

Descriptions of vestibular migraine and Menière's disease in Greek and Chinese antiquity

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Abstract

Background: Vestibular migraine and Menière's disease are two types of episodic vertigo syndromes that were already observed in Greek and Chinese antiquity. Descriptions first appeared in the work of the classical Greek physician Aretaeus of Cappadocia, who lived in the 2nd century AD, and in *Huangdi Neijing*, a seminal medical source in the Chinese Medical Classics, written between the 2nd century BC and the 2nd century AD.

Aim: The aim of this paper is to search in Aretaeus' book *De causis et signis acutorum et chronicorum morborum* and in *Huangdi Neijing* for descriptions of vertigo co-occurring with headache or ear symptoms that resemble current classifications of vestibular migraine or Menière's disease.

Results: Aretaeus describes a syndrome combining headache, vertigo, visual disturbance, oculomotor phenomena, and nausea that resembles the symptoms of vestibular migraine. In the Chinese book *Huangdi Neijing* the Yellow Thearch mentions the co-occurrence of episodic dizziness and a ringing noise of the ears that recalls an attack of Menière's disease.

Conclusions: The descriptions of these two conditions in Greek and Chinese antiquity are similar to the vertigo syndromes currently classified as vestibular migraine and Menière's disease. In clinical practice it may be difficult to clearly differentiate between them, and they may also co-occur.

Keywords

Vestibular migraine, Menière's disease, headache, vertigo, Greek antiquity, Chinese antiquity, Aretaeus of Cappadocia, Yellow Thearch

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Introduction

During a systematic search of the literature for ancient descriptions of fear of heights and seasickness in the Chinese Medical Classics (1) and Greek antiquity (2,3), we discovered two reports of vertigo syndromes that strikingly resemble today's definitions of vestibular migraine (VM) and Menière's disease (MD). These descriptions appeared in the book of Aretaeus of Cappadocia *De causis et signis acutorum et chronicorum morborum* and in *Huangdi Neijing*, the Yellow Thearch's *Classic of Internal Medicine*, a book that lays the theoretical foundation for Chinese medicine (Figure 1).

Vestibular migraine in the Greek *De causis et signis acutorum et chronicorum morborum*

The Greek physician Aretaeus was born in Asia Minor, Cappadocia, at the end of the reign of the emperor

Hadrian in the 2nd century AD. Little is known about his life, but it is thought that he studied in Alexandria and possibly practised in Rome. He was well versed in the science of Hippocrates, who was apparently an important role model for him. Eight books of his work contain extensive descriptions of the aetiology, features, and treatment of different diseases. Two were preserved: *De causis et signis acutorum et chronicorum morborum* and *De therapia acutorum et chronicorum morborum*. In the first of these he examines headache and differentiates, apparently for the first

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time, between different forms of headache: a chronic type (**κεφαλαία**, cephalaea), a brief type lasting up to several days (**κεφαλαλγία**, cephalalgia), and heterocrania (**έτεροκρανία**), which later evolved into ‘hemicranias’, from which our word ‘migraine’ is derived (4,5). To the best of our knowledge no historical descriptions of VM have so far been published.

The term was first coined in 1999 (6). In the meantime VM has become a well-recognised medical entity and the most frequent cause of a spontaneous episodic vertigo syndrome. It is also the most common cause of episodic vertigo and dizziness in children (7). A chameleon of sorts among the episodic vertigo syndromes, VM is characterised by the variety of its clinical manifestations, especially as regards its duration (from minutes to days) and severity (6,8–10).

Diagnostic criteria have been jointly formulated by the Committee for Classification of Vestibular Disorders of the Bárány Society and the Migraine Classification Subcommittee of the International Headache Society (IHS) (11, Table 1). VM is simple to diagnose if the attacks are generally or sometimes followed by headache and if the patient has a positive family or personal history of other types of migraine. The occurrence of symptoms like hypersensitivity to light and sound, a need for quiet, tiredness after the attack, an urge to urinate and an especially heightened susceptibility to motion sickness also makes the diagnosis easier. However, if headache is absent (in about 30% of cases; (6)), the attacks are more difficult to recognise. Most patients with VM also have mild central ocular motor disorders in the form of gaze-evoked nystagmus, saccadic smooth pursuit eye movements, or a positional nystagmus even in the attack-free interval

(6,10). These disturbances are more severe during the attack and are often associated with postural instability.

