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EARLY EVIDENCE OF CRANIAL SURGICAL INTERVENTION IN ABDERA, GREECE: A NEXUS TO ON HEAD WOUNDS OF THE HIPPOCRATIC CORPUS

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ABSTRACT

This paper presents the case study of a cranial surgical intervention involving head trauma at the right occipito-parietal region carried out during the second half of the 7th century B.C. the Archaic Period, on an adult female individual, a member of a larger group of colonists from Klazomenai, [one of the twelve cities of the Panonian League in Greek Asia Minor], who endeavored to found the city of Abdera (Herodotus: Historia) in Aegean Thrace.

The wound, suspected to have been caused by a sling shot, must have caused a compressed cranial fracture, endangering the dura mater and necessitating a surgical intervention resulting in a 14.78mm by 9.19mm cerebral opening by the method of scraping, as opposed to trepanation, for the removal of bone splinters and possibly of the lodged projectile, for the obliteration of fissure fractures, and for the subsequent therapy of the wound.

Of great importance to medical science is the opportunity afforded by the treated wound which provides a nexus predating the methodological and procedural approaches of the late 5th century B.C. recommended in the Hippocratic treatise On Head Wounds (Hippocratic Corpus: III), specifically as it refers to protocols of examining, diagnosing, and surgically treating and caring for head trauma – a rich legacy of medical knowledge and practice of ancient Greek Medicine.

KEY WORDS: Cranial surgical intervention, Abdera, Head wounds, Hippocratic Corpus
INTRODUCTION
Before the end of the 7th century B.C., a surgeon in the Greek city of Abdera on the northern-eastern coast of the Aegean faced a difficult case. Standing back from his patient, a young woman who lay on the table before him, the surgeon cautiously examined her serious head wound. Normal practice required that the healer ask how the injury occurred, but in this case it was clear from the broken flesh and hair matted with blood that a stone or lead missile hurled from a sling had crashed into the back of her head. Stepping closer, the surgeon gently explored the wound first by hand and then with a probe. As he feared, the missile had landed at a sutural junction which was still unossified at her young age, and which was one of her weakest loci of the cranial structure.

CASE STUDY FROM ABDERA
New evidence, on which this article is based, will further elucidate aspects of the history of the development of Greek medical practice. The patient was among those sent north by Klazomenai, one of the Greek cities of the Panionian League, to establish a colony at Abdera around 654 B.C. She was successfully treated [a difficult operation performed by a master surgeon saved her] and lived for a considerable number of years (Agelarakis 2004a; 2006). Her remains, which were excavated at Abdera (Skarlatidou 1984; 1985; 1987; 1990; 2005), and excavations have revealed many traces of their colony, including its 4.0m fortification walls and cemeteries (Koukouli-Chrysanthaki 1997). In one of the Clazomenaeans burial grounds was the grave with the well-preserved skeleton of the woman who had survived the sling shot and subsequent surgery. From her bones, it was possible to determine that she had died of an unknown cause(s). Her cranial, dental and infracranial axial and appendicular skeleton showed paleopathological changes of both traumatic-infectious and degenerative nature which were not debilitating, however, for she had been relatively healthy and quite physically active as revealed by her skeletal remains and skeletomuscular imprints. Therefore, she was able to contribute to the workings of the community at Abdera.

The locus of surgical intervention (fig. 1, 2 and 3) presents a cerebral ovoid-shaped hiatus at the dorso-cranial norma occipitalis, measuring 14.78mm in length by 9.19mm in width, on a nearly superio-inferior direction and in effect parallel to the sutura sagittalis, surrounded by a larger nearly ellipsoid area of an ascendingly shallower surgical intervention through the smoothed diploic components tapering off at the ectocranial surface and measuring 66.36mm in length by 19.91mm in width and extending from the occipital bone over the lambdoid suture into the right parietal (fig. 4). That the surgeon took considerable time to carefully carry out the operation while using a rasp for the scraping of the bone within the walls of the wound is
clear not only from the morphology of the wound, but also from faintly discernible U-shaped scraping marks, radiating outwards from the cerebral opening and situated in a tightly packed formation approximately 3.0mm wide outlining the border of the cerebral opening. The traces of these scrapings may not disappear entirely through reparative osteoblastic process, therefore remaining traceable for a considerable time after patient recuperation. Each of the U-shaped scraping traces measured a maximum width of ∼0.8mm superiorly, between the lips of their individual outlines, and a minimum of ∼0.4mm inferiorly at their basal component. The recognition of the severity of the traumatic impact on the cranial bones, and the surgeon’s remarkable care, commitment and attention to detail during the application of the medical procedure is further realized by the significantly reduced thickness of the diploic components and endocranial compact table at, and peripheral to, the cerebral opening measuring approximately 1.0mm at locus “c” (fig. 4) and 0.5mm at locus “d”, the latter being embedded into the synarthrotic sutura dentate / limbus at the specific locus of the joint.

