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Headache in Ancient Greek Medicine from Hippocrates to Galen

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Abstract

Ancient Greek culture – albeit dominated by cardiocentrism that attributed all vital and mental functions to the heart – recognized early the prominent role played by head and brain in individual identity and its preservation, as Homeric poems and Greek mythology show. Ancient Greek medicine, too, focused on the head as a relevant part of the body and dealt thoroughly with head pain. The present article provides the first review of ancient medical sources concerning headaches, from Hippocrates (5th century BC) to Galen (2nd century AD), passing through Aretaeus, the Anonymus Parisinus, Caelius Aurelianus and Scribonius Largus. It also reconstructs the evolution of the vocabulary, from the earliest attestations of the term indicating headache as a disease (κεφαλαλγίη) in the most advanced texts of the Hippocratic Corpus, to the introduction of new and more specialized terms (κεφαλαία and ἡμικρανία) in the Imperial age, up to the most complete exposition on the head, brain and nervous system by Galen, who possessed impressive anatomical knowledge.

Key words: Headache - Cephalalgia - Migraine - Greek medicine - Hippocrates - Galen

1. Encephalocentrism and cardiocentrism

The *Sacred Disease* – a text from the Hippocratic Corpus (5th-4th century BC) that is rightly considered as one of the finest examples of Greek rationalism – gives us the clearest and most radical account of encephalocentrism in the following passage (17: 174,7-12 P):

> *People must know that from the brain, and from the brain alone, come our pleasures, our joys, our laughter, and our jests, as well as our sorrows, our troubles, our griefs, and our tears. With it in particular we think, we contemplate, we look, we listen, we judge between which things are ugly and which beautiful, which are bad and which good, which are pleasant and which unpleasant*[1].

This passage is remarkable and even unique in the Greek-Roman world, where another theory played a central role, namely cardiocentrism, that was later sponsored by Aristotle (384-322 BC) and remained influential in subsequent biology and medicine[2]. By concentrating all vital, intellectual, emotional, perceptual and motor functions in the heart, as the source of blood and innate heat, Aristotle believed that the brain was bloodless and cold, and that its function was to maintain in the organism the balance that is necessary for the existence (*Parts of Animals* II 7: 652b, 20-28; 150,13-21 P):

> *Nature has contrived the brain to counterbalance the region of the heart and the heat in it [...]. The brain, then, makes the heat and the boiling in the heart well blent and tempered*[3].

Later on, Greek anatomists – from Erasistratus and Herophilus in the Hellenistic period (4th-3rd centuries BC) up to Galen in Imperial Rome (2nd century AD) – expanded the knowledge of the brain by opening the skull and studying the brain parts and the nerves, in their branches down to their final endings, eventually classifying them as sensory and motor nerves. But even then, the cardiocentric model retained its followers among physicians and philosophers, so much so that Galen still had to attack them in his own works. Particularly in the *Opinions of Hippocrates and Plato*, taking a stand against Aristotle, the Peripatetics and the Stoics, Galen expounds his views on the tripartition of the soul, according to which the parts of the soul are located in heart, brain and liver[4]. This theory draws on the Pythagorean tradition that found expression and transmission in Plato's *Timaeus* – a dialogue that was quoted and commented on by Galen – but it can also be understood as a synthesis and mediation between encephalocentrism and cardiocentrism. Certainly, the head (κεφαλή) could not be neglected in Antiquity – even in the Archaic period, before any medical and scientific research – for many good reasons: its prominent position, its sensory concentration, its expressive and communicative function as well as its vital one, undisputed. This clearly emerges from the two Homeric poems: both the *Iliad* and the *Odyssey*, despite not questioning cardiocentrism, often depict duels or clashes between warriors in which death occurs due to head injuries, for example by cutting off the head (cf. *Il.* 13,202-204; 14,465-468) or by striking the head

(cf. *Il*. 5,72-74; 15,430-435; *Od*. 12,411-414). In these episodes, as elsewhere, the head represents the individual as its most important bodily part (cf. *Il*. 11,54-55; 18,114; *Od*. 1,343-344) or, metaphorically, life itself (*Il*. 4,161-162; 17,242-243; *Od*. 15,260-263; 19,91-92). Therefore, it is not surprising that the spilling out of the head content, namely the brain, is evoked as a deterrent for those who would not keep an oath (*Il*. 3,300-301). And it is no coincidence that the powerful Athena, the wise and warrior goddess, was born from the head of her father Zeus according to Hesiod's *Theogony* (924-926). Similarly, headache could not be neglected by the Greek physicians, regardless of the role they attributed to the brain, either explicitly or implicitly. This article will address this topic by examining the representative ancient sources with the aim of highlighting the specific terminology and tracing the concept of headache in medical history, from Hippocrates to Galen[5].

