

PROTO-SURGERY IN ANCIENT EGYPT





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Summary: This article investigates the evidence we have for the existence of proto-surgery in ancient Egypt during the Dynastic Period (c.3200 - 323 BC). Climate and chance have preserved medical literature as well as paleoarcheological specimens and these artefacts, along with extant Greek and Roman treatises appear to support the conclusion that proto-surgery was practised in ancient Egypt (the prefix *proto-* designates an original or early form). Elements of proto-surgical development including analgesia and sedation, the incision, trephination, proto-surgery of trauma, mythical proto-surgery and antisepsis, drawing on primary sources, surviving artefacts and modern commentary are discussed. Where appropriate comparisons are made with proto-surgery in ancient Mesopotamia and the Bronze Age Aegean.^a

Key words: *Photo-surgery; Ancient Egypt*

Introduction

Historically medicine in ancient Egypt begins in the IIIrd dynasty with the semi-mystical figure of Iemhetep  (he who cometh in peace), a priest of Ra, vizier, architect and astronomer to the Pharaoh Djoser Teti, and the first fully identified doctor Hesy-Re who held the title 'Chief physician of teeth',  (1). Although it has not been shown that Iemhetep was an ancient Egyptian doctor he was later to be deified as the god of medicine by both the Egyptians and the Greeks, who identified him with *Aeskulapeia* (2). In Eusebus's version of Manethos account of Iemhetep we are told, "Sesorthos (Djoser Teti) under whom lived Imuthes (Iemhetep), and who on account of his skill as a physician was looked upon as Asklepios". Although never actually given the title doctor the Westcar papyrus describes Iemhetep as a magician and alchemist. It is well known from hieroglyphic translations that the ancient Egyptian word for a doctor was *sunu*^b from the hieroglyphic symbol for the arrow and the pot with the seated man as the male determinative , - the pronunciation is based on the finding of the scriptio plena in texts from the Middle Kingdom, . Although the eminent Egyptologist Hermann Grapow initially used this translation in his monumental work on ancient Egyptian medicine, *Grundriss der Medizin der Alten Ägypter*, he later went on to prefer the transliteration *sinu* (Wb III, 86, n.a.)^c basing this on the

etymology of the Coptic word for doctor (Wb. III, 427,13) (1).



The origins of medicine in predynastic and early dynastic Egypt are unclear. Some scholars argue that the Dynastic period arose by immigration and population replacement along the Nile valley. The migration of the so-called 'broad headed' people, a group from Syria, or Palestine, to Upper Egypt via the Nile Delta around 3300 BC (3), may have brought some knowledge of Mesopotamian medicine to the intellectually fertile grounds of the Nile. Medicine was certainly practised in ancient Mesopotamia but its influence on the development of early medicine in ancient Egypt is likely to have been small (4,5). Diplomatic and commercial intercourse was certainly flourishing between Egypt and Babylon by 1400 BC, as evident by the cuneiform tablets found at the ruined palace of Amenophis IV at El Armana, and the vivid paintings in Thebes of Asiatics and Nubians paying homage before the Royal throne found (1411-1375 BC) (6). There is another obscure reference in *Orientalistische Litteraturzeitung* (1901, IV, p8) that claims evidence of Royal correspondence between the Assyria and Egypt at an even earlier date (at end of the XIIth dynasty, c.2000 BC) (7). Max Müller went further to identify a fragment of limestone slab in the Cairo museum which he claimed contained a depiction of royal non-Egyptians, possibly northern Semites. Although the chronology is uncertain it may be as old as the Vth dynasty based on stylistic interpre-

^a This article represents a personal view. For those wishing to study this subject in greater depth I commend the exoteric work of John Nunn, *Ancient Egyptian Medicine*, and the esoteric works of Wolfhart Westendorf / Hilgard Von Deins *Übersetzung der Medizinischen Texte*, as well as Bardinets *Des Guerisons Immediates dans les Textes Medicaux*.

^b Egyptian transliterations are given in italics, Sumerian in upper capital Roman and Akkadian in bold italics.

^c Wb references refer to volumes VIII and VII2 respectively of the *Grundriss der Medizin der Alten Ägypter*, von Deines, H. Westendorf, W. *Wörterbuch der medizinischen Texte, erste Hälfte (3-r)* 1961, op.cit., *zweite Hälfte* 1962.

tation (7). The evidence that is available places any possible medical contact between Dynastic Egypt and ancient Mesopotamia no earlier than the Middle Kingdom period. Furthermore, some excellent studies of non-metrical traits in Egyptian skulls has shown that there was little change throughout the pre-Dynastic, Old and Middle Kingdoms (8). These findings suggest that the population remained more or less genetically stable until the waves of immigration during the New Kingdom. The early development of medicine in ancient Egypt was most likely endogenous and closely allied, if not concordant with the priesthood.



In ancient Egypt medical development was intimately linked with the priesthood and the religious rites of life and death (9). The Egyptians from the early dynastic periods practised “a sacerdotal and theurgical system of medicine,” where a polytheistic creed was applied to practical medical necessity (10). Texts from the Old Kingdom talk of the priests of Sekhmit , a goddess representing the violent heat of the sun who also inflicted death and disease, as being medically qualified (i.e. a *sinu*) (11). It has even been suggested by Ebbell, based on examinations of the Ebers and Edwin Smith papyri, that the *wab*-priest of Sekhmit was also versed in matters proto-surgical. In these medical texts the *sinu*, *hekay*  (magician) and the *wab*-priest of Sekhmet feel the pulse and diagnose disease indicating the apparently separate nature of these professionals. Unfortunately the lack of interpretative tools required to separate these titles precludes definitive conclusions on their apparent separate identities (12).

