurs than in TTH sufferers [8]. In addition, it has

recently been demonstrated that neck pain is present in 75% of migraine attacks [9].

The trigger factors for TTH and migraine are also similar. In a study of 172 patients with the IHS diagnoses of migraine, TTH, or both, the percentage of patients indicating common particular factors as responsible for triggering the attacks did not differ between headache types [10]. In addition to the similarities in their clinical manifestations and precipitants, migraine and TTH share several epidemiologic characteristics that may make the differentiation of the two headache types even more difficult. Migraine and TTH are more prevalent in women than in men, although the female:male ratio is greater for migraine than for TTH. The prevalence of both migraine and TTH peaks in middle age (age 30–45 years) [11]. It also increases with increasing educational level. Moreover, the frequent co-occurrence of the two entities may render their differential diagnosis more challenging.

In a Danish population-based study, 83% of individuals with headaches meeting IHS criteria for migraine also had headaches meeting IHS criteria for TTH [12]. In a Canadian population-based study, 22% of patients with classifiable headaches reported experiencing both migraine and TTH [13].

The correct diagnosis is also affected by a common tendency of physicians to choose either a TTH- or migraine-specific diagnosis. For instance, the threshold for admitting the presence of photophobia or phonophobia in the diagnosis is not clearly established in the IHS classification. Consequently, the different methods of detecting how sound or light may affect the headache patient result in clinical discrepancies during initial evaluation, and therefore, diagnosis. It means specifically that the response may be different than a reply to the standard question: does light or sound bother you during the headache attack? In addition, when a patient has a mild headache fulfilling TTH criteria and a more severe headache with migrainous features, the primary diagnosis may be arbitrary, and the doctor’s subjective perception becomes the key in defining which headache type the patient presents, although this is not always a reliable approach to performing a diagnosis.

### Migraine and TTH: Similar or Distinct Disorders?

The similarities between migraine and TTH regarding their clinical manifestations, precipitating factors, and epidemiologic features, as well as the frequent association of both headache types in many patients, have raised questions on their uniqueness. Whether migraine and TTH are distinct or similar disorders has been debated among the headache community for years. The continuum concept suggests that TTH and migraine may represent a single entity in different

**Table 1. Migraine and tension-type headache features**

Feature	Migraine	Tension-type headache
Throbbing type	+	–
Severe headache	+	–
Aggravated by physical activity	+	–
Nausea/vomiting	+	–
Photophobia/phonophobia	+	–
Unilateral headache	+	–

moments of the same spectrum [14]. However, they may be temporarily distinguished by the severity of the head pain, with TTH on the mild end of the continuum and migraine on the severe end [15,16]. Proponents of the view that migraine and TTH are separate disorders contend that TTH arises from abnormal muscle activity or emotional distress, whereas migraine has underlying neurovascular mechanisms.

### Migraine Transformation

Migraine and TTH are also significantly related when migraine transformation into daily or near-daily headache is considered. The clinical experience in tertiary headache centers demonstrates that many patients have a headache occurring daily or almost daily (more than 15 days/month). These patients commonly have a history of episodic migraine, which evolves over time through a process of transformation (chronification) when headache increases in frequency but loses associated symptoms, which become less severe and even absent. The ultimate typical presentation of transformed migraine is less severe headache without typical migraine features resembling TTH but with superimposed full-blown migraine attacks [17]. The process of transformation is often related to analgesic overuse and rebound headache, as well as psychiatric comorbidity [18,19].

However, there is sharp disagreement on the classification of frequent primary headache disorders, as well as on the appropriate use of the term “chronic daily headache.” In 1988, when the Headache Classification Committee of the IHS first defined the various headache disorders, the issue of frequent primary headaches was not addressed [7]. The term chronic daily headache refers to the broad group of frequent, daily, or near-daily headaches that last longer than 4 hours and therefore have a different time presentation than the brief headaches such as cluster headache and paroxysmal hemicrania. Chronic TTH was the only term in the 1988 IHS classification system that was related to frequent primary headaches, but this is not the most common presentation of frequent headaches. In addition, most patients who had IHS-defined chronic TTH also had an additional diagnosis, such as migraine with or without aura. Because these daily headaches often

evolve from episodic migraine, it seems inappropriate to classify them as a form of TTH.

The term “transformed migraine” or “evolutive migraine” was first proposed by Mathew et al. [20] and was incorporated into the criteria proposed by Silberstein et al. [21] in 1996. Recently, TM has also been called chronic migraine, which is widely used nowadays and was included in the last revision of the International Classification of Headache Disorders, coded as 1.5.1, under the group complications of migraine 1.5 [1].

The general group of the chronic daily headaches is defined as headache attacks occurring more than 15 days a month and lasting longer than 4 hours if untreated. It is subdivided into four different entities: 1) chronic migraine, 2) chronic TTH, 3) new daily persistent headache, and 4) hemicrania continua. Each of these disorders may occur with or without analgesic overuse. Secondary headache disorders (such as brain tumor or sinus disease) must be excluded.