2. Headache and its names

The Hippocratic Corpus, a collection of writings that represent the medical knowledge of the Classical Greek period, addresses headache by adopting a variety of expressions such as κεφαλῆς ὀδύνη,-αι (14 occurrences) and κεφαλῆς ἄλγημα,-τα (3 occurrences), both meaning "headache"; circumlocutions such as ὀδύνη ἔχει τὴν κεφαλήν, "the pain takes over the head", and τὴν κεφαλὴν ἀλγεῖν, "to have pain in the head"; and similar, more articulate phrases, which are numerous overall. But a more specialized term is also attested, namely κεφαλαλγίη (Ionian form for κεφαλαλγία), resulting from κεφαλή and ἄλγος, meaning "headache". This term – together with the words from the same root, κεφαλαλγεῖν, a rare verb, and κεφαλαλγικός and κεφαλαλγής, quite frequent adjectives – does occur 63 times: it appears in some of the most famous Hippocratic texts, such as the *Aphorisms*, *Airs, Waters and Places,* and *Prognostic*, as well as in numerous passages of the *Coan Prenotions* (31), *Prorrhetic I* (15), and *Epidemics VII* (6). Remarkably, it was almost never used in the nosological treatises (*Diseases*, *Internal Affections*, *and Affections*) nor in gynaecological ones (the verb κεφαλαλγεῖν may have one occurrence in *Diseases of Women I*), which generally represent a more archaic form of medicine[6]. Galen, in a renowned passage concerning the names of diseases of the *Method of Medicine*, an impressive work in fourteen books, mentions two terms for headaches, κεφαλαλγία and κεφαλαία, and explains their formation in light of the comparison with others; the first term derives from the affected part and the symptom, the second only reflects the affected part (II 2: X 82,1-9 K; 126,19-128,3 J-H):

> *Very often, they [those who first applied the names assigned to diseases] derived the names from the damaged part (pleuritis, peripneumonia, sciatica, gout, nephritis, arthritis, ophthalmia, headache* [κεφαλαία]*, and dysentery), very often from the symptom […], very often from both simultaneously (cephalalgia, otalgia, cardialgia, odontalgia and hysteralgia)*[7].

The term κεφαλαία never appears in the Hippocratic Corpus, nor does ἡμικρανία (migraine), composed of ἡμι- (half) and κρανίον (skull), which designates a one-sided headache, as Galen briefly points out in his *Differences between Fevers* (II 13: VII 380,4-6 K):

> *Pain occurs in the ears and head, either on one side, which is called migraine* (ἡμικρανία)*, or both sides*[8].

Both κεφαλαία and ἡμικρανία can be found, together with κεφαλαλγία, in at least two passages of Galenic writings. First, in Galen's *Commentary on Epidemics VI*, where he lists the names of diseases affecting the head (I 2: 14,31-32 W = XVIIA 815,9-10 K):

> *Some [head ailments] are called headaches* (κεφαλαῖαι)*, others migraines, others simply pain in the head* (κεφαλαλγίαι)[9].

Secondly, in the *Thinning Diet*, where Galen warns against drinking wine those who suffer from headache and migraine as well as from various types of head pain, epilepsy and madness (95: 100,1-5 M):

> *Most of them, however, are also well odoured and hotter than most other wines, and so naturally affect the head; they should therefore be avoided by sufferers from headache* (κεφαλαία)*, hemicrania, or indeed any other complaint of the head* (κεφαλαλγεῖν)*, including epilepsy or mania*[10].

Among the terms employed by Galen to designate headache, the most frequent is κεφαλαλγία (240 occurrences, counting verbs, nouns and adjectives from the same root); much less frequent are ἡμικρανία (21, counting nouns and derived adjectives) and κεφαλαία (16). An additional term, ἑτεροκρανία, deriving from ἕτερος (one or the other of two) and κρανίον (skull), meaning "pain in one part of the head or migraine", appears just seven times in Galen, while it is absent from the Hippocratic Corpus.
Apparently, the terminology of head pains and diseases observed since Hippocrates expanded as anatomical and pathological knowledge advanced or deepened. But what does κεφαλαλγία mean in the Hippocratic Corpus? When did the other terms appear? How did Galen and other physicians interpret this and other head pains and diseases named as κεφαλαία, ἡμικρανία and ἑτεροκρανία? We will address these questions in the following sections.

