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# Trauma Management in Ancient Greece: Value of Surgical Principles through the Years

Emmanouil A. Pikoulis, M.D., Ph.D.,[1] John C.B. Petropoulos, D.Phil.,[1] Christos Tsigris, M.D.,[2] Nikolaos Pikoulis, M.D.,[1] Ari K. Leppäniemi, M.D., Ph.D.,[3] Emmanouil Pavlakis, M.D.,[1] Evgenia Gavrielatou, M.D.,[1] David Burris, M.D.,[4] Elias Bastounis, M.D.,[2] Norman M. Rich, M.D.[4]

[1]Second Department of Surgery, General Hospital "Asclepion," Voulas, Athens, Greece
[2]1st Surgical Department, University of Athens Medical School, Athens, Greece
[3]Department of Surgery, Helsinki University, Finland
[4]Department of Surgery, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Road, Bethesda, Maryland 20814-4799, USA

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**Abstract. This article surveys in an interdisciplinary fashion the evolution of ancient Greek medicine and traumatology in particular. In sounding out the key methods and themes of Greek medicine, we cite a range of medical treatises and correlate them to the rich evidence of ancient Greek art (iconography), which often is explicit in its depiction of the management of disease and of trauma in particular. The article begins its survey from Homer, our first source of medical information, and highlights the pioneering work of Hippocrates and the secularized professional guild of the "sons of Aesclepius."**

"The doctor must first of all examine the wounded."
—Hippocrates, *On Head Wounds*, 10(Π 1 212, 6L)

## Introduction

Traumatology began in prehistoric times when caring for wounds that resulted from everyday activities such as hunting, the construction of living quarters, and the conduct of war. For thousands of years, because of man's scant knowledge of human physiology and the natural environment, medicine was the preserve of religious officials and functionaries; disease, madness, and bad health in general were believed to be caused by the gods. In the case of the ancient Greek world, the doctor-magus was comparable to an African witch doctor [1]. The early Greek doctor was versed in the secret properties of plants and minerals, from which he used to make medicinal unguents, lotions, salves, and other treatments.

The first Greek doctors also knew how to treat wounds and unavoidably combined practical methods with magical incantations, as we note in Homer's *Odyssey* (Od. 19.455-8). [Homer here reports that Odysseus' wound was bandaged, the flow of blood being checked by means of an incantation.]

*Correspondence to:* Emmanouil Pavlakis, M.D., Kidonion 8-10 Papagos, 15669 Athens, Greece

The resort to religion or magic was only natural in a society that regarded the gods as the bestowers—or destroyers—of health. Yet we already see the beginnings of medical science in Homer. The *Iliad* makes mention of professional doctors such as Aesclepius and his sons Machaon and Podaleirios. All three figures owed their competence to the fact that they had studied under the centaur Cheiron. Homer showed that wounds sustained in battle could be treated in a strictly secular fashion. In the *Iliad* Patroclus (a layman, as it were) performed surgery on his injured companion Eurypylus. Patroclus placed his buddy on a bull's hide, removed the piercing arrow from his thigh, rinsed the wound with warm water, and finally applied an analgesic and styptic herbal drug (Il. 11.844-8).

Homer's *Iliad* and *Odyssey,* in fact, are our first sources of information about trauma management in the Greek (and Western) world. This poet recorded some 147 wounds, of which 106 were caused by spears, 17 by swords, 12 by arrows, and another 12 by slings [2, 3]. The mortality rates associated with such trauma were 42% for arrow wounds, 67% for slingshot wounds, 80% for spear wounds, and 100% for sword injuries (Table 1). The latter type of injury was obviously the most serious, and an eighth century BC surgeon's success rate in its treatment would have been practically nil. By contrast, wounds created by slingshots, arrows, or spears would have been less serious and the success rate commensurately higher. One of the traits of Homeric medicine is that it is, by and large, a secular (i.e., human) activity, although in at least four cases [4] the gods also cured wounds and disease wholly of their own accord—in effect, miraculously.

