



The Asclepian art of medicine and surgery

Pantelis Limneos¹ · Andreas Kostroglou² · Spyridon Sioutis¹ · Konstantinos Markatos³ · Theodosios Saranteas² · Andreas F. Mavrogenis¹ 

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Abstract

Purpose To summarize the available information from mythology, archeology, and classical literature aiming to compose the image of Asclepieia, Asclepius, and the Asclepiads, and to depict the atmosphere of medicine in its infancy.

Method A thorough literature search was undertaken in PubMed and Google Scholar as well as in physical books in libraries to summarize the pharmacies and pain practices used for trauma in ancient Greece.

Results The antiquity of medicine is confirmed by the worship of God Apollo and Asclepius, who were the persons who possessed the knowledge of medicine and surgery, and delivered it to mortals. The available archaeological data, stone offerings, and inscriptions from Asclepieia were the first testimonies of divine and human knowledge and provide insights on individual cases of patients cured by the Asclepiads. Sparse descriptions offer a first glimpse of the methods and means used by the first priests-physicians for wound healing and diseases treatment.

Conclusion Asclepieia established the roots of medicine and the first step of human knowledge, and contributed to the field of surgery and pharmacology that gave birth to the rational medicine. With Hippocrates and his research, the circle of Asclepieia ended, and the era of the organized medical schools with theories and experiments on every aspect of medicine begun.

Keywords Asclepius · Asclepieia · Ancient Greece · Medicine · Surgery

Introduction

Medicine is inseparably linked to the presence of man on earth because of the need for wound healing and disease therapy. Prehistoric men without language and culture focused on every experienced disease instinctively to plants and herbs; these pharmacies progressed after millennia of evolution to modern treatments [1–3]. The first references surrounding the early steps of medicine move to the fine line of mythology and date around the fifth to fourth century BC. The first medical institutions and centres of medical knowledge were the Asclepieia [4]. This is considered the era of those who with their apprenticeship in Asclepius and their writings formed medicine as a

coherent and rational body of knowledge and practice [1–4]. Yet, in that era, the ancient people were trying to understand the institution of Asclepieia in mythology fiction, with supernatural elements and unproven divine factors in the fine line between superstition and science, exaggeration, and realism. The available archeological data, stone offerings, and inscriptions from Asclepieia were the first testimonies of divine and human knowledge and provide insights on individual cases of patients cured by the Asclepiads [4]. Sparse descriptions offer a first glimpse of the methods and means used by the first priests-physicians for wound healing and diseases treatment [5–7].

This historical note summarizes the available information from mythology, archeology, and classical literature aiming to compose the image of Asclepieia and the Asclepiads, and to depict the atmosphere of medicine in its infancy.

✉ Andreas F. Mavrogenis
afm@otenet.gr

¹ First Department of Orthopaedics, National and Kapodistrian University of Athens, School of Medicine, 41 Ventouri Street, Holargos, 15562 Athens, Greece

² Second Department of Anesthesiology, National and Kapodistrian University of Athens, School of Medicine, Athens, Greece

³ Kapandriti Medical Center, Athens, Greece

Apollo and Asclepius

The antiquity of medicine is confirmed by the worship of God Apollo and Asclepius; these were the persons who possessed the knowledge of medicine and surgery and delivered it to mortals. There are four characteristics of God Apollo, son of

Zeus, and Leto, born in the island of Delos: music, foretelling, medicine, and arching (Fig. 1) [1]. Apollo loved dialog and science; in ancient Greek religion, he represented the light of science that never got old but always stayed young and prolific [5, 6]. He symbolized the early philosophical dialog that, with its doubts and spirit of inquiry and questioning had become the matrix of every science. According to the myth, the birth of Apollo symbolized the rise of the philosophical discourse that led people to become acquainted with themselves and the world around them [5, 6]. Apollo is important for the creation of logic; he relieved human from ignorance and dogmatism and instituted pure scientific knowledge. The myths about Apollo symbolized the early stages of scientific thought and the non-dogmatic knowledge that was flowing without stagnation [5, 6]. The foundation of the scientific world is attributed to Apollo who delivered his knowledge and detached humanity from its barbaric custom and superstition [7]. Apollo described a number of pharmacies made from plants, herbs, and roots and taught people a variety of therapies such as thermal and herbal baths, as well as diagnostic methods such as observation and focus on symptoms [1, 2]. Ancient Greeks worshiped Apollo for his therapeutic knowledge and practice [7].

