

HOLES IN THE HEAD AND MORE: SURGERY IN THE AEGEAN BRONZE AGE*

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INTRODUCTION

Recently Vivian Nutton wrote that "... for our knowledge of Greek medicine and its physicians before the late fifth century BC, we are largely at the mercy of a combination of later legend and modern plausible speculation, and neither can be trusted entirely".¹ This work attempts to remove some of this speculation, and look at what we really know about one aspect of medicine in the Aegean Bronze Age, the practice of surgery, from the actual pathological, archaeological and textual evidence.

It is not that we do not already know a great deal about the material culture and social and economic structure of the Minoan and Mycenaean civilisations which dominated Crete and the Greek mainland during the second millennium BC, but that only very recently has it been possible to understand something about the diseases and forms of trauma present in the population and how these were treated. This has been painstakingly pieced together from the work of palaeopathologists and an interpretation of the material record. What we do not have, in contrast with evidence from contemporary Late Bronze Age societies of the Eastern Mediterranean and the Near East, is a rich textual record of medical practice. The clay tablets found in the burnt remains of the Mycenaean palaces are essentially storage inventories, and can tell us little about medicine. However, whilst there are no soft-tissue remains, the skeletons, mostly found in funerary contexts, can tell us something about the practice of surgery.

A society's attitude towards the health of its population and the sophistication of its medical knowledge reflect both its social order and the quality of human development. This is as true of Minoan and Mycenaean civilisations as of any other. As in all ancient societies, the population suffered physical trauma and illness and would have sought help from specific individuals whose role it was to provide the skills and remedies necessary for healing. Amongst those skills was primitive surgery. However, as in all early societies, healing and medicine would have begun as magic and folklore. The Minoan and Mycenaean healers would not have differentiated between therapies based upon physiological techniques (such as the administration of drugs, the treatment of injured limbs and surgery) and those of a purely magical character; they likely applied both types of intervention in a single regimen of treatment. Spirits of deities would have been considered largely responsible for a disease or condition, and as a consequence, invocations made to a deity to cure them.

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¹ Vivian Nutton, 'Healers in the market place: towards a social history of Graeco-Roman medicine', in *Medicine in Society*. ed. by Andrew Wear (Cambridge: Cambridge University Press, 1992), pp. 15-58, on p. 16.

The earliest surgical skills in the Aegean, including those which are instinctive and use teeth and fingernails, would by necessity have preceded internal medicine. They would have come into existence because of the need to save a life or a limb, most likely born on the battlefield in an attempt to arrest haemorrhage and to suture wounds. One of the most difficult problems facing healers would have been the removal of arrowhead barbs, the curse of battlefield surgery in the ancient world. Guido Majno believes they would have enlarged the wound with a knife to extract the arrow, or may have pushed it right through, after removing the flight.² This supports what we do know: that surgery in the prehistoric Aegean was primarily related to the treatment of trauma, most specifically fractures to long bones and head injuries. There also arose other, albeit not very sophisticated, surgical procedures for which we now have evidence. However, surgery would have been kept as a last resort because of pain, surgical shock and infection.

Cranial Trepanation

The most obvious examples of surgery are the instances of trepanation. Much has been written about this very ancient surgical procedure, but its use in the Aegean has been neither fully documented nor understood. From the study of the skeletal material found in the Middle Bronze Age graves at Asine, Lerna and from later at Mycenae, it is possible to identify a number of trepanations, mostly performed on the parietal and frontal regions of the cranium (and occasionally on the occipital) for the removal of cranial bone in the hope of causing as little damage as possible to the underlying blood vessels, meninges and brain.³ Initial incision of the scalp produces a lot of blood but the haemorrhage can be minimised by used by turning back the scalp flaps created, a procedure no doubt adopted from almost the first operations. One can only imagine the pain suffered by the patient during the cutting through the periosteum, but the operation that follows is comparatively painless.⁴ The patient was perhaps partially anaesthetised with opium, alcohol or some other compound; in the case of head injuries, he was probably already unconscious.