When she was hit, the missile crushed the soft tissues of her scalp and caused a serious depressed bone fracture, possibly with the projectile embedded in it, accompanied by fissure fracture(s) endangering [with marginal sharp bone components] the dura mater, the two layered fibrous membrane enveloping the brain, the coarse and richly fibrillated outer surface of which closely adheres to the inner endocranial table, especially at the loci of the sutures. Surgery was needed to remove bone splinters and possibly the lodged missile in order to obliterate the danger of hidden fissure fracture(s), to evaluate the condition of the dura mater if incised and/or exposed, and to apply “healing drugs”, to deter the potential of morbid post-traumatic implications due to inflammatory processes and infectious conditions.

The surgeon, to judge by procedures recommended in the Hippocratic text On Head Wounds, first would have evaluated the injury without touching the patient, then would have touched the wound, and subsequently would have used a probe, if needed, to better diagnose the type, extent, and severity of the trauma. He also would have tried to gather information from the patient and/or witnesses about the circumstances of the injury and the patient’s immediate physiological responses to the impact. Then, he would have proceeded in cutting and opening up the soft tissues surrounding the wound in length and width at the focal point of impact for better visual inspection and preparation for surgical intervention before dressing the wound with a paste of fine barley wheat boiled with vinegar. The next day, after removal of the lint dressing and barley paste he would have further cleaned and dried the soft tissues involved and would have carried out a final diagnosis of the nature and range of the bone injury, possibly applying a treatment of black ink on the cleaned bone followed by an additional application of barley based paste which he would have lint dressed in order to locate on the following day the suspected, invisible, hair-line fissure fracture(s) that in the meanwhile would have been discolored by traces of absorbed ink, and also to examine and care for the condition of the dura mater if it was exposed and/or scratched.

On Head Wounds sets up a procedural protocol for the medical examination and treatment of the patient, as it describes variants of ecctocranial morphologic expressions of human cranial sutural joints, diagnostic procedures for identifying and treating a range of more than seven types of cranial injuries caused by different weapons and episodic circumstances, prognostics for carrying out a conservative or surgical procedure, mode of surgical procedures, time tables for carrying out surgical procedures, and the application of pharmaceutical and curative treatments. In most cases, a wound on the back of the head, where “bone suppuration takes longer where the bone is thicker and oozing puss will take longer to reach the brain” was less likely to be fatal than one in the front. But, “as in the case of the woman from Abdera, “when a suture shows at the exposed bone area of the wound, of a wound anywhere on the head, the resistance of the bone to the traumatic impact is very weak should the weapon get wedged in the suture.” Therefore, according to the Hippocratic text, the case was a serious one. It was made more so because of the nature of the weapon, a missile from a sling, because “[o]f those weapons that strike the head and wound close to the cranial bone and the cranium itself, that one that will fall from a highest level rather than from a trajectory parallel to the ground, and being at the same time the hardest, bluntest and heaviest...will crack and compress the cranial bone.”