Asclepius (Fig. 2), son of Apollo and Coronis, was born and practiced medicine in the temples of Asclepieia. Archeological studies provided a number of inscriptions with evidence of his practice in addition to the written testimonies of historians mainly of the sixth to fourth century BC, when Asclepius' medicine flourished [7–11]. These inscriptions were found in Epidaurus, Kos, and Miletus that instituted the first hospitals (Asclepieia) of Greek antiquity and ancient world.



Fig. 1 Marble statue of God Apollo (Archeological Museum of Olympia, Ancient Olympia, Peloponnese, Greece)



Fig. 2 Marble statue of Asclepius holding a stick with one twisted serpent (Archeological Museum of Epidaurus, Peloponnese, Greece)

The emergence of Asclepius as a physical and spiritual continuation of Apollo symbolized an evolutionary step in the development of medicine through the centuries. He was the first therapist without delusions and superstitions about human healing, with largely rational methods with very limited influence of religious beliefs. The knowledge and the tradition of Asclepius' medicine continued and preserved within his temples called the Asclepieia [7].

Asclepieia

The praise of Asclepius dates around the sixth century BC with the foundation of his temples named Asclepieia throughout ancient Greece. The Asclepieia were the first medical institutions in history that inaugurated the art of Asclepius [7]. More than 300 Asclepieia have been discovered throughout ancient Greece; among the most famous of the temples were Trikke, Epidaurus, island of Kos, Athens, Corinth, and Pergamon. A visit to Asclepieia as restored by modern excavations reveals a careful and thoughtful insight of their founders and physicians, namely, Asclepius and Asclepiads; these areas were away from urban areas in locations with lush and sunny forest vegetation. They were set of buildings that included the temples of Apollo and Asclepius, around which extensive excavations brought to light theaters, patient shelters, and hospitals where the patients were treated as a soul and

body [7]. Furthermore, the construction of the temples reveals their creators' extensive knowledge of the sanitary facilities [7]. Archeological excavations, except the glorious Doric sanctuaries with tombs and symbols, brought to light hydraulic works for the drainage of dirty water, lavatories, and arcades with sky-lighted rooms to bring in abundant light and oxygen. Asclepius and Asclepiads were aware of the healing powers of the climate and the sun and used them in general and for the management of patients with infectious diseases specifically. The cause of illnesses according to Asclepius' medicine was the disturbance of body-spirit balance and body humours. This notion is based on the idea that human is a dual creation consisting of a material (body) and spiritual (soul) substance; this idea was subsequently adopted in Hippocratic and French medicine [1, 2, 7].

The medicine of Asclepieia was a mixture of herbal medicine, pharmacies, and surgery and involved powerful poisons and antidotes for the treatment of severe diseases as well as the use of therapeutic roots for the preparation of ointments or herbal remedies [7]. In the temples' prophecies, the first reports of surgery are found, interpreting the term "surgeon" as someone who performs technical treatments with his hands [1, 2]. The origin of the four humors theory (blood, phlegm, yellow bile, and black bile) of Hippocrates is found at the Asclepieia. It was thought that an anomaly of the body's humours carried the disease; the theory and related pharmacies were based on herbal remedies found in the abundant florid forests surrounding the Asclepieia [7, 11]. The origin of the four elements theory (fire, air, earth, and water) of pre-authoritarian philosophers is also found at the Asclepieia. It was thought that human was made from raw material of nature; therefore, if the bond of materials was disrupted, a disease appeared. In fact, the term physiology came from the association of the human body and mankind as a whole with nature. The physicians who observed these phenomena could understand a disease and make a diagnosis [7, 11–13].