Whilst there are a number of ways the operation might have been performed, the evidence shows that the Aegean surgeon utilised the scraping technique, using a sharp stone or bronze tool. Avoiding cranial sutures and major blood vessels, he would remove the required area of bone by gradually scraping away first the *lamina externa* and *diploe*, and then the *lamina interna* to finally expose the *dura mater*. The end result was a roughly circular opening with bevelled edges.⁵ The scraping method probably allowed for a more precise and controlled penetration of the inner table of bone and lessened the likelihood of brain injury.

There is no evidence to suggest that there was any specific post-operative treatment, although this cannot be completely dismissed. Perhaps there was some attempt at closure of the skin wound, either by drawing together the skin flaps or by the

² Guido Majno, *The healing hand: man and wound in the ancient world* (Cambridge: Harvard University Press, 1975), p. 143.

³ F.P. Lisowski, 'Prehistoric and early historic trepanation', in *Diseases and antiquity. A survey of the diseases, injuries and surgery of early populations*. ed. by Don Brothwell and A.T. Sandison (Springfield: Charles C. Thomas, 1967), pp. 651-72.

⁴ Charlotte Roberts and Keith Manchester, *The archaeology of disease*, 2nd ed. (Stroud: Alan Sutton, 1995), p. 93.

⁵ Lisowski, pp. 662-63.

application of a pad, possibly of linen. In a number of trepanations from prehistoric Europe, osteitis and bone scarring surrounding a trepanation hole may be attributed to chemical irritants applied post-operatively,⁶ but they are more likely to be due to sepsis of the wound.⁷

The operation was probably performed in the hope of curing intracranial disease or extradural haematoma, persistent migraine or paralysis. But it is more likely that it was a surgical clearing-out for the removal of splinters of bone from a head injury brought about by combat, hunting or farming. We cannot rule out, however, the possible magical or symbolic use of the operation on the living for the curing of perceived 'mental illness' such as epilepsy or schizophrenia, or for the catharsis of 'evil spirits'. However, it is only possible to speculate as to whether the surgeons in these circumstances had ritual or therapeutic motives.

Amongst the examples of trepanation from the Aegean, there is one, performed just before death, on the cranium of a tall, approximately 25-35 year old man (51 Myc., from Grave Γ (East Body) of Shaft Grave Circle B at Mycenae, dated to the Late Helladic IA period, approximately 1550 BC).⁸ It was performed on the left side of frontal, anterior to the left coronal suture. Two roughly semi-circular roundels of bone that had been cut out survive and show that the skull had been cut with great skill through the outer table only, the internal diameter of the hole being greater than the external. As it was cut it had sprung away from the head and split into two, curling slightly in the process, probably because it may have been still attached to the scalp. The patient survived at least until the operation had been completed, but, as there is no trace of healing or remodelled edges, not apparently much longer. From the appearance of the trepanation, it was performed very skilfully with a very keen-edged chisel or gouge.

It is possible only to speculate as to why the operation was necessary, but there are two fractures which lead away from the trepanation towards the front of the cranium; therefore it is likely that the trepanation had the aim of curing concussion and possibly extradural haemorrhage following a cranial depressed fracture wound to the head. Close examination suggests the wound was made by a sharp instrument, perhaps a sword, rather than by a blunt-edged axe. This robust Mycenaean warrior may also have had some form of cranial surgery some years earlier, as he has a healed depression on the right side of his skull.⁹

From what we now know, many patients seemingly died as a result of the operation, but there is evidence from a skull found at Asine (107 As., dated to the Middle to Late Helladic IA transitional period, around 1650 BC) of a trepanation being performed successfully on a man aged approximately 30-40 years for the removal of fragments, probably after an axe wound, as indicated by the ante mortem remodelling of cut edges.¹⁰ This must point to a surgeon having skill in mastering the technical side of

⁶ Roberts and Manchester, p. 93.

⁷ T.D. Stewart, 'Stone age skull surgery. A general review with emphasis on the New World, *Smithsonian Institution Annual Report*, 1957, 461-91.

⁸ J. Lawrence Angel, 'Human skeletons from Grave Circles at Mycenae', in G.E. Mylonas, *Ο Ταφικός των Μυκηνηών* (Athens: Archaeological Society, 1972), pp. 379-97, on pp. 380-81, pls. 244, 249 (Γ-51).

