

# The Hippocratic Doctrine of “the Acute Brain Suffering” as the Brain Stroke

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*Background:* The ancient Greek term “apoplexy” as is repeatedly mentioned by the Hippocratic School of Medicine, included a cluster of diseases, mainly those concerning the central nervous system. The term was wrongfully infiltrated in Western European medicine as synonymous to what is called today a “stroke” of the brain. *Objective:* While in “*Corpus Hippocraticum*” the definition of the stroke was rather ambiguous; our study aims to unveil those fragments referring to it, in order to compose the Hippocratic theory of what it stood for “*Acute Brain Suffering*” (Greek: Οξείες Οδύνες του Εγκεφάλου) during the Classical era of ancient Greece. *Method:* A bibliographic research of the “Hippocratic Collection” was conducted during our study in order to connect all fragments from the original ancient Greek text, and reconstruct the “*Hippocratic Stroke Theory*”. Three editions have been used as reference. French edition by Littré, and two Greek ones by Kaktos and Pourmaropoulos. *Results:* The “*Acute Brain Suffering*” seems to be the entity we call “*Stroke*” in modern clinical practice. Edema (collection of fluids-humours theory) was considered to be the most significant element which though could have been addressed by a cranial decompression for the symptoms to improve. The symptoms in question were, acute brain pain, diplopia, vertigo, ataxia, saliva, and urine loss as well as feces incontinence. *Conclusion:* Both therapeutic approach and symptomatology exhibited significant similarities with the modern concept of the stroke. The Hippocratic School was a scientifically advanced sect of medicophilosophers who promoted global medicine.

**Key Words:** Apoplexy—stroke—acute brain suffering—ancient Greece—Hippocrates

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## Introduction

A plethora of Western European physicians, being attracted by the ancient Greek medicine which once more influenced current practice, strongly favored the term “apoplexy” in their treatises, a custom which flourished until the first half of the 20th century. As Cooke wrote during 1820, “*The term Apoplexy (Greek: αποπληξία) was employed by the Greeks, and is still used, to denote a disease in which the patient falls to the ground, often suddenly, and lies there without having their senses, or voluntary motion. Thus the inflicted persons who were instantaneously affected, as if struck by lightning, were named in antiquity as apopliktiki, attoniti and syderati*”.<sup>1</sup> The term “apopliktiki” etymologically derives from the Greek verb “πλήττω” (pletto), which means to strike down, or to stun, while in modern lexica as a noun (Greek: πλήξιη, plexes) has an identical meaning with the “stroke”. Thus, “*the organic paralysis due to reduced blood supply of the brain*” (Greek fragment:

οργανική παράλυση λόγω μειωμένης αιματώσεως του εγκεφάλου),<sup>2</sup> it was tightly connected throughout the centuries with the acute brain disease known today as the "acute stroke".<sup>3</sup> In some cases, the modern scientific still uses the term "apoplexy". The two Latin terms "attoniti and syderati", the former derived initially from the word "attonitus", which meant thunder-struck or stupefied, and the latter from the word "sideror", which meant "to be planet-stroked".<sup>4,5</sup> The Hippocratic doctrine, states that the blood was one of the four basic humors considering that this substance contained the very core of human's spirit or vitality (something like the vital force, spirit, or the soul). In "Corpus Hippocraticum" apoplexy was defined as the "Stagnation or blockage of the blood's circulation, whereby all motion and action of the spirit were (suddenly) taken away" from the living human body causing a complete biomechanical shutdown.<sup>4</sup>

The term "apoplexy" was introduced in medical terminology by Hippocrates (ca 460-377 BC) (Fig 1) and his followers used the term between 5th and 4th century BC.<sup>5</sup> It was considered to be a nosological entity which contained a number of neurological diseases such as stroke, cranio-cerebral lesions, tumours and degenerative brain diseases, as well as other pathological forms, not always restricted to the central nervous system. Meanwhile, "apoplexy" was also considered as a symptom for other conditions, including a series of visceral organs' pathology (brain, heart, liver, kidneys and more).<sup>6</sup> The Hippocratic School