In Asclepieia, the patients retained the element of faith for cure as well as the mystic of the divine nature of treatments. After the diagnosis was obtained by observation and physical examination, treatment was initiated with purification of the patient (isolation of the individual from the urban environment and offerings to the Olympian Gods); diets with small amounts of meat and mainly soups were administered, and daily baths at sunrise and sunset to relax the body were started [14]. A stone inscription of an Asclepian treatment for patient Marcus Julious Apellas (second century AC) reads as follows: "I, Marcus Julious Apellas, visited the Asclepeion of island Aegina for chronic symptoms of dyspepsia (indigestion). The Asclepiad was Poplios Aelios Antiochos; he recommended to have my head covered for 2 days (it was raining heavily), to eat cheese and bread, celery and lettuce, milk and honey, to wash my hair by myself, to run and exercise, to use lemon-cups and scrub myself at the "wall of hearings" (a place at the

temple where one could hear eerie voices), to scrub in mud (therapeutic properties of mud), to walk bare foot, to soak in wine before entering the thermal bath, to give 1 Attica drachma to the man in charge of the bath, and to sacrifice to Asclepius, Epione and Eleusinian Goddesses [...]; last, he ordered me to put in writing his recipe in this inscription [...]; I left the Asclepeion with gratitude and in complete health" (Fig. 3).

Cleansing lasted from 1 day to 1 week depending on the disease, and then the patient was led to the avaton (holly temple) where he asked for Gods' cure and then he fell into a deep sleep [14]. This sleep was called the Holy Sleep and was instituted by seeds kept in the temples and hypnotic-relaxing and analgesic substances that were opiates such as poppy and ergot that relaxed the soul and body of the patient. An example of such a beverage was the nepenthes, an opiate formulation of wine with sedative properties to reduce stress and ill feeling, as well as artemisia that was administered before sedation for relaxation of the mind and the nervous system [10]. The above constitute the early form of anesthesiology and pharmacology from natural pharmacies with tremendous therapeutic value. Healing was performed during the Holy Sleep with the patient accepting Gods' methods but in reality, it was the Asclepiads' methods. The Holy Sleep cannot be explained with current data. In the Asclepian medicine, the human was considered to be constituted by a material as well as an ethereal body; therefore, treatment included

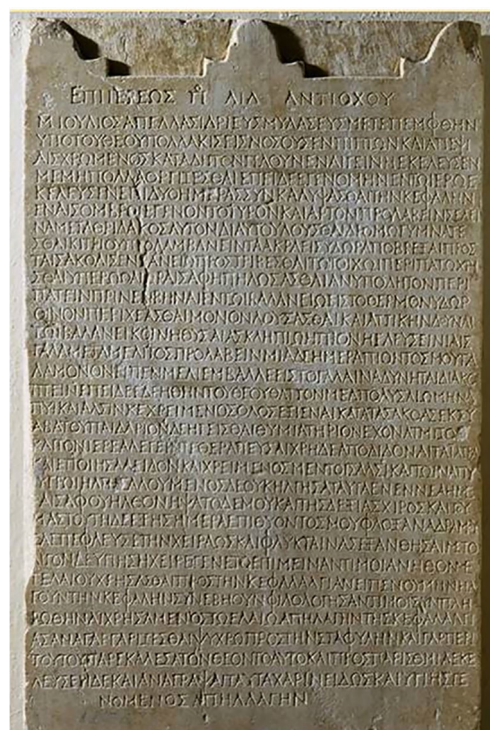


Fig. 3 Stone inscription of an Asclepian treatment for patient Marcus Julious Apellas (second century AC, Archeological Museum of Epidaurus, Peloponnese, Greece)

reinforcement of the ethereal over the material body for a healing purpose of the aura [7, 14]. “Anticrates of Knydos was wounded in a battle by a spear in the eyes and was left blind, he was transferred to the Asclepeion [...] while in the Holy Sleep he saw a vision of himself pulling the piece of spear and then reinserting the so-called pupils in his eyes” [11]. “Gorgias from Heraclia was wounded in a battle by an arrow in his lung and was discharging pus from his wound for a year and a half [...] while in the Holy Sleep he saw a vision [...] and then came out healthy by holding the tip of the arrow in his hand” [11].