Depending on the condition of compressed head fractures, On Head Wounds recommends, after careful diagnosis and preparatory procedures, surgical intervention using trepanation by drilling with rotating cylindrical saw bits to remove a disk of bone from the skull at the locus of impact. This would eliminate the danger of leaving untreated surface bone splinters and radiating fissure fractures. It would also permit the removal of bone components that crushed inward allowing the brain to swell from the contusion without pressing against loose bone elements laden with sharp edges as it had been recognized that an untreated puncture of the dura mater would not have aided in the patient’s recovery. But there was one cranial area where a scraping approach was strongly recommended instead of trepanation: “It is necessary, if the wound is at the sutures and the weapon penetrated and lodged in the bone, to pay attention to recognize the kind of injury sustained by the bone [b]ecause...he who received the weapon at the sutures will suffer a far greater impact at the cranial bone than the one who did not receive it at the sutures. And most of those require trepanation, but you must not trepan the sutures themselves...you are required to scrape the surface of the cranial bone with a rasp in depth and length, according to the position of the wounded, and the weapon...to be able to see the hidden breakages and crushes...because scraping exposes the harm well even if those injuries, although they exist in the bone, were not otherwise revealed...and if you determine that the cranial wound requires an operation you must carry it out within three days...”

Faced with a compressed fracture with radiating fissure fracture(s) and fearing damage to the dura mater, [see differential diagnosis in endnote], the surgeon would have proceeded within the second or third day to scrape the bone in length, width, and depth, removing fragments and eliminating through scraping the fissure fracture(s) using a rasps and not trepanation. He then would have tended to the suppuration of any adjacent injured tissues, applying drug treatments while cleaning and drying all tissues involved. Such an approach, as recommended in On Head Wounds, would nurture the swift regeneration of new soft tissue which, proliferating over the crucial area of the wound and surgical intervention, would aid in the reative, healing, process.
ON THE IMPLICATIONS OF THIS CASE STUDY FOR GREEK MEDICAL SCIENCE

While the reconstruction of the patient’s treatment is in part conjecture, based on the Hippocratic text itself, the size and shape of the surgical intervention and use of the rasp and scraping especially over the locus of a suture, rather than trepanation, is certain from evidentiary data retrieved from the cranial bones themselves. Hence, the particular medical approach that reflects a conceptualized method and surgical procedure matches the course of action that was recommended two centuries later in On Head Wounds for this type of injury in the specific anatomic location of the head. Therefore, the prima facie evidence offered by this case study readily contributes new data in support of both the crucial issues of antiquity, and the presence of ancient elements to be identified in On Head Wounds, as important component of ancient elements of original ownership, tangential issues may not be addressed concerning the specter of original “ownership” of medical knowledge and praxis, and also of the mode of transfer and conveyance of that information [of truly empirical and anthropocentric nature in this particular case] over generational time, about two centuries later, through the treatise On Head Wounds. Consequently, starting with the latter issue this case study offers prima facie evidence reflective of “a unity of method and procedure considerably older than the record in On Head Wounds from approximately the late 5th century BC. Whereas the latter provides a testimonial in support of a medical epistemological environment attained by Greek medical practitioners prior to the advent of the Ionian School of Natural Philosophers, [a significant argument not only about the antiquity but also about the kind of empirical methods versus philosophical concepts the foundation of medical science was based on]", it also pays tribute to the masterful skills of the learned medical practitioner in Abdera, lending further support to the Hippocratic treatise On Ancient Medicine whose author argues that the field of medical art had already been established in an earlier era based on observation and empirical methodological procedures and approaches, rather than as a collateral derivative of philosophical concepts and/or doctrines.