Operative procedures require a basic medical understanding as well as instruments and surgical accoutrements. The Egyptian Neolithic cultures of Faiyum and Deir Tasa (c.5000 to 4000 BC) did not have copper tools until their development in the Chalcolithic phase of el Badari and el Amra, and certainly complex writing had not been devised until c.3100 BC. It is therefore highly unlikely that the predynastic period had developed a recognisable system of medical care, never mind proto-surgery (12). But the extant medical papyri leave us in no doubt that certain forms of proto-surgery were carried out by the IIIrd and IVth dynasties. The Edwin Smith surgical papyrus, written mostly in Middle Kingdom hieratic, is believed by some scholars to be a copy of a much older, perhaps even an Old Kingdom original. But this is controversial as the archaic words used in the text may be designed to give the impression of antiquity rather than being a true reflection of the actual chronological age (p.27) (13). The mixture of styles may reflect an amalgamation of various proto-surgical cases from different times of now lost proto-surgical treatises, or else an original form updated as far as possible with contemporary hieratic, including the remarkable glosses that are used to explain some of the archaic words and grammar^d. An interesting point here is that we know that by the IVth dynasty important collections of written materi-

als had been made; in the Giza grave one finds a high civil servant with the title ‘Governor of the House of Books’ (14). The process of compilation is attested to by the finding of medical papyri such as the Carlsberg where gynaecology is dealt with on the recto and ophthalmology on the verso. It is a tantalising prospect that all extant papyri may be copies of much older versions, which could explain why Clemens Alexandrinus in the 2nd Century claimed that of the 42 sacred volumes of text housed in ancient Egyptian temples, six dealt with medicine. The Egyptian historian Manetho (280 BC) went even further to suggest that the pharaoh Athotis (1st Dynasty 2935-2785 BC) wrote books on medicine, one of which dealt with anatomy^e.

Analgesia and Sedation ?

The development of safe and effective analgesics and anaesthetics has been a prerequisite for the development of modern surgical techniques. The evidence that the principles of sedation were understood within a medical context in ancient Egypt is sparse and controversial. It is interesting to note that certainly in to-days agrarian societies in North Africa the high pain thresholds of individuals are unprecedented. Patients can withstand exceptionally painful procedures without the need for any sedatives or anaesthesia (authors own experiences working in rural areas of Upper Egypt). It is tempting to speculate that this phenomena may also have been present in Dynastic Egypt.

From the Old Kingdom the analgesic and sedative properties of the Mandrake fruit (*Mandragona officinarum*), which contains atropine and scopolamine, may well have been known (15). The controversial depiction of their use at banquets would suggest that, aware of the narcotic and hallucinogenic properties from leisure use (see Fig. 2), the Egyptians may well have applied them for medicinal purposes. It has been suggested that the hieroglyphics for this fruit are not to be found in any medical papyri, even though in Mesopotamia the Mandrake (NAM.TAR, *pilú*) was often prescribed (16). Moreover the Mandrake was not a native of Egypt whereas the Persea (*Mimusops laurifolia*), similar to the Mandrake in form, was grown in the Ethiopian hills and has been recovered from XVIIIth dynasty tombs. It is believed that the Egyptians had a word for Persea, *shawabu*, but this translation is not universally accepted. However, there is a little known herb, *matet* , used for the treatment of pain [Hearst 9.13 (135)] that Victor Loret (1894) equated with the Arabic word for celery. But Warren Dawson disagreed with this translation preferring to identify it with the Mandrake, as the word bore the epithets “of the Delta” and , “of a foreign country”. But the etymology of Egyptian botanical names is fraught with difficulties. To this date there have been eight attempt-

^d an excellent discussion of this can be found in James Henry Breasted’s Introduction to his transliteration and translation of Edwin Smith op.cit. 1-29.

^e see the English translation of *Manetho* by Waddell p.33 Loeb Classical Library.

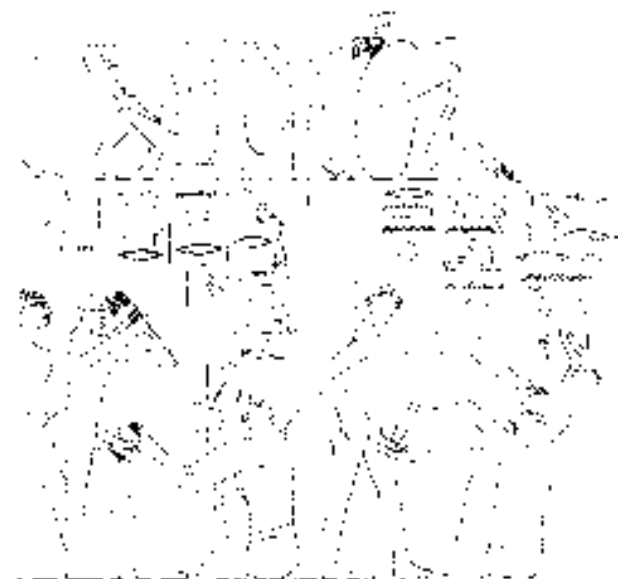
^f These are the works of Loret (1982), Drogennamen der Grundriss (1959), Faulkner (1962), Germer (1979), Charpentier (1981), Aufrère (1983-9), Ghalioungui (1987) and Manniche (1989).



Fig. 1: Asiatic Tribute-Bearers. An illustration that diplomatic intercourse was certainly flourishing by this period. From the tomb of Nebamun in the British Museum, c. 1400 BC. (Courtesy of the Trustees of the British Museum)



Fig. 2: A further tomb painting from Nebamun's burial chamber. The women, second from left in the lower line, appears to be offering what looks like a Mandrake fruit to the women on her right. c. 1400 BC. (Courtesy of the Trustees of the British Museum)



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Fig. 3: Line drawing from the tomb of Ankh-ma-hor showing what is a highly unusual tomb scene of ritual purification by circumcision and shaving in the lower register. (after Max Müller)



Fig. 4: Photograph of the mummified head of Seqenenre Tao. The compound fractures to the head can be clearly seen. (from the photographic collection of the Egypt Exploration Society, London)



Figs. 5 & 6: Damaged bas-reliefs on the temple of Amon, Luxor. They show the counting of the severed hands and penises. From the Ramesside period. (Courtesy of Dr Akin Adamson, London Business School).

ts at systematic reviews^f. Some of these reviews have even identified cannabis from the word *shemshewet* but there is no indication of its use medicinally although it does crop up occasionally in the medical papyri. Bearing in mind the limitations of etymology there are a number of interesting pain remedies that have been identified in medical texts other than Ebers and Edwin Smith. *aaat* 𐎠𐎡𐎢 is thought to be a type of fresh water mollusc and is used to treat pain in “sinews” or muscle [Hearst 8.17(120)]. The word *djaaret* 𐎠𐎡𐎢 is extremely common plant in medical texts where it is used internally to treat belly pain [Hearst 2.15(29) & 24.10(97)] and sharp pains (?neuritis) [Berlin 11.7-8(138)]. In the Hearst papyrus [3.4-6(35)] an unusual herb is used for topical and internal relief of iliac pain,

“There is a herb, *senutet* 𐎠𐎡𐎢 is its name; it grows on its belly like the *kadet* and its flowers are like the lotus. Its shoots are found like ‘white-wood’. Gather it and smear it on the groins, then it (the pain) subsides immediately. Its seeds, made into a cake, are given for (i.e. to relieve) the pain.”