3. Hippocratic Corpus

3.1. The *Aphorisms*

The *Aphorisms* – a collection of sentences encapsulating the essence of classical Greek medicine, and the most successful of the Hippocratic writings, repeatedly commented on since the Hellenistic period and employed in university teaching until the

19th century – feature several passages concerning headache (Ionic form: κεφαλαλγίη; Attic: κεφαλαλγία). A very concise and general sentence is *Aph.* III 23 (130,6-8 J):

> *In winter occur pleurisy, pneumonia, lethargus, colds, sore throat, coughs, pains in the sides, chest and loins, headache* (κεφαλαλγίαι), *dizziness, apoplexy*[11].

Occurring in winter, headache is a cold-related illness, associated with respiratory and neurological disorders of different degrees. *Aph*. III 13 provides a similar statement, except that winters are those following summers and autumns with specific climatic characteristics and the expected illnesses are mainly those of the respiratory tract (126,1-3 J):

> *If the summer prove dry and northerly, and the autumn rainy and southerly, headaches* (κεφαλαλγίαι) *are common in the winter, with coughs, sore throats, colds and, in some cases, consumption.*

This aphorism corresponds to one passage of *Airs, Waters, and Places*, a renowned book for travelling physicians concerning the influence of environment and climate on health and disease (10: 106,11-14 P)[12]. Compared to *Aph*. III 13, the text of *Airs, Waters, and Places* mentions gangrene (σφάκελοι) of the brain among the diseases that typically arise in winter. Therefore, it associates headache with respiratory and neurological diseases, as already seen in *Aph*. III 23.
Aph. VI 51 describes a neurological disease, where pains in the head occur (190,9-11 J):

> *Those who when in health are suddenly seized with pains* (ὀδύναι) *in the head, becoming forthwith dumb and breathing stertorously, die within seven days unless fever comes on.*

The text of *Aph*. IV 70 mentions headaches that affect patients with fever and urinary disorders, probably due to an infection (152,19-21 J):

> *In cases of fever, when the urine is turbid, like that of cattle* (ὑποζύγιον)*, headaches* (κεφαλαλγίαι) *either are, or will be, present.*

In the context of dietary recommendations, *Aph*. V 64 advises against giving milk to those suffering from headaches, as well as to those with fever or gastrointestinal problems (176,5-9 J):

> *To give milk to sufferers from headache* (κεφαλαλγέουσι) *is bad; it is also bad for fever patients, and for those whose hypochondria are swollen and full of rumbling, and for those who are thirsty. Milk is also bad for those whose stools in acute fevers are bilious, and for those who pass much blood.*

Later on, in *Aph*. V 68, bloodletting is recommended for those suffering not from headaches in general, but specifically from pain in the back of the head (178,4-5 J):

> *Pains at the back of the head* (τὰ ὄπισθεν τῆς κεφαλῆς ὀδυνωμένα) *are relieved by opening the upright vein in the forehead.*

The above sentences from the *Aphorisms* may provide a first overview on headache, or headaches, in the Hippocratic Corpus. From this it emerges that headaches arise from cold, at least in some cases, associated with neurological disorders and respiratory tract disorders, but also gastrointestinal disorders or serious infectious conditions accompanied by fever. With regard to the treatment, a distinction is made between general headache, designated as κεφαλαλγίη, and pain in a specific part of the head, which still lacks a specific name, as seen in *Aph.* V 68.

3.2. Different types of headache and symptoms in other Hippocratic writings

What concerns headache found in the *Aphorisms* is confirmed and integrated by the *Prognostic*, another influential Hippocratic text devoted to symptomatology. In ch. 4, headache (κεφαλαλγίη) is likened to febrile, pulmonary and psychic (more precisely, frenetic) conditions rather than neurological disorders, which are fatal when causing alterations of mental functions that reveal themselves in uncontrolled movements of the hands (4: 20,8-13 P):

> *Regarding movements with the hands, I am aware of the following. In patients with acute fevers, pneumonias, phrenitises, or headaches* (κεφαλαλγίαι)*, for the hands to be raised in front of the face clutching at empty space, gathering up tiny particles, picking fluff off the bedding, or scratching bits of straw off the house wall are all bad, indeed fatal, signs*[13].

Ch. 21 addresses severe headaches accompanied by fever occurring in fatal cases or in cases that resolve with nosebleeds or abscesses in the lower regions (21: 50,17-22 P):

> *Severe continuous headaches* (κεφαλῆς ὀδύναι) *accompanied by fever are very ominous if any of the fatal signs should be added. But if without the appearance of any such signs the pain and fever persist beyond twenty days, you must expect there to be a hemorrhage <or expulsion of pus> from the nostrils, or some different abscession in the lower parts.*

Ch. 24 is a long section of *Prognostic* devoted to fevers. It states that, in a fever of non-fatal character, headache accompanied by vision disorders and stomach problems will be seized with vomiting of bile (24a: 56,23-58,1 P):

> *A person with a nonfatal fever who reports that he has a headache* (τὴν κεφαλὴν ἀλγέειν) *or also that something dark is appearing before his eyes, if befallen in addition by heartburn, will bring up bilious vomitus* (χολώδης).