EPILOGUE

Ancient Greek sources offer little aid in tracing the development of medicine before Hippocrates (Kouzis 1929; Jouanna 1999). It is not surprising that the medical historian G. Majno wrote (Majno 1975) that "the beginnings of Greek medicine, which should fill a library, are mostly blank pages." Greek medical writings predating the Hippocratic Corpus have not yet been discovered. Moreover, historical references record [excluding the Homeric poems] the names of few Greek physicians before Hippocrates. The earliest of them is recorded by historian Herodotus who notes that [some time after 522 B.C.] the surgeon Democedes of Kroton [son of Kalliphon] successfully treated the Persian king Darius for a sprained ankle after Egyptian doctors had failed. Democedes had already practiced in Aegina, Athens, and Samos before treating Darius, but that is still a century after the physician of Abdera performed his masterful surgery. Should one look to earlier times, Homer, describes in the Iliad over 140 combat injuries, many of which were inflicted by spear and arrowheads which sliced through flesh and bones. The wounds treated, the weapon extracted, the wounds bound, healing aided by the applications of herb ointments to reduce pain and restrain hemorrhaging—these offer clear indications that the contemporaries of Homer had the ability to fully comprehend, visualize and/or possibly recall, events of such injuries sustained in battle and the life-saving intervention of the physician, who was often implicated in surgical procedure. But in all the Greek army there were few trained physicians, for example Machaon and Podalirios, both sons of the legendary hero-physician Asklepios, son of the god Apollo and Koronis daughter of Phlegyas, the king of the legendary Lapiths. In the battle, Machaon is wounded in the shoulder by Paris’s arrowhead while Podalirios is on the battlefield fighting. Machaon is rushed by Nestor who takes him in his chariot back to camp for treatment “for deserving the lives of many men is the physician who knows how to extract arrowheads and with herbal ointments to cure the wounds” says Idomeneas in the Iliad. Further, Achilles’ comrade Patroclus treats the injured Eurypyllos using a method he learned from Achilles. Who taught both Asklepios and Achilles? According to Homer it was Cheiron the wisest of all centaurs to whom Apollo entrusted the raising and mentoring of his new born son Asklepios.

The narrative of medical interventions of Homeric times, describing treatments and curative capabilities of the Early Iron Age seem rather simplistic when compared to the quantum leap of medical advancements of later Greek medical practice, such as the achievements of the physician at Abdera during the second half of the 7th century B.C. It is proposed that the roots of Greek medical advancements, as reflected in this case study, may be traced to the early migrations of Greeks to the East and West, and their endeavors to claim territory to establish and sustain their colonies. Further, it appears that the sociopolitical organizational changes that ensued with the incipient development of city states during the 9th century B.C. (Agelarakis 2005) and their subsequent emergence in the 8th century B.C. (34) favored a rapid evolution in medical practice, especially the treatment of acute trauma sustained in warfare of hoplite nature toward the end of the 8th century B.C. (Zafeiropoulou and Agelarakis 2005).

While it could not be argued that the Greeks developed sophisticated medical practices entirely in isolation, there is no strong evidence that they drew on an outside
source making the leap from healing in the context of the magical and the occult, the treatments of incipient surgical procedures with application of herbs, to performing the sophisticated head surgery exhibited on the female individual from Abdera which calls knowledge, procedures and empiricism we may now examine further in On Head Wounds of the Hippocratic Corpus.

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Kouzis, A. (1929) Istoria Iatrikis, Athens, Greece.


1 To date the relations between the native Thracians and the Clazomenaeans colonists have not yet been explored independently, by means of archaeo-anthropological research, of accounts available to us through the historical record. Hence, for the purposes of this article and as it pertains to the subject matter of such relations, I have drawn a course using as a compass the historic data of Herodotus, Historia: A:168, which rather underline difficulties in the relations between the natives and the colonists. Hence, hypothetically, the sling could have been hurled by one of the native Thracians intent on the colony’s destruction. Nevertheless, it should be considered that archaeological research detects an uninterrupted sequence of Clazomenaeans activities in Abdera for at least eight decades, cf. Skarlatidou, E. (2000) “Apo to Archaios Nekrotafeio ton Abdiron: Symboloi stin Ereuna ton klazomenion sta Abdira“, Ph.D. Thesis , Dept. of History and Archaeology, Aristotelian University, Thessaloniki. Further, anthropological research with a focus on skeletal biology and paleopathology on the Clazomenaeans population sample recovered so far in Abdera indicates a distinct lack of skeletal trauma, especially among adult individuals, the specific nature of which could offer clues about the possibility of warfare, possibly reflecting an engagement environment characteristic of opportunistic skirmishes and attrition impact on yieldable resources carried out by the natives against the colonists, cf. Agelarakis, A. (2004) “The Clazomenaeans Colonization Endeavor at Abdera in Retrospect: Evidence from the Anthropological Record“. Klazomenai, Teos and...