Areataeus draws attention to some of these features, especially in Book III in the chapter entitled ‘**Περὶ κεφαλαίης**’, ‘About headache’ (4). Here he notes that hemi-headache can be accompanied by vertigo, and even movements of the eyes:

... έτεροκρανία τόδε [μοῦνον] καλέεται
...σπασμὸς καὶ διαστροφή τοῦ προσώπου
γίγνεται• ὀφθαλμοὶ ἢ ἀτενέες κεράεσι ἴκελοι
πεπήγασι, ἢ τῆδε κακέϊσε σπασμωδέως ἔνδον
εἰλῶνται σκοτόδιος•...

‘This type of headache is called heterocrania...The face is distorted spasmodically, the eyes remain glassy and rigid like horns or move to and fro forcedly, and the patient is dizzy...’ (mentioned by Koehler and van de Wiel (5) and showing similarities to a German translation of 1790 (12)).

In this chapter Areataeus points to other symptoms accompanying VM such as the patients’ nausea, vomiting of black bile, and slumping down. They avoid light and feel relief when in the dark. Their sense of smell may be impaired, and they may even feel a weariness of life, ‘taedium vitae’ (based on a German translation from 1790 (12)).

In the next chapter, entitled ‘**Περὶ σκοτωματικῶν**’ or ‘About vertigo’, a physical state is mentioned in which darkness befalls the eyes, the head whirls, and the ears hear sounds of a river murmuring; this condition is called **σκοτωμα** (skotoma), i.e. vertigo (4). Moreover,

Table 1. Current definitions of vestibular migraine and Menière’s disease.

Vestibular migraine	(a) At least five episodes with vestibular symptoms of moderate or severe intensity, lasting 5 minutes to 72 hours (b) Current or previous history of migraine with or without aura according to the International Classification of Headache Disorders (ICHD) (c) One or more migraine features with at least 50% of the vestibular episodes: - headache with at least two of the following characteristics: one-sided location, pulsating quality, moderate or severe pain intensity, aggravation by routine physical activity - photophobia and phonophobia - visual aura (d) Not better accounted for by another vestibular or ICHD diagnosis
Menière’s disease	(a) Two or more spontaneous episodes of vertigo, each lasting 20 minutes to 12 hours (b) Audiometrically documented low- to medium-frequency sensorineural hearing loss in one ear, defining the affected ear on at least one occasion before, during or after one of the episodes of vertigo (c) Fluctuating aural symptoms (hearing, tinnitus, or fullness) in the affected ear (d) Not better accounted for by another vestibular diagnosis

Adapted from Lempert et al. (11) for vestibular migraine and Lopez-Escamez et al. (22) for Menière’s disease.



Figure 1. Icons of classical medicine. I) Left: ‘Galen, Hippocrates, and Aretaeus of Cappadocia’ (from left to right) Window (The University of Sydney (34)). Right: The Yellow Emperor (Huangdi) as depicted in a tomb from the mid-2nd century AD (35).

this symptom may arise from the head (in the sense of headache – cephalaea), and subsequently a severe condition develops. One has to be careful when interpreting the word ‘scotoma’ since the vestibular organ was not known at the time and the word was also used to mean ‘to darken’ or ‘make dim-sighted’. The following attributes are used to describe the symptoms of scotoma:

...βάρος τῆς κεφαλῆς, ὀφθαλμῶν μαρμαρυγαὶ ἐπὶ πολλῷ τῷ σκοτώδει, ἀγνωσίη ἐωυτέων τε καὶ τῶν πέλας. Κῆν ἐπ’ ἀυξήσει ἢ νοῦσος γίγνηται, τὰ τε γυῖα λύνονται καὶ ἔρπονται χαμαί• ναυτίη καὶ ἔμετος φλέγματος ἢ χολωδέων, ξανθῶν ἢ μελάνων.

‘...they sense a heaviness of the head and a pronounced darkening of the sense of sight; flying threads float before their eyes; they are aware of neither themselves nor those around them. And when the illness worsens, the forces that keep them upright become so weak that they crawl on the ground. They are overcome by a nausea and have to vomit watery, bilious, brightly yellow or black fluids’ (based on a German translation from 1790 (12)).

The fundamental cause of scotoma is ascribed to dampness and cold:

‘... ἐπ’ αὐτῇ ὑγρῇ τε καὶ ψυχρῇ’.