However, when in such fevers with headache, vision disorders and stomach problems are of a different kind, a hemorrhage from the nose, as in ch. 21, should be expected (24b: 58,15-20 P):

> *Patients who have this kind of fever [a nonfatal fever] together with headache* (κεφαλὴν ἀλγέειν), *but who instead of seeing something dark before their eyes have dimness of vision and see sparks, and rather than having heartburn feel a tension in the hypochondrium on*

> *the right or the left without pain or inflammation, you may expect to hemorrhage from the nostrils rather than to vomit.*

The above passages from the *Prognostics*, as well as *Aph*. VI 51, do refer to headache using expressions such as κεφαλῆς ὀδύναι and (τὴν) κεφαλὴν ἀλγέειν, but not the term κεφαλαλγίη, which occurs only in the first example. The latter is more common in other Hippocratic writings, such as *Prorrhetic I*, a collection of 170 clinical observations aimed at prognosis from the mid-4th century BC (15 occurrences); and *Coan Prenotions*, a collection of 640 aphoristic sentences collected from previous works, mainly *Prorrhetic I*, but also *Prognostic* and *Aphorisms*, towards the end of the 4th century BC (31 occurrences). These writings display several parallels concerning headache, of which we will give just one example, that is *Coan Prenotions* 116 (130,3-4 P):

> *Headache* (κεφαλαλγίη) *in an acute fever, unless there is a haemorrhage from the nostrils, develops into phrenitis14.*

This states that bleeding from the nose is a positive outcome for headache accompanied by fever, in tune with the aforementioned ch. 21 and 24b of *Prognostic*, which do not mention κεφαλαλγίη though. Apparently, this is a technical term of the Classical era, making its appearance in more recent texts.

In the Hippocratic Corpus, in general, headache shows up in a variety of cases of different illness severity. Good examples can be found in the *Epidemics*, a collection of medical records in seven books that do not go back to the same author or even the same era. In this collection the term κεφαλαλγίη only occurs in *Epidemics II* (1 occurrence, in the form of adjective) and in *Epidemics VII* (6 occurrences), a more recent book than the others[15].

Epidemics VII 5 (286,6-290,10 S) tells the story of Cydis' son, who fell ill during the winter solstice and died of sepsis in less than one month. His illness began with chills, fever, earache and headache (κεφαλῆς ὀδύνη). The earache already occurred in the past, since childhood, but then the situation worsened: the pain was now stronger, involving the head (κεφαλαλγίη), and was more intense the greater the flow of pus coming out of the ear, until the infection became generalised, compromising the whole organism. This text employs both κεφαλῆς ὀδύνη (3 occurrences) and κεφαλαλγίη (2 occurrences).

Epidemics VII 112 (382,3-19 S) reports three short cases of patients suffering from headaches with a fatal outcome. The first two are similar. Polyphantus, based in Abdera on the Thracian coast, has headache (κεφαλὴν ὀδυνᾶσθαι), high fever and altered urine, similar to that of cattle (ὑποζύγιον) – as in the aforementioned *Aph*. IV 70. Similarly, the servant of Eualcides, based in Thasus, island in front of Abdera, has headaches (κεφαλαλγίαι) and altered urine; she eventually died with the same

convulsions as Polyphantus. The case of Diopeithes' sister is much less serious: she was suffering from benign malaria or semi-terzine fever, had heartburn and headache (κεφαλαλγίη) during the period of the Pleiades' sunset, between late winter and early spring; the same happened to other women, not to men (*Epidemics* VII 95: 372,9-12 S); but the symptoms seemed to be episodic, as they disappeared without consequences.
The fact that there are different forms of headache of different severity is explained in *Prorrhetic II*, where ch. 30 considers headaches. This is how it begins (30: 274,3-276,20 P):

> *First, types of headaches* (τὰ περὶ τὴν κεφαλὴν ἀλγήματα): *the one kind is benign, while the other is much more difficult*[16].

Immediately after, the text asserts the need to distinguish between the different forms of headache, which are then reviewed in a long passage. It provides a detailed description of the symptoms with an assessment of their severity. Here headaches are generally designated with expressions such as κεφαλῆς ὀδύνη,-αι or ἄλγημα,-τα, while the term κεφαλαλγίη appears only once.