In Asclepieia, the knowledge of healing was cultivated and a mystic system was created that kept medical knowledge secret in the healthy minds of the Asclepiads clear of superstitions and idiosyncrasies. The Hellenistic world including the art of medicine transferred the medical knowledge of Asclepieia to all humans of the ancient world with the campaigns of Alexander the Great [1–5].

Asclepiads

The priests-therapists who were taught and continued the medical art of Asclepius in the Asclepieia were the Asclepiads. Their mentors were Apollo and Asclepius. Asclepiads were hierarchical aristocratic generations whose ancestry came from Asclepius either naturally as descendants or spiritually after his teachings. Machaon and Podaleirios, sons of Asclepius, treated systemic diseases and wounds as reported in Homeric text [5]. Asclepiads understood that the logical and scientific observation of nature contributed to the understanding of phenomena and diseases. Therefore, the pillars of their therapeutic methods were the observation of symptoms to find the causes of the disease, and then the correlation of the symptoms to the human body and soul [7]. For their services, there is no testimony for fees except for the pledge to God. The center of medicine was humanistic so it was ruled by a spirit of humanism; the purpose of the Asclepiads was the common good and not wealth [7].

The generations of Asclepiads safeguarded the tradition of their knowledge by transmitting it through the mysteries of medicine within the Asclepieia from one generation to the next, and to those who were considered worthy to receive this knowledge [7]. To be considered worthy to become an Asclepiad, one had to possess virtues such as faith, justice, temperance, modesty, and freedom. In spite of their status as priests, Asclepiads were not governed by any spirit of competition between religion and science, nor did they confuse knowledge with magic or other fictional elements. In contrast, they faced everything in human nature with a sharp eye that the art of medicine requires. Importantly, for a physician to be considered an Asclepiad, he should have recovered a patient with apparent death (coma) from a disease. In Greek antiquity,

the concept of miracle did not exist. The terms resurrection and miracle referred to ill-conceived situations where Asclepiads kept alive people who were clinically dead. What was interpreted as a miracle by simple people, for the Asclepiads, was the application of knowledge and medicine.

The Asclepiads had profound understanding of the healing properties of plants, herbs, roots, earth, and poisons, as well as the methods for their identification in earth, harvesting and preparation for therapeutic purposes. They were fully trained in the art of medicine from diagnosis to implementation of treatment, as well as to continued education and transfer knowledge: “[...] the power of the humors is the peak and the shapes are the organs of the human body [...]” [8]. “The sacred things are revealed only to sacred people [...] the inexperienced have the right to know them only after being initiated into the mysteries of science” [8]. “The flesh is created by mixing the four elements in equal quantity [...] the nerves are made by the mixture of fire, earth and water [...] the bones are made by mixing two parts of water and earth and four parts of fire” [9]. In this way, Asclepiads “could restore from hell the power of a dead human” [9].

The virtues of the Asclepiads are profoundly described in the initiatory text of the medical oath: “I swear to Apollo, Asclepius, Health and Panacea to teach this art without pay or contract [...] to keep my life and my art clean and unadulterated [...] wherever I go to help patients [...] if it is something that should not be disclosed I will not divulge it and will keep it a sacred secret [...]” [6, 8]. The Hippocratic oath, though a later text, essentially reflected the medical knowledge of Asclepieia, which was initiated by Asclepius, Apollo’s son and pupil, and Hippocrates [8, 9]. Hippocrates, the father of medicine, studied medicine at the Asclepeion of Kos and wrote his treatises there; his writings provided the primary knowledge of pharmacology and surgery.