About two centuries later, by about 500 BC, scientific medicine was developing in Greek society (compare the anatomic investigations of Alkmaeon in southern Italy [5]). The greatest advances occurred from around 450 BC onward, beginning in the "golden age of Pericles" and largely coinciding with the efflorescence of the physical sciences and the arts. The most significant medical figure of this period was Hippocrates.

Born around 460 BC, Hippocrates was a disciple of and later an

**Table 1.** Mortality rates in Homer's *Iliad* and *Odyssey*.

| Cause of death | Incidence (%) |
|---|---|
| Arrow wounds | 42 |
| Slingshot wounds | 67 |
| Spear wounds | 80 |
| Sword injuries | 100 |

instructor attached to the medical guild of the Asclepiads on the island of Cos. In the *Iliad* the Thessalian hero/demigod Asclepius was the best of the Achaian doctors. Because he raised men from the dead, he was (according to one version of the myth) punished by Zeus, who killed him with a thunderbolt. He was worshipped as a local hero particularly at Epidaurus and Cos possibly by the late Archaic Period (ca. 500 BC). The relation of the sanctuaries of this hero cult to the Asclepiadai, or "sons of Asclepius," is controversial. Although by Plato's time claiming common descent from the hero (as well as common knowledge of his medical therapies), these physicians and their schools were more in the nature of a secular *koinon,* or professional guild, than temple doctors [6]. The principles of the new science spread rapidly, and Hippocrates himself was instrumental in bringing medicine into the secular sphere. In his opening comments on the sacred disease epilepsy [*Sacred Disease* 1 (VI.352, 1-9 L)], he explained it strictly in terms of natural, not divine, causes.

At the various Asclepiea throughout the Greek world, doctors were equipped to deal with, among other cases, trauma and fractures, and they used numerous surgical instruments. The theory and practice of these guilds grew by the fifth century, crystallizing into a formidable corpus that no single physician could master, far less memorize. It was at this time that Hippocrates presumably felt the need to commit some part of this expertise to record. No one, either in antiquity or now, has been able to determine which works of the so-called Hippocratic corpus are by him [7]. Of the approximately 60 "Hippocratic" treatises assembled into a loose, noncanonical collection by Alexandrian scholars and lexicographers during the third century BC, at least six are concerned with surgery. Of these, *On Head Wounds* was the most widely studied from the Hellenistic Period until the Renaissance and well into the early twentieth century. This book stresses the importance of carefully questioning the patient (if possible) to determine the precise location and extent of the head injury (e.g., 14.32 f.L.) when it is not subject to inspection. Like other Hippocratic works, *On Head Wounds* correctly links giddiness and loss of consciousness to brain damage caused by a skull fracture or contusion. According to this work, an injury to the left temple region causes spasms on the right side of the body and vice versa [3]. What is more, the treatise on head fractures recommended trepanation during the first 3 days after the injury to prevent a collection of intracranial suppuration in fissures.

*On Fractures,* which has a good claim to being by Hippocrates himself, gives a coherent account of dislocations (e.g., of the foot and ankle) and fractures (e.g., of the forearm and upper arm, compound fractures). *On Joints* details, in no fewer than 12 chapters, dislocation of the shoulder joint. Chapters 2 and 3 advise the physician to place his fist or preferably his heel on the armpit of the patient and to pull his forearm; in doing so doctors reduced a dislocated shoulder in a "manner compatible with nature." In the opening chapter of *On Fractures* Hippocrates opines that the ideal position of a restored fracture is "as straight a line as possible," a position that complied entirely with nature. As these two treatises

**Fig. 1.** Nosebleed. Attic amphora, ca. 530 BC. London, British Museum B 295. (From the British Museum, with permission.)

show, Hippocratic doctors carried out the débridement of bone fragments before reducing dislocations and setting bones by means of casts. The various manipulations prescribed for the reduction of dislocations in *Joints* are still in use today.