⁹ J.H. Musgrave, R.A.H. Neave and A.J.N.W. Prag, 'Seven faces from Grave Circle B at Mycenae', *Annual of the British School at Athens*, 91(1996), 107-36, on 115-17. 131-32.

¹⁰ J.L. Angel, 'Ancient skeletons from Asine', in S. Dietz, *Asine II: results of the excavations east of the Acropolis 1970-1974*, Fasc. 1, *General stratigraphical and architectural remains*, Vol. XXXIV, *Acta*

this operation, as well as possessing good, hard and well-sharpened instruments. Found more recently is a male skull from Delphi (dated to the Middle Helladic period, approximately 1700 BC) which displays on the right parietal bone (unusually, in the middle of the squamosal suture) a 'tear-drop' shaped trepanation of medium size, also made by the scraping technique. The operation was performed whilst the patient was alive; and he survived, since at the edges of the aperture were observed traces of osseous regeneration.¹¹ In later periods, increased technical efficiency must have contributed towards a higher recovery rate, but the chances of survival must have been reduced by the surgeon carrying pathogens, such as staphylococci, from one patient to the next through the use of unsterilised instruments.

In the trepanation of a skull of a young male aged approximately 20-25 years from Grave BA-1 at Lerna (33 Ler., also dated to 1700 BC) the scraping seems to have been carried out very crudely and with a blunt tool.¹² Angel describes how the cranium has a roughly cut opening of the right frontal region, 40 x 60 millimetres long, its edges cut with a scalloped bevel from the periphery toward the centre, as if the two complete trepanned fragments had been raised with the scalp at the time of death. The muddy earth in the area seems unusually adherent to the bone, perhaps facilitated by the presence of blood. This trepanation does not exhibit the same high level of surgical skill as is seen from Mycenae and Asine, but it was performed a few generations earlier; trepanation of any sort takes skill, and the difference is likely to be one of an improvement in cutting instruments. However, there is no evidence of injury, so it is quite possible that the young man died a ritual death, or as Angel puts it, 'as a *pharmakos* or scapegoat', and actual surgical skill would have been a secondary consideration.

Although we know very little about the specific origins of trepanation in the Aegean, its beginnings are not to be found in rational medical practice. As in other ancient societies, it would have made its first appearance in the region as a ritual act and experience would have taught that humans could survive the operation. Once a crude technique was learned, this would eventually have led to its refinement for medical use. The evidence for trepanation in the Aegean has come almost exclusively from Middle and earlier Late Helladic cemeteries on the Greek mainland, but this does not render trepanation unique to those periods, as these are the only Greek mainland cemeteries so far to receive extensive palaeopathological study. There is no evidence as yet of the operation having been performed by the Minoans for therapeutic purposes; therefore it is unlikely that the clinical and magico-clinical practice of trepanation was introduced to the Greek mainland from Crete.

Because of the examples of trepanation from earlier prehistoric Europe,¹³ Piggott suggested that central and northern Europe may have witnessed the origins of the

Instituti Atheniensis Regni Sueciae (Stockholm: Swedish Institute in Athens, 1982), pp. 105-38, on pp. 109, 137, figs. 10 and 14.

¹¹ S.K. Manolis, A.A. Neroutsos, M.J. Papagrigrakis and C. Zafeiratos, 'Trepanations in Greece: observations on a Middle Bronze Age skull', in *Papers on Palaeopathology presented at the 10th European Members Meeting of the Palaeopathology Association*, Göttingen, 1994, 1995, p. 16.

¹² J.L. Angel, *The People of Lerna: analysis of a prehistoric Aegean population, Vol. II, Lerna: a preclassical site in the Argolid* (Princeton: American School of Classical Studies at Athens, 1971), pp. 43-44, 93, pls. x, xxi, xxii.