This is probably a member of the *Convolvulus* family *C. hystrix* which is common in Egypt and secretes a powerful sedative sap. There is also archeo-botanical evidence that it existed in ancient times (17). Of the more unusual topical analgesics used to relieve ‘stiffness’ we find in papyrus Ebers [85,5] a recommendation for crushed mouse (18), and in papyrus Hearst [8,15 (115)] the wings of the scarab beetle. Unusual prescriptions for pain relief from ancient Egypt are often repeated by Classical authors. In his *Natural History*, after describing the stone sarcophagus at Assos in the Troad (XXVII, 131) which was able to consume a body in forty days, Pliny discusses the gentler actions of the more ‘preservative’ stones which were claimed to be able to relieve gout if the feet were plunged into a vessel hollowed out of Egyptian white limestone (XXXVIII. 132-133). But we have no real serious evidence on the efficacy of much of these prescriptions.

But what of that king of analgesics, opium? Again we have a discrepancy between ancient Mesopotamia and Egypt, as well as the paucity of archeobotanical evidence from the latter. In Mesopotamia the opium poppy (*irru, aruru*) was cultivated and used in prescriptions for pain relief (opium could be delivered as a suppository mixed with fat, AMT^g 43.1.3-4) (19) whereas even by the XVIIIth Dynasty there seems to be no conclusive evidence that the Egyptians knew of *Papavar somniferum* and opium (20). New research on material found in the tomb of Kha (1405 BC) has not demonstrated opium or its derivatives, contrary to earlier reports (20). As the Danish archeo-agriculturist Helbaek so succinctly put it, “.....among all the gallons of grain from Turkey, Lebanon, Jordan and Egypt I have never established *P.somniferum*. These findings reach in time from 7500 BC to AD1000.” Even the Egyptian words *shepen*

(Ebers 782) and *djaret* (which believed to be cognate with the Akkadian word *irru*) have both been shown to be plant extracts other than opium seeds. If one accepts from the documentary evidence that opium was cultivated in Mesopotamia then it may be possible to find further written evidence of a trade in this commodity from cuneiform economic records. Beatrice Teissier’s examination of pre-dynastic glyptic transmission (pre-written language symbols) identified a strong overland route connecting the civilisations of Babylon and Egypt from the earliest times (21). Concentrations of Uruk IV settlements on the middle Euphrates provided a focus in Northern Syria for fluvial contact along the Euphrates and the Orontes river to Palestine, via the overland journey to Çatal Hüyük, and then across to the Egyptian Delta. However, of the many extant Assyrio-Babylonian cuneiform trade records nowhere is there any mention of a trade in opium (22).

A similar situation arises with the Bronze Age Levant. Although literary evidence is sparse, and certainly nothing comparable with Egypt and Mesopotamia, Robert Arnott’s review demonstrated that opium latex was known in Crete at least by 1250 BC and perhaps even earlier (23). There is solid archaeological evidence that *P. somniferum* was cultivated and opium extracted in Minoan Crete (by the Late Minoan III period) (24), Cyprus and Mycenaean Greece. In the latter contact with ancient Egypt by the 18th Dyn (New Kingdom) is attested to by the finding of scarabs with the cartouche of Tuthmosis III in Eleusis and Argos, and poppy capsule Cypriot vases in Egypt (25). It would be very unusual indeed for Dynastic Egypt never to have obtained and used opium considering that from at least 2000 BC onwards it was surrounded by countries for which we have evidence of *P. somniferum*. Diodorus of Sicily even ascribed the origins of the use of opium to the Egyptians (26),

“And as proof of the presence of Homer in Egypt they adduce various pieces of evidence, and especially the healing drink which brings forgetfulness of all past evils, which was given by Helen to Telemaclus in the home of Menelaus. For it is manifest that the poet had acquired exact knowledge of the nepenthic drug (quieting pain) [opium?] which he says Helen brought from Egyptian Thebes....., a drug to cure anger and sorrow was discovered exclusively among the women of Diospolis, but Thebes and Diospolis, they add, are the same city.(I.97.3-7)”

In ancient Egypt many medical preparations also employed the use of alcohol (*henqet* 𐎠𐎡𐎢) which may have been used to induce a state of stupor before a particularly painful procedure. Seventeen types of beer are listed by the medical papyri, the majority of which remain unidentified (27). However, it is known that grain beer was produced to which was added spices, dates and possibly Mandrake fruit (28). There is a bas-relief at the Baden museum that shows

^g AMT and BAM refer respectively to, Thompson R.C. *Assyrian Medical texts*. Trustees of the British Museum, London 1923, and Köcher F. *Die Babylonisch-Asstriche Medizin in Texten und Untersuchungen*. De Gruyter, Berlin, 6 vols 1963-80.

dates being trampled in preparation for making beer. A medicinal use for beer was adopted in ancient Mesopotamia although we do not have any idea of the comparative chronologies. Geller and Cohen have identified an obscure passage in a Babylonian medical text dealing with kidney disorders (BAM, 260, 1-3, pp6-10),

“If a man is to get drunk [for sedation?], tie up flour and baxwood in linen, and put it into wine and have him drink it; he will get drunk...”.

