Aegyptus et Pannonia VII.

Acta Symposii anno 2021

BUDAPEST

Aegyptus et Pannonia VII.

Acta Symposii anno 2021

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Plants and Health Conference 2021, and the Proceedings

Dr. Hedvig Győry PhD

HEFT AEC president

In 2021, the HEFS Ancient Egyptian Committee, in partnership with the HNM Semmelweis Museum of Medical History, organised an international conference entitled "*Plants and Health from Ancient Egypt to the Present Day*". The three-day conference focused on topics related to the application of plant material in medicine, but also included other topics connected to the use of plants in any practical or theoretical area of human life. We planned four sections with the following keywords:

History of healing and nutrition from the time of ancient Egypt to the present day
Which plants were used for healing, how, where, by whom and when, which plants were used to maintain health, or prevent disease in different parts of the world; what did people eat in everyday life, what were the festive foods/drinks, what were the expected results; and what are the related issues raised by ethnographic research.

Medicines and pharmaceutical science in historical periods in the light of sources
Who, how and why recorded knowledge of medicine in each period; what principles were used to treat patients or maintain health; what were/are the popular explanations of these issues or principles.

Herbal medicine and contemporary medicine
According to our current knowledge, what can we assess about the active ingredients of a given plant, the mechanism of action and its intensity, and what biochemical relationships can be discerned from their interactions.

Religious views and beliefs about plants
By whom, where, when, and what special magical properties have been attributed to plants, what is the role of plants in the social context, how is it explained, and how have plants been incorporated into everyday life/celebrations or healing practices

The conference was held between 14 and 16 October 2021 with 40 presentations. Due to the COVID pandemic, circumstances did not allow for a face-to-face meeting, so the event was entirely online. However, the possibilities offered by the Internet also allowed for smaller group discussions. The topics presented included the appearance and use of plants in different times and places, from ancient Egypt to contemporary Europe. They were divided into thematic and language (English and Hungarian) sessions, led by recognised scholars. After the lectures, it was possible to discuss the issues raised in front of the general public, and topics of narrower interest could be further discussed in separate rooms created within the Zoom system. Valuable contacts were made and new research ideas were generated. A small exhibition was also organised by the HNM Semmelweis Museum of Medical History for the occasion, as we had hoped until the last minute that the pandemic situation would change. However, it was only available to personal visitors.

During the conference it was possible to learn about new methods, we exchanged ideas and heard about research results and ongoing projects. A significant part of the presentations were given in English, the other part in Hungarian, but the papers included in the proceedings are all in English. The first part of the proceedings, as a result of the presentations and discussions, is published in this volume; the other part can be read in the next volume of the Aegyptus et Pannonia series.

Although not all the presentations are published, most of the aspects we covered are included in the volumes. The programme covered a wider range of topics: We were able to learn about plant finds from recent Egyptian archaeological excavations, the identification and use of plants in textual sources, religious connotations, and even the possibility of reconstructing perfumes. We could also look at the trade in plants between the Hittite Empire and Egypt, and learn which plants were used by the Copts in the Middle Ages. The latest research on Roman herbaria was discussed, and hitherto unknown ancient Egyptian texts were presented. Other presentations were devoted to the reproduction of some medicines based on ancient recipes. In one of the lectures we saw on video the process of preparation and examination of an ancient Egyptian medicine. Several papers dealt with temporal and spatial changes in the everyday and liturgical use and interpretation of a given plant, e.g. pomegranate in Greece. In India, Soma. In Hungary, thorn apple. In Estonia, pelargonium. In Finland and the Arctic, roseroot. And in the Arabian desert of Egypt, the apple of Sodom. The role of plants in religious ceremonies and concepts was also discussed, as well as the variety and significance of the scent they produce.

The lectures presented a wide range of the application of herbs in ancient and medieval medical methodology, with the help of Egyptian, Greek, Anatolian, and Hungarian herbariums. The conference participants were the first to hear that many ancient Egyptian medicines can still be found in the medieval Welsh medicinal knowledge. We also learned that a significant part of Dioscorides' usage of herbs could also be observed in Anatolian folk medicine. Lectures were given on the wide range of magical effects attributed to plants, spanning from antiquity to the Renaissance, in terms of iatromagic, iatromathematics, and iatromythology.

In separate sections, the participants were introduced to Hungarian ethnobotanical research, where, in addition to the methods of the way of collecting ethnobotanical data throughout Transylvania, the lecturers presented both the botanical aspects and the therapeutic potential of the plants included in the various Hungarian medicinal herbariums and pharmacopeias. In addition to the knowledge of plants preserved in the Hungarian witch-trial documents of the 15th to 19th centuries, the possibilities of historical and folk use against various diseases – such as tuberculosis and cholera – were also presented, and in connection with diabetes and surgery we also visited India and China. We got again an idea of how wound care has changed over the centuries, how plants have influenced the toolkit of surgeons, and which plants are still used in modern wound management. In connection with the Székesfehérvár Pharmacy Museum, an overview of the museum's extensive educational activities was presented in addition to its history. We have got acquanted also with the the most important medical tariff book of Hungary in the 18th century and the drawer labels of five apothecary furniture of the same period.

The approach to the flora of ancient Egypt is also diverse, and the study of the Ancient Near Eastern relations encompasses several scientific fields, such as Assyriology, Hittiteology and Biblical studies. The classical Greco-Roman world is also included in the next volume to facilitate comparison. In addition to history, interdisciplinarity also extends to other branches of the humanities, such as – among others – archaeology, history, linguistics, ethnography, philology, the history of religion and magic or iatromathematics.

In recent decades, the development of the sciences has moved in the direction of interdisciplinary cooperation, not only between related sciences, but also between seemingly distant branches of science. In addition to textual and material sources, the results and methods of the natural sciences are of fundamental importance for a more precise understanding of the past. The role of analyses and investigation of the various materials is thus becoming increasingly important, complementing traditional descriptive studies. As we also wanted to play a role in this process, several areas of natural science, such as archaeobotany, phytogenetics, types of data investigation and plant breeding, or various facets of medicine and medical history are also represented in the proceedings.

In this volume, we publish 11 studies that approach the world of plants from different perspectives within the broad framework of the conference. The focus is on ancient Egypt, but the articles also look at other areas. In addition to the data found in the articles and the results obtained, the methodological and theoretical approaches raise many new ideas, give exciting results and draw attention to various possibilities. For example, the multifaceted role of medicinal plants in the museum world or their application from the perspective of medical history and ethnomedicine.

With this volume, we hope to arouse interest in the unique world of the past, especially Egypt, to bring closer the world of nature and its possible effects on human life, and to encourage the birth of further results that will make the ancient Egyptian world better known and our own world better understood.

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Armamentarium Chirurgicum et Plantis surgical instruments and plants in ancient Egypt

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Abstract

Throughout the 3000 years of the ancient Egyptian history, medicine itself, its treatments, and options changed slowly in each era. From the period of the New Kingdom the Edwin Smith papyrus written down latest around 1600-1550 BC, describes the surgical interventions of the time in a highly rational way. Doctors practised this type of medicine on a scientific basis, while magical spells were also recommended for some ailments. The Ebers papyrus, written nearly at the same time is one of the earliest records of drug therapy as conservative treatment with sketchy prescriptions, but also contains some surgical protocols. They are fundamental in medical history. Even after the decline of the pharaonic culture, the knowledge and tools of ancient Egyptian surgeons lived on in Greek and Roman medicine.

Surgery is a manual activity. However, a skilled hand needs good tools to be effective. From the Neolithic onwards and up until the 19th century, healing persons were forced to make their own surgical instruments, similar to household utensils, partly from materials found in nature and partly from materials that they have transformed. The oldest extant Egyptian instrument-depiction is the relief on the wall of the double temple of Haroeris and Sobek at Kom Ombo, built in the Ptolemaic period. In the Roman reliefs, we can see that ancient Egyptian doctors used knives, scalpels, forceps, scissors, saws, probes, trepan as direct instruments for surgical interventions, while cupping vessels, incense burners, beaked cups and vessels, bags, amulets, scales, herbal vessels, or sponges are represented as accessory tools in the patients' perioperative actions. Their shape has remained essentially unchanged for hundreds of years.

In this article we investigate the ancient Egyptian roots by collecting and investigating the few occurrences of pharaonic surgical instruments as objects or mentioned in texts, considering the functions used nowadays. Based on practical viewpoint we are also working on the identification of the possible ways extant tools could be used, looking among them especially for those, which were made of vegetable material, or for those, which may have originated from plants. We thus describe "target tools" and operating instruments that were among the first to be developed and used for various surgical tasks and movements.

Keywords: surgery, mummification, circumcision, plant-based, cutting and grasping tools, haemostatic, retracting, closing, special instruments, Kom Ombo

Introduction

"*Every man is a healer there, more skilled than any other men on earth – Egyptians born of the healing god himself*" wrote Homer in Odyssey (IV.230-232) during the 1st millennium BC.[1] The ancient Greeks and other ancient Western civilisations are much younger than the Egyptian one, and although they are now regarded as the foundations of modern European-Christian culture, all looked to Egypt as their role model showing how much they appreciated it. Modern human civilisation is based in many respects on the achievements of the ancient Egyptian culture, and this fact is very much in evidence in many different areas of life to this day.