**Figure 1.** Hippocrates, comparative anatomy and neurology. Hippocrates studies the skulls of a man and a bull, 16th century woodcut, artist unknown.

of Medicine acknowledged the tripartite dogma for the separation of the soul by placing the epicenter of the mental functions in the brain, thus correlating with it all neurological and mental disorders.<sup>7</sup> Moreover, the brain (Fig 2) was also recognized as a gland, "and the brain is similar to a gland, because the brain is white and soft like the gland... the brain is larger than the other glands". Like any gland, the brain had the function of relieving the body of a possible excess of humors. It is therefore considered as a reservoir, where the humors accumulated, a place from where they were dispersed throughout the whole body mainly towards a "peripheral circulation". According to this theory, "the brain releases the cranium from the humours and sends them out in a stream towards the extremities". If those liquid streams were to be disturbed by the bile (Greek: χολή, yellow or black), or phlegm (Greek: φλέγμα) they were retained in the brain's area, creating an overload of "humours", causing a series of abnormalities, resulting inevitably to "apoplexy".<sup>8-10</sup> The ultimate interruption of this brain (spirit's) stream combined with the restriction, or complete loss of the physical movements, contributed to the recognition of "apoplexy" as a freeze status of all body actions, with a simultaneous lithification (Greek: λιθοποίηση) of the body, as if it had received a powerful sudden blow, a "plexes" (apoplexy). Thus, in modern terms, "plexes" means a complete loss of operation of voluntary muscles movement due to structural lesion of the central nervous system.<sup>8-9,11</sup>

A thorough insight in "Corpus Hippocraticum" reveals the term "Acute Brain Suffering" (Greek: Οξείες οδύνες του εγκεφάλου), a syndrome described with a symptomatology identical to the modern perception of the "acute brain stroke" incident.<sup>12</sup> We must emphasize that in fact "Corpus Hippocraticum" was actually a collection of works, resulting from both the efforts of Hippocrates and the additions further added up by his pupils and followers; a collective series of treatises written by various authors around the 5th-4th century BC.<sup>6</sup> Every ancient Greek medico-philosopher attempted to introduce a



**Figure 2.** An illustration copied in Salerno School around 1250 AD, possibly copied by another illustration possibly Alexandrian circa 300 BC, Andrew P. Wickens, A History of the Brain, 2017.

personal touch of his believes in the medical theories of the era, resulting to a blended and blurred clinical image concerning stroke. As not all apoplexies mentioned were actually a stroke, we have attempted to decipher form inside the "*Corpus Hippocraticum*" the meaning of what we believe it represented the entity stroke itself.

During our study we have performed a thorough bibliographic research of the "Hippocratic Collection" in order to unearth and connect all those fragments from the original ancient Greek text, and attempted to reconstruct the "*Hippocratic Stroke Theory*". Thus, by connecting all text pieces which are relevant to the "*Acute Brain Suffering*", we aimed to compose a distinctive theory concerning the stroke. Three collections have been used as reference, one French "*Oeuvres Complètes d'Hippocrate*" (English: Complete Hippocratic Collection) by Littré, and two Greek "*Ἱπποκράτης Ἀπαντα*" (English: Hippocrates' Opera) by Kaktos Editions and "*Ἱπποκράτης Ἀπαντα τὰ Ἔργα*" (English: Hippocrates' Opera Omnia) by Pournaropoulos. The key terms used in our search were "εγκεφάλω γένηται" (English: born in brain), "οδύνη οξείη" (English: acute suffering), and "αποπληξία" (English: apoplexy).