¹³ Lisowski, pp. 652-54.

technique.¹⁴ However, the specific use of trepanation in the Aegean may have originated in the Eastern Mediterranean, since a confirmed Early Chalcolithic trepanation (dated to approximately 4000 BC) has recently been identified at Kuruçay-Höyük in south-west Anatolia. Here the skull has three holes, each 0.5 centimetres in diameter, which Güleç believes may have been made by a drill.¹⁵ Until this recent discovery, the oldest recorded trepanation in the region came from a female skeleton found at Elmali-Karatas and dated to approximately 2300 BC.¹⁶ Excavations at Tuttul/Tall Biç'a in Syria in 1987 and 1990 uncovered two clear examples of trepanations being performed in approximately 1700 BC.¹⁷ The Middle Bronze Age Aegean trepanations are not a great deal later than the Elmali-Karatas example and are contemporary with those found in Syria.

Orthopaedics

As to the treatment of fractures, many of which were brought about by combat, occupational injury, or as the result of being gored by a bull or wild pig, the evidence suggests that those of the forearm were the most common, and that the skills of surgeons went beyond a knowledge of simple bone-setting. As W.A. Clark observed: 'the simple and primitive expedient of holding together the parts of a broken staff by bounding them to a sound staff would naturally occur to any people of intelligence and its application to a broken bone would not be very hard to imagine'.¹⁸ Photini McGeorge, from her work on Crete, has concluded that the proof of the existence of surgical orthopaedic practice is that fractures do not spontaneously heal in the manner evidenced by the archaeological remains. She points out that this conclusion is in agreement with a study of fractures in wild animals, published in the *Lancet* in 1986, which contradicts the commonly held view that such fractures heal without reduction. Techniques like fracture reduction may have developed empirically, perhaps even from the experience of shepherds treating animal fractures.¹⁹

For example, the skeleton of a woman, aged approximately 30-40 (58 Myc., found in Grave Γ (South Body) of Shaft Grave Circle B at Mycenae, and dated to the Late Helladic IA period, approximately 1550 BC)²⁰ and a member of one of the ruling families (as confirmed by the quality of the grave goods found with her), had a perfectly healed midshaft three-part fracture to her right humerus, an injury which could not have healed naturally in this way. When compared with many of the lower status occupants of

¹⁴ Stuart Piggott, 'A trepanned skull of the Beaker period from Dorset and the practice of trepanning in prehistoric Europe', *Proceedings of the Prehistoric Society*, 6(1940), 112-33, on p. 116.

¹⁵ Erskin Güleç, 'Trepanation in ancient Anatolia: six new case studies' (abstract), *Papers on Paleopathology presented to the 22nd Meeting of the Paleopathology Association, Oakland, 1995*, 1995, p. 6.

¹⁶ J.L. Angel, 'Appendix: Human skeletal remains at Karatas', in M.J. Mellink, 'Excavations at Karatas-Semayük in Lycia, 1965', *American Journal of Archaeology*, 70(1966), 255-57, on p. 255.

¹⁷ Wanda Wolska, 'Zwei Fälle von Trepanation aus der altbabylonischen Zeit Syriens', *Mitteilungen der Deutschen Orient-Gesellschaft zu Berlin*, 126(1994), 37-50.

¹⁸ W.A. Clark, 'History of fracture treatment up to the sixteenth century', *Journal of Bone and Joint Surgery*, 19 (1937), 47-63, on p. 47.

¹⁹ P.J.P. McGeorge, 'Biosocial evolution on Bronze Age Crete', in *ΕΙΛΑΠΙΝΗ: Τομος τιμητικός για τον Καθηγητή Νικόλαο Πλατόνα (Heraklion: Βιβλιοθήκη, 1987)*, pp. 406-16, on pp. 412-13, after Christopher Bulstrode, John King and Brian Roper, 'What happens to wild animals with broken bones?', *Lancet*. (1986)(1), 29-31.

²⁰ Angel, note 8 above, pp. 380-81 (Γ-58).

contemporary and earlier cemeteries in the locality, whose fractures had healed with faulty union, consequent permanent dysfunction and clearly without any medical intervention, we obviously have here the remains of someone of rank who may well have had access to better medical treatment. However, later in the Bronze Age the work of bone-setters would have become more commonplace.