The juxtaposition of this recipe with another referring to a kidney treatment (*pu*) strongly suggest that inebriation was used as a pre-treatment sedative and analgesic (29). But agreement with this interpretation is not universal. Some scholars have suggested that it was the additions to the wine or beer of either frankincense (*kanaktu*) or myrrh (*murru*), that gave it analgesic and sedative properties (4). It may be that the actual means of anaesthesia, if one can call it that, were altogether more physical. In the famous bas-relief from the tomb of Ankh-ma-hor (Fig. 3) there is a depiction of a circumcision where the patient's hands are firmly held aloft by an assistant who is told to, “Hold him fast! Do not let him fall!”, presumably because the intense pain may well cause loss of consciousness^h.



What is particularly remarkable is that the extant surgical papyri (Edwin Smith and Ebers) are silent on matters of sedation. Perhaps the required treatment was taken for granted and it was not considered necessary to write it down. Maybe a separate document existed which is why we find analgesic medication cropping up in papyrus Hearst and Berlin. But these are all suppositions; it may be that physical restraint was all that was employed during procedures and analgesic preparations given afterwards. Even by the time of Celsus anaesthesia and sedation, it seems, were not important considerations, as this passage makes clear (30), “The surgeon should be youthful or in early middle age, with a strong and steady hand, as expert with the left hand as with the right, with vision sharp and clear, and spirit undaunted; so far void of pity that while he wishes only to cure his patient, yet is not moved by his cries to go too fast, or cut less than is necessary.”

On a more positive note many other plants and minerals found in the ancient Egyptian doctors' pharmacopoeia have yet to be identified. It is quiet possible that other analgesic agents may come to light in the future.

The Incision

In ancient Egypt there is literary evidence to indicate therapeutic incisions but virtually no paleopathological examples have been identified. With Ebbell's translation of the Ebers papyrus (p.107) (31), “then you shall go round it with a *hepet*-knife to the limits of all....”, we have our first

description of what may be a scalpel incision. Georg Ebers further discussed the case of this instrument (1889, p.223) (32), concluding a different translation, *kheper*. It appears that the function of the *hepet*, or *kheper*, was to debride a wound, and the most logical instrument would be a curved scalpel. This word is close to the ancient Egyptian meaning ‘sculptured relief’, which may well indicate that this particular knife may have had a particular medical function which may have been used by a proto-surgeon. However, this interpretation of *hepet* or *kheper* as a proto-scalpel is speculative.

A further knife of medical origin is described in Ebers (109, 875). Ebbell (1937, p.127) translated it as *des*-knife . The use of this particular knife is advised to split certain swellings (*anut*, ) and then use the *henweh*-instrument (possibly forceps) (Wb III.494.9) to remove the contents of the swelling. The Ebers papyrus goes on further to talk also of ‘removing’(?) the swelling with a *shas*-knife. Although the terms for these instruments do not appear in any other texts in relation to commercial (butchery) or domestic use, there have been no finds of instruments in a medical settingⁱ. However, some of the knives catalogued by Flinders Petrie are unlikely to have been used for commercial, domestic or military purposes (33). This conclusion is based on a simple examination of their shapes and sizes.

Although many artefacts purporting to be surgical instruments have been recovered there is only a single pictographic depiction on the temple wall of Kom Ombo. Unfortunately the instruments depicted on this bas-relief are most probably Roman in origin (IInd Century AD). Comparisons of this bas-relief with drawings or real artefacts is difficult but in Charles Dana's examination of Roman surgical instruments^j one can see that a number of them certainly seem to correspond to those depicted at Kom Ombo, suggesting that the Roman date for this bas-relief is probably correct. Although this does not detract from a possible earlier Egyptian origin for these instruments (34).

It has proved exceedingly difficult, even with modern technology such as scanning electron microscopy and specialist forensic techniques, to discover any iatrogenic incisions that a proto-surgeon may have made (35) (& personal communication). In John Nunn's superb work on ancient Egyptian medicine he discusses the report by Rowling that of the thirty thousand or so mummies examined not a single case of surgical scar had been found (36). One of the most unusual reports of a surgical incision, later proved false, was on the head of Tut-Ankh-Amun (37). The scar behind the left mastoid was initially thought to be due to an operation. However, later examination of the skull x-rays by Horne and colleagues concluded that the sclerotic changes to the bone were probably secondary to suppurating otitis media, and not as originally thought to an operative procedure (38).

^h for a full discussion of this fascinating tomb and particular case see John Nunn op.cit. p169-171 and references therein.

ⁱ In contrast to those instruments found in Nauplion and Ugarit. See Nauplion (Late Helladic IIB) in A.Delt 28 (1973) B'1 Chronika, 92-3, Arnott, Bob *Medizinhistorisches Journal*; 31 (1977) 271-3 and Ugarit (Ras Shama) JCS 33 (1981) 52-5.

^j see also the drawings of Vulpès (*revue d'andrologie*, 1897 & 1900) and Milne (1907).

From a forensic viewpoint the identification of a modern surgical incision is based on the characteristic lack of epidermal follicular disruption. Whereas a wide, blunt traumatic incision causes extreme disruption. The difficulty then is apparent when one considers ancient mummified specimens. Ancient instruments do not conform to the modern scalpel and mummified tissues are rarely in good condition - a result of both time and the employment of natron and libation fluids in the mummification process (39,40). Any attempt to identify therapeutic incisions is almost bound to fail (M. Aronson, Emeritus Forensic Examiner, personal communication). The only possible recourse is to look for site specific incisions to the fasciae where there are indications of an underlying pathology (e.g. an abscess).

Trephination

Trephining (from the Greek *trypaîn*: to bore) is perhaps one of the oldest of known proto-surgical and magico-ritualistic procedures. Evidence of its practice has been found in most parts of the world from the earliest times to the modern day. Although there is archaeological evidence of this practice dating to the Neolithic period (41,42) the earliest written account is first to be found in the treatises of the Hippocratic Corpus (460 - 377 BC) (43). The history of trephination in dynastic Egypt is based on fragmentary evidence and modern dogma.