If the disease progresses and becomes intractable, then it may lead to other diseases such as melancholy, which may be preceded by nausea due to black bile. The classical authors tried to explain the cause of diseases within the framework of the humoral theory of Empedokles and

Aristoteles valid at the time: the four body fluids (χολή= yellow bile, φλέγμα= phlegm, μέλαινα χολή= black bile, αἷμα= blood) were said to be out of balance (13). It was also used to explain the pathophysiology of seasickness (3). Therefore, the therapy recommended by Aretaeus was primarily a non-drug treatment like bloodletting, even for headache (14).

Nowadays the pathophysiology of migraine aura is usually considered to be a transient cortical ‘spreading depression’. The symptoms of VM could be classified as brainstem aura in the sense of a non-cortical spreading depression (15). This fits findings of an animal study that proved the presence of spreading depression in the brainstem of rats (16). Animal studies also identified the locus coeruleus in the pontine brainstem to be the modulator of cerebral blood flow, in which the trigeminovascular system plays a central role along with neurogenic inflammatory reactions (17).

The interpretation of ancient texts presents problems. We are well aware of the limitations of medical historiography, in particular the retrospective diagnosis based on a few statements. Misinterpretations are possible not only due to translations of the original texts into contemporary languages but also due to completely different pathophysiological medical concepts (18).

Menière’s disease in the Chinese book *Huangdi Neijing*

Huangdi Neijing has two parts, the ‘*Lingshu*’ and the ‘*Suwen*’ (19), both dating back to somewhere between the 2nd century BC and the 2nd century AD. The book presents the fundamental principles of Chinese

medicine and provides lively descriptions of vertigo in different situations, e.g. at heights (1). The Yellow Thearch, Huang Di, is considered a cultural hero who bestowed the gift of medicine on the Chinese people. The book is mostly written in the form of dialogues between Huang Di and his physicians. One vertigo syndrome described in this book resembles MD.

The full picture of MD was first described by Prosper Menière in 1861 (20); it is the second most frequent cause of peripheral vestibular vertigo (21). MD is characterised by recurrent attacks of vertigo lasting minutes to hours with unilateral hearing loss, tinnitus and a feeling of fullness in one ear. Single attacks have no antecedent signs or recognisable precipitating factors. Approximately one-third of patients report an increase in tinnitus, ear pressure and hearing loss preceding the abrupt vertigo attacks. Monosymptomatic attacks that are purely cochlear or vestibular can occur, particularly at the beginning of MD. Over time most patients develop a progressive, persistent hypoacusis of the affected ear. In 2015 the diagnostic criteria for MD were reformulated by several otolaryngological societies working in collaboration with each other (22, Table 1). Vestibular drop attacks (Tumarkin's otolithic crisis) can also occur. They are characterised by sudden, recurring falls without loss of consciousness.

The Chinese character 眩 'dizziness' (**xuan**) is used to define a malfunction of the eyes in one of the ancient dictionaries (*Shuowen Jiezi*) dating from the 1st century. The character has a semantic indicator for 'eye' on the left side and the phonetic character 'xuan' on the right side. The latter stands not only for the semantic field dark, black, darkness, unsureness but also suggests how the character is pronounced. It thus evokes an image of how it becomes dark before the eyes during dizziness. Later the character stood for different types of dizziness, which were never clearly differentiated. Dizziness is interpreted to be an optical phenomenon and thus a malfunction of the eyes which is evident in the most important character for dizziness. Already in the 4th century BC the eyes were associated with the liver and its function in Chinese medicine. In the *Huangdi Neijing Suwen* is written (19): '[diseases with] wind [that causes] tumbling and dizziness belong without exception to the liver'. In all cases involving optical phenomena, the liver is immediately considered the cause.

Medieval European medicine observed correspondences between the heavenly bodies, the fluids in the human body, the temperaments and illnesses by means of which the phenomena of the macrocosm (world) and the microcosm (man) were ordered and divined. Likewise Chinese thinking connected climatic phenomena, cardinal directions, and calendric constellations with the actions of specific forces in the world