2 This pertains to the dry skull remains of a female individual the biological sex assessment of which was based on skeletal anatomical morphological traits and metric indices of the cranio-infracranial skeletal structures. The age assessment was carried out based on morpho-anatomical criteria and skeletal indices, as well as developmental and acquired manifestations permanently recorded on the cranial, dental and postcranial remains. Hence, the degree of cranial suture closure indicated an age of ∼25 to ∼35 years, the dental record indicated an age of approximately 45 years, the nature and degree of degenerative axial and appendicular skeletal pathologies indicated an approximate age of ∼35 to 40/45 years, and the morpho-anatomical changes of the iliac auricular surface indicated an approximate age of 45 to 51 years.


4 By Dr. Eudokia Skarlatidou of the Greek Archeological Service.


6 Infra-cranially, on the axial skeleton, there were spindlyloarthropathic changes at several of the cervical and thoracic vertebrae in the form of osteophytic growth [such as lipping], and osteophytic reactions accompanied by traceable porosity at articular facets of the ribs. On the appendicular skeleton there were osteoarthropathic changes in the form of lipping and porosity affecting unilaterally, to a moderate degree, the left proximal humeral articular surfaces, and bilaterally, to a severe degree, the mesial areas of the proximal ulnar articular surfaces; the latter may be suggestive of changes caused by occupational or culturally mandatted circumstances. Further, the right os coxae revealed enthesophytic growth at the area of the superior pubic ramus and right iliac wing, while there are additional coeval burial grounds, such as those in sector "P". And both parietals reveal ectocranial changes caused by inflammatory-infectious reactions [either primary, and/or secondary to the wound with granulomatous layers of depository hyperporous subperiostial bone, basal layers of which had converted into lamellated bone some time before death. The area of reaction is more apparent posteriorly to the bregmatic / vertex region, peaking at the parietal tuberosities and extending over the lambdoid region to the planum occipitale and nuchale. Hyperporosity was also observed at the splenial wings, and at both orbital roofs, however without any hypertostic changes.

7 A: Local enamel hypoplasias as permanent markers of arrested and improved enameloblastic cell growth and matrix deposit, possibly reflective of early life constitutional stress occurring at 3.2 and 4.2 years respectively [causative agents could include but are not limited to childhood diseases, fevers, or even a seasonal environmental stressor, which in both occasions the individual was able to overcome]; b: Mild curve of Spee with homogeneous, moderate to advanced incisal edge and occlusal surfaces’ wear due to functional masticatory modification showing flattened occlusal platforms lacking occlusal cusps with creases of tertiary reparative dentin; c: Maxillo-mandibular / labio-buccal enamel ring surfaces’ micro fractures caused by the preparatory quality of dietary intake and/or combined with habitual conditions of the use of teeth in "third" hand functions; and d: Periodontal disease related changes: i) alveolar ridge hyperporosity; ii) periodontal windows at both maxillary first molars, iii) advanced alveolar bone reduction exposing alveolar foraminal anatomical dental root surfaces further exhibiting invagination with early life constitutional stress occurring at 4.2 years, cavity causing excessive dental movement within the alveolus and enhancing the probability of infectious pathogenity; and iv) moderate accumulations of supragingival calculus deposits. For the demographic and paleopathological profiles of the Clazomenaeonian population at Abdera c.f. Agelarakis, A. (2004) "The Clazomenaeonian Colonization Endeavor at Abdera in Retrospect: Evidence from the Anthropological Record." Klaifornia, Teos and Abdera: Metropolis and Colony, Proceedings of International Symposium. (eds.) Moustaka, A. Skarlatidou, E. Tzannes, M.-C. and Ersy, Y. Thessaloniki, 327-349.

8 Infra-cranially, on the axial skeleton, there were spindlyloarthropathic changes at several of the cervical and thoracic vertebrae in the form of osteophytic growth [such as lipping], and osteophytic reactions accompanied by traceable porosity at articular facets of the ribs. On the appendicular skeleton there were osteoarthropathic changes in the form of lipping and porosity affecting unilaterally, to a moderate degree, the left proximal humeral articular surfaces, and bilaterally, to a severe degree, the mesial areas of the proximal ulnar articular surfaces; the latter may be suggestive of changes caused by occupational or culturally mandatted circumstances. Further, the right os coxae revealed enthesophytic growth at the area of the superior pubic ramus and right iliac wing, while there are additional coeval burial grounds, such as those in sector "P". And both parietals reveal ectocranial changes caused by inflammatory-infectious reactions [either primary, and/or secondary to the wound with granulomatous layers of depository hyperporous subperiostial bone, basal layers of which had converted into lamellated bone some time before death. The area of reaction is more apparent posteriorly to the bregmatic / vertex region, peaking at the parietal tuberosities and extending over the lambdoid region to the planum occipitale and nuchale. Hyperporosity was also observed at the splenial wings, and at both orbital roofs, however without any hypertostic changes.