Pharaonic Egypt as a great and unique riverside empire with its more than 3000-years existence was a longest-lived culture in world history. During this time, medicine itself, the methods, tools, and options for treatment have changed only very slowly. Throughout the great periods of ancient Egyptian history, the change, the transition, and the permanence have been a common feature in all kinds of activities.[2]

Surgery is a manual activity. But a skilled hand can do almost nothing without good tools.[3] Our ancestors just used what they had on hand – literally! The earliest "doctors" used their teeth, hands, fingers, fingernails and mouth, and only later were used sharp stones like flint, then copper or bronze, finally iron and steel.[4] For example, sharp human nails could be employed as primitive surgical knives, scalpels, lancets, scarifiers, curettes or elevators. It is documented that natural tribes' people pinched through the umbilical cord with

1 Homer 800 BC, 56; Todd 1921.

2 David 1998.

3 Ferencz 2015.

4 For the details of the below mentioned events see Kirkup 1995, 380-381.

their fingernails, or certain rabbis used sharpened thumbnails for circumcision of the new-born baby. In traditional Ethiopian surgery, the long index fingernails were used to scarify infected tonsils or to extract them completely.[5]

Grouping of basic surgical instrument's types by their function	**Body part and its function, as prehistoric "tools"**	**Ancient Egyptian tools used in the Graeco-Roman period, seen at Kom Ombo**	**Some examples for equivalent instruments, used now**
1. Cutting and dissecting instruments	Tearing type movement with fingernails and teeth.	Scalpel, Knife, Saw, Razor, Trepan, Scissors	Mayo scissors Liston amputating knife
2. Grasping, clamping, and holding instruments	Pinching and grasping motion with the fingers and thumb, or the clenching action of the teeth.	Forceps, Mosquito	Surgical forceps Hegar needle holder Doyen intestinal clamp
3. Haemostatic instruments	Compression of vessels by hands and fingers.	Cautery iron and fire, Incense burner, Mosquito	Diathermia (electric knife) Tourniquet Esmarch-cuff Vascular clamp
4. Retracting and exposing instruments	Pulling and opening incisions and wounds.	Bifurcated sharp hook, Hooks, Tri-valve specula	Guthrie hook Weitlaner self-retaining retractor
5. Wound closing instruments and materials	Holding and pulling the tissues together with fingers and/or teeth.	Needles and threads, acacia thorns and strings	Michel clips Suturing
6. Special instruments (includes sucking and aspirating tools)	The action of the mouth to suck out fluid.	Probes, Drill, Catheters, Scoop probes, Double-ended probes	Suction system Redon drain

Table 1. Groups of basic surgical instruments in the prehistoric era, in the ancient Egyptian periods and today

5 Pankhurst 1964.

It is an interesting note that the use of body parts as tools and the experience gained then ultimately evolved into the tools we use today. Each of the six groups of medical tools we classify nowadays can be derived from interventions carried out by body parts (Table 1).

Thus, from the Neolithic onwards, man has been forced to make his own surgical instruments, as well as household tools, partly from materials found in nature, and partly from materials, he has transformed. Ancient Egyptian surgeons stitched up wounds, set broken bones, maybe trepanned the skull, and also recognised that some injuries were so severe that they could only keep the patient comfortable until death.

In everyday practice of handicrafts, people have improved the tools and implements to extend and refine their activities. It can be assumed that the first surgical tools were borrowed from these households, workshops (barber, butcher, blacksmith etc) or military equipment sets.[6] In the process of the healing practice, the physician learned also which forms were good for what purpose, and which materials could be used for a certain process.

In the Upper Egyptian Tasian and Badari cultures and the Lower Egyptian Ma'adi culture of the fifth millennium BC, people already kept domestic animals – animal cult appeared, had a mature Neolithic tool culture, and used stone tools even for agriculture.[7] They could only adapt the same tools for wound management. About 3500-3000 BC, the use of copper instruments started to become widespread, although many tools were still made of stone. The development of irrigated agriculture and unified production management inevitably led to the unification of the Nile bank under one ruler, and the sharing of knowledge, at least in leading circles. As medical skill was vital for life, healers might belong to these leading circles.

During the Early Dynastic Period, ancient Egypt was already a highly organized society in which medical practice developed and started to be recorded.[8] The basic principle of ancient Egyptian medicine got established then for the entire dynastic era: a mixture of religious / magical and empirical / scientific procedures.[9]

The ancient Egyptian population suffered from numerous diseases as we have today. They include infection-based illnesses (e.g. dracunculiasis, schistosomiasis, malaria, dysentery, pneumonia, tuberculosis, trachoma and other eye infections, etc), problems with inflammatory origin (e.g. arthritis,

6 Forrai 2008.

7 Overview in Bard 2013.

8 There is a debate about the representation of some ivory tablets made during the reign of Aha and Djer whether they represent tracheotomy (Vikentiev 1955, 171-200, Pahor 1992, Carroll – Pahor 2001) or a sacrifice (Blomstedt 2014).

9 Győry 2003a.

bronchitis, appendicitis) or traumatic cases (war injuries, accidents or penalty), or just different diseases of the organs (such as heart, liver, or cancer, thyroid, high blood pressure, the common cold, kidney stones, umbilical hernia, arteriosclerosis, gynecomastia, skeletal deformities, dementia, ovarian cyst etc.). This suggests that the duties of Egyptian physicians included creating medications, providing magic spells and prayers for healing, or mending broken bones and surgery especially in the field of wound care.[10]

Based on New Kingdom papyri, originating latest from the Middle Kingdom/Second Intermediate Period, Egyptian doctors identified three categories of injuries: treatable, debatable, and untreatable. The Smith and Ebers papyrus attest that curable diseases were quickly repaired by surgeons. The trauma in which the victim could presumably survive the treatment, but the certainty was missing, needed monitoring and, if the patient survived, surgical attempts could be made to correct the problem.[11]

Egyptian civilisation has left us a tremendous material and cultural heritage that has stood the test of time, but the written documentation and the archaeological finds concerning surgery is scanty. At this time, surgical medicine did not have yet special instruments, they used tools, which they would have used in everyday life, holding them in a special storage device for having at hand during patients' treatment. The descriptions are incomplete; thus, the reconstruction is frequently hypothetical and the reason for the potential use of tools and the actual process of their use is usually unknown. Presumably, few procedures could be performed with purely stone or partly metal tools, thus other natural materials with plant origin were also used as tools.[12]

This paper attempts to explore the place of plant-based surgical instruments in the ancient surgical practice according to the content of the oldest surgical textbooks; the potential practitioners for surgical interventions; the extant tools and instruments, and representations resp., potentially used to do the surgery thousands of years ago.

1. The Smith and the Ebers papyri as the first surgical texts

There are 13 major ancient medical papyri and several fragments in various sizes. They are named after
(1) the site where they were found (as in the name of the oldest one, the Kahun gynaecological papyrus, or the Ramesseum papyri named after the temple); or
(2) the person who found, purchased or owns/owned them (e.g., Edwin Smith,

10 Sullivan 1995; Győry 2001a; Dobanovački et alii 2012.

11 Shafik – Elseesy 2003.

12 The phenomenon was present in other fields of activities as well, e.g., the branch of acacia (*ḏr.t n šnḏ.t*) was used in caching the birds (Eb848).

Georg Ebers, William Randolph Hearst); or
(3) the institution where they are housed (e.g., Royal Institute of London, Berlin Museum, Brooklyn Museum, Carlsberg Foundation).[13]

The 17 columns on the recto of the Edwin Smith papyrus is the only surviving copy of an ancient Egyptian book specialised on surgical treatments of injuries, while the Ebers papyrus, which is compiled about the same time, is a general medical papyrus, containing some passages with surgical actions on various types of burns, swellings, boils or tumours.[14] Both were written in hieratic writing of the 18th Dynasty (Table 2.).

The Smith papyrus[15] (467 cm x 33.02 cm) might be an updated copy of a book originating in the Old Kingdom (1600 BC).[16] It is exhibited at The New York Academy of Medicine Library (Figure 1.). It was purchased by the American merchant Edwin Smith from the dealer Mustafa Aga in Luxor in 1862, along with other famous scientific papyri, such as the Ebers papyrus,[17] held now by the Egyptian Museum in Leipzig, the Rhind mathematical papyrus or the British Museum mathematical roll. All four writings were said to be found in the same tomb.[18]

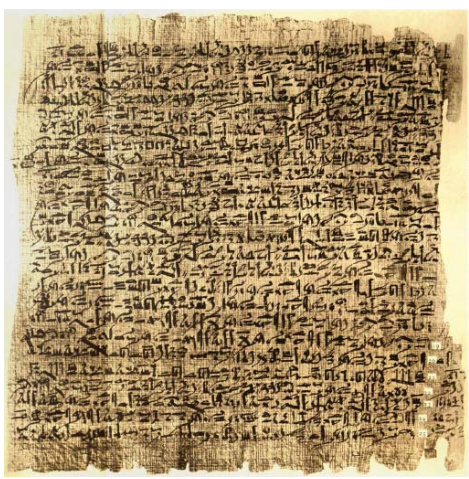


Figure 1. Column 2 in the Edwin Smith Papyrus written in hieratic script and describing surgical cases 4 and 5 (Source: Breasted 1930, pl. II.)

The surgical interventions described on the Smith papyrus are rational. The book recommends only once a magical spell (Case 9, col. 4,19-5,5). Two different kinds of physicians are mentioned in the book (case 1, col. 1.7): the *swnw*-doctor, and the *wʿb*-priest of Sekhmet. In a parallel text of the Ebers papyrus (Eb 854a), the *amulet/protection man* (*s3*), translated often as magician, is added. The papyrus goes systematically through each

13 Metwaly et alii 2021.

14 El-Gammal 1990.

15 Main publications: Breasted 1930, 31-466; Deines – Grapow 1958; Grapow 1958; Westendorf 1999, 711-748; Allen 2005, 70-105, no. 60; Sanchez – Meltzer 2012.

16 Pommerening 2014, 39-40.

17 Wreszinski 1913; Ebbell 1937; Deines – Grapow 1958; Grapow 1958; Ghalioungui 1987; Westendorf 1999, 547-710.

18 Feldman – Goodrich 1999.

Periods of ancient Egypt	Extant medical papyrus and their main topics	materials and beginning of the use of medical instruments
neolithic cultures to Predynastic period (5000-3000 BC)		Stone Age tools, obsidian blade, jade stone, flint knife
Early Dynastic Period / Archaic period (3000-2635 BC) Dynasty 1-2.		Stone Age and Cooper Age tools
Old Kingdom (2635-2155 BC) Dynasty 3-6.		surgery development into a rational science and skilled art copper-alloy instruments also for artificial mummification
First Intermediate Period (2155-2040 BC) Dynasty 7-10.		
Middle Kingdom (2040-1791 BC) Dynasty 11-12.	Kahun Papyrus (1850-1700 BC) gynaecology	
Second Intermediate Period (1791-1550 BC) Dynasty 13-17.	Ramesseum Papyri (III-IV-V) (c. 1700 BC) – ophthalmology, paediatrics (magical texts), prescriptions for muscle pain	
New Kingdom (1550-1070 BC) Dynasty 18-20.	Edwin Smith Papyrus (c. 1600 BC) surgery / magical spells etc. Ebers Papyrus (c. 1550 BC) general medical papyrus Hearst Papyrus (c. 1450 BC) general medical papyrus Berlin Papyrus (c. 1350 BC) general medical papyrus London Papyrus (1300 BC) with magical spells Carlsberg Papyrus (c. 1300 BC) – obstetric prognosis, ophthalmology Chester Beatty Medical Papyrus (c. 1200 BC) intestinal movements	bronze tools

Third Intermediate Period (1070-945 BC) Dynasty 21-24.		
Late Period (716-332 BC) Dynasty 25-31.	Brooklyn Papyrus (c. 450 BC) snakes and scorpion bites	also iron tools
Ptolemaic Period (332- 30 BC)	Rubensohn papyrus against coughing	
Roman Period (30 BC - AD 395)	Crocodilopolis papyrus (c. 150 AD) – general	beginning of regular cauterisation
Byzantine age (395-640)		end of mummification

Table 2. Main medical papyri and tools used during the ancient Egyptian culture

body part starting with a description of the injuries to the head, continues with the neck, arms, and torso, thus follows the *a capite ad calces* (from the head to the calves) method. Finally, the text stops in the middle of case 47, before the diagnosis would be written. The treatments include suturing wounds (at the lip, throat, and shoulder injuries), preventing and treating infection with honey and oil, and bleeding control with raw meat. For head and spinal injuries, it recommends that the patient should not be moved.