One dominant strand of Hippocratic pathology explained disease in terms of an imbalance of the two vital humours (or fluids), bile and phlegm; this arose when these fluids became "too dry or too wet or too hot or too cold" as a result of external factors, such as food and drink (*Affections,* ch. 1; *Diseases,* I, ch. 2). Of course ill health could also be the consequence of "exercise and wounds." Either way, conservative therapy was invariably enjoined in the first instance. When drugs proved ineffectual, however, specifically in cases of accidents, surgical intervention was recommended. Surgery was, in fact, exclusively concerned with accidental injuries such as the one pictured on a sixth century BC Attic vase (Fig. 1). The boxer on the left is bleeding profusely through the nose. [The visual arts of the ancient Greeks, their vase paintings, gemstones, frescoes, and other art reflect their daily life. It is not surprising, therefore, that these arts have also preserved snapshots of trauma and its treatment in ancient Greece. See especially: St. Geroulanos and R. Bridler, *Trauma* (Greek translation, Athens, 1998; original German, 1994), with illustrations.]

War was a common cause of injuries. In a vase painting from about 560 BC (Fig. 2) a duel is in progress. The warrior on the left has pierced the left shoulder of his opponent. The tip of the spear

**Fig. 2.** Duel. Lakonian water jug, ca. 560 BC. Rhodos Museum 15373. (From the Rhodos Museum, with permission.)

**Fig. 3.** Implant of a leg following amputation. Etruscan vase. (Photograph by Giraudon. From the Louvre Museum, with permission.)

seems to be coming out of the region of the scapula. Between the two lies someone who is hemorrhaging from the heart.

As noted above, the relation between religious worship at the Asclepiea and the progressive development of hospitals and training sites is unclear. Most Asclepiea were located either outside or at the margins of the town. By contrast, medical practitioners seem to have become an urban phenomenon, usually opening their clinics and nursing homes in cities. In a bas-relief from the temple of Asclepius at Athens, ventouses, or cupping devices, are conventional artistic emblems of a doctor. The implement case pictured between them was virtually a trademark of a surgeon in ancient times. Figure 3 suggests that surgeons fitted limbs once the healing procedure of coloboma was carried out: The one-legged Figure 4 man at the middle is probably waiting for this procedure to be performed.

**Fig. 4.** Doctor's surgery. Attic aryballos, ca. 480 BC. (From the Louvre Museum, with permission.)

The Hippocratic treatise *On the Surgery* describes the consulting room. Although registering the importance of proper lighting, clean bandages, correctly placing the patient on the surgical table, and using correct bandaging techniques, the author overlooked the need for a clean surgery. In the same book he recommended using as few and as simple instruments as possible. This ensured simplicity of the procedures as well as facilitating the washing and sterilization of the instruments. The recommendation that the surgeon's fingernails be neither too long nor too short was also dictated by Hippocrates' premium on an uncluttered, expeditious procedure. The instruments themselves (e.g., needles, saws, drills, chisels) were for the most part made of bronze, although iron tools were also used (e.g., scalpels, knives, phlebotomy instruments).

Surgeries were well stocked, as doctors bought their materials (e.g., drugs, iodine, laxatives) from shops specializing in plants and herbs. Throughout the ancient Greek and Roman periods, opium was in common use both during and after operations. Doctor's offices also had rooms for the medical staff and for the treatment and accommodation of patients. The walls of these buildings had recesses to support the pulleys used; doctors were assisted by apprentices and slaves, but slaves were never allowed to practice medicine in their own right. [See especially St. Geroulanos and R. Bridler, *Trauma* (Greek translation, Athens, 1998; original German, 1994), with illustrations.]Surgery during the Roman Period (i.e., from