and in the human body. Based on such systematic correspondences, this form of quasi-scientific, rational Chinese medical theory is called a medicine of correspondences. Dizziness was associated with the element/phase wood, wind, the liver, and the eyes. The brain (in our modern meaning) is also associated with the phenomenon of dizziness. It is interesting that otherwise the brain virtually plays no role in traditional Chinese medicine: It is not one of the six yin (**zang**) nor one of the six yang organs (**fu**). More often it is described as a storage organ of a substance called and translated as 'marrow', which is equated with the spinal cord. Thus, in one of the oldest and most fundamental texts of Chinese medical theory there is nevertheless a conceptual connection of the brain with the phenomenon of dizziness. This suggests there was anatomical knowledge of a connection between the brain and the eyes, but not with the ears. It is interesting that this theoretical 'eye connection', which was apparently based on anatomy, was not thematised in later works. In general the anatomy of the human body was never, with very rare exceptions, investigated in China. In the Chinese view the flawless operation of bodily function is closely connected with all parts of the body receiving an adequate supply of specific body substances, such as blood and the vital force Qi. Various subdivisions included essences (**jing**), blood (**xue**) and Qi, conceived as implementations or various aggregate conditions of the same life force Qi. Assertions are made about the significance of the body substances in connection with dizziness. The only functional link between brain, eyes, and ears is related to hearing symptoms:

'If Qi is insufficient above, the brain is not sufficiently filled by it, the ears suffer a ringing noise, the head is bent low by it, the eyes [experience] dizziness' (19).

Here the brain is to be understood as the 'sea of marrow', i.e. the storage site of the marrow – a substance of the body. Thus, dizziness occurs with tinnitus and an imbalance of the head due to deficient Qi in the head. The following citation from the chapter 'Discussion of the sea' refers to the same subject matter: 'If the sea of marrow is not sufficiently filled, the brain begins rotating around, the ears ringing, the calves/shins suffer from sour pains and the veil-dizziness (**xuanmao**) appears, the eyes can see nothing and passivity and hypersomnia occur' (19).

This combination of a ringing in the ears and dizziness is similar to the current diagnostic criteria for MD, but the pathophysiological explanations differ from our current views. The pathophysiological mechanism underlying the condition was not known in ancient China, since the function of the vestibular organ had not yet been discovered. The clinical history of the

vestibular system spans a period of only about 100 years (2). The aetiology and pathophysiology of MD still remain unclear (23–25), although vascular, neuroimmunological, or inflammatory aetiologies have been discussed. Evidence for a viral cause of MD is still equivocal (26). The pathognomonic histopathological finding is an endolymphatic hydrops (27) that may develop as a result of a relatively too high production or too low resorption of endolymph. The elevated pressure causes the endolymphatic membrane to rupture or the pressure-sensitive unselective cation channels to open (28). As a result the potassium concentration in the perilymph rises, causing the attack: first due to excitation and then to depolarisation of the vestibulocochlear nerve fibres. Evidence of endolymphatic hydrops can be found in post-mortem temporal bone studies (27) and also in vivo on high-resolution magnetic resonance imaging (MRI) after transtympanic gadolinium injection, since gadolinium primarily diffuses into the perilymphatic space (29). This technique has been considerably improved and now provides a supportive diagnostic tool (30,31).

Conclusion

We discussed these two vestibular forms of vertigo jointly because in clinical practice they often resemble each other: Both have attacks of variable duration and the attacks reoccur. Sometimes it may be difficult to clearly differentiate between VM and MD, especially if attacks of VM occur without headache as is the case in 30% of patients (6) or if attacks of MD occur without ear symptoms, especially at the beginning of MD (32). The duration of vertigo attacks alone does not permit a reliable distinction. It is important to stress that 60% of patients with MD also fulfil the diagnostic criteria for VM and vice versa (33). Moreover, both diagnoses (uni- or bilateral MD and migraine with and without aura) often coincide in 56% compared with 25% in an age-matched control group (33). Frequently, the diagnosis can be made only on the basis of the patient's response to therapy and on the course of the disease. However, a progressive hearing loss is evident in patients with MD, whereas vestibular migraine patients have normal hearing results.

Article highlights

- In the 2nd century AD Aretaeus of Cappadocia describes in his book *De causis et signis acutorum et chronicorum morborum* an association of hemicrania with vertigo, nystagmoid eye movements, and nausea that resembles our current view of vestibular migraine.
- In the Chinese Medical Classics *Huangdi Neijing* from the 2nd century BC to the 2nd century AD, the Yellow Thearch reports on an episodic disorder with dizziness involving the connection between eyes and brain and associated with a ringing noise in the ears that recalls a Menière's attack.
- The ancient view of the pathophysiological mechanism underlying both conditions was based on humoral processes: the theory of Emedokles and Aristoteles in ancient Greece and the medicine of correspondences with dysfunction of the vital force Qi in ancient China.

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