3.3. Aetiology

Headache can take different forms depending on different causes: this is noted in the *Regimen in acute diseases*, and more precisely in the *Appendix*, which is believed to be a later addition (55: 276,4-6 P):

> *Take note of patients with headaches* (οἱ κεφαλαλγικοί) *that have arisen from physical exercises, running, walking, hunting, some other untimely exertion, or venery*[17].

The same passage lists some causes of headache, mostly related to lifestyle, but also, in tune with the Hippocratic doctrine, to pathological causes of humoural origin.
This can also be seen in the passages already mentioned. For example, if bleeding from the nose solves the headache, as seen in *Prognostics* 21 and 24b as well as in *Coan Prenotions* 116, the cause must be an excess of blood. If headache is solved by vomiting of bile, as in *Prognostic* 24a, the pain must depend upon bile. The vomiting of bile is also present in the illness of Cydis' son, depicted in *Epidemics VII* 5 (286,11 S), but in that case was not that beneficial. Excessive bile in this patient was confirmed by his bilious evacuations, which are promptly reported (286,12 S). But after a few days and following the administration of a purgative, his evacuations became phlegmatic (288,2 S). In addition to bile and phlegm, another fluid or pus coming out of the ear is mentioned: this is ultimately white, grainy and foul-smelling (286,9; 288,10; 290,8-9 S). Indeed, Cydis' son had a multiple and complex humoral disorder that proved fatal. The evolution of the disease and its symptoms are realistically described, and make one think of a severe otitis leading to sepsis.

For headaches occurring in winter and caused by cold, the phlegm is responsible. No explicit statement can be found in *Aph.* III 23, III 13 or in *Airs, Waters and Places* 10 – although in the latter there is a continuous distinction between phlegmatic and bilious men, who are exposed to different diseases in the same season and climate. But phlegm is considered as the cause of headaches in other Hippocratic texts, namely in the nosological treatises, devoted to diseases, their symptoms, causes and therapies, which preserve material from a more archaic medical culture. In these treatises the term κεφαλαλγίη is not attested, but there is mention of pain in the head (ὀδύνη,-αι or ἄλγημα,-τα) in *Affections* and *Diseases II* and *III*. Also, phlegm is the cause in *Affections* (2: 8,11, 13 and 17 P) and in *Diseases II* 15 (194,7 P). Pain caused by the phlegm affects only one part of the head, that is the front, in *Diseases II* 8 (180,6, 13 and 18 P).

As for headaches in general, however, bile and phlegm may be both responsible according to several passages. A good example can be found in *Epidemics I* – one of the most important texts for clinical examination of the Hippocratic Corpus – more precisely in the second constitution, a sort of account of the epidemic trend of a certain community over an entire year (I 12: 170,10-21 P):

> *Pains* (ἀλγήματα) *about the head and neck, and heaviness combined with pain, occur both when fever is absent and when it is present. […] But in ardent and the other fevers, […] those with heaviness* (βάρεα) *of the whole head, heartburn, and nausea, later vomit material with bile and phlegm. Generally, children in this state are most likely to suffer from convulsions; women have both these symptoms and pains in the uterus; older people and those whose natural heat is already failing have paralysis, raving, or loss of vision*[18].

Vomiting may contain bile or phlegm without any significant difference. The disease progression depends rather on the age and sex of the patients: children, women and the elderly are the most vulnerable, who may suffer worse consequences. Women are affected in the uterus, an organ that is closely monitored throughout the ancient medical literature, as it performs the main function of female individuals, namely reproduction; as a result, ailments and diseases that affected women were attributed almost automatically to the uterus.

Therefore, for headaches affecting female patients, uterus was considered a more probable cause than humours. The opening passage of *Epidemics VI* does mention a heavy feeling in the head is supposed to be caused by the uterus, weakened by a recent abortion (VI 1,1: 206,1-4 S):

> *In women in whom, after miscarriage and after swellings about the uterus, it turns to headaches* (καρηβαρίη)*, there is pain mostly around the front of the head, along with whatever other pains come from the uterus: for these women it terminates at the hip in the eighth or tenth month*[19].

In *Epidemics VII* 64, reporting the story of Aspasius' wife, there is a therapeutical prescription for headaches caused by the uterus, a substance found in preputial sacs of beaver (348,6-7 S):

Castoreum stops headaches (κεφαλαλγίαι) *from the womb*[20].

In case of headaches affecting female patients, a uterine condition, with related traditional remedies, is quite common in the gynaecological treatises. In these writings, the term κεφαλαλγίη never occurs, as in nosological ones. As an example, we quote only one passage from *Nature of women*, where pain in the head and other parts is attributed to a uterus filled with bile, which must be evacuated (89: 298,1-5 P):

If a woman suffers (sc. pain) in her head (τὴν κεφαλὴν ἀλγέειν), *lower abdomen, and loins, there is bile in her uterus. Give her a medication that will clean both upward and downward, bathe her in hot water, and apply an agent to clean bile. Dissolve anise and black cumin in wine, and give to drink*[21].