The current IHS criteria for chronic migraine differ from the criteria proposed for TM by Silberstein et al. [21] in 1996. Its case definition comprises migraine headaches that occur for more than 15 days per month for more than 3 months and does not require the transformation period from an episodic form. The operational limitation is when acute or symptomatic medication (SM) is used for more than 10 days (for triptans, ergotamines, and opioids) or 15 days (simple analgesics) per month for more than 3 months. When it is observed, the diagnoses of “probable chronic migraine” (1.6.5) and “probable medication overuse headache” (8.2.7) have to be carried out until the acute medication overuse stops for 2 months and the headaches subside and/or reassume the previous pattern of episodic presentation. This is unethical and impractical because one should not propose solely washout for patients with debilitating severe headaches that commonly present rebound and need frequent doses of SM until a treatment is started. Therefore, starting a migraine-preventive treatment should always be the rule and the ethical and humanistic approach. However, this impedes the accomplishment of the proposed diagnosis, and one must stick with the IHS 2004 “probable” chronic migraine or medication overuse diagnosis for an unbearable suffering time for the patient. Moreover, in order to carry out the medication overuse headache diagnosis, the current criteria also state that at least one of the following must be present: 1) bilateral pain, 2) non-throbbing type, and 3) mild

to moderate severity. In addition, the previous pattern of episodic headache has to be presented after SM withdrawal, which is not always observed due to comorbidity maintaining the chronic presentation pattern. Therefore, further studies are necessary to improve the diagnostic criteria for chronic migraine and its relationship with SM overuse. This has been tried with the new appendix of the International Classification of Headache Disorders-2. It is now recommended that the medication overuse headache diagnosis no longer require improvement after discontinuation of medication overuse but be applied to patients even if they have a primary headache plus ongoing medication overuse, defined previously (ie, 10 days or more of intake of triptans, ergot alkaloids, mixed analgesics, or opioids, and 15 days or more of analgesics/NSAIDs, or the combined use of more than one substance). If these new criteria for chronic migraine and medication overuse headache prove useful in future testing, either in clinical or research settings, they should be included in a future revised version of International Classification of Headache Disorders-2.

### TM/Chronic Migraine: Disease Progression

The concept of disease progression in migraine has been recently considered after the publication of a neuroimaging study of Dutch adults aged 30 to 60 years. It showed that male patients who had migraine with aura were at an increased risk for posterior circulation infarct [22•]. Additionally, women with migraine with or without aura were at a higher risk for deep white-matter lesions, compared with controls. The white-matter lesions increased over time with the increasing of attack frequency, possibly suggesting progression of the disease.

Another finding, which may suggest disease progression, comes from an elegant study by Welch et al. [23], who demonstrated abnormal deposition of non-heme iron occurring in the periaqueductal gray area in patients with migraine and chronic migraine. Moreover, in a longitudinal population epidemiologic study carried out over the course of 1 year, 3% of individuals with episodic headache (headache frequency from 2–104 days/year) progressed to chronic daily headache (episode frequency > 180 days/year). The authors concluded that the incidence of chronic daily headache in patients with episodic headache is 3% per year [24]. In other study, 532 patients with episodic migraine (< 15 days/month) were followed for 1 year; 64 patients (14%) developed chronic daily headache.

Despite its clinical relevance, the evidence for the existence of risk factors for migraine progression is still limited. The prevalence of chronic daily headache has been reported to decrease slightly with age and to be higher in women (OR = 1.65; 1.3–2) as well as in divorced, separated, or widowed individuals (OR = 1.5; 1.2–1.9). Social risk factors have also been described. The risk of chronic daily headache in individuals with less than high school education was threefold that of a

college-educated sample (OR = 3.56; 2.3–5.6). Chronic daily headache was also associated with a self-reported diagnosis of arthritis (OR = 2.5; 1.9–3.3), diabetes (OR = 1.51; 1.01–2.3), previous head trauma, and medication overuse. The highest risk factor described for development of chronic daily headache was obesity (OR = 5.53; 1.4–21.8) [25•]. Psychiatric comorbidity may also play an important role in migraine transformation [26•]. A study comparing migraine with medication overuse headache found that there was an excess risk for suffering from mood and anxiety disorders associated with use of psychoactive substances [27]. In addition, psychiatric disorders occurred significantly more often before rather than after the transformation from migraine to medication overuse headache [28•].

### Conclusions

Migraine and TTH remain commonly underdiagnosed and undertreated conditions worldwide. The similarities and differences between these two frequent headaches may impose diagnostic and management challenges. The process of migraine chronification or transformation emphasizes the potential for true interaction for sharing pathophysiologic mechanisms, and the continuum concept may represent the key to the understanding of this association. Future epidemiologic studies should clarify this issue and shed light into better ways of approaching these patients and relieving their suffering.

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