The Smith papyrus also contains some anatomical observations: cranial sutures, the meninges, the outer surface of the brain, cerebrospinal fluid and the first known description of the cerebral arteries. The functions of some of the major organs were correctly assumed – for example, blood was correctly thought to be the transpiratory medium for vitality and waste products, not far removed from its actual role in oxygen transport and carbon dioxide removal. However, working of other main internal organs remain unknown or were incorrect – for example the heart and brain, whose functions were exchanged.[19]

Since all illnesses were believed to have supernatural causes, it was logical to rely on the supernatural for healing, thus, medical treatment was often accompanied by a spell to help cure the illness. With other words, besides science, surgical treatment involved also the use of magic, incantations, amulets, offerings, tattoos, and statu(ett)es.[20] Although physical injury was usually addressed pragmatically through bandages, splints, and salves, even the broken bones and surgical procedures described in the medical texts were thought to have been made more effective through magic spells or actions.[21]

19 Vargas et alii 2012.

20 Katona et alii 2015.

21 Sipos et alii 2004.

In addition, religious concepts involved in all treatments, could be the only possibility in incurable cases. People developed mythological anatomy, which meant that each body part had its own god to protect it and keep it healthy; and illness-mythology, that is, first every disease had its own god, who caused illnesses and secondly other gods protected them against illnesses, keeping away the disease-gods and spirits, also called now demons, and ensured the cure.

2. The healing profession in ancient Egypt

The medical profession naturally found its place in the social organisation. Disease and health were integral elements of the contemporary worldview, as part of the *maat*, the maintenance of which was a fundamental task of the pharaoh. In this respect, he was the supreme doctor in the country. He delegated this task to the special group of scribes called *swnw*, the secular physicians.[22] This name was written with an arrow above a jar. Among the many physicians, there is also attested a woman overseer of female doctors, called Peseshet, during Dynasty 4.[23] Particularly distinguished doctors reached special grades such as overseer of doctors (*jmy-rꜣ swnw*), great/chief/master doctor (*wr swnw*), elderly/senior doctor, registrar (*smsw swnw*), inspector of doctors (consultants?, *sḫḏ-swnw*). Besides, there were specialists (physicians for the eyes, the teeth, the abdomen, the anus etc.).[24] Their main activity was exercised by various medical preparations.

Another kind of doctors belonged to the priestly class. These *wꜤb.w,* "*pure-priests*", were part of the temple personnel, mainly, of Sekhmet,[25] and were well acquainted with religious practices, among them also with magic. Their main field of activity is shown to be epidemics, surgery, and probably veterinary medicine. They applied the same methods in treatment as the secular doctors, but with much bigger emphasis on divine intervention, gained by prayer, accessories or other divine help. Other specialised priests are the Selket-priests (*ḫrp Šrkt*) who treated snakebite and scorpion-sting. We hear occasionally other god's priests also involved in curing activities, the most important ones seem to be those of the gods Khonsu, Horus, Sobek or, started from the Late Period, Imhotep.

22 Reeves 1992, 1-38; Sullivan 1996; Győry 2001b; Ziskind – Halioua 2005, 7-40; Ziskind – Halioua 2007; Nunn 1994; Saber 2010, etc.

23 Ghalioungui 1983, 18-19, no. 19.

24 It is attested by titles from the Old Kingdom on, and also by Herodotus, who wrote: "*The practice of medicine is so divided among them, that each physician is a healer of one disease and no more. All the country is full of physicians, some of the eye, some of the teeth, some of what pertains to the belly and some of the hidden diseases*" Translation from Todd 1921.

25 Hoenes 1976, 35-42.

A third class of official healers are called by the Egyptians *s3*-men, which means "*protection- or amulet-men*", translated usually by magician, who not necessarily belonged to a given temple personnel. This name suggests the key role of magic in their activity. The amulets and various magical healing practices attested with the many iatromagical (magical healing) papyri were their main field of activity, probably for cases when severe divine help was needed or physicians were not available.[26] Their training took place in the "*House of Life*" (*pr-ˁnḫ*) as all the other professions with written material.

Medical knowledge

Ancient Egyptian doctors were renowned in the ancient Middle East for their healing skills, and some, such as the name of Imhotep, remained famous long after their deaths. By modem standards, however, they applied a relatively weak pharmacopoeia, and a very limited repertoire of operative surgery.[27] Nevertheless, they had other therapeutic tools at their command. These included tender care, the placebo effect of magical treatments, and attention to diet.[28] In addition, there is good evidence that massage and other forms of physical medication were practised.[29] Although the tradition of separation of drug-therapy and surgery is generally thought to go back a long way, it is unlikely that in ancient Egypt the role of the surgeon was limited to the wab-priests of Sekhmet. The only probable depiction of a surgical operation is a circumcision (see later), and this is being undertaken by a *ḥm-k3* (funerary) priest.

Because Egyptians have performed a lot of mummification and worked with a lot of cadavers it is mistakenly believed that physicians had considerable anatomical knowledge. In contrast, modern reconstruction of the mummification process showed that the descriptions were inaccurate in some places: (1) through the short abdominal wall incision the embalmers could not view the viscera *in toto* (this is literally like performing surgery in the dark); (2) often the role of viscera was unknown; and (3) the prohibition of dissection and the defilement of the human body has always been the supreme law and the main obstacle to anatomical knowledge. Making an incision in the abdomen was, paradoxically, both necessary and yet ritually prohibited. Diodorus Siculus in his description of mummification (I.91) says: the specialist makes the cut "… *as the law commands, with an Ethiopian stone and at once takes to flight on the run, while those present set out after him, pelting him with stones, heaping curses on him* …" (translated by C. H. Oldfather), so, the embalmers seem to

26 Győry 2008a, esp. 1513 and 1517-1518.

27 Attested by human remains e.g. Győry et alii 2020.

28 Győry 2003a; 2003b and 2011.

29 Nunn 1994, 5-13.

live a cursed life and worked far away in the West side of the Nile – at least during the early Roman period of Egypt. Nevertheless, they formed a special class of priests and were highly skilled professionals, probably with close ties to doctors through the House of Life or family ties.[30] Even so, the process may well have been a secret knowledge handed down from father to son.[31] The first description of the surgical aspects of human mummification comes from Herodotus (Histories, II,86-89). Egyptian descriptions are known only from the Roman imperial period, although the formulation of the texts suggest much earlier times.[32] Embalming and mummification are believed to have been carried out by a caste or family and was passed down from generation to generation. This may explain why the surgical steps of mummification were not described for a long while.

Medical specialisation

From Stone Age the archaeological specimens that demonstrate some forms of surgical procedure are rare, though no doubt, the existence of a recognizable surgical profession or even of the practice of surgery by medically qualified personnel started with the development of large settlements based on agriculture and animal husbandry, with great building constructions and the establishment of stratified human society. Purely anthropological material is, however, difficult to interpret in this aspect – it depends much on the state of preservation of the material, and also on the precision of the available technical devices for the investigation. In addition, several surgical interactions cannot be detected on mummies or bones, such as many infections, healed abscess, cataract or tumour, but we have the written evidence. Far more reliable sources of information on surgical practice seem thus be provided by ancient Egyptian medical sources or writings of Graeco-Roman historians, though their interpretation also raises questions. They indicate surgical actions and types of instruments used. [33]

Medical titles used during the Old Kingdom indicate highly specialised medical society, thus most probably surgical specialists existed already at that time. No special name for them is, however, known during the pharaonic period, thus their profession must have been part of another one. Among healers were some in charge of the medical care of the work force of the pharaoh.[34] Depending on specific needs, administration assigned the medical people to mines and quarries, to large building sites, royal necropolises, temples, large

30 Ziskind – Halioua 2005, 44.

31 Bier – Wade 2001.

32 Sauneron 1952; Goyon 1966; Goyon 1972; Győry 2010.

33 E.g. Győry 2006.

34 Ziskind – Halioua 2007.

farms or to the army in war. These were the first "*occupational doctors"* as they carried out their work within a community. Certainly, among these general practitioners were "*surgeons"* who treated the injured people both in war and in peacetime. Moreover, such practitioners surely accompanied the military campaigns and important journeys giving free treatment as they received their support from public funds.[35] Their skill is attested for instance by the few extant remains of successful amputations in Giza, Deir el-Bersheh or Thebes, which could not be achieved without this very specialised skill.[36] Sekhmet was a lion-headed goddess associated with blood, death, and destruction; her priests could be practitioners not only for human surgery but also for animals'. The bloody wound management was certainly one of their main occupations.

Thus, "mine and quarry doctors" ensured medical, and within that surgical care of expedition personnel sent to exploit the minefields in regions far away from the Nile valley. "Farming doctors" were from the 6th Dynasty looking after the health of peasants assigned to large farmlands/settlements (*grgt*) founded by the pharaoh. "The gods' doctors" were the personnel in charge of the management of the great temples and the funeral foundations probably benefited from medical treatment carried out by a particular corps of medical practitioners.[37]

3. Tools for medicinal use

Human flesh, either living or dead is almost the same. From this physical point of view, mummification and surgical action needed tools with the very similar physical properties to handle body and inner organs. As special tools, doubtless only for medical use are not extant, we can assume that mummification priests and surgeons had in majority the same choice of tools to take for their operations. Mummification had a well-known religious connotation, and a practice we can deduct from texts and mummies, which are displaying the result of the process. Moreover, in several cases mummification materials and tools were buried, giving the unique opportunity to find tools used with whole certainty for this purpose. Thus, both mummification tools and every day, cosmetical or various professional tools must be compared to possible medical applications.