Asclepian symbols

Medical art in Asclepieia was incorporated into symbols that made the Asclepiads recognizable to one another in the outside world. The symbols depicted laws, values, and knowledge that were not easy to understand by the common people and led to spiritual values through imagery that goes beyond common understanding. Each symbol was a step in the initiation of medical science and expressed the natural sequences that connect the body and the soul, the disease and health, and the methods of treatment in variable diseases [10, 11]. The Asclepiads knew the symbolic language and used it to encrypt knowledge and apply medicine [1, 2, 8, 9].

The Asclepian symbols of medicine had a key element with variable interpretations. The serpent was a sacred feature of Asclepius and was found in all its sanctuaries. The serpent was a chthonic symbol that indicated the two genders, destruction

and death. But at the same time, it was a symbol of life and resurrection, a lunar and a solar element. The twisted serpent symbolized the cycles of life, wisdom, light, and darkness. Living underground, the serpent entered the underworld gaining access to the magic and secrets of the infidels, becoming the master of Gaia against the sun. The upright serpent symbolized the vital energy, the connection between earth and heaven, and the spirit inherent in every organism [7]. For Asclepius, the serpent symbolized the beginning of life, healing, and renewal, and as a good of demons, it was protected by these forces of healing. According to the Greek mythology, the serpent was also called the housekeeper because it was considered the guardian of the house by diseases and mishaps [7, 11].

The Asclepiadic symbol of the serpent twisted around a stick is currently used in medicine (Fig. 4). The wrapped serpent symbolized the forces of ascension and winding and the cycles of life, and it is identified as the spine that forms the axis of the body with the serpent around it as a primordial force. This symbol co-existed with the health-healing and



Fig. 4 The stick of Asclepius with one serpent twisted around it currently used in medicine

resurrection forces of a disease together with death from the disease. In contrast, the symbol of the serpent twisted around a chalice that currently is used in pharmacology (Fig. 5) symbolized pharmacies as an antidote to diseases because the first drugs were effective therapeutic mixtures based on snake venom and their antidotes [7, 11]. The most known Asclepiadic symbol was the kerykeion (κηρύκειον, caduceus) that was depicted by two serpents wrapped around a stick with wings on its top (Fig. 6). The kerykeion was an emblem that combined all Asclepiadic symbols. The wings symbolized the air and divine nature, the stick symbolized the axis of the world that connected the earth and heaven, and the two serpents symbolized the cure (health) and the venom (disease). The kerykeion symbolized the binary of the universe such as the gender (male and female), the matter (fire and water), the health (disease and treatment), the time (night and day), and the ethics (good and bad). The kerykeion represented a symbol of health and happiness that exorcized the diseases and the negative aura of the patients [7].

Asclepian surgery

Asclepius was induced into the art of medicine by his father, God Apollo, and in surgery by Centaur Chiron who was famous for his skills in surgery, wound dressing, and pain relief. Chiron was considered the first who performed surgery for war wounds and fractures [1, 2, 7]. According to the myth, Asclepius had exceptional healing skills; he raised people from the dead that caused the rage of Zeus who killed him by lightning. References to his practice are cloudy with regard to the techniques he used.

Stone inscriptions and first medical literature entitled “On Nature” written by ancient Greek philosophers constituted the first reference to pathological observations with a first description of symptoms as well as references to early chiropractic



Fig. 5 The chalice with one serpent twisted around it currently used in pharmacology



Fig. 6 The kerykeion, a symbol that combined all Asclepian symbols

and surgical techniques. A surgical art was developed mainly in the context of managing war wounds and trauma. Subsequently, understanding of the human body and knowledge of the human anatomy has become more vivid for better treatment of trauma. “A man with an abscess in his belly [...] while in the Holy Sleep in the temple [...] Asclepius cut his abdomen and removed the abscess and restored the skin” [11]. “A man came begging for Gods’ cure [...] he was so blind that his eyes only had eyelids [...] while in the Holy Sleep he saw a vision of the Gods preparing some medicine and opened his eyelids and poured it into his eyes [...] at dawn, he left with both eyes cured” [11].