**Fig. 5.** Achilles tying the left arm of his companion Patroclus. Attic Kylix, ca. 500 BC. Antikensammlung, Staatliche Museen Zu Berlin-Preussischer Kulturbesitz [Antiques Collection, State Museums of Berlin, Prussian Cultural Heritage], F 2278. (Photograph by Johannes Laurentius. From the Antikensammlung Museum, with permission.)

about 146 BC) was deeply affected by Greek precedents and reflected traditional Greek therapeutic practices. The first Greek physician-surgeon known to have settled in Rome was Acagathos of Sparta (200 BC). Arguably the most influential surgeon in Rome was Asclepiades from Bithynia (120–70 BC), a Greek whose treatment of Roman legions made a lasting contribution to traumatology.

Ancient Greek doctors systematically employed bandages. They preferred cloth shaped like wheat stalks, which they tied double and diagonally to fasten it at the slender end. In Figure 5 Achilles, who is kneeling, is carefully applying a white bandage on the left arm of his companion Patroclus after having removed the arrow from the wound. The patient is helping with his right hand but turning his head aside. His stiff position and his outstretched left leg suggest that the wounded warrior is flinching.

As in other cases, bandages for the head and face were applied according to a set procedure. During the second century AD the renowned physician Soranus of Ephesus offered a special class in tying bandages: In a miniature illustration featured in a manuscript of Soranus' handbook *On Bandages* [Florence, Biblioteca Medica Laurenziana (ms. 74, 7; 9th/10th centuries)], there are two ancient styles of head bandage—the romvoit bandage and the helmet type—both of which were used to stabilize the bone fragment and to tamponade the bleeding sources (Fig. 6).

In his book *On Wounds* Hippocrates stated that such wounds should be washed in clean water or wine, but they must not remain moist because the dry element (not the wet one) is conducive to good health. Rest and immobility are crucial to the healing of the wound. Hippocrates then related the symptoms of purulence in a wound. Sutures should be soaked in hot olive oil, he noted, a method that evidently sterilized the sutures. For severe trauma (and compound fractures) of the limbs, he recommended tightly bound bandages to achieve necrosis. When the necrosis occurred,

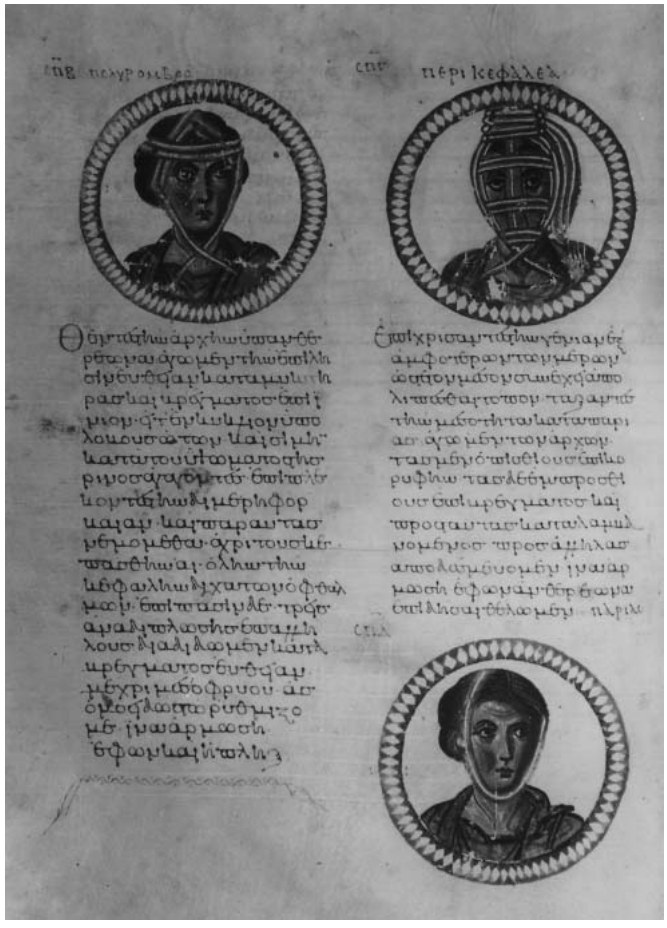

**Fig. 6.** Typical ancient head bandaging. Firenze, Biblioteca Medicea Laurenziana Ms. Laur. Plut. 74.7. (With permission from the Ministry of Cultural Goods and Activities.)