3.4. Therapy

Widely treated in the nosological and gynaecological treatises of the Hippocratic Corpus, therapy is missing from the writings with the most frequent occurrences of the term κεφαλαλγίη, namely the *Coan Prenotions* and *Prorrhetic I*, devoted to prognosis. In some of the passages that we have quoted, however, dietary and therapeutic advice against headache is transmitted. For instance, in the *Aphorisms*, one sentence recommends to avoid milk (*Aph*. V 64), another prescribes bloodletting for pain in the back of the head (*Aph*. V 68). In *Epidemics VII* 5, the son of Cydis, suffering from a lethal otitis, took a purgative based on annual mercury, now considered toxic but frequently employed in the past as an effective laxative (286,14 and 288,1 S), and drank barley infusion (χυλός) (286,16 and 288,8 S). Furthermore, in *Epidemics VII* 112, Polyphantus was given a sternutatory, a substance placed on the nasal mucosa in order to cause violent sneezing to clear the head of humours and relieve headache (382,6 S). All these passages find parallels in the Hippocratic Corpus. For example, the avoidance of milk (*Aph*. V 64) can also be found in *Regimen in Acute Diseases* (2: 74,1-3 P), in case of severe or acute disorders, among which were certainly forms of headache[22]. In the same writing, instructions are given on the administration of barley soup or infusion, and barley infusion is recommended before soup in patients seriously ill, when presenting signs of improvement (19: 88,17-22 P). In tune with this prescription, Cydis' son took barley infusion, as soon as his condition seemed to improve after the purgative (*Epidemics VII* 5). Moreover, cutting the straight vein on the forehead to solve the pain in the back of the head (*Aph*. V 68) has a parallel, more precisely, quotes the text of *Epidemics VI* 2,13 (218,12-13 S).

However, *Epidemics* VII 112 tells the story of a fifty-year-old man from Halicarnassus who had pain (ὀδυνᾶσθαι) in his ears and head in winter (382,14-19 S). He died after a bloodletting that should not have been done. This is an example of controversy among the authors of the Hippocratic Corpus – a particularly lively practice in the

therapeutic field. It is not the aim of this article to reconstruct in detail the remedies against headaches attested to in the Hippocratic writings, nor their peculiar and distinctive characteristics, but it may be interesting to observe the variety of remedies in an exemplary passage of *Affections*, a recent nosological treatise dated between 370 and 355 BC (2: 8,9-10,2 P):

> *If pains befall the head, it benefits the patient to warm his head by washing it with copious hot water, and to carry off phlegm and mucus by having him sneeze. If, with these measures, he is relieved of his pain, that suffices; but if he is not relieved, clean his head of phlegm, and prescribe a regimen of gruel and drinking water. Do not give wine until the intense pains stop; for when the head, in its warmness, draws wine to itself, its pain becomes even more intense.*
> *These pains attack as the result of phlegm, when, having been set in motion, it collects in the head.*
> *If, from time to time, pain and dizziness befall the head, the above administrations are also of benefit; it helps, too, if blood is let from the nostrils or from the vessel between the eyes. If the disease in the head is protracted and intense, and does not go away when the head is cleaned out, you must either incise the patient's head, or cauterize the vessels all around it. For, of the possible measures that remain, only these offer a hope of recovery*[23].

The above passage lists all remedies known at the time for headaches: baths, sneezing, diet, purgatives, bloodletting and cautery. For the most part, these remedies also apply to all other illnesses, but sneezing is specific for clearing the head when it is compromised or affected by humours.

4. Post-Hippocratics and Galen

The Hippocratic writings deal mainly with acute diseases, namely serious diseases with rapid progression, including the nosological treatises – *Diseases*, *Internal Affections* and *Affections* – which approach acute diseases *a capite ad calcem* (from head to heel). In the post-Hippocratic medicine, however, physicians start to consider long-term diseases, defined as chronic. Despite the almost complete loss of medical literature between Hippocrates and Galen, two Greek treatises on acute and chronic diseases have survived: the writing of Aretaeus of Cappadocia, in eight books, and that of an anonymous author, commonly known as Anonymus Parisinus, in one book, both from the Imperial age[24]. Soranus of Ephesus, great methodical physician who lived in Rome in the first half of the 2nd century AD, had written a work on the same subject, subsequently lost in the original Greek, but preserved in the Latin translation, that reworked the model, made by Caelius Aurelianus of Sicca (5th century AD), in eight books[25].