The twisted oblique fracture on the distal tibia on the skeleton of a man from Armenoi on Crete, dated to approximately 1300 BC, has also been successfully repaired after medical attention.²¹ Since approximately twelve weeks are required for healing, the repair of the bones suggests that the limb was immobilised, presumably by a splint of plaster or strong tree bark such as were used in Egypt at this time.²² Reduction by manipulation and splinting of bones with natural products other than bark (reeds, animal skins or even clay) may have been used in the healing process.

We also have unusually early evidence from the Early Minoan cave ossuary at Agios Haralambos on Crete (in use around 2400 BC) of a successfully healed ulna and humerus.²³ The fracture of the humerus is at a site on the arm which is difficult to manipulate and where healing is almost impossible without reduction and immobilisation. McGeorge has also identified healed rib fractures on a later male skeleton from Khania dated to 1300 BC.²⁴ She does not rule out the application of immobilisation techniques, but this is problematic, as to immobilise the chest like this would probably cause immense difficulty in breathing.

Other surgery

There is also evidence from Crete of yet other forms of surgical treatment. On a male cranium found in the Ailias cemetery at Knossos (cranium V.LVc, dated as early as the Middle Minoan I-II period, approximately 1800 BC), it is possible to detect a small circular depression on the left posterior parietal, 16 millimetres in diameter, beside which are seven precise shallow incisions varying in length from 3-10 millimetres; these seem to have been made by a cutting instrument.²⁵ As for the cranial depression, it is absolutely smooth and there is no sign of bone callus formation to suggest it might be due to a depression fracture. Recent angiographic techniques have shown that similar depressions can be attributed to a swelling of the blood vessels, possibly traumatic aneurysms. An aneurysm may cause severe headaches and, owing to chronic pressure, cause local

²¹ P.J.P. McGeorge, 'Health and diet in Minoan times', in *New aspects of archaeological science in Greece, Occasional paper 3 of the Fitch Laboratory of the British School at Athens* ed. by R.E. Jones and H.W. Catling (Athens: British School at Athens, 1988), pp. 47-54, on p. 49, fig. 27a and c.

²² The Ancient Egyptians knew of the use of bark splints by the time of the Vth dynasty (c.2450 BC), when fractures of the forearm were set by them. The blood-stained lint found associated with the splints may have been made from palm fibres and is mentioned in the Edwin Smith Papyrus. The excavation of a rock-cut tomb of a young woman from the Period shows a complex splinting arrangement used to treat the fracture of her right femur. Four splints were applied to the limb, each one consisting of a rough, narrow strip of wood carefully wrapped in a linen bandage. See G. Elliott-Smith, 'The most ancient splints', *Brit.med.J.*, (1908)(1), 732-34, on p. 732. In the Aegean no splints have been found in funerary contexts, but most fractures found archaeologically are healed, which would preclude the need.

²³ McGeorge, note 21 above, p. 51, fig. 29a-b.

²⁴ P.J.P. McGeorge, 'Part II: The Burials', in B.P. Hallager and P.I.P. McGeorge. *Late Minoan III burials at Khania* (Göteborg: Paul Åströms Förlag (*Studies in Mediterranean Archaeology* XCII), 1992), pp. 29-44, on pp. 34-35, 41, pls. 39-44, 121.

²⁵ McGeorge, note 21 above, pp. 51-52; McGeorge, note 19 above, pp. 414-15, fig. III.

atrophy and an imprint on the skull such as those described above. It is more than possible that the incisions on this cranium are due to some sort of surgery, in a crude attempt at treating with a knife what may have been persistent headaches. The scalp is well supplied with blood and with such forms of surgery, even in Minoan Crete, there must have been a good chance of recovery.²⁶

Other than the little we can perceive from skeletal remains, we do not really know anything about other surgical techniques of the period. Ghislane Lawrence has suggested that they were likely to have been a spin-off from hunting and butchery and that much of the necessary anatomical knowledge for surgical medicine probably grew out of early man's increased dependence on meat.²⁷ She goes on to question whether surgeons cut like barbers, cooks or craftsmen, and asks whether flaying or jointing relate to any clinical procedure.