Tools of mummification: knifes, hooks and spatulas

The artificial preservation of the corpse started to be practiced in ancient Egypt already in the prehistoric period, but the first known whole

35 Nunn 1996.

36 Győry et alii 2020.

37 Ziskind – Halioua 2007.

mummies originate from the Old Kingdom, and the classical mummification lasted until the Christian era.[38]

During the time of the Persian rule in Egypt, Dynasty 27, when Herodotus visited Egypt, the mummification techniques were classified into three types (II.85-88). They were different from each other in the process complexity but also in their price. The whole process[39] took up in all cases about 70 days, and only during the most expensive one was the inside open by an incision. Among these mummies, in all cases the straight and sagittal incision made in the left side of the abdominal wall is a wrist width. It is named very rarely, but interestingly, in three cases the same word, *npḏ* is written,[40] which usually means "*slaughter (of animal/Seth)*".[41]

Once the embalmer inserted the hand through the incision and removed the liver, stomach, and intestines, the diaphragm was cut and the lungs pulled out. Most likely, the initial incision to the abdomen had to be lengthened to remove the liver, as it happened in 1994, when Bob Brier, a professor of Egyptology at Long Island University and Ronald S. Wade, an anatomy specialist at the University of Maryland Medical Center, attempted to replicate the mummy-making process of the ancient Egyptians, using only ancient Egyptian-era tools and following Herodotus's first description.[42] The heart was left inside because Egyptians believed it to be weighed in the Afterlife to determine whether the individual deserved the eternal life among the gods.[43] A similar experiment was made by Francis Janot and his team based this time besides the reconstructed tools, on scattered ancient Egyptian notes concerning mummification,[44] as one of his aims was to find out how the various instruments could be used.

To cut and to tear organs' connections the priests could use their fingers, or copper alloy or the sharper bronze knives. For holding apart, the incision during this act, hooks could be used. After that, each of the removed organs was individually dried, wrapped in linen and mostly placed in one of the four canopic jars. After organ removal, the abdominal incision was normally left

38 E.g. David 1998; Pommerening 2015; etc.

39 David 2001.

40 Kees 1963: it is called *npḏ* in three times, on the sarcophags of Psusennes, Aspelta and Petamenophis. Janot 2000, 60 could find only two other mentions: *mn* „*illness*", and *r3*: „*mouth, opening*".

41 E.g. Edfou VII, 320, line 12. See TLA: https://aaew.bbaw.de/tla/servlet/GetCtxt?u=guest&f=0&l=0&db=0&tc=24960&ws=35&mv=3, or Edfou VII, 316, line 6, See TLA, https://aaew.bbaw.de/tla/servlet/GetCtxt?u=guest&f=0&l=0&db=0&tc=24932&ws=28&mv=3 .

42 Brier – Wade 2001.

43 Iskandar 1980, 6.

44 Janot 2000, 13-87.

open, and the body was dried also from inside by natron bags inserted into the cavity. At the end, the incision was sometimes covered with a plate of wax or copper alloy, mainly depicting a wedjat eye or was a double-fingers amulet – in accordance with the tradition of the actual period.[45] Occasionally the incision was sewn shut.[46]

According to Herodotus, the incision process was made with a piece of obsidian blade that is a "*stone of Ethiopia*", where it was imported from. Obsidian is a naturally occurring volcanic glass. Since ancient time it has been found all over the word, especially near volcanoes, so it was a widespread cutting tool in the ancient Mediterranean civilisations, but also in Aztec, Maya, or Polynesian cultures. Modern electron-microscopic-studies have shown that the surface of obsidian is smoother than that of the stainless-steel blade, so this blade is suitable for precise dissection of fine structures. The cutting edge of obsidian blades is near of molecular thickness (3 nm), namely they would be able to cut cells or molecules.[47] By this way, they are about 3 times sharper than diamond, and 5 times sharper, than good quality carbon steel or stainless-steel blades (Figure 2. A-B). It means cleaner cut and lesser tissue trauma, which leads to faster and near scar free wound healing, which explains why ophthalmologists and neurosurgeons are still using it today.[48]

Moreover, flint knives were probably also suitable for cutting abdominal and thoracic organs and tissues, although their sharpness was far below that of obsidian tools (Figure 2.C).

A B C

Figure 2.A. Obsidian blades from ancient Egypt (Source: https://edu.glogster.com/glog/ancient-egypt-science-and-technology/1p2i1o48xgx) 2.B. its modern, sterilisable form with handle. 2.C. Flint knife with ivory handle from Naqada II. period, 3200 BC, Upper Egypt (Source: The Trustees of the British Museum, EA68512)

45 For more details, see Janot 2000, 56-60.

46 E.g. Salem – Eknoyam 1999, 142, fig. 2.

47 Piccardi – Masse 2007, 308.

48 Ferencz 2021.

The Egyptians did not consider the brain important in the Afterlife. Therefore, over the long history of ancient Egyptian mummification from as early as the Middle Kingdom – at the most elaborated cases – they removed it through a small slot of the skull. Its removal had become widespread by the New Kingdom period. It seems to be logical, based on tools found that for brain crushing the embalmers used different thin and flexible copper or bronze hooks, and the brain was pulverized to fragments so that it could be removed with a spatula type instrument. Nevertheless, mechanical crushing with hooks alone cannot remove brain tissue. The skull cavity firstly had to be irrigated and filled with water. This was confirmed by the embalming and mummy-making process replicated in 1994.[49] Examinations of ancient Egyptian skulls showed that about every second mummy had a hole made in the base of the skull through the plate of the ethmoid bone (transethmoidal route). In other cases, the nasal septum had been wholly or partially removed, which resulted in the base of the skull in perforation (transsphenoidal route). Brain removal was often incomplete, and modern studies confirmed that some tissue was usually left behind.[50]

Although several tools could be used for the mummification,[51] the basic tool-kit included a knife to make the abdominal incision, hooked copper/bronze rods to extract brain matter, a wooden adze-like tool to remove internal organs, and a funnel to pour resins into the cranial cavity through the nose (Figure 3.C).

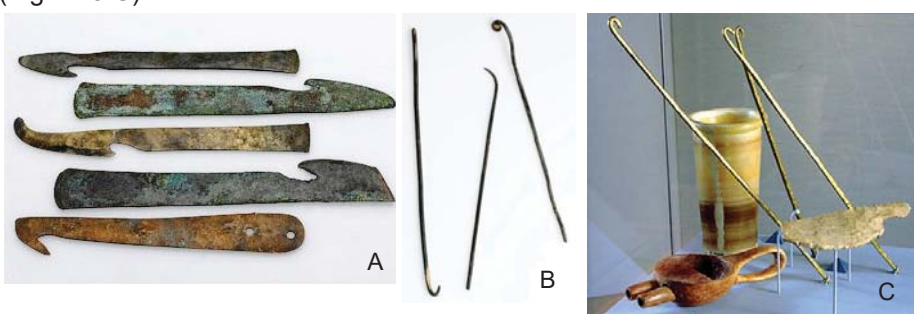


Figure 3. A: Bronze, hook-shaped knives used during mummification, London, Science Museum (https://wellcomecollection.org/works/eahksjvd) 3.B. Cranial hooks used to crush the brain from 2000 BC – 101 BC, London, Science Museum L0058415, 600-200 BC (https://wellcomecollection.org/works/ej23b2n4) 3.C. Basic mummification kit, (replicas based on examples from the Rijksmuseum, Leiden (Oil jar), Royal Ontario Museum 948.1.17 (funnel), Smithsonian Institution 221.389 (Embalmer's knife) (https://www.historymuseum.ca/cmc/exhibitions/civil/egypt/egcr06e.html)

49 Brier – Wade 2001

50 Abdel-Maksouda – El-Amin 2011.

51 For tools and process, see Janot 2000.

Depictions of medical-surgical tools

The oldest depiction of instruments and materials used for specifically medical purposes are depicted in the Kom Ombo temple (KO 950). Ancient Kom Ombo, called Nubit by the Egyptians, was an endpoint for golden expeditions during the pharaonic period, and became an important administrative centre and a prominent transit point for trading caravans coming from the Red Sea to the Nile during the reign of the Ptolemies (332-30 BC). This role it kept also during the Roman era. The main temple was built, about 2 km southeast of the city, overlooking the Nile. Although the founder was possibly Thutmose III, the today's architectural shape was established during the Ptolemaic period (Figure 4.A). The reliefs were carved both in Ptolemaic (starting with Ptolemaeus VI) and Roman periods, yet were not completely finished still in the 3rd c. AD (Macrinus is attested as the latest emperor). In Middle Ages, the ruins got covered by the desert, and it was only at the end of the 19th century that the excavation of the temple began. The temple of Kom Ombo was dedicated in an unusual way, equally to two deities – Haroeris and Sobek (Figure 4.B). Horus the Elder, in Greek Haroeris, son of the god of sun and sky, was depicted with the head of a falcon. Sobek, the god of water and time, was portrayed as a crocodile-headed man, and was a protecting god.

On the internal side of the east wall of the outer passage or second surrounding wall around the temple of Kom Ombo, there is a series of scenes where Trajan is making offering to various gods. Here he is kneeling in front of two small statuettes of Isis and probably Osiris (crown missing), just beside the famous scene with the medical kit,[52] which is followed by a sitting god and standing goddess behind a measuring vessel, which is accompanied by the inscription of fractions of floodwater units from various places connected to body members of Osiris (Figure 4.C). From here, we know that Egyptian physicians at that time used the same scalpels, curettes, chisels, pincers, forceps, scissors, saws, probes, spittoons, and sponges to treat wounds (Figure 4.C-D) as their Roman counterparts – even in sacral-liturgical environment.

The shapes of these instruments have remained essentially unchanged for thousands of years, their roots unquestionably going back to ancient Egypt. Moreover, many of these basic instruments' forms and consequently the main functions were very similar to today ones (Table 1.).

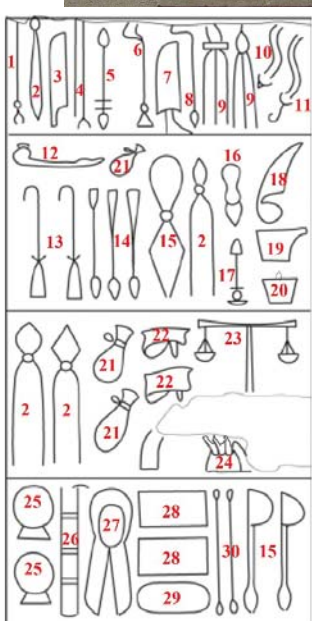
Many of the instruments depicted on the walls of the temple of Kom Ombo were used during surgery or in the post-operative period, but some of them could not be used directly during surgery but for general treatment, including incense burners, beaked cups and vessels, bags, amulets, scales, herbal vessels, cupping vessels or sponges.