There was initially tentative evidence that trephination was used in ancient Egypt. As early as 1918 Ruffer had indicated a possible case of trephination in an ancient Egyptian skull 44. A further discovery by El-Batrawy (1935) of a Nubian skull with a 3cm roundel removed from the right frontal region may also have been due to ante-mortem trephining (45). Later (1959) Oakley and colleagues reported a case of early dynastic trephination from Tarkhan (46). Wood-Jones maintains that trephining did not occur in ancient Egypt (47). Moodie likewise expresses initial reservations that this practice existed in ancient Egypt (48), as did Ruffer (44) and Ghalioungui (49). But as Ruffer pointed out this situation is not without precedence - no trephined skulls have ever been recovered from early Hindu India or ancient China and only a single case has come to light from Mesopotamia (in an area corresponding to modern Iran) (50). On the other hand Wolfgang Pahl argues that because the prevailing belief is that trephination was not carried out in dynastic Egypt any possible cases are automatically ascribed extremely rare pathogeneses, e.g. dysraphisms, infection, neoplasia and congenital bilateral openings of the parietal bones. However, even his definitive modern survey using the latest scientific techniques has only identified fourteen trephination's of dynastic origin, spanning some three thousand years from countless hundreds of thousand of skulls examined. Pahl further identified two possible dynastic depiction's of trephinning (p.81). The first is from the tomb of Userhêt in Thebes which depicts a badly damaged painting of a seated man having some in-

strument applied to his head by a single standing individual (this is also the depiction quoted by Ruffer). The second, more complete bas-relief is that of a single standing individual with two people in attendance obviously applying obsidian (?) knives to his head (Mastaba of Kaemrehu, Saqqara). However, it is very unlikely that either of these depict trephination's for the reason that they are both found in sacerdotal settings. The latter certainly depicts ritual purification by the shaving of hair whereas the former may also be a barber in action (the pot in front containing the balm that would be applied to the scalp to aid shaving) (51).

Why then have so few examples of this procedure been found in dynastic Egypt compared with other caches of skulls from Çatal Hüyük and the Mycenaean necropolis of Deiras, and of those found could any have been proto-surgical procedures? Trephinations can be carried out to accomplish a number of tasks - for the purpose of obtaining powerful fetish objects (46), curing mental disorder or the 'release of demons' (52), or as curative procedures, for instance in the relief of skull fractures. Most trephinations have been thought of as post-mortem for purely magico-ritualistic purposes. However, some scholars argue that this procedure was carried out as a therapeutic treatment for skull fracture by aboriginal tribes in America (48), Peru, and in Melanesia (46). Although in Africa this procedure has always been ascribed primarily to the need for fetish objects (53).

There is no literary evidence in magical or religious texts that in dynastic Egypt there was a requirement for trephinations to obtain fetish objects, a conclusion reached by Pahl. Furthermore neither the Ebers nor Edwin Smith papyri mention trephination, even though in the latter text the section on head and neck trauma appears to be complete. Again one may speculate that, aware of the high mortality associated with trephination the ancient Egyptian *sinu* avoided such a procedure. Religious factors may have also played a part in ensuring that this procedure never became prevalent in ancient Egypt (see final chapter for comments and references on the religious sanctity of the body).

Proto-surgery of trauma

If surgery ever needed a *raison d'être* then wars would be it. In ancient Rome surgeons (as opposed to the lay physicians) were the doctors with military attachments - the *medicus militum*, *medicus cohortis*, *medicus castensis*, *medicus extriremis*, etc (34). There is no doubt that in Dynastic Egypt medically qualified personnel would have accompanied the armies. The early Dynastic period has gained a reputation for militarism from the prodigious quantity of battle scenes found on relief's and adorning king lists (54). Penetrating wounds and fractures would have been the injuries of the Dynastic Egyptian battlefields. It is no coincidence then that the Edwin Smith and Ebers papyri are repositories of collected wisdom on just such injuries,

just as it is no surprise that the mace, axe, club and staff were the instruments of choice for conflict (28). In the Edwin Smith papyrus thirty of the cases deal with penetrating injuries of the head and lacerations of the ear, nose and throat. The remainder are split between fractures (seven cases) and dislocations (six cases) with some on breast ulcers. What is fascinating is that we know that the tactics of Sumerian warfare relied mainly on hand-to-hand combat with spears and axes. The only missiles used were spears thrown from chariots, but mostly they relied on sheer weight to crush enemies. Bows and arrows were for hunting (54). For Nubian enemies of the Pharaoh the weapon of choice was the heavy staff, which would explain the pattern of fractures found by Wood-Jones (see penultimate paragraph in this section). The ancient Egyptians certainly used bows and arrows from the Old Kingdom where archers are depicted holding them in their hands (quivers did not appear until the New Kingdom). It appears that the first time the Egyptians faced enemies who used archers against them was during the Hyksos wars (55) (see also the depiction of Semite archer at Beni Hassan (56)).

Faced with enemies utilising these sorts of tactics and weapons the composition of the Edwin Smith papyrus begins to make sense. Even more remarkable is a piece of paleopathological evidence that would seem to support the apparent emphasis of Edwin Smith papyrus on compound head injuries. It is known that the pharaoh Seqenenre Tao met his end at the hands of the Hyksos invaders who occupied the Delta region during the 2nd Intermediate Period (17th Dyn). We have his mummified head that shows five compound skull fractures, two of which correspond exactly to a known type of Hyksos-battle axe (28) (and personal communication - see also Fig. 4). These proto-surgical texts may also have been heavily influenced by occupational accidents especially where crushing injuries are described. There is certainly evidence to show that doctors were attached to the workman's village in ancient Egypt e.g. at Deir el-Medina. However, the composition of Edwin Smith gives it a far more military than occupational flavour.