There are many other possible explanations for the presence of cut marks on human bones, although surgery, surgical bleeding or other medical operations cannot be ruled out. Among the factors which might lead to determining the truth about any such marks are the archaeological contexts in which the bones were found, evidence as to whether the marks were made by cutting, chopping, sawing, or scraping, of what sort of instrument was used, and whether the cuts were made while the person was living and exhibit signs of healing. The cut marks found on 35.7% of children's bones found by Peter Warren in his excavations at the Stratigraphical Museum Extension at Knossos, dated to the Late Minoan IB period,²⁸ are indicative of the removal of flesh; whatever the reason for the procedure, the children seem to have been in normal health at the time of death. It has been suggested to the excavator of these bones by a senior forensic pathologist that those responsible for the flesh removal were very skilled and knowledgeable in their activity and that those who stripped the bones were not butchers, but had surgical skills.

Dentistry

While dental disease appears early in the ancient skeletal record, in the Aegean there is not a great deal of evidence of its sophisticated treatment and, in general, the evidence of dental surgery — the deliberate intervention in the treatment of dental disease — is quite rare in ancient populations. Joe Zias and Karen Numeroff believe that is surprising in that surgical procedures, which presume a rudimentary knowledge of human anatomy, were being successfully performed throughout the Eastern Mediterranean in the second millennium BC. They believe that drilling a carious tooth, wiring loose teeth or fashioning a simple prosthetic device to bridge a gap are fairly simple procedures which could easily have been undertaken by a jeweller or someone skilled in these matters. Whilst the great value of gold and silver may have been a deterrent to their use for these purposes, this conspicuous absence amongst the elites of the Minoans and the

²⁶ McGeorge, note 19 above, p. 414.

²⁷ Ghislane Lawrence, 'The ambiguous artefact: surgical instruments and the surgical past', in *Medical theory, surgical practice: studies in the history of surgery*, ed. by Christopher Lawrence (London: Routledge, 1992), pp. 295-315, on p. 307.

²⁸ S.M. Wall, J.H. Musgrave and P.M. Warren, 'Human bones from a Late Minoan IB house at Knossos', *Annual of the British School at Athens*, 81(1986), 333-88.

Mycenaeans, where gold jewellery was fairly plentiful, points to the population being little concerned with dental care of this sort.²⁹

As in all societies the simple treatment of oral disease long precedes the development of dental appliances; it is likely that both the Minoans and Mycenaeans developed a very modest form of dental treatment. Both Carr and McGeorge show evidence of complete bone healing following tooth loss; from this they conclude that extractions were performed from very early on in the areas of a number of Minoan cemetery sites in Crete such as the Middle Minoan cemetery at Ailias at Knossos,³⁰ the Late Minoan site at Annenoi, and the Early Minoan cave ossuary at Agios Haralambos.³¹ However, it must be admitted that once healing has taken place, it is sometimes difficult to state whether ante mortem tooth loss has been due to deliberate extraction or to a natural process such as periodontal disease. At the Agios Haralambos site, McGeorge has observed that the rotten crown of a tooth had broken off during what she believes to have been an extraction and the roots retained in the jaw, later to be naturally exfoliated.³² A similar case has been noted at Armenoi, where the broken roots of a left maxillary second molar remain embedded in the alveolus. A more likely explanation is that the rotten crown of the tooth broke off during eating and that this is not evidence for extraction. In another case found in Tomb II of the Sellopoulou cemetery at Knossos, on a female aged approximately 25 years, although both of the maxillary second molars were missing and the alveolus was completely healed, there was no evidence of caries on any of her other teeth. Both the third maxillary molars of this young woman were impacted in a distoangular position. It is possible that the impacted third molars may have caused referred pain, which incriminated the second molars and thus resulted in the removal of both teeth.³³

Dental extractions are not that easy to perform and require particular skills. As for instruments, one of the variety of bronze tools in use in a Minoan workshop would have sufficed for this purpose. That dental extractions may have been more widely practised in the town than in rural areas, is suggested by the evidence amongst the urban population of lower incidence of abscesses despite the higher rate of dental caries.