**Fig. 7.** Warrior bandaging the wounds of a comrade after a battle. Etruscan bell-shaped Krater, ca. 380 BC. Crater Inv. 4026. (With permission from the Ministry of Cultural Goods and Activities.) Firenze, Museo Archeologico Nazionale Inv. 4026. Picture from: Toellner, Vol. 1, p. 201. (From the Museum Archeologico Nazionale, with permission.)

**Fig. 8.** Machaon bandaging Menelaos' thigh wound. Ancient gemstone. Antikensammlung, Staatliche Museen Zu Berlin-Preussischer Kulturbesitz [Antiques Collection, State Museums of Berlin, Prussian Cultural Heritage]. (Photograph by Isolde Luckert. From the Antikensammlung Museum, with permission.)

the limb eventually fell off on its own, and the lives of many patients were thus saved.

Returning to the topic of battle injuries: Because of the small number of doctors, who were themselves often wounded in battle, laypersons were known to have attended to casualties, much like the Good Samaritan. In a Chalkidian amphora dating from about 520 BC [see G. Carstensen, H. Schadewaldt H. & P. Vogt, *Die Chirurgie in der Kunst* (Düsseldorf-Wien, 1983), p.73] the Homeric hero Sthenelos is bandaging the right index finger of his companion Diomedes in an ad hoc manner. Both are near the battle scene, Diomedes is still wearing his helmet and armor, ready to join the battle again, whereas Sthenelos has removed his helmet to carry out his medical procedure unhindered. [See St. Geroulanos and R. Bridler, *Trauma* (Greek translation, Athens, 1998, p. 85; original German, 1994) whose interpretation of Figure 7 we have adopted.]

Figure 7 shows a warrior bandaging another soldier who has been wounded in the joint of his right hand (the radiocarpal joint). Note the right section of the vase painting. The painter probably sought to depict the aftermath of a fracture of the radius of the forearm. The scene takes place during a lull in a battle: Two other men are already sitting; one is so fatigued he falls into a deep sleep. Everyone seems to be expecting a renewal of hostilities.

First aid offered by a friend was not always enough. Some injuries required the specialized intervention of a surgeon. Army doctors in antiquity were mainly accident surgeons-traumatologists who had to treat injuries (e.g., fractures, extensive injuries, foreign objects lodged in the body) in a nonconservative manner. [See St. Geroulanos and R. Bridler, *Trauma* (Greek translation, Athens, 1998, p. 85; original German, 1994.]

**Fig. 9.** Attic pelike, ca. 450 BC. London, British Museum E 382. (From the British Museum, with permission.)

**Fig. 10.** Decorative relief from Herculaneum, first century BC. Napoli, Museum Archeologico Nazionale. (Photograph by Alfredo Foglia, Napoli. From the Museum Archeologico Nazionale, with permission of the Ministry of Cultural Goods and Activities.)