These three authors all devote a chapter to headache in their works that treat the diseases according to the usual order *a capite ad calcem*. Aretaeus addresses headaches in two different places of his work as, for each disease, he first deals with causes and

symptoms, then with treatment (I [3] 2: 36-37 and I [7] 2: 144-149 H); the Anonymus Parisinus devotes to headaches some chapters (V 30-38 G) and so does Caelius (I [4] 1: 430-458 B). Both Aretaeus and Anonymus Parisinus call the disease that causes pain in the head as main symptom κεφαλαία (headache) on the basis of the affected part (κεφαλή). The same term was used by Soranus, as Caelius writes that the disease of the head (*capitis passio*) is called *cephalaea* by the Greeks (430,11 B). This term, never employed in the Hippocratic Corpus, highlights the evolution of the concept of disease: from symptom to anatomical part. However, Aretaeus and Caelius placed headache among chronic diseases, while the Anonymus Parisinus places it among acute diseases.

Aretaeus is particularly rich in terminology. He mentions κεφαλαλγίη (in Ionian dialect) that is distinguished from κεφαλαίη, as the first represents an acute and short-term condition (36.19-20 H); and he uses the term ἑτεροκρανίη to indicate the pain affecting one of the two parts (ἕτερος) of the head (κρανίον), already described in the Hippocratic texts. Furthermore, the pain affecting just a half of the head is called by Caelius ἡμικρανία (migraine), derived from ἡμι- (half) and κρανίον (430.18 B): this term, that is not attested in either Aretaeus or the Anonymus Parisinus, was bound to become very popular as to survive in all modern medical languages, English, French, German, and Italian[26].

The chapters of these three authors share common aspects, but display also differences that partly depend on their doctrinal affiliation. We can recall that Aretaeus, an admirer of Hippocrates, remained substantially faithful to the Hippocratic tradition, even imitating and adopting the Ionian dialect, unusual in his days; the Anonymus Parisinus is rather close to the Pneumatic school, while Caelius reflects the teaching of the Methodic school, following Soranus' thought[27]. With regard to headache, Aretaeus delivers the most accurate account; the Anonymus the most concise and beginning with causes; Caelius provides most information about therapy. We will not go into detail here about their interpretations of the disease and the treatment. The latter corresponds to all traditional remedies listed in the above-mentioned passage from *Affections* 2.

It is worth considering a unique therapy of popular origin only attested by Scribonius Largus, a Sicilian physician of Greek culture who lived during the reigns of Tiberius and Claudius, author of a pharmacological work called *Compositions*[28]. For headaches Scribonius listed ten recipes based on plants and natural elements, and increasingly powerful; ultimately, he recommends the application to the hurting part of the head of a torpedo fish, which is equipped with electrically charged organs, capable of generating strong, electric shocks (11: 107 S). This testimony had a huge impact on the studies begun in the 17th century by Francesco Redi, and crowned in the 18th century by the discoveries on electricity of Luigi Galvani and Alessandro Volta[29].

Galen, the greatest physician of Graeco-Roman Antiquity who dominated the Western medical tradition until the 19th century, addressed headaches in numerous writings

treating the subject as a clinician, pathologist, pharmacologist, dietitian and commentator of Hippocratic texts. In the *Affected Parts*, Galen's most important treatise on diagnosis and pathology, he discusses headache (κεφαλαία and κεφαλαλγία) and migraine (III 13: 204,9-207 K)[30]. Κεφαλαία is defined as a form of chronic and incurable headache, as in Aretaeus' work; other forms of headaches (κεφαλαλγία) have similar symptoms, generally less severe, but are not chronic, as they depend on individual nature and lifestyle. Migraine represents the same disease, yet affecting half of the head; this is explicitly associated with other chronic diseases in the *Capacities of Simple Drugs* (X 25: XII 303,2 K)[31]. Galen provides accurate explanations of the pathological processes of headaches and migraine, relying on his own theories and those of his time – in which humours and air (πνεῦμα) play a key-role – but also showing a profound anatomical knowledge of the nervous system acquired both from tradition and from direct dissection practice.

In the above-mentioned passage of the *Affected Parts*, Galen mentions, among the causes of headache (κεφαλαλγία), the superfluous bilious substances that accumulate in the pit of the stomach (III 13: VIII 206,10-12 K). This is also stated by Galen in another passage of the *Affected Parts* (I 1: VIII 17,8-11; I 6: VIII 52,4-7 K), as well as in the *Composition of Drugs according to Places*, while recalling and discussing the remedies for stomach-related headache suggested by Archigenes of Apamea, a Pneumatic physician renowned in Rome during the reign of Trajan, whose works were lost (II 1: XII 535,10-541,2 K)[32].