Surgical instruments and equipment

As for instruments, few have so far been discovered. However, a complete set of what I believe to be surgical instruments made from bronze, was discovered in Chamber Tomb K of the Palamidi-Pronoia cemetery at Nauplion in 1971 and dated by the associated pottery to the Late Helladic IIB period, approximately 1450 BC.³⁴ These instruments would probably have been the property of a healer and buried with him. Also found were stone vessels for the preparation of medicines for application both externally and internally. From these instruments it is possible to identify a curved bladed knife or razor, a long saw, a pair of large denticulated forceps, a short tanged knife, three chisels, a long-

²⁹ Joseph Zias and Karen Numeroff, 'Ancient dentistry in the Eastern Mediterranean: a brief review', *Israel Exploration Journal*, 36(1986), 65-67.

³⁰ H.G.Carr, 'Some dental characteristics of the Middle Minoans', *Man*, 60(1960), 119-22.

³¹ McGeorge, note 19 above, pp. 411-12.

³² *Ibid*

³³ *Ibid*.

³⁴ E. Protonotariou-Deilaki, *Αρχαιολογικόν Δελτίον*, 28(1973), Β'Ι Χρονικά. 90-94, pp. 92-93, fig. 6, pls. 89b-c, 91c-e.

handed spoon or scoop, two long probes or lancets, and a small broad forceps or tweezers.

At least two of these instruments — the razor and tweezers — which originate in the Early Bronze Age, a thousand year earlier, are indistinguishable from what have been thought to be toilet articles, or objects used for shaving and the removal of hair, and it is possible that these toilet articles were adapted for surgical use.

Of course, bronze does not always produce the most efficient of tools for cutting flesh and bone as it blunts quite easily. Knives or scalpels made from a hard stone such as the volcanic glass obsidian would have been more in use as surgical instruments. One of the best sources of this material in the whole of the Eastern Mediterranean lies on the island of Melos which provided obsidian for stone tools well before the emergence of the Bronze Age. Use-wear traces on obsidian blades suggests that it was used to cut soft-tissue and bone, probably in order to facilitate a deceased individual being buried in the traditional 'crouching' position. This may have been the precursor of clinical use. Flint knives were still in medical use in New Kingdom Egypt at the end of the second millennium BC and it has been pointed out that a freshly flaked flint knife, and presumably an obsidian knife as well, would be sterile, and although unlikely, could even be discarded after use.³⁵ Whilst it is not possible to compare the surgical instruments found at Nauplion directly with modern surgical instruments, as one must be very cautious when applying modern terminology to ancient medicine, they are unlikely to have any use other than clinical, which suggests that surgery may well have been advanced enough to make proper use of them. But of course, any view on the actual surgical use of ancient instruments without corroborative textual records, is based upon informed speculation.

Presumably there were also other forms of medical equipment such as linen bandages. The use of good quality linen was certainly known in the Aegean Bronze Age, as it was in Ancient Egypt where linen bandages were used for covering and keeping in place external medication, mechanically retaining in position and protecting during healing ruptured tissue or broken or dislocated bones. Other everyday objects may often have been adapted to medical use. On an Early Minoan ivory sealstone, one can clearly observe teeth marks, which suggests that it may have been used later in the Bronze Age as a prophylactic that was placed in an epileptic's mouth during a fit to avoid obstruction to the air passage.³⁶

As for other forms of surgical appliances and techniques, an examination of the figurines from Crete reveals the men as having very thin waists and to be wearing only codpieces and belts, the latter drawn very tightly. It has been suggested that the thick padded codpiece was necessary as a sort of primitive truss, because their mode of dress is a classic cause of rupture.³⁷

The surgeons

Who were those who practised medicine and surgery in the Aegean Bronze Age, what little do we know of them, and how free was their practice from the magico-

³⁵ John F. Nunn, *Ancient Egyptian medicine* (London: British Museum Press, 1996), p. 165, after Dr R.L.Miller.

³⁶ V.E.G. Kenna, *Cretan Seals* (Oxford: Oxford University Press, 1960), p. 91. no. 30.