52 Reeves 1992, 26-28; Sambin 1997; Coppens – Vymazilová 2010.

A

B

C



D

Figure 4.
4.A The temple of Kom Ombo, photo by Gusztáv Szegedy.
4.B Relief of Horus and Sobek, photo by Hedvig Győry
4.C. The relief of surgical instruments and materials in their context, photo by Gusztáv Szegedy.
4.D Drawing of the instruments:
1 Bifurcated sharp hook, 2 Forceps, 3 Saw, 4 Probes, 5 Drill, 6 Mosquito, 7 Razor, 8 Cautery, 9 Tri-valve specula, 10 Female catheter, 11 Male catheter, 12 Censer, 13 Hooks, 14 Scoop probes, 15 Scalpel, 16 Beaked cup, 17 Trepan, 18 Knife, 19 Beaked vessel, 20 Incense Burner, 21 Bags, 22 Amulet (Eye of Horus), 23 Scales, 24 Herb pot, 25 Cupping vessel, 26 Cylindrical carrying case, 27 Scissors, 28 Razor blade or ointment applier 29 Sponge, 30 Double-ended probes) (based on Coppens – Vymazalová 2010, 128, fig. 1.)

Actual Instruments for surgery

Most of the objects we know from the pharaonic period are originated from tombs, a smaller number from settlements, but only very limited number has exact known provenance. The tools used for cosmetic purposes, mummification and medical and, in some cases, domestic care can thus usually not be separated by archaeological records. The situation can be well illustrated by the case of Qar. Some people believe that the world's oldest copper surgical instruments were discovered in his tomb in Saqqara. Qar was a royal physician and keeper of the secrets of the king during the reign of Pepi I. (Dynasty 6), and died at the age around fifty. His mummified remains were discovered in 2006.[53] Like at many other mastabas in Saqqara, even his burial shafts have been reused several times,[54] but next to his mummy in his intact limestone sarcophagus, copper instruments were found. Being a doctor, his tool-set was automatically thought to be a medical one. However, they look exactly like models of common artisan tools, known from other Old Kingdom burials as well – these types might be used for engraving, stonecutting or decorating.[55] They also look to be too rough for surgical use (Figure 5). Nevertheless, they were put in his tomb, suggesting to be connected to him somehow. The question of why remains to be answered.

We can guess possible surgical use by the shape and typological changes of the instruments on practical base. Modern surgery classifies its tools into 6 groups according to the way of use. We tried to review the possible ancient Egyptian surgical tools by the help of this classification adapted to the ancient situation (see Table 1.).

Figure 5. Metal chisel-like tools discovered in Saqqara, Imhotep Museum, photo by Ildikó Ipach

53 The instruments are now displayed in the Imhotep Museum, at the entrance to the monuments of Saqqara. For this excavation see El-Aref 2006, mentioned also in *NBC News.Dec 6, 2006.*

54 Supreme Council of Antiquities Excavations, 2001: https://web.archive.org/web/20160408235856/http://www.saqqara.nl/excavations/other-excavations/supreme-council-of-antiquities-excavations and Hawass 2002. (accessed 12.12.2022)

55 Messiha – Messiha 1964.

Looking for vegetal based surgical tools, we can rarely rely on objects. Most plant-based devices might be discarded after one use; only the wooden ones are to be discovered. Wood was indeed often used as handle, which is just part of an instrument, making the use of the tool more comfortable or appropriate; for fractured bones, also wooden splints were used to fix them[56] – correctly aligned completely healed bones attest good practice.[57] Some type of instruments could however, take their origin from plant use. Thus, the task here is complex: to conclude by shape to an eventual vegetal origin and to find actual vegetal tools among the material available to us.

1. Cutting or dissecting instruments

The most ancient cutting instrument is the knife. Humankind used it in all fields of life (e.g. hunting, fishing, agriculture, construction, household use or shipping). An instrument with this function is hypothesized to have existed for more than 2 million years ago, longer than *homo sapiens* have walked on the Earth. People used stone, mostly flint, which is a hard grey stone, developed from the silica shells of marine animals.[58] It can be shaped well by cracking, and adjusting to various operations, and when having a sharp edge, it is well adapted to distribute meat and cut all types of natural materials. Thus, the importance of the knives and its predecessors is extraordinary. They have been one of the defining tools of human civilisation.[59]

Evidence of actual knives used for everyday purposes are to be traced back to the Mesolithic period around 8000 BC.[60] Their material was initially stone (obsidian, jade, flint, other minerals), and over the millennia it was followed by the actually dominant type of metal-use (copper, bronze, silver, carbon steel, stainless steel, etc.).

The various types of knives differ mainly by the ratio between the length of the blade and the handle, and by the width of the blade. Among surgical instruments, the blade of knifes is always longer than the handle. We speak about scalpel, when the handle is several times longer than the blade. The name scalpel comes from the Latin word, "*scalpellus*". Double-edged knifes are referred to as "lancets".

Nowadays, the surgical use of knives has been significantly reduced. They are practically only used during amputation. Liston-type single-edge and Catlin-type double-edge amputation knives are used to cut through soft tissue during amputation of extremities. By implication, "knife" connotes danger and

56 E.g. in Naga ed-Deir, see Smith 1908, 732-4.

57 E.g. Saqqara: Kozieradzka – Ogunmakin 20l3, 155.

58 Aston et alii 2000.

59 Kirkup 1995.

60 Ochsner 1999; Ochsner 2009, 441.

is more likened to a weapon associated with severe injuries and death. (The Greek Hippocrates may have been the first to describe a Greek surgical knife termed μαχαίριον – it was named so because it was a smaller version of the Lacedaemonian sword, μάχαιρα.[61]) If anyone else takes a knife to another person outside of medicine, it's a criminal attack.[62] Currently in medical practice also electric knives (diathermy), or improved versions of them (ultrasound knife, gamma knife, radiofrequency device, etc) are widely used as "healing knifes" because of the simultaneous cutting and coagulation (surgical bleeding control) when using them during surgical interventions.[63]

The ancient Egyptians could make the sharpest knife blade from obsidian, which was used already during the Naqada Period,[64] while the rougher blade was the flint (Figure 4.D, 18). No wonder, that in the mummification and in medicine, obsidian was used for incision, while flint knives could be used as scrapers e.g. during trepanation process, to get through the skull by a regular circular or rectangular shape.[65]

With the advent of metals, stone was slowly replaced, though the important role of stone knife was maintained at certain occupations.[66] Ancient Egyptians were aware of this process of substitution, at least those who knew chapter 143 in the Book of the Dead, which states: "*He, who sharpens his knife … when copper was not yet created in the mountain*".[67]

Copper alloy's manufacture began in the early dynastic period, and it was developed constantly. Bronze was invented when they mixed copper with tin. The various copper alloys were used throughout the dynastic period – it started to be replaced with iron only during the last few dynasties. Molten copper and copper alloys were manufactured by pouring the melted metal into moulds to create tools and weapons much more rapidly than stone instruments. Both copper and bronze, while hardening, require hammering to get the most durable cutting edges, important on household tools, on weapons, and certainly on the medical instruments.[68]

61 Ochsner 1999; Ochsner 2009, 442.

62 Ochsner 1999.

63 Ferencz 2021; Brill et allii 2017

64 Bard 1999, 100: in Abusir el-Meleq tombs, p. 446: Hieraconpolis, p. 676: in general, as material for tools.

65 Collado-Vázquez – Carrillo 2014.

66 It was used e.g. also in the city Amarna: there is one among the finds even in the Great Aton temple, King's Palace or the King's House (Pendlebury 1951, p. 19, 32, 83, 84, 88, 91, pl. LXXVI)

67 Barguet 1967, 198: "*Celui qui aiguise son couteau… alors que le cuivre n'était pas encore créé dans la montagne* ", Jean 1999, 34 for the English translation.

68 Ogden 2000.

Knife treatment: ḏw-ʿ

The ancient Egyptians had several words for knives used in surgery but we do not have any contemporaneous descriptions of these tools. In the papyrus Ebers, there are a few prescriptions (Eb860, 866-872, 875-876) where "*cutting/knife-action*" (*ḏw-ʿ*) treatment is undertaken, namely for the opening of *ʿ3.t*-abscesses / *sfḫ*-swellings and for the removal of a *ḥnḥn.t*-tumour of fat.[69] The same operation was done again once in the Hearst papyrus (H171) above the patient's leg (*jns.t=f*) for curing the *jrtwn*-illness and once in pEbers (Eb501) for the incision of burn blister. It was applied still at the end of the pharaonic period, even several times for the treatment of snakebite in the Brooklyn ophiological papyrus (Brk31, 32, 81).[70]

The expression consists of two words, the "*action*", written by the *ʿ* "*arm, act, action"*, and the *ḏw*, which has several meanings, depending on the classifier behind the word. Here always the knife is drawn, thus the "*cut*" and "*knife*" meaning is given.[71] What these *ḏw-ʿ* actions mean more precisely are not elaborated by texts. The only explanation handed down to us is written in Eb876c, where "*make then the patient a cut (ḏw) with the bulrush (or sedge, swt), which belongs to the act of the cutting/knife action*" (*jrj.ḫr=k n=s ḏw m sw.t n.t jrj.t ḏw-ʿ*), which seems to suggest that this medical intervention happened regularly with a sort of rush,[72] or a group-name for several rush species. The word *ḏw* with the meaning of "*knife"* is cited by the Wb/TLA connected to the above text and a fragmentary spell from the magical pTurin no. 91, where *ḏw* is directly behind a lacuna, and is followed by *ds=k nn* ("*you cut them"*), thus it referred also to a tool for cutting, but nothing more precise can be stated. The general context, however, puts the historiola into the wetland Khemmis, where rushes were grown abundantly, thus the use of a rush leave for cutting seems to be obvious, which might hint at a vegetal origin for this type of cutting instrument. Taking into account an eventual rush-origin, this *ḏw*-knife might have sharp edges at both sides, being then a kind of lancet. Rush leave's cut

69 Sullivan 1996.

70 Golding 2020, 123-124.

71 Deines – Westendorf 1962, 1000; Lalanne – Métra 2017, 215 or Golding 2020, 123-124 with earlier literature.

72 The common rush is mentioned by Dawson, JEA 22, 1936, 107 – however, Renata Germer does not accept it; she found it to be an unidentified plant. See Germer 1979, 193-197 or Germer 2008, 113-114, because of its depictions in the desert as well. Nevertheless, Hepper 2009, 34 states, that *Juncus arabicus (Asch. & Buchenau ex Boiss.) Adamson*, or *Juncus rigidus Desf* grows indeed there at salty places. Besides, the stem ends in very sharp points, as he states, thus not only the edge but also its tip is appropriate to make a cut on the area where needed. For the above species see https://aaew.bbaw.de/tla/servlet/GetWcnRefs?f=0&l=0&of=0&ll=183040&db=0&lr=0&mo=1&wt=y&bc=Start (accessed 22.03.2022)

is indeed very thin, penetrates fairly deep, and destroys the smallest possible surface.