### Acute Brain Suffering: Physiology and Symptomatology

Hippocrates commented about the diseases of the central neural system, "*In my opinion the diseases that inflict the brain appear with an extremely acute, very severe and seriously dangerous nature, while their diagnosis and treatment is extremely difficult for the inexperienced physicians*".<sup>13-14</sup> His ability to observe, standardize and categorize the injuries of both the brain and the spinal cord, as well as pyretic seizures, epilepsy, cranial and vertebrae fractures after a sudden fall, or an acute trauma was really impressive.<sup>6</sup>

The Hippocratic treatise "*De Natura Hominis*" (On the Nature of Man) introduced the "*Four Humours Theory*" (blood, yellow bile, black bile, and phlegm) being strongly influenced by the earlier theory of the "*Four Basic Elements*" of life (air, water, fire and earth), which should be considered to be a reflection of the Empedoclean philosophical poems.<sup>15</sup> For Hippocrates and his followers, a normal quantity of blood inside the human vessels was the main contributor to a healthy life, but when it was in excess, it could cause a severe pathology.<sup>16</sup> The Hippocratic School was the first to mention the thick and dense blood, "*the solid blood*" (Greek: αἷμα στερεόν), to describe a clot.<sup>17-19</sup> Hippocrates had apparently understood that the blood could be clotted, probably as a result of his extensive work with dissected animals, since human body was considered sacred, not to be touched. The following fragment testifies that; "*if however, someone disturbs it, it does not coagulate due to its fibers which are cold and sticky*" (Ancient Greek fragment: Ἦν δέ τις αὐτὸ τυνάσσει, οὐ πύγνεται αἰ γὰρ ἰνες εἰσι ψυχραὶ καὶ

κολλώδεις).<sup>20-21</sup> Inside "*Corpus Hippocraticum*" we have probably encountered the first reference of the word "*thrombus*" (Greek: θρόμβος, clot) used to describe fluids' coagulation.<sup>22</sup> According to the Hippocratic views any "*humour*" blockage (trauma, clot) could cause an excess of "*humours*" in the brain area, resulting to "*apoplexy*".<sup>6</sup>

When describing the wide cluster of diseases and symptoms under the term "*apoplexy*", Hippocrates, recognized an entity named inside his collection as the "*acute brain suffering*".<sup>23-24</sup> According to his cautious observations its definition was the following; "*there is also another disease, which appears with a concentration of fluids within the brain (oedema or haemorrhage), acute strong pain in temporal and/or parietal lobe area (sudden headache with no cause), with a simultaneously appearance of shivering and fever in waves. The patient feels a kind of anguish pain in the area of his eyes (around orbital wall), his vision is afflicted, the eye pupil is divided (dilation, mydriasis?) and his thinks that he sees two objects instead of one (blurred vision, diplopia?). When he attempts to rise from his position (initially fallen to the ground, stroked down) he is conquered by vertigo (loss of balance, ataxia?), his ears bell, he vomits, while sometimes looses saliva, phlegm (salivation, face drooping, convulsions?), and aliments*" (Greek fragment: Ἐτέρη νόσος ἣν ὕδωρ ἐπὶ τῷ εγκεφάλῳ γένηται, οδύνη οξείη ἰσχει διὰ τοῦ βρέγματος καὶ τῶν κροτάφων ἄλλοτε ἄλλη, καὶ ρίγος καὶ πυρετός ἄλλοτε καὶ ἄλλοτε, καὶ τὰς χώρας τῶν ὀφθαλμῶν αλγέει, καὶ ἀμβλώσσει, καὶ ἡ κόρη σχίζεται, καὶ δοκέει ἐκ τοῦ ἐνὸς δύο ὀράν... καὶ ἣν ἀναστή, σκοτοδινίη μιν λαμβάνει... καὶ τὰ ὅτα τέτριγε... καὶ ἐμεί σιέλα καὶ λάπην, ἐνύτε δὲ καὶ τὰ σιτία).<sup>24</sup> In a following text fragment the description continues, "*the patient does not feel anything, not even when touched (tweaked) by others (loss of sensibility), looses control of both the anal and bladder sphincters, in such a way that in the early stages he has neither faeces, nor urine, and can void himself only under medication treatment (cathartics). In the next stages, when the disease progresses, that changes to involuntary defecation and urination (incontinence), and then, death is near*".<sup>25</sup> The Hippocratic School considered "*blockage of the brain as fatal*". Thus, when a disturbance of fluid flow occurred, for example when the blood vessels of the head were heated up, attracting phlegm, its excess could cause a fluids-humors stream discontinuance,<sup>26-28</sup> while "*paralysis and bile vomit are fatal symptoms*".<sup>22,29</sup> This fragment may also imply that a heating of the cranial vessels could immerge by other conditions beside trauma, like psychic, mental anguish, sudden terror, increased cardiac rhythm (heart was strongly connected to the brain, testifying a broaden physiology when a disturbance of the humours, homeostasis was in place.