³⁷ J.D.S. Pendlebury, *The archaeology of Crete* (London: Methuen, 1939), p. 117.

religious elements of medicine? The answer to these last two questions is: 'precious little'; however, it is possible, supported by pathological and archaeological evidence, to piece together something of medical practice in the period.³⁸

Whilst there is no pictorial evidence from the prehistoric Aegean of medical practice, from some of the Linear B texts it is possible to infer that there was a recognised category of individuals specialising in healing. From its phonetic resemblance to *ιατηρ*, Michael Ventris and John Chadwick were the first to interpret the word *i-ja-te* on tablet PY Eq 146 from Pylos (dated to the destruction of the palace in 1200 BC) as a 'healer' or 'physician'. The individual referred to bore the name *[.]meno* and is recorded as holding a lease of land; regrettably there is no occupational context for him.³⁹ A palace healer, with his position in society, but tied to the *wanax* ('king') or the *lawag-etās* ('under-King'), may well have owned or leased land.

Assuming we are correct in identifying *i-ja-te* as a healer, it is not clear whether he had any special position over and above that of, for example, a craftsman,⁴⁰ although it has to be said that his landholding is large and this may indicate status. Certainly, other tablets in the same series from Pylos, concerning land tenure, mention the land holdings of priests and other palace servants — the king's fuller, the king's potter and the king's armourer. In the Late Bronze Age, although the material culture points to the practice of a great many crafts, they need not have been the work of individual specialists; only those whose crafts used expensive raw materials or had been patronised by the ruling elite would have been the true professionals. Whether the palace healer fitted into this category we may never know, but I would have thought that the physical condition of those who lived in or under the immediate control of the palaces would have been such as to provide sufficient full-time work.

How palace healers were trained in the setting of bones and surgery, whether indeed they carried out the work themselves and did not, as in many other ancient societies, restrict themselves to physical medicine, will probably never be known. Knowledge was likely to have been acquired through practice and through observing lesions on the living, mostly gained in combat, accident, or even punishment. As for anatomy, it is reasonable to assume from much of the pathological evidence that palace healers possessed some very basic knowledge concentrated on the most vulnerable and most visible parts of the body — the limbs, neck and head. Much could also have been learned from the dissection or the treatment of cattle and domestic animals. However, the features on an ivory and gold *kouros* found at Palaikastro in eastern Crete, and dated to the Late Minoan IA period (approximately 1550 BC), shows a remarkable knowledge of surface anatomy,⁴¹ some of which, Jean Coulomb goes so far as to suggest, the Minoans may have acquired through the dissection of cadavers.⁴² Probably little would have been

³⁸ Robert Arnott, 'Healing and medicine in the Aegean Bronze Age', *J.Roy.Soc.Med.*, 89(1996), 270-75.

³⁹ Michael Ventris and John Chadwick, *Documents in Mycenaean Greek*, 2nd ed. (Cambridge: Cambridge University Press, 1973), pp. 123, 547.

⁴⁰ In Homer, healers were considered craftsmen; in the *Odyssey* (v.383-384) they were classed together with other itinerant labourers.

⁴¹ J.H. Musgrave, 'Anatomy of a masterpiece', in *Ivory in Greece and the Eastern Mediterranean from the Bronze Age to the Hellenistic period*, ed. by J. Lesley Fitton (London: British Museum (Occasional Paper 85), 1992), pp. 17-23.

⁴² Jean Coulomb, 'Le <Prince aux lis> de Knossos reconsidéré', *Bulletin de Correspondance Hellénique*, 103(1979), 29-50, on p. 39 n.27.

known about the respiratory, cardiovascular and digestive systems, other than the effectiveness of the remedies used to treat internal ailments, although there is evidence from children's bones found at Knossos (dated to the Late Minoan IB period, 1500-1450 BC) for the removal of the brain, lungs and heart before interment.⁴³

From this work I hope it is now possible to begin to understand the extent of the medicine and surgery that existed in Greece and the Aegean before the fifth century BC, and that the eventual establishment of the healing cults and the Hippocratic school of practice on Cos and elsewhere by Dorian immigrants, may well have drawn upon Mycenaean healing traditions. Much more palaeo-pathological and archaeological study needs to be undertaken to further this work; as for Crete, it is hoped that skeletal remains from a Late Minoan palace may one day be found which produce evidence of injuries received whilst indulging in bull leaping, or other activities for which we have clear pictorial evidence.

⁴³ Wall, Musgrave and Warren, pp. 373, 375.