9 Linear enamel hypoplasias as permanent markers of arrested and improved enameloblastic cell growth and matrix deposit, possibly reflective of early life constitutional stress occurring at 3.2 and 4.2 years respectively [causative agents could include but are not limited to childhood diseases, fevers, or even a seasonal environmental stressor, which in both occasions the individual was able to overcome]; b: Mild curve of Spee with homogeneous, moderate to advanced incisal edge and occlusal surfaces’ wear due to functional masticatory modification showing flattened occlusal platforms lacking occlusal cusps with creases of tertiary reparative dentin; c: Maxillo-mandibular / labio-buccal enamel ring surfaces’ micro fractures caused by the preparatory quality of dietary intake and/or combined with habitual conditions of the use of teeth in "third" hand functions; and d: Periodontal disease related changes: i) alveolar ridge hyperporosity; ii) periodontal windows at both maxillary first molars, iii) advanced alveolar bone reduction exposing alveolar foraminal anatomical dental root surfaces further exhibiting invagination with early life constitutional stress occurring at 4.2 years, cavity causing excessive dental movement within the alveolus and enhancing the probability of infectious pathogenity; and iv) moderate accumulations of supragingival calculus deposits. For the demographic and paleopathological profiles of the Clazomenaeonian population at Abdera c.f. Agelarakis, A. (2004) "The Clazomenaeonian Colonization Endeavor at Abdera in Retrospect: Evidence from the Anthropological Record." Klaifornia, Teos and Abdera: Metropolis and Colony, Proceedings of International Symposium. (eds.) Moustaka, A. Skarlatidou, E. Tzannes, M.-C. and Ersy, Y. Thessaloniki, 327-349.
EARLY EVIDENCE OF CRANIAL SURGICAL INTERVENTION IN ABDERA, GREECE

It is suggested that the surgical tools used were made of bronze.

As seen in a perspective that would simulate sagittor-cornual cuts pending on their location to those plains

Accidental versus malevolent causalities and in the latter case stipulations on the form/shape, weight, and trajectory of handheld weapons or projectiles, cf. On Head Wounds

Significant observations in the variability of human cranial synarthrotic morphologies to be used as anatomic landmarks in medical-surgical treatment

By drying out carefully any excessive secretions and by controlling any gathering of wetness, cf. On Head Wounds

In the case of a wound that would have involved a cranial bone fracture, involving the weaker bone area of the lambdoidal sutureal joint (HW:3). Judging from the morphologic clues retrieved from the locus of surgical intervention and x-ray imaging of cranial surfaces and manifestations, it was assessed that the traumatic event had caused either a deeply penetrating depressed fracture comprising all superimposing tissues to the endocranial table [with the possibility of a wedged projectile into the diploic component], or a depressed fracture with less severe compression effects but accompanied by a fissure fracture(s) reaching the endocranial table; in either case, the endocranial table reveals a surgically manipulated cerebral opening equal to a 14.78mm by 9.19mm fissure fracture(s) using rasp(s)--and not trepanation (HW:12), then he would have tended to the suppuration of all damaged scalp tissues (HW:15) and necrosis (HW:16) of the severed bone fragments at the area of the wound, applying drug treatments while cleaning and drying the wound. Then, after the subsidence of the swelling he would have proceeded to remove any necrotic bone fragments, subsequently carefully overseeing the growth of new, healthy, scalp tissue, applying drug treatments while cleaning and drying the wound. Then, in the case of a wound that would have involved a compressed fracture with wide bone fragmentation, adequate separation of bone fragments, lack of radiating fissure fracture(s) and unharmed dura mater he would have followed a conservative treatment by the surgeon would have proceeded within the second or at the latest third day (HW:14) to scrape the bone in length, width and depth (HW:14) removing bone fragments and eliminating by method of bone scraping fissure fracture(s) using rasp(s)–and not trepanation (HW:12), then he would have tended to the supputation of any adjacent injured tissues, applying drug treatments while cleaning and drying all tissues involvedfollowed up by the treatment for a healthy recovery of the patient (HW:15). In carrying out a differential diagnosis it is suggested that the surgeon had to follow the latter mode of surgical intervention considering the osteological evidentiary data retrieved from this case study.