What is not mentioned in medical papyri can often be as important as what is. It is apparent that the removal of arrows is not mentioned in either Edwin Smith or Ebers surgical papyri. Granted the former is incomplete, the papyrus stops after the thorax, so there may have been a section on this for abdominal wounds although it seems surprising that eye / thoracic arrow wounds had not been mentioned if indeed they occurred. This really then is the crux of the matter - did the Egyptians face this threat in battle and if so at what period in dynastic development? Archaeological evidence has shown that the Egyptians certainly had the bow and arrow in the predynastic period, bows were found in grave 22 at Tarkhan, and by the XIth Dynasty (Middle Kingdom) metal arrow heads were used (found in the temple of

Sonkhkara) (57). What is lacking are any paleopathological specimens with arrow injuries, or even arrow heads found with graves from the Old Kingdom. The battle relief's are more revealing on this subject. In the late Vth Dynasty tombs of the nobles Shedu and Inti at Deshasheh in Middle Egypt, a bas-relief depicts warfare against Asiatics who are shown pierced with arrows. However, this Old Kingdom relief does not show the pharaohs enemies using bows and arrows. In fact we have to wait until the end of the Middle Kingdom before a relief from the tomb of Khety at Beni Hasan actually shows both attacker (Egyptians) and defenders (Unknown) using bows and arrows (58). However, by the New Kingdom we again see only the Egyptians using the bow and arrow - particularly evident in the depiction of Tutankhamun slaying Syrian foes (Cairo Museum No 324, Pl LXXVIII) (6). This circumstantial evidence might then give some chronological setting to the Edwin Smith papyrus - we know it was not compiled in the New Kingdom, so we are left with the early Middle / Old Kingdom date of Edwin Smith, based on the hypothesis that Egyptian armies tended not to face the threat of archers during this period.

The practice of splinting bone to aid non-union was certainly understood as early as the Vth dynasty (59). The Edwin Smith papyrus discusses the use of basic splints, and there must have been a great calling for such skills especially in time of war or in accidents from building sites. The Edwin Smith papyrus (Ch7, III2-IV4, p.175-201), in the case of 'A Gaping Wound In The Head Penetrating To The Bone And Perforating The Sutures', uses the word *medjat nethet*, literally 'a wooden brace'. This is the only use of the word in Edwin Smith but it may be identical to the word *medjat*, meaning chisel or graver^k (Wb II.188.6-10). There is a further description of a splint in Edwin Smith papyrus ChII, V10 - 15 (p.234-244) where on the treatment of a broken nose (V11-14) one is instructed to splint the nose with a *bedjau* (Wb I.488.13). This is a rare word that occurs in traditional religious texts, in which it is only found twice, meaning the 'spar' of a ship^l (Wb I.488.12).

From the extensive work of Wood Jones on a series of 6000 Nubian skeletons (47), Ortner found a 3% incidence of fractures (60). Of these, 31% were in bones of the forearm, with the ulna having proportionally greater number of fractures compared with the radius, the so called parry fracture. This finding is in keeping with the practice of Nubian warfare that emphasised the use of the heavy staff. Fractures would occur to the forearm because of the necessity to fend off attacks with such a weapon. Splints in the medical papyri were most often described applied to the ulna and radius, and the fact that non-union was rare would seem to confirm the opinion that those who applied the splints were well versed in this technique. However, archaeological evidence of splints is rare. This is unsurprising. Consider this modern analogy. Archaeologists in the future

^k see the works of Leyden K15, Leemans, Mon. Fun., pLXXIV; Schiaporelli, Libri dei funerali, T.70, lowest row, No.2; cf. Griffith on *medjat* Proc Soc Bib Arch, 21 (1899) p.270.

^l see *Book of the Dead*, Naville, 99, 20 Aa and Lacau, Recueil de trav. 30, 67, No15a.

may disinter our remains and, finding bones which have been fixed with K wires, pins and plates, and, in the absence of any surviving orthopaedic literature, erroneously conclude that this was the main method of treatment. This is because plaster casts and external fixation devices will not be found - they are removed from the deceased before burial. This was probably a similar practice in ancient Egypt, and would explain the lack of archaeological evidence.


Although therapeutic amputation for non-union has never been proven, Möller-Christensen reported a possible case of amputation from ancient Egypt, with subsequent stump healing of the distal right forearm, dated to circa 2000 BC (61,62). In his report Möller-Christensen, although not discarding the theory of therapeutic amputation, preferred the explanation that the amputation was a form of punishment rather than injury from warfare. Alder was to challenge this notion on the grounds that punishment by amputation would deprive Egyptian Pharaohs of slave labour (63). However, Stuart concluded that the amputation was secondary to trauma as the morphological similarities between this specimen and a pseudarthrosis were too great to ignore (64). It is this latter conclusion that is most plausible. The famous relief of amputated hands and emasculation from the Ramesside temple show clearly that certainly by the New Kingdom victims of battle were counted by means of battlefield trophies i.e. hands were removed from dead enemy foot soldiers and dead officers were emasculated (see Figs. 5 and 6).

Certainly the basic concepts of fracture treatment did not require sophisticated knowledge. Even with rudimentary knowledge there must have been reasonable success. As Elliot-Smith notes the only evidence of infection occurred in one case in a hundred fractures that he examined (65). It appears as though in severe, and necessarily compound fractures sepsis rarely occurred. Some reports have given a higher prevalence of infection but caution needs to be applied in interpreting these results. Macropathological evidence for infection can often be spurious, and a result of post-mortem processes (66,67). However, it was the ancient Egyptians who were first to use closed reduction and external fixation, three and a half millennia before this became a widespread practice in Great Britain (68).

Proto-surgical procedures that never were

A fascinating mummy examined in the early 1900s was initially thought to provide circumstantial evidence that reconstructive surgery was carried out in ancient Egypt. The mummy of Nes-Tet-Nab-Taris (XXI Dyn), examined by Professors Elliot-Smith and Ruffer, was that of an emaciated, elderly lady, with a number of ante-mortem pressure so-

res. These were located between the shoulders, on the back, and on each buttock. The lesions on the gluteal region had two square sheets of fine leather sewn onto them. Furthermore, there was a sinus extending transversely from the left pudendal labium outward into the gluteal area, which had been sewn up with string (69). This was performed by the embalmers to restore the integrity of the skin. It may have been possible that the gluteal pressure sores were covered whilst this lady was still alive to provide some sort of cushion to ease the pain. However, they would not have been stitched on.