The word composition *ḏw-ꜥ* is known for the Wb/TLA besides the medical expression only in two Pyramid texts (§660 and §661), where twice the epithet of the same person consists from this word (*ḏw-ꜥ ṯsb.w* / "*Messer des Kastrierers*(?)").[73] The person is not named there, but his negative effect on the dead is clear. This dangerous person must be kept away by a spell. The activity expressed by the epithet is, however, not clear.

Circumcision and its instruments

A special kind of knife is generally used during circumcision, which has to be performed almost without pain. We do not know yet, when this habit started to be practised, but there is a chance that it started in the East-Mediterranean with the Egyptians: Herodotus states namely, that according to his knowledge in the 5th century BC, people around the Mediterranean learnt this habit from the Egyptians. The question was for him only whether they invented it and taught the Ethiopians, or vice versa (II.104). His opinion was that the Egyptians practiced it mainly for hygienic reasons: "*They practice circumcision for the sake of cleanliness, for they place cleanliness before comeliness*" (II.37).[74]

Although circumcision as a procedure was rarely represented[75] or mentioned[76] by the Egyptians, the result is commonly identified on mummies, and often noted by the neighbouring other cultures. It seems to be the usual state, as there remained a word only for uncircumcised or impure man/youth: *ꜥmꜥ*.[77] There are only few depictions of the procedure. The most often cited one is in Ankmahor's tomb[78] at Saqqara (Figure 6.B and 7.D). He was a doctor under the reign of Teti, Dynasty 6, and adolescents or adults are shown in his mastaba undergoing a purification procedure, in the process of which there is the scene usually interpreted as circumcision. In the case of the 5th Dynasty king, Djedkare's pyramid complex, however, two children underwent a similar but bit different process, and during the New Kingdom period also

73 TLA, at *ḏw*.

74 Cox – Morris 2012; Kanawati – Hassan 1997; Spiegelman 1997; Roth 1991.

75 Best known are those in Karnak, Mut temple: Pillet 1952, 82, fig. 5 and Deir el-Bahari: Brunner 1986: 162-166.

76 Possible complications mentioned in ancient Egyptian texts are discussed by Bailey 1996, 19; Spiegelman 1997, 92.

77 Westendorf 2005; Quack 2012.

78 Badawy 1978, 42, figure 60; Kanawati – Hassan 1997, 49-50, pls. 19, 55b. Latest, however, Grunert 2002 has concluded that the scene is a purification process, and the actual process is the pubic shaving. This would mean that a razor is represented in the hand of the priest.

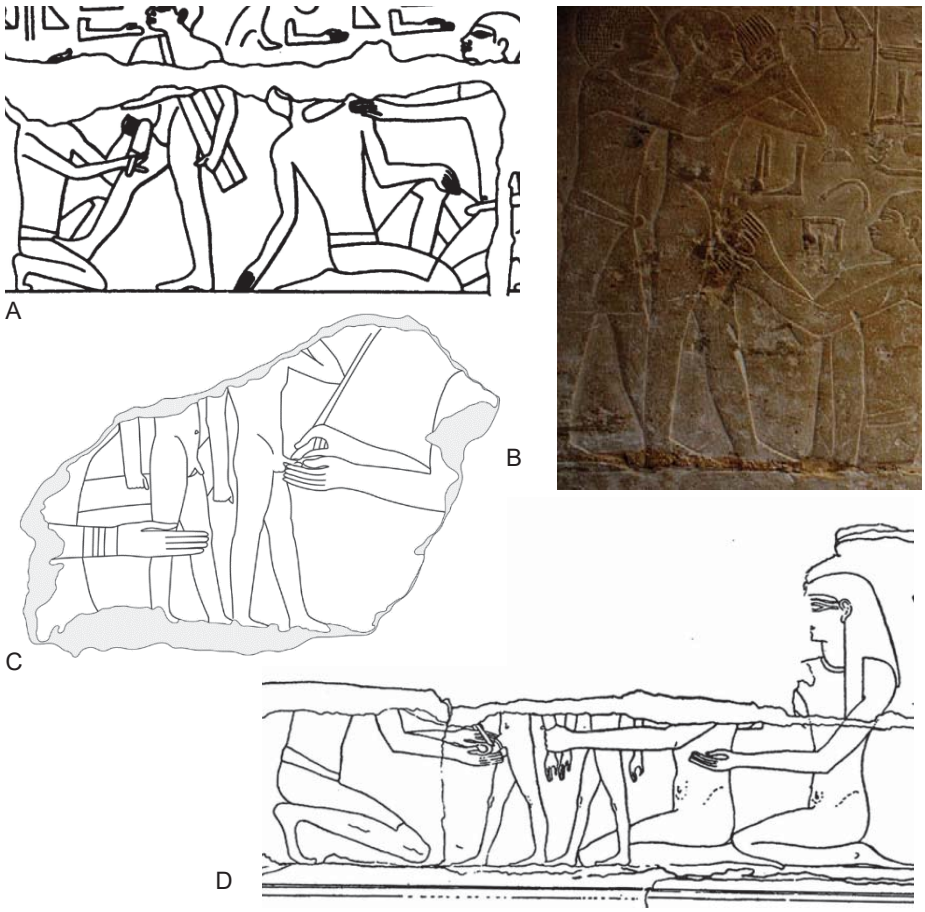


Figure 6.A. Niankhnum and Khnumhotep (Grunert 2002, fig. 2.). 6.B. Anhmahor (photo by Istvánné, Fakó). 6.C. From the debris of the Djedkare pyramid complex (Megahed-Vymazalová 2011, 157, fig. 2b. 6.D. Karnak, Khonsu temple (Megahed-Vymazalová 2011, 157. fig. 6.)

infants are attested in parallel situation (Karnak: Amenhotep III).[79] This scene is represented directly after birth, and before presenting the infants to the gods (Figure 6.C-D). We know from the Hebrew tradition that circumcision (*brit milah*) is preferred to be performed on infants (of 8 days),[80] as is represented

79 Bailey 1996: 24-26. For the Middle Kingdom see Roth 1991, 71.

80 E.g. Pillet 1952, 94. In this case „The statement that circumcision is almost painless to the child is not made lightly. Indeed, it has happened that while performing a circumcision on an adult, the local anaesthetic has not taken effect. This occurs in rare cases where the patient is immune

in the latter cases, although it was possible to do it also at older persons, when being foreigners.[81] According to Muslim tradition, however, it could be done at any lifetime, although 5-6 years is preferred. Usually a barber does it. The Jewish tradition says, that it was done initially by family members at home, using a flint knife,[82] later by practitioners specialised for ritual circumcision (*mohel*), who are checking the health of the babies before the operation, recite the prayers and do the snip. Similar change might happen in Egypt – as at Djedkare and Amenhotep III, we can see a woman taking care of the children.[83] At Ankhmahor's scenes (Figure 6.B and 7.D)[84] and its close parallels, only men are represented at the event. Both types of operations seem to be made by a specialist, probably (*k3*-)priest, but certainly not by a doctor. The circumstances suggest a religious ceremony.

At Ankhmahor, according to the inscriptions, this process is somehow painful (*mr*) as it is said there. It belonged to a series of representations of physical purification. The caption gave the word *sb.t*, which is interpreted as the infinitive of *sˁb* (< *s-wˁb* "*making clean*" or *s-ˁb* "*making separate, clean internally*").[85] At an exact parallel scene, Niankhnum and Khnumhotep's tomb the caption describes it by the *š3ḳ* "*shave*" (for razors see Figure 7. E-F), thus it refers to an action, which cannot be interpreted as any kind of incision, as Grunert (2002) declared. It was done by a short knife with fairly wide blade, but based on this interpretation, the instrument must be a type of sharp razor. And indeed, even the last century Muslim circumcision was made by barbers, who used to make it with their razor, and the patients did have pain for a while.[86] Thus, the scene could be interpreted both as shaving and circumcising. Looking at the knife at the Ankhmahor scene (Figure 7.D), we can find similar

to the anaesthesia. In one particular case, the patient experienced absolutely no pain from the circumcision itself. After the circumcision was completed, he inquired as to when the procedure would begin. It was only when the attending surgeon attempted to tie off the blood vessels and to suture the skin that he made it known in a most vocal manner that the anaesthetic had not taken. Since a new-born does not require sutures and does not need the blood vessels to be tied, he does not experience this pain. In addition, it should be noted that the nerves in a new-born on the eighth day are not fully developed." (https://www.circumcision.net/overview/almost-painless)

81 God requested it first from Abraham as an eternal sign of their alliance (Genesis 17, 9-14).

82 Exode, IV, 25: Zipporah circumcised the son of Moses with a sharp stone; Josue V.2: Joshua circumcised all the men on the hill of Gilgal with a stone knife.

83 That is the child and his ka-spirit. See Megahed – Vymazalová 2011.

84 See also Capart 1907, 97, pl. LXVI = Pillet 1952, fig. 10.

85 Grunert 2002, 146-150.

86 See e.g. Pillet 1952, 94. Shimshon Kashi, a *mohel* in Afghanistan in the 1950's used his razor also as a circumcision knife. (New York, The Jewish Museum, https://thejewishmuseum.org/collection/5359-circumcision-knife).

Figure 7. A. *Izmel* from 1720-1780, 15 cm, Circentral, Judaica collection (http://circcentral.bobmeyer99.com/knives.html) 7.B-C. Copper alloy blades from the Amarna Royal estate (Pendlebury 1951, pl. LXXVI.) 7.D. process at Anhmahor, photo by Istvánné, Fakó. 7.E. New Kingdom razor (Swansea, Egypt Center AB82) 7.F. another type of razor, New Kingdom (London, Petrie museumUC40538)

– although much longer tools among ancient Egyptian devices (Figure 7. B-C), and they resemble the *izmel* (Figure 7. A).