Asclepius and Asclepiads knew about the use of opioids in anesthesia for invasive surgical procedures. Inscriptions in Asclepieia revealed the first logical of anesthesia and surgery in archetypal forms. Inscriptions provided pharmaceutical

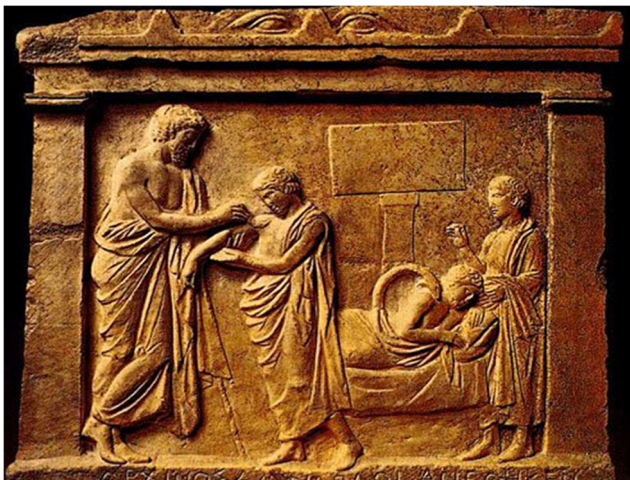


Fig. 7 Marble shows an Asclepiad treating a wound and a man in Holy Sleep (Archeological Museum of Epidauros, Peloponnese, Greece)

prescriptions for the preparation of patches, ointments, and pharmacies from plants, roots, and herbs as anti-inflammatory medications. Essential ingredients of these recipes were flour, vine leaves mainly for wound bladder patches, pine and cypress that were steamed for respiratory diseases and for the preparation of ointments for skin diseases [12]. Equally important was cedar either as a decoction for stomach ailments or as an ointment for wounds and leaves used for spraying for respiratory diseases, a form of nebulizer of the era.

The variety of patients that were admitted to the Asclepieia for cure lead to the evolution of medical and surgical skills of the Asclepiads, specifically for the care of wounds, reduction of dislocations, and reduction and immobilization of fractures. The first interventional specialty that grew in Asclepieia was general surgery practicing on the management of wounds and ileum. The continual treatment of patients with wounds, fractures and dislocations, and skeletal deformities leads to the genesis and evolution of the orthopaedic specialty with a variety of methods and techniques (Fig. 7). At this era, in Asclepieia were found the first documented reports on the management of orthopedic trauma ranging from simple wound dressings to surgical operations. “Dimandros from Gortyna suffered from sciatica [...] God himself insisted that he visited the Asclepieia [...] as soon as he was admitted, God himself treated him (Holy Sleep) and he recovered” [11]. However, in Greek antiquity, there was no distinction between medical specialties; according to Asclepius and Asclepiads, medicine constituted an undivided uniform scientific entity; “He (the Asclepiad physician) reduced and tied a broken leg for Asclepius and a broken hand for Apollo” [11].

Orthopaedic techniques were initially depicted in Asclepian testimonies and were subsequently included as documented orthopaedic knowledge in Hippocratic texts. Asclepiads instituted the basis for the management of bone injuries and wounds, which were further refined and organized in orthopaedic practice by Hippocrates and in medical schools by Galenos; they introduced the current orthopaedic specialty [15].

Asclepieia established the roots of medicine and the first step of human knowledge and contributed to the field of surgery and pharmacology that gave birth to the rational medicine. With Hippocrates and his research, the circle of Asclepieia ended, and the era of the organized medical schools with theories and experiments on every aspect of medicine began.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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