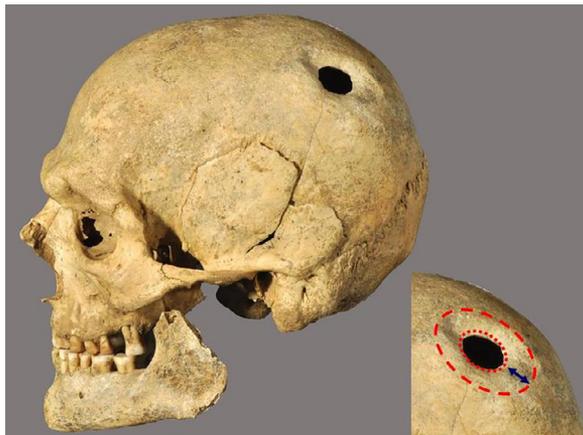
Hippocrates was not only a great clinician but a pioneer epidemiologist too. With his method of thorough observation he had precisely understood that these incidents "*inflict mainly people between 40 to 60 years of age*", while he had also described death from what seemed to be a

subarachnoid hemorrhage incident, "from the moment of the appearance of the brain suffering, absolutely healthy individuals fell, remaining speechless (aphony), presenting rhonchus breathing (antemortem), while they die within 7 days from the appearance of the fever"; a fact that indicated the great significance given to prognosis.<sup>30-31</sup> Surprisingly, he had understood the huge role of the vascular system, mainly this of the carotid arteries, "there is a wide vascular tract for the blood perfusion of the brain, most of them thin, with the exception of two big vessels, the carotic arteries". He had also observed the coma (named again as apoplexy) after the sudden blockage of the blood's circulation inside those arteries, naming them after the ancient Greek term "caros" (Greek: κάρος), which meant deep "sleep" (Fig 3).<sup>30</sup> He had also stated that "unaccustomed attacks of numbness and anaesthesia" (most probably the first description of transient ischemic attacks) precede the suffering and may predict an oncoming acute incident.<sup>32</sup> Thus, according to the Hippocratic School, an "acute brain suffering" (the stroke) could be classified as a hemorrhaging (fluids concentration) and ischemic (blood flow blockage).

### Treating Acute Brain Suffering

In "*Corpus Hippocraticum*" the treatment proposed concerning the "acute brain suffering" was divided into conservative, based in herbal medicine and minerals and for the heavier cases into invasive, and focused in cranial trepanation (trephine), a well-known surgical procedure of the era systematized firstly by the Asclepiads, at least since the early Bronze Age.<sup>33-35</sup>

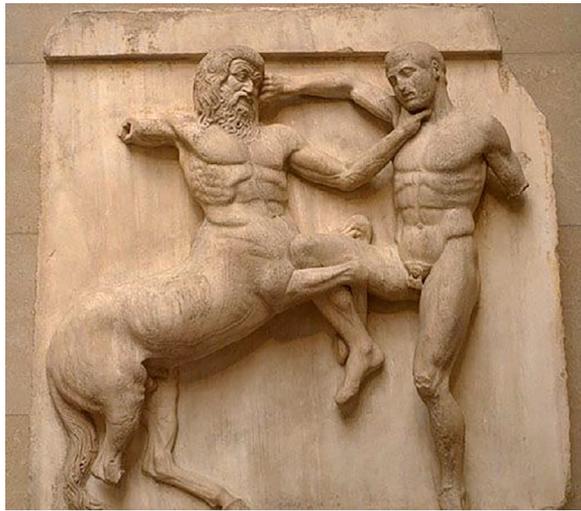
For the conservative treatment a plethora of herbal preparations were proposed. Thus, there had been suggested a series of expectorants such as "*origanum Vulgare*, *Hyssopus officinalis*, *Thapsia garganica*, *Veratrum album*, *Ecballium elaterium*, *Scilla Maritima*, *Cyclamen Persicum*,



**Figure 3.** The 31st metope from the south side of the Parthenon in Athens depicting the battle between the Centaurs and the Lapiths at the wedding of Peirithus, the king of the Lapiths. The left carotid artery of the Lapith is here being intentionally compressed to induce unconsciousness, Elgin Marbles, British Museum.