The other process type, connected to the birth, is nowhere captioned for the present. The context reveals, however, that it also served as a ritual having a symbolical meaning of life renewal and rejuvenation by the gods whom the infants were presented after this performance. The scene represents an infant, so the shaving act can be excluded, remains only the circumcision as an option for interpretation. It is exercised at several part of the world, and with different devices, on various ways. Two main techniques can be used, but separated: the linear and the annular. Different types of instruments are

ideal for them. Thus, there is the possibility, that adolescents and infants were differently circumcised for the same or different result.[87]

As the snip had to be done fast and precisely, the most appropriate early blade was the obsidian, but any sharp cutting instruments could be used. At Djedkare a long tube-like stick with fairly wide blade-like tip is held in the hand to make the operation. It is different than the present day instrument called *izmel* in Hebrew,[88] but their essential elements might be the same: double edged razor sharp blade with rounded tip, tightened on a handle, as the incision should be prompt and not/minimal injuring the blood vessels, and the tool be easy and accurate to handle at a small place. In this case, as a possible device we can think on long obsidian blades (as Figure 2.) fixed into a long narrow handle, or a long, pointy cane.

Incision and scalpel

No doubt, modern surgeons prefer the term scalpel over knife.[89] This is the other type of the surgical knife, which takes its name from the Latin word, *scalpellus*. In contrast to knife, the scalpel implies security associated with healing. Today's scalpels are small, one sided, especially sharp bladed instruments, used mainly in surgery. They may be single-use disposable (stainless steel blade and plastic handle) or re-usable (all of it made from stainless steel). While nowadays a traditional stainless-steel scalpel is only used to cut through harder tissues (skin, scars), diamond or obsidian blades are recommended for extremely delicate tissues (in ophthalmology and in neurosurgery), and in general, electrosurgical instruments are preferred for soft tissue to quickly reduce bleeding.

In earlier centuries, the scalpel was generally used in the treatment of disease on the surface of the body (abscess incision, phlebotomy, removal of foreign bodies, tumour removal, cutting the umbilicus, etc), thus for superficial incisions. For thousands of years, medical practitioners clung to the belief that sickness was merely the result of "bad blood", thus to restore bodily harmony, the doctors would often simply cut open a vein and drain some of their vital fluids into a receptacle. In some cases, leeches were even used to suck the blood directly from the skin. Bloodletting (phlebotomy) probably began with the ancient Near Eastern cultures,[90] but it became common practice from the time of classical Greece and Rome.

87 It would be interesting to make a survey on ancient Egyptian mummies to see whether the linear or the annular circumcision was used more frequently at the different periods.

88 E.g. example for a 20th century one at https://collections.ushmm.org/search/catalog/irn7120

89 Ochsner 1999.

90 The only pharaonic text, which might relate to it is H171, where an incision on the thigh is recommended.

Looking at the medical texts of ancient Egypt, we find several words for cutting or dissecting instruments, translated usually with the word knife, such as *ds, ḫp(ȝ)t*, and eventually *ḥmm*[91]. A cutting tool again, determined by a knife is the *šȝs*-instrument. It was but used to cut out the fragmented parts of a worm – so it's better to classify it under the retracting tools. Most often, however, ancient texts do not mention the actual instruments used for the treatment, they give simply the discussed cutting action by the expression *ḏw-ḳ*.[92] The above mentioned tool names for this purpose might mean different types of scalpels, but in these cases, we do not have representations with captions given the names. We are left with nameless specimens, the above-mentioned brief descriptions of the practices, and the much later relief at the Haroeris-Sobek temple, in Kom Ombo with 37 instruments, where some are undeniably surgical instruments known from Roman kits, some others are but too large and could represent ritual instruments, not medical ones in modern sense.

During the pharaonic period, the scalpel was only a blade made from stone or later from metal (Figure 4.D, 15). To ensure the safe use, the smaller blades were fixed to longer handle made from wood, ivory, horn, metal, and other materials. Concerning their use, in contrast to the written evidences, there are several contradictions in the anthropological literature. After examination of 30000 mummies in the first decade of the 20th century, a very interesting statement is, that there wasn't any report about surgical scar.[93] Which should mean that (1) no surgery was performed on so many human remains, (2) the scar is no longer visible on the mummies, as has disappeared after recovery, or (3) they did not survive minor surgery and there was no wound healing and thus no scarring. Probably none of these should be entirely true, and in several cases (4) the modern technical equipment was not precise enough to reveal the trace of such process. Probably all of these opportunities occurred. For the last explanation, there is an example published in recent literature:[94] During the new examination, a surgical bony incision seems to be found in the region of the right fracture of the right condylar head in the temporomandibular joint of a Nubian person (NU 761). This is the point, where an earlier traumatic event can be reconstructed by the above-mentioned fracture. It is partly separated from the mandible and ankylosed to the glenoid fossa. The incision is thought to belong to the separation process of the fused joints, to make possible the natural movement of the joint. The operation could only be revealed by a micro-

91 Nunn 1996, 120 – In Eb872 the knife is heated, in other cases the tool is not written out. This single denomination might hint at an unusual case. If so, the *ḥmm* tool is another type of device, more probably a piercing one that is a probe.

92 Győry 2006, 1.

93 Rowling 1989.

94 Forshaw 2016, 130-131.

computed tomography scan of the site in question. The cortication indicates a high-level skilled *ante mortem* procedure, made by a double-sided sharp instrument – a sort of lancet. This last statement is based on the smooth sides and the tapering nature of the lesion.[95].

Looking at the different words for knives, we can find the *ḫpt / ḫpꜣt* in Ebers 767, where it seems to debride a wound, for which act Sullivan finds to be the most appropriate tool a curved scalpel. He also notes that in the Gardiner Sign list it is very close to the „sculptured relief". He concludes from it, that this particular knife shape was used by the medical sculptor, i.e. the surgeon, so it is a scalpel.[96] We learn from the Egyptian texts, that the *ḫpꜣt* served to encircle a *kꜣ*-boil(?) inside of the ear to get the fluid pus out, thus in this case it could only be a miniature instrument.

Another type of cutting instrument is called *ds*, again mentioned only ones, namely in Eb875. We know from other sources that it was made of flint, but the shape is unknown. As flint and obsidian are very sharp cutting materials, possibly the flint was the main characteristic of this peculiar knife. And indeed, in the prescription a very thin and accurate cut was needed to be done at the worm below the skin of the patient, so that thereafter it could be taken out in one piece by the special forceps.

In summary, the knife, lancet and scalpel were the dominant instruments for sharp cuttings and their shape, size and usage were perfected during the thousands of years of the Egyptian, Greek and Roman times. There is no doubt that these old instruments retain their place among the basic surgical set. Today, the modern surgeon relies on a wide array of technologically advanced and ever-changing equipment, yet the operation still begins with the scalpel, the profession's oldest instrument.[97]

Saw and amputation

The use of saws in medicine may have been mainly necessary to cut sticks or splints for example. In cutting of limbs and bones the saw might have been used only to complete spontaneous amputations of traumatic or ischemic origin. The amputation or deep surgery were avoided for the rules that the body should not be disintegrated, as the whole body was necessary for the afterlife. When it still happened, it could only be a last resort to keep patient alive.[98] In cases of missing body parts, there was already a demand for

95 Harris – Lowe – Ahmed 2014. Another newly discovered case is from Deir el-Bersha, see Chapman et alii 2007.

96 Sullivan 1996, 471.

97 Brill et allii 2017.

98 See the few examples at Győry et alii 2020, 79-80.

replacement, which is attested extremely rarely for living persons,[99] but well known with mummies, so that they could go to the afterlife with as full body as possible. In preparation for burial, missing body parts were replaced. Thus, artificial limbs, arms and eyeballs were also used; but these had religious, and only decorative purposes.[100]

Cutting with scissors

The oldest technical solution typical for scissors date back more than 4000 years ago, and were found in the Middle East. The old Mesopotamian versions were used as scissors indeed, and consisted of the traditional two blades and one metal piece, which connected them together (Ω-shape scissors).[101] Around the year 1500 BC. ancient Egyptians also used a similar tool. Its shape was carved later in the Kom Ombo relief (Figure 4.D. 27, example: Figure 8.A) pointing to a medical use, but no surgical cutting could be done with such a device – in the medical literature this type is called shear.[102]

In general, surgical scissors with a cross-blade or pivoted design were developed later (for the technical solution see Figure 8.B). This new shape allowed the device to be lighter and controllable with only one hand, which set free the other one. This last form of scissors was already suitable for surgical interventions, and we derive today's modern scissors types from them.

Figure 8.A. Shears made from bronze, copper, and silver alloy, 200 AD. (Metropolitan Museum 39.2.2.) 8.B. Crossed-bladed gold "scissors", 1500 BC . Brooklyn Museum 37.654E.

Plant instruments

Reviewing these devices, we can conclude, that plants could be used as active tool only for incision. It is even written out in the case of *šȝs*-knife

99 Győry et alii 2020, 95-97 and 102-106.

100 Győry 2008b.

101 Swift 2017.

102 Møller-Christensen 1938; Kirkup 1996, 546.

and once at the *ḏw-ʿ* action. Several plants have leaves or stems which are razor-sharp, as in Egypt the palms, reeds, and some coarse grasses. They are serious hazards to those who handle them carelessly. The reason is that silica is concentrated at the edges. It is natural thus to have them as first instruments.[103] There are even today some remote places, where this method is applied.[104] These stems or leaves are very flexible, so it is easy to scoop or cut out with them amorphous or worm-like formations or even pus, as they can be easily adapted to irregular shapes.

The papyrus itself could be an accidental source of injuries even during production, cutting up arms and legs. But, the papyrus itself, after processing, was not only suitable for writing, but probably could also be used intentionally to cut open superficial blisters and make incised wounds.

2. Grasping, clamping, and holding instruments

Forceps are useful in medicine for grasping for a short time, that's why these are the simplest grasping instruments without any locking device. They are now used (1) for holding the tissues during cutting and suturing; (2) to direct vision of the operating field; (3) to grasp blood vessels during coagulation; (4) for placing swabs or gauze strips for elimination of blood in bleedings; (5) for removal of foreign bodies etc.[105] They are practically the medical variation of tweezers (spring forceps), used anytime when people want to hold an object which is impossible or uncomfortable to grab by hand.[106] The other type of forceps is pivot-controlled, which technical solution was also present in Egypt from early time, although the medical application of the tool is controversial.

Tweezers / spring forceps

The first tweezers in Egypt probably used for surgical purposes, as they seem capable to extract even arrow heads, date from 3300 BC.[107] These instruments were made by folding a copper alloy strip, as throughout the pharaonic period. The introduction of the specimens prepared with two separate legs seems to be Roman. The Egyptian tweezers can be divided into two main categories by their limbs: those with the inside curved and the straight ones, and by the structure: the simple bent legged ones (Figure

103 Kirkup 1995, 381.

104 Kirkup 1995, 381 mentions the Loanga tribe in Africa to section the umbilicus with the leaf stem of a palm tree or in Annam with a piece of bamboo, both being very sharp. According to Lillico 1940, certain Polynesian and Melanesian tribes make the scarification still with slivers of bamboo and thorns.