It has also been suggested that tracheotomies were performed in ancient Egypt. Although there is no mention of this operation in any of the available medical papyri two basalt slabs found by Petrie and Saad^m, one at Abydos and the other at Saqqara, and dated to the Ist dynasty reigns of Aha and Djer respectively, were reported to show just such an intervention. However, these primitive tracheotomies were designed to be of magico-ritualistic purpose in order to give the pharaoh the 'breath of life' and related to their *heb-sed* ceremonies. However, as Weill correctly showed the posture of the victim, kneeling with hands tied behind the back, is a well used determinative meaning 'capture' or 'captive' - Gardiner's sign-list A13  (70). It is more probable that these slabs relate to human sacrifice, or may even simply be pictorial ideographs.

There have also been a number of well documented artefacts arising from the process of mummification. Embalmers often added prosthetic limbs to achieve a more aesthetic result. Gray notes that a mummy in the Middleburgh museum in Holland had extra long bones added to the legs in order to make the body fit the coffin (71). Thuthmosis III^{rds} mummy was also splinted to improve its dimensions after it had been destroyed by grave robbers (p92) (72). Artificial eyes were also an embalmers modification e.g. Leiden mummy No 21 (Pl. XVIII.3) (73). One of the most interesting modifications was the addition of artificial phalluses. These could be modelled in clay to minute precision (p75-77) (72). This type of accoutrement has also been found modelled in cloth in a Vth dynasty mummyⁿ.






All these cases again illustrate the difficulties of interpreting extant material from ancient Egypt in a medical context.


Antiseptics

Antisepsis is an essential element of modern surgery. Little therapeutic benefit can be gained from an operation if the work is undone by infection, which may lead to wound dehiscence, septicaemia, and ultimately death. Without understanding the principles behind this process the ancient Egyptians may have understood the dire consequences of inaction when faced with an open wound.

^m see excavation reports of Petrie, W.M.F. *Royal Tombs II*, pl III, 4 & 6, and Saad Z.Y. and Emery W.B. *The Tomb of Hemaka* p35, fig 8 & pl. XVII, XVIII.

ⁿ see Petrie's expedition report of *Deshasheh* 1897-8, p15.




Medicaments were heavily based on honey, an unknown mineral *imru*, willow (salix - essentially the disinfectant salicin), ammoniacal applications and bactericidal copper containing solutions 68. In the Edwin Smith papyrus honey, *bit* , is used either alone (6 cases) or with the mineral *imru* as an external application (cases IX.6 & XII). By the time of Hellenistic Greece, the wound healing properties of honey (season honey) were still well appreciated by Pliny in his Natural Histories [Book XI, Ch14] (74). We do not know what *imru*  was although it has the determinative for a mineral. It is an archaic word that is found in no other texts. However, we do know that copper salts were employed from the translation of *shesit net wadju* , "powder of green pigment" [Ebers 78,5-6; Hearst XII,1; Edwin Smith case 41]. All these preparations were formulated using various types of grease, *merehet shu*  (literally "dry oil") and lint, *fetet*, . Grease could also be used for social occasions when it was impregnated with fragrant essences and allowed to melt on the body during social events (see Chassinat, Recueil Champollion, pp. 447-65). Interestingly modern research has demonstrated that commercial unboiled honey does indeed improve wound healing. The mechanism is probably multifactorial and related to inhibition of Gram negative and positive bacilli by the bee enzyme inhibin, the hypertonicity of the honey and its low pH, all of which also cause bacteriolysis (74). Furthermore Estes used a modern pharmacological approach to test several of these ores for bacteriostatic and bactericidal activity against *S. aureus* and *Ps. aeruginosa*; finding that they had an activity that would facilitate wound healing (75).

Incense was often burned in Egyptian religious temples and perhaps in those associated with medicine. The Egyptians certainly used fumigation with the incense *kap*  (Terebinth resin) for priestly rituals. But whether it was also used during medical procedures remains a matter for debate. In Lucas and Harris's examination of this subject they concluded that the use of incense was predominantly the domain of temples and magico-ritualism^o. There is also evidence for this practice from Mesopotamia. Kinnier Wilson has identified from a damaged section of BAM 39, 1-9 and AMT 49, 4: iv 1-9 evidence that the atmosphere was sweetened (?) with incense which was circulated or swirled (*sabā'u*) through the house prior to operations (76).

From this evidence alone it may seem that in proto-surgical work we find the beginnings of a rational and systematic approach. Where a slit in the ear [Edwin Smith 23, VIII 18-19] requires nothing more than to have it stitched up, a penetrating wound of the head requires the elaborate application of honey, copper salts, lint etc. at regular intervals. But we also have *imru* and honey being applied to a post-reduction of the mandible [E.S. 25, IX 5-6] and dislocation of the clavicles [E.S. 34, XII 18-19] where its be-

nefit is very doubtful. What is truly remarkable about the Edwin Smith papyrus, and to a lesser extent Ebers, is their lack of recourse to magico-ritualism when faced with possible therapeutic failure, unlike in other areas of medical practice, e.g. the reproductive health of women (77).

Proto-surgery - a real phenomena or just wishful thinking?

If a separate title for proto-surgeons existed it is most likely that it would have been discovered by now amongst the extant material. This is despite valiant attempts by Jonckherre and Ghalioungui (1,9). Even Grapow did not find any instances (III, 91). The fact that the first *sinw* Hesy-Re was spelt using the arrow hieroglyph, and that in many cases this is the sole indication of a medical title, has lent support to the belief that the dynastic Egyptian doctor was versed in matters of trauma i.e. 'of the arrow' and were therefore *de facto* proto-surgeons. Indeed the ancient Egyptians did use archers from the earliest recorded period. This suggests that the arrow hieroglyph represents the development of a medical 'profession' from the needs of war. Alternatively it may be nothing more than philological convention, completely removed from any other relationship, i.e. acting as a rebus. There is another hypothesis. Considering the previous discussion on the tactics and weapons of warfare in dynastic Egypt, if this hieroglyph was related to the occupation why not use the triconstant hieroglyphic for the mace ( *mnw*)? An alternative explanation for the arrow hieroglyph is that its presence is an indirect reference to the goddess Neith or Net, . The crossed arrows () were the symbol of Neith as far back as the IVth Dynasty where the arrow hieroglyphic is first found on the stele of Nofret (University of California, G1207) and Wepemnofret (*ibid.* G1201). As well as being the Mother-goddess her responsibilities extended to guarding Duamutef, the jackal-headed son of Horus who presided over the canopic jar which contained the lungs and heart removed during embalming (78). Ghalioungui was certainly of the opinion that embalmers and bandagers (*wr*) had links to the doctors through their dual association with matters religious. Perhaps Neith was also the divine benefactress of dynastic doctors and this was the origin of their association with the arrow ?