*Centaurea Centaurium*, *Sinapis*, *Cuminum Cyminum*, *Salvia Officinalis*, *Raphanus Sativus*, *Lepidium Sativum*, *Piper Nigrum*, *Satureja thymbra*, *Ruta graveolens*, *Capparis Spiosa*, *Seseli Ethiopic*, *Oli-banum*, *Myrrha*, *Galbanum*, *Apples of pinus pinae*, *Arum Maculatum*, *Dracunculus*, *Tussilago Farfara*, *Amygdalus Communis*, *Punica granatum*, *Sesamum*, *Daucus carota*, *Psoralea Bituminosa*, *Artemisia Abrotonum*", of cathartics such as "*Mercurialis Annu*, *Brassica Oleracea*, *Amaranthus blitum*, *Beta Vulgaris*, *Allium Sativum*, *Allium Porum*, *Allium Cepa*, *Apium Petroselinum*, *Sinaris nigra*, *Coriandrum Sati-vum*, *Mentha Pulegium*, *Adiantum Capillus*, *Thymus Calamintha*, *Sisymbrium Polyceratium*, *Origanum Heracleoticum*, *Satureja Capitata*, *Eryca Sativa*, *Ruta Hortensis*, *Athamanta Cretensis*, *Daucus Carota*, *Cucumis melo*, *Cucuriba lagenaria*, *Pix*, *Lens culinaris*, *Phaseolus vulgaris*, *Sambucus Nigra*, *Urtica Portulaca Oleracea*, *Aprlenium Ceterach*, *Portulaca Oleracea*, *Caucalis Daucoides*, *Menthe Sativa*, *Vitis Vinifera*, *Ficus carica*, *Punica granatum*, *Castanea*, *honey*", of anti-edematous and diuretic medication such as "*Allium sativum*, *Allium ampeloprasum*, *Allium cepa*, *Petroselinum crispum*, *Mentha*, *Adiantum Farleyense*, *Ruta graveolens*, *Thymus vulgaris*, *Foeniculum*, *Apium Graveolens*, *Crithmum Maritimum*, *Fraxinus Exelsior*, *Meloe Cichoreus*, *Lytta Vesicatoria*, *Carabus Lucidus*, *Cucumis melo*, *Asphodelus Ramosus*, *Medicago Arborea*", in an effort to recompensate the disturbed balance of the humors in the brain. According to the Hippocratic medico-philosophers all three categories could have been helpful for the expulsion of fluids in excess. There had also been proposed a series of other non-invasive interventions such as stimulating feeding, sneezing inhaler,<sup>33,36</sup> and a mixture of milk and wine, diluted with water in a half-half proportion.<sup>37</sup>

For the brain to be decompressed, and for the excess of humors to be liberated, a cautious drilling, trepanation, of the cranial bones should be operated, as soon as a thorough examination of the whole head, with the help of a metallic probe (Greek: μήλη), was performed. According to the Hippocratic views, "the bones should be perforated until the end of diploic layer, while the meninges should be left intact. During the drilling the physician should often pull out the drill (Greek: πρίων) from the skull, as it warms up much the bones, and dipped it into the cold water, as the drill could be heated by the constantly rotation, warming and drying the bone, it burns it and causes the bone part adjacent to the intersection a necrosis, greater than it would be without the extreme heat. If someone want to immediately drill and remove a bony fragment to the dura, he should also take many times the drill out and dive it into the cold water. The patient should be cauterized around the surgical wound and a poultice should be applied in a way to cover the cranial gap. Cathartics for the reduction of the visceral fluid volume should be administered, alongside with tranquilizers (mulberries, honey and vinegar, valerian, lavandula) and sedatives (mandragoras, opium, ervum ervillia)".<sup>24,33,38-39</sup> There is evidence that in some cases a livability was observed after trephine, like in the cranial found in Chios (2nd century BC) (Fig 4).<sup>40</sup>



**Figure 4.** The case of the trepanism of Chios with signs of livability, dating from the 2nd century BC, Archaeological Museum of Chios.