It is suggested that the surgical tools used were made of bronze.

25 If a headdress, headband or other pertinent cover was recommended in order to both conceal the wound for purposes of aesthetics and/or as a safeguard from accidental puncture wound the sensitive area of the head no relative discernible traces were detected focally, in the specific region of the wound, neither in the larger cranial vault and lateral walls’ surfaces; assessments were carried out at the macroscopic level, under low (45x) magnification, and through x-ray imaging.

26 It is suggested that the wound sustained by the female individual had been caused by a heavy and compact object, cf. On Head Wounds:

27 It is assumed that the surgical tools used were made of bronze.
whereas Machaon (Μάχαιον) etymologically explained by the nouns μάχαιρα (a short sword or dagger of the kind Patroklos used to extract an arrowhead from Eurypyllos’ thigh, q.v. Homer, Iliad: 11.844 and μάχη (battle), as well as the verb μάχωμαι (I am fighting) is translated by the Oxford Classical Dictionary as “Warrior”. Machaon is indeed a warrior but also a medical practitioner in the Iliad; the etymology of his name rather could be explained as relative to surgery and the use of surgical knives to extract penetrating objects [as the Thessalians were known for using the single edged slightly curved sword formidable for its cleaving/chopping and thrusting abilities in battle, q.v. Euripides, Electra:836-837] depicted accordingly in antiquity, as a young individual holding in the left hand botanical medical remedies [c.f. Theophrastus: Enquiry into Plants (Περί Φυτών Ιστορίας)], and in the right hand the scalpel, hammer, and trepanning drill, the earliest surgeon in Greek iconography. The two Homeric physicians were revered as gods for their contribution to Medicine together with their father Asklepios throughout ancient Greece, cf. Pausanias, Guide to Greece (Ελλάδος Περιηγήσεως), Korinthiaka: 16.10; Diodoros, IV: 71.4; Svoronos, I. (1917) “Asklepiaka Mnemeia kai Kionolatreia en Athenas”, Archaiologiki Epitiris, 86-87; Kranioti, L. (1990) “Archaia Epigrafi apo tin Strymi”, Mnimi D. Lazaridi: Recherches Franco-Helleniques, vol. 1, 629-633.

42 “And my ancestor, Asclepius, ...the creator of our art, as our friends and poets here tell us, and I believe them; and not only medicine in every branch, but the arts of gymnastic and husbandry are under his dominion” [said by the physician Eryximachus in his speech on the human body and medicine, Plato, Symposium: 186, cf. Jowett, B. M. A.)1937], The Dialogs of Plato, New York].

43 Pyndar, Python Odes (Πυθικά) 3: A.5-10, B. 24
44 Iliad: 11:505-520
45 Iliad: 11: 809-848
46 Iliad: 11: 832
47 Pyndar, Olympian Odes (Ολυμπιακοί) 3: B.40-46; Pausanias, Guide to Greece (Ελλάδος Περιηγήσεως): 2.26.6
48 Specifically including the Mycenaean cultural elements and the wealth of their accumulated medical traditions
50 A contrario to L. Edelstein who had attempted to propose that there was no incipient science in Greek medical prognosis but rather the result of social changes and ensued pressures on physicians to professionalize their inconsistent methods, q.v. Edelstein, L. (1939)"The Genuine Works of Hippocrates," Bulletin of the History of Medicine, vol. 7, 247-248, and (1967), in translation, In Ancient Medicine: Selected Papers, (eds.) Temkin, O., and C. L. Temkin, Baltimore.