Headaches driven by stomach issues and solved by treating them had been already observed by Hippocratic physicians. It was later at the centre of a debate on how to interpret this kind of pain compared to that generated in the head, as Galen reports in the *Affected Parts* (I 1: VIII 17,8-14 K):

> *According to this type of thought some [authors] declare that the head is not affected by the kind of headache* (κεφαλαλγίαι) *which arises from retention of biliary humors in the stomach. In fact, this headache instantly subsides after the patient has vomited bile. But if the headache persists after vomiting, then they declare the head [itself] to be affected*[33].

Some physicians believed that, when the headache originated in the stomach and ended in vomiting, the head was not affected. Galen rejects this opinion and agrees instead with Archigenes' stance, albeit disputing his terminology (I 6: VIII 48,11-49,7 K):

> *But I have to remind you first that I prefer to define as idiopatheia a condition which other physicians call protopatheia. It really makes no difference if one calls it a protopathy. However, it is better not to argue about definitions but to understand the differences of the facts. Indeed, when noxious vapors or even the humors themselves rise up from the cavity of the stomach to the brain and the mind becomes damaged, nobody will declare that the brain is affected in the beginning nor will he say that the brain remains wholly undamaged. On the basis of the same considerations it is generally agreed upon that according to the most adequate definition it suffers from a sympathetic disease. The term 'sympathetic affection'*

> *does not indicate a complete absence of a [primary] affection but a combination with an affection of another organ. It is better and clearer to declare that an organ suffering by sympathy is affected because of [a disease of] another organ*[34].

Archigenes considers the headache caused by the stomach συμπάθεια (sympathetic affection), and that caused by the brain πρωτοπάθεια (primary affection), while Galen would replace πρωτοπάθεια with ἰδιοπάθεια (proper affection). But he does not seem too fond of this alternative, so much so that later on he considers it as a synonym for the rejected one (V 4: VIII 329,13-14 K). This distinction is absolutely modern and can be partly superimposed on primary and secondary headaches.
Anyway, standing on a solid anatomical knowledge, Galen could provide material evidence of the connection between the brain and the abdomen through the nerves that would later be called vagus nerves, in order to explain headache caused by the stomach or this secondary headache (III 9: 178,19-179,4 K):

> *The gastric cavity transmits its affections to the head and the head to the stomach. This [transmission] is made possible by the large size of the nerves which descend from the brain to the upper opening of the stomach [vagus nerves]. They make this part more sensitive than all the other areas of the body*[35].

Galen gives the oldest account of vagus nerves in this passage, as well as in more detail in the *Anatomical Procedures* (XIV 10: III 1080-1082 G)[36]. He did not know all their functions, but he recognized that they transmit to the stomach a sensitivity that other organs do not show. Thus, thanks to clinical observation, erudition and anatomical research, Galen brings research and knowledge of headache and relative nosology to another, advanced, if not modern, level.

5. Conclusions

Ancient Greek culture, even if dominated by cardiocentrism, a theory that attributed all vital and mental functions to the heart, was always concerned with the prominent role played by head and brain in individual identity and its preservation, as both Homer and Greek mythology attest. Ancient Greek medicine also focused on the head as a bodily part and on the pain afflicting it. In the Hippocratic Corpus, the writings that preserve earlier material – namely nosological and gynaecological texts – indicate headache through descriptive expressions, such as κεφαλῆς ὀδύνη,-αι or κεφαλῆς ἄλγημα,-τα. On the other hand, the writings that represent the most advanced medicine of the Classical era employ the term κεφαλαλγίη (headache), meaning both the symptom and the disease.
The terminology enlarged, as medical understanding advanced – especially in the fields of anatomy and pathology. The medical literature of the Imperial age, so far as we know, did employ several terms related to headaches: in addition to κεφαλαλγία, it used

κεφαλαία (headache), ἑτεροκρανία (headache in one of the two parts of the head or migraine) and ἡμικρανία (migraine), the latter of which was the most fortunate in medical history. All these terms derive from the name of the affected part and may indicate diseases of different severity: κεφαλαία and migraine are chronic, κεφαλαλγία is transient and linked to lifestyle. Galen, while providing us with a summary based on Asclepiades' works, otherwise lost, adopted a distinction between primary and secondary diseases, that can be applied to headache as well as to other diseases. Moreover, he demonstrated the connection between brain and abdomen through the nerves that would be called vagus nerves. A great scholar and scientist, Galen drew on tradition, but also stood on anatomical knowledge that set him apart from his contemporaries and allowed him to be ahead of his time, anticipating notions and views of today's medicine.

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