The most convincing written evidence to support archaeological discoveries on the matter of proto-surgery is to be found in the Edwin Smith papyrus (79), a papyrus that describes forty-eight trauma cases where the use of charms is mentioned in only one case. This seems to demonstrate an interest in science that, like the Rhind mathematical papyrus, transcends simple observation (80). However, some may argue that Edwin Smith is only an exercise in empirical observation without any underlying science. The scarcity of paleopathological for proto-surgery may be due to two

^o see Ancient Egyptian Materials & Industries p.90-97.

factors. First any specimens would have had to survive a vast period of human history, and second surgery may not have acquired the necessary social and legal position in ancient Egypt for it to be actually practised. Medicine in neighbouring Mesopotamia did not acquire this position until 1750 BC with the Code-law of Hammurabi (81). Although this Code was not an exhaustive corpus of logically arranged legal dispositions, such as Justinian's *Institutes* or Napoleon's *Code Civil*, it is a remarkable example of an extant archaic legal document. Compared with other legislative documentation from ancient Mesopotamia it is also the most complete^P. Although common law was the normal day-to-day practice in Mesopotamia each ruler since Urukagina enacted acts of *mêsharum* (justice). Hammurabi's royal decisions (*dînat sharrim*) were recorded and collected into the so-called 'Codes of Law', several copies of which exist ranging from the Old Babylonian to Chaldean dynasties (500 BC). The finest example was found by the French in 1901 and now stands in the Louvre. It is an 8 ft stele of polished basalt written in the Babylonian cuneiform script and containing 282 laws. What is so fascinating about this stele is that it contains legal pronouncements on matters medical. Here clearly written in cuneiform are examples of how social class determined the fees for medical treatment. Babylonian society was divided into three classes: freemen (*awêlu*), military or civilian 'state-dependants' (*mushkênu*) and slaves (*wardu*). For a life-saving operation the cost was 10 shekels for an *awêlu*, 5 for a *mushkênu* and 2 for a slave (§§ 215-17). Unfortunately for the ancient Babylonian *asû* (doctor) the cost of therapeutic failure was high. If the *asû*'s treatment injured a freeman, even if the offence was unintentional, then the Law of Retaliation applied (a more extreme form of the Sumerian penal system). From the stele we are told, "If a surgeon (?) performed a major operation on an *awêlum* with a bronze lancet and has caused the death of this man...they shall cut off his hand" (§ 218). We also know from surviving records that a similar policy of 'life for life' existed in medicine during the Hyksos rule (XV-XVI Dyn) of the Second Intermediate Period in ancient Egypt. It is tempting to speculate that codification of medicine by Royal command could also have existed in ancient Egypt by this time, of a similar nature to the Mesopotamian system. This would have made operative surgery, with its associated high mortality, a rather unpopular form of treatment with the ancient Egyptian *sinu*. However, this must remain a speculation. Assessing just how much medical and/or proto-surgical knowledge was learnt from the Assyro-Babylonian system is difficult until some cuneiform medical texts are found in Egypt or vice-versa. It was only after the removal of the Hyksos, or *Heqau Khasut* (Princes of Foreign Uplands), from their northern capital Avaris by the pharaoh Ahmose I (between 1570 and

1546 BC) that a period of new, aggressive expansion started and continued for more than 300 years. Knapp has suggested that prior to this Egyptian mentality had been isolationist (82). This could explain why there appears to be so little influence on medical development from Mesopotamia even during the acknowledged diplomatic periods of the Middle Kingdom and during the expansionary period of the New Kingdom- the latter were considered barbarians from whom Dynastic Egypt could learn nothing.

The question must also arise as to whether proto-surgeons could have existed as a separate group, even though no titles for them have been found. Herodotus' visit to Egypt during the Persian occupation of the Vth Century BC identified Egypt as the birthplace for individual medical practitioners,

"Medicine is practised among them on a plan of separation; each physician treats a single disorder, and no more; thus the country swarms with medical practitioners, some undertaking to cure diseases of the eye, others of the head, others again of the teeth, others of the intestines, and some those which are not local" (*Histories*, Book II ch84-85).

As Alan Lloyd discussed whilst specialist titles are comparatively rare the Egyptian physician was quiet capable of accumulating medical offices and duties, e.g. like those found on the Stele of Iri. Dynastic Egyptian medicine showed a considerable degree of specialisation without necessarily fulfilling the strict criterion that defines a specialist today (83).

The possible groups to whom the expression proto-surgeons could have applied are the military doctors and those concerned with the health of the temple/tomb builders. However, even these doctors would have dealt with matters non-surgical - perhaps it is sufficient to say that they were the practitioners and repositories of proto-surgical wisdom. Even in modern Egypt in rural areas the village doctors are still called upon to treat all manner of complaints, surgical and non-surgical, as well as acting as the local vet (84).

Practitioners of proto-surgery may have had to exist in relative secrecy because of social and religious taboos ascribed to the making of incisions on the human body (85). A rubic in the Book of the Dead (or Going Forth By Day) instructs the deceased to say, "I have not done what the God abominates" (Spell 125123, a, S2) (86), with the suggestion that this refers to the mutilation of the body. Lefebvre also describes an ancient Egyptian physician called Khouy as an interpreter of the "secret art"; one wonders whether or not Khouy was one of those versed in matters surgical ? (11). What is apparent is that the ancient Egyptians did practice proto-surgery but surgeons as a separate group probably did not exist. Instead, *sinu* were generalists who practised various techniques that we now call surgical.

^P Other examples include Code-laws from the reigns of Ur-Nammu (who founded 3rd dynasty Ur and restored the Akkadian empire in 2112-2004 BC), Lipit-Ishtar (an Amorite of 1934-24 BC), Bililama (founder of the Akkadian Code-law of c.1850 BC) and the legal 'reforms' of the last prince of Lagash, Urukagina, in c.2350 BC.

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