This ancient gemstone (Fig. 8) portrays the warrior Machaon (Asclepius' son) and one of the Achaians' two chief surgeons. The latter is tending Menelaus, a scene inspired by the *Iliad* (4. 200-19). As noted earlier, Greek poetry also recorded nonmedical (i.e., apparently miraculous) cures. Telephus, an Arcadian hero who ended

up as King Mysia, was wounded in the foot by Achilles. The injury became incurably purulent; and an oracle told him that "only the man who had caused the wound could heal him." The hero thereupon abducted Orestes and was later healed by the scrapings of Achilles' spear. [Telephos injury and care, see: F. Schwenn *Telephos* (1), RE V/A/1 (1934), col. 362-369, and P. Grimal, *Lexicon of Ancient Greek and Roman Mythology*, translated by B. Atsalos et al., Thesalonika, 1991, pp. 652-654, l. "Telephos."] In Figure 9 Telephus' left thigh is wrapped in an elaborate bandage, and he is holding Orestes hostage. [See St. Geroulanos and R. Bridler, *Trauma* (Greek translation, Athens, 1998, p. 86; original German, 1994), whose interpretation of Figure 9 we have adopted.] This is an Attic vase dating to roughly 450 BC. On a decorative relief from Herculaneum (Fig. 10), Achilles is scraping rust from his spear onto the purulent injury, thus miraculously healing the king. Telephus is seated on a broad stool and leaning on a long walking cane. As Geroulanos and Bridler also remarked [see St. Geroulanos and R. Bridler, *Trauma,* (Greek translation, Athens, 1998, p. 86–87; original German, 1994)] that bronze rust causes static electricity when scraped across the surface of a wound and so kills the surrounding bacteria.

One of the top priorities of Homer's surgeons was the mechanical débridement of a combatant's wound, which cleansed it of dead tissues. After cleansing the wound with pure water, they rinsed it in a mixture of water and wine and then covered it with clean bandages soaked in wine. The antiseptic effects of such a procedure were recently confirmed by a group of Canadian researchers, who showed that even in a 10% solution of wine mixed with water the polyphenols in wine (or vinegar) kill various bacteria [3]. This group also showed that polyphenols disinfect a wound within 3 to 4 hours. As already noted (cf. *Iliad* 11. 844-8), Homer's doctors were also aware of the analgesic and styptic qualities of certain herbs (e.g., dictamon) when they were applied to wounds.

Finally, whenever a doctor was unable to remove an object from a wound, it was dislodged by wound exploration and by removing the surrounding tissue. The ancient gemstone formerly in the Berlin Antiquarium shows just this kind of intervention: a surgeon removing a spear from the right thigh of a warrior.

We close by returning to Homer, our first witness of ancient Greek medicine. Machaon, he tells us, was the Achaian's chief trauma specialist. He was a fine doctor and a brave warrior; and he eventually died in action. When he was wounded in the shoulder by Paris (*Iliad* 11. 505–520), the Achaians were deeply alarmed because, as Homer noted, "the life of a doctor is worth that of many men." The poet is right: An army certainly has a vested interest in its doctors. More importantly, Homer's words show how grateful ancient Greek society generally was to those who managed trauma.

**Résumé. Cet article passe en revue l'évolution de la médecine grecque ancienne et de la traumatologie en particulier. En cherchant les méthodes et les thèmes principaux de la médecine grecque, les auteurs ont pu trouver plusieurs traités médicaux qu'ils ont corrélés avec l'iconographie riche de l'art grecque ancien souvent très explicite dans sa description du traitement de la maladie et de la traumatologie en particulier. Cette revue commence à partir de ‹‹Homer››, qui est notre première source d'information médicale, et souligne les travaux de pionnier qu'était ‹‹Hippocrate›› ainsi que la confrérie professionnelle séculaire des ‹‹fils d'Asclépias.››**

**Resumen. Se realiza una revisión interdisciplinaria de la medicina de la Antigua Grecia, especialmente por lo que a la traumatología atañe. Investigando sus procedimientos y los términos de la Medicina Griega, los autores recopilan una serie de tratamientos médicos que correlacionados con la rica iconografía de los textos, ofrecen descripciones explícitas del tratamiento de diversas enfermedades y particularmente, de los traumatismos. El artículo revisa la obra Homero, nuestra primera fuente de información médica, realzando los trabajos pioneros de Hipócrates, así como los de la cofradía profesional secularizada de los denominados "hijos de Esculapio."**

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