## Discussion

Lengthy text fragments were dedicated in “*Corpus Hippocraticum*” for a condition, or in some cases a symptom, named “*apoplexy*”. The term was wrongfully adopted as almost having one and only meaning by (the) modern Western European medicine, that of the “stroke”. However, a condition named at the era “*acute brain suffering*” emerges to be compared to what is today called a brain stroke. The composition of all ancient Hippocratic text fragments referring to this syndrome, unveil a high likely similarity. However, the distinction between an ischemic and a hemorrhagic incident was rather blur, even if we could hypothesize that some fragments implied just that. The Hippocratic School of Medicine, many centuries before modern neurology had tried to systematize central nervous system's disorders, thoroughly described their symptomatology and defined the acute brain stroke. The condition was thought to be transient, which could be treated conservatively, but it could also appear as an installed or hemorrhagic lesion, requiring a more aggressive and invasive surgical therapeutic approach.

Some researchers agree that the fragments about the acute brain pain, and a fallen down speechless patient, implied a subarachnoid hemorrhage, while others note a possible classification as rather difficult.<sup>41</sup> On the other hand a vast majority correctly marked that the first stroke's description should be credited to Hippocrates, while wrongfully thought that the term “*apoplexy*” defined it.<sup>42</sup> This paradox though, does not prove nothing but most probably a loquacious study of the original ancient Greek text, or a continuous plagiarism among the Western European writers.

Hippocrates adopted the word “*apoplexy*” from the ordinary nonmedical language of ancient Greeks, where it was quite commonly used by many authors to introduce

a wide medical definition (not only to describe a stroke).<sup>43</sup> Refuting the Hippocratic School was difficult, and historically the term was favored until the 19th century,<sup>44</sup> when the widely used term “*cerebrovascular accident*” was introduced.<sup>42</sup>

According to the Hippocratics, the only solution for a possible recovery was the cranial decompression. While in the Hellenic peninsula surgery existed since the era of the Aegeans (first native residents),<sup>45</sup> during the Hippocratic era it was recognized as a significant part of the therapeutic approaches. Surgery was soon upgraded, somehow modernized with a plethora of metallic surgical tools, endotracheal intubation, sedatives, anesthetics, cauterization, sutures (mostly made by animal intestines), giving the opportunity for invasive procedures.<sup>46-48</sup> Archaeological findings proved that cranial operations, performed on living men, presented some rate of survivability, provided that the highly elastic dura mater was not damaged either by the traumatic event, or during the surgical operation. An intact dura mater was the most important protection against infections which inevitably led to death in those times. Hippocratic collection described such a cautious approach.<sup>49</sup> Although the majority of the Hippocratic authors considered that “*acute brain suffering*” was an entity characterized by an acute impairment of motion, sensation and mental functions which was somehow of an “*encephalocentric*” origin (encephalos=brain),<sup>50-51</sup> in some fragments of the “*Corpus Hippocraticum*” the “*vascularocentric*” cause was also implied, as inside vessels (brain and carotid branches) the humors constantly flow (Fig 4).<sup>6</sup>

## Epilogue

Apoplexy dominated medicine as a term for centuries, predominantly considered as the synonym of the stroke. The eminent French librarian, medical historian, and classical philologist Charles Victor Daremberg (1817-1872) said once, “*The true protagonists on the stage of medical history are the diseases*”, implying a secondary role for the physicians.<sup>51</sup> However in the case of the “*acute brain suffering*” the Hippocratic doctrine should be added to the leading role, as for such a disease to be understood. Hippocrates and his followers in the eve of medical physiology, in the edge between philosophy and medicine, gave an early definition of what we today call a “*stroke*”.

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