105 Ferencz 2021.

106 Walgrave 1998, 68 nº 20.

107 Møller-Christensen 1938.

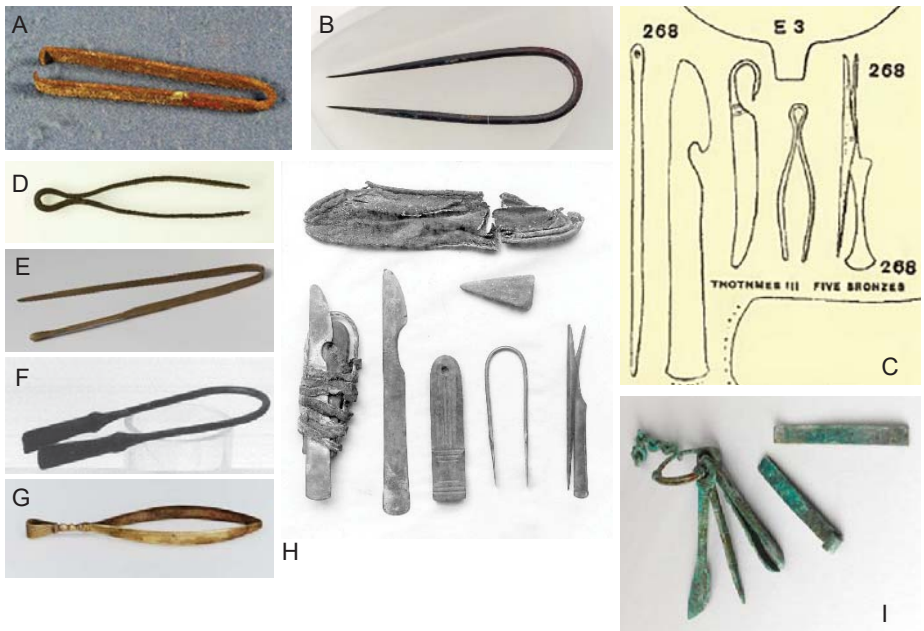


Figure 9. Forceps: A. Abydos, Dynasty 18, with incurved tip.[108] B. Abydos, New Kingdom[109], C. set from El-Arabah, New Kingdom[110] D. Lisht, New Kingdom[111] E. Thebes, Dynasty 21.[112] F. Esna, Dynasty 18,[113] G. Nuri from piramid of Aspelta, 6th c. BC, H. set from Thebes, New Kingdom[114] I- Coptic set.[115]

108 Brussel, Musée Cincantenaire, E2035, from tomb D113 in Abydos.

109 Liverpool1977.112.283. The same type was used already during the Old and Middle Kingdoms, see e.g. Garstang 1903, 30-31, 34, 38, pl. XXXIII, XLIII, tomb 349 (6-11th Dynasties) with four other copper instruments, mirror and vessels, Garstang 1901, pl. XIV (photo) and XVI (drawing) – tomb E20, p. 8, 9 (12th Dynasty), it seems to be a cosmetic device, as it was found together with beads, mirror, hair pin, kohl pots among others.

110 Garstang 1901, 12, 14, pl. XVI (drawing): tomb 268, time of Thotmes III, together with four other copper alloy instruments and many vessels.

111 Lisht, Ramesside period, see https://www.metmuseum.org/art/collection/search/568362.

112 Metropolitan Museum 47.123h (Jansen-Winkeln 2007, 87-8, cat. 6.29 and https://www.metmuseum.org/art/collection/search/553624) together with scribe palette and reed pens of Smendes II., high priest of Amun.

113 Boston Museum of Fine Arts, Acc. no. 07.447.1. https://www.brooklynmuseum.org/opencollection/objects/4203.

114 Hayes 1959, 64, fig. 33.

115 London Science Museum https://www.lookandlearn.com/history-images/YW065481L/Depilatory-tweezers-Egypt-500-100BCE.

9.A-B, E-F, H-I), and those with a circle-like ending at the hoop made by inflexion (Figure 9.C-D, G). Comparing them to the classical forceps, they follow the general trends known from the Graeco-Roman medicine (Figure 10. nos. 1-2.). Among these instruments, we can find various tip-shapes.[116] Tweezers were kept on a wooden block, often together with a razor-knife, whetstone and a scissors-like instrument, as shown in the Theban set Figure 9.H. By the Roman times, several shapes – from the simplest to the most ornate – were available and were part of the basic surgical kit (Figure 9. A-I).

Kirkup in 1996[117] suggested, that the copper tweezers/forceps were preceded by organic ones. Among these, he mentions the green wood and bamboo, split and wedged open. For the first one, he gives an ethnographical parallel and a medical one at the people of Sarawak, which was used during ritual piercing of the metal bar, for holding the glans of penis.

Figure 10. Set of surgical / medical instruments made of bronze. The tools seem to be from the same original set or at least manufacturer. Tools (from left to right): two forceps, pointed-tip probe, smaller and medium wound hook, double blunt-ended probe, a longer and shorter cylindrical carrying cases, two small medicinal boxes for pills, rectangular shape golden blade which one is a razor blade or ointment applier. 2-3rd c. AD, Marcopoli Collection, Damascus (Source: Museum of Fine Art Boston, https://collections.mfa.org/objects/470262).

It is certain that pharaonic Egyptians used vegetal tweezers. Namely the *hnw*(*h*) / *hnw*(*yt*)-part of the carob pod (*hnw.yt n.t ḏ3r.t*)[118] was ordered to be used to grip the worm in the case for the *ꜥ3t*-abscess caused by the

116 E.g. Capel – Markoe, 75-76.

117 Kirkup 1996, 545.

118 The word *ḏ3r.t* is here classified by the seed sign, though it is usually interpreted as the pod of the carob tree. This orthography might hint explicitly at the cover of the seeds.

Dracunculis medinensis worm (Eb875).[119] As this is the only place where the tool is mentioned, and without explanation, we cannot identify it, only raise as possible interpretation the actual pod or a part of it. It should be elastic enough not to crush the worm, but firm enough to have it there as long as the worm got taken out, and large enough for a comfortable human application.[120]

Forerunner of pivot forceps

A scissors-like device (Figure 8.B and 9.H) often with decorative pattern is known from Egypt from early time. Its simplest form is attested in a 5th Dynasty burial at Mahasna,[121] but the general use is attested only from the New Kingdom period. As in the University College, London online catalogue is written, "one element is formed from a sheet of metal and it could also have been used as a razor. The other element forms a trough on one side and sharp point on the other." Its interpretation is dubious – many scholars think it to be hair curl / hair curling tongs and trimmer,[122] or razor-tweezers/ tweezers-razor.[123] Looking, however, at the surgical instruments found in Pompeii, the question arises, that it had/could have another function namely a medical use:[124] "Pivot forceps for crushing piles and uvula; holes in the jaws permit insertion of cord to clamp them fast." – is given as explanation on the illustrated specimen from 97 AD (Figure 11, no.3).

Figure 11. Pompeian (97. AD) instruments identified as 1. spring forceps, 2. shear, 3. pivot forceps for crushing piles and uvula, 4. Pivot forceps for removing sequestra, 5. Spring forceps with locking slide, 6. Pivot forceps of uncertain use, 7. scarificator (Meyer-Steinig – Südhoff 1922)

119 Győry 2001.

120 Details see later at 4th retracting instruments.

121 UC40535, Mahasna, Tomb 395, Dynasties 6-10. https://collections.ucl.ac.uk/Details/petrie/406

122 E.g. Fletcher 2002 or Getty Museum (https://www.gettyimages.com/detail/news-photo/the-ancient-egyptians-were-very-conscious-of-their-personal-news-photo/90775821)

123 E.g. Hayes 1959, 64, fig. 33.

124 Kirkup 1981, 280, 281. Kirkup 1998, 424 mentions that the pair of scissors was called by Fergusson (1857, 9-10) the „cutting forceps".

3. Haemostatic instruments

Haemostatic instruments serve to stop bleeding. In modern medicine, three main groups were used as surgical bleeding control techniques: use of mechanical instruments (vessel clamps, ligatures, metal clips, etc), electric devices caused thermal effects (warm – diathermy, cold – cryotherapy), and finally apply of biological-chemical materials (collagen, gelatine, zeolite, chitosan, etc).[125]

In ancient times, there were fewer options to stop bleeding, such as direct pressure on the spot, tying the blood vessels by tendons or linen, closing it by acacia thorn and burning body parts.[126] This last solution might need special instruments, which seem to be used in ancient Egypt.

In major injuries, bleedings caused certainly problem for the doctors. As deep operations with severe blood loss could only happen in extreme cases, and are not described in extant medical texts, we can only guess, how they managed the problem. During classical antiquity and medieval times, cauterisation was a widespread solution, thus an instrument for heating the given surface was used. And indeed, an instrument shown on the Kom Ombo relief looks like a cautery tool, and there is also an incense burner (Figure 4.D, 8 and 20) there among the medical devices.[127] These tools point to a heating process also in Egypt. In fact, cauterisation was indeed widespread in Egypt after the Arab invasion (640 AD).[128] Looking to the pharaonic medical texts, we can find even two instruments, connected to which heat is used.

The ḥmm-instrument

In Eb865c an inguinal hernia was described as an abscess above the genitalia, which appears on coughing, and could be restored by heat application (one of the methods to reduce a strangulated hernia).[129] Beside the incision for lancing boils and draining abscesses, the use of a certain *ḥmm*-instrument was also mentioned. It was used in this treatise for *ṯḥn* / ***piercing*** the *ꜥ3t*-abscess at the lower abdomen. According to its classifier, the tool was made of metal. The *ḥmm* is used only in 5 cases (Eb863, Eb864, Eb865, Eb872, Eb876) in the known medical texts. In case Eb864, *šmm.ḫr=k sy* "***you should warm it***", in case Eb863 *ḏꜥr.tj m 3ḫ.t* "***being palpated with fire***" is said to be done first, then comes the treatment, which might be made by some sort of heated(?) probe or scalpel. The physical reason, they might experience by chance, is that this way the blood loss was considerably diminished. Interestingly, in

125 Ferencz 2021.

126 Dobanovački et alii 2012, 28.

127 Saber 2010.

128 Maravelia 2020, 302-305.

129 Dobanovački et alii 2012, 31.

all three *ꜥ3t*-abscess cases it is stipulated at the end of the prescription, that the patient should be treated as usual when the *ḥmm*-instrument was used, although the heat is not mentioned in the Eb865 case. This might suggest that the heating was not obligatory when this tool was used for an operation, or there existed several types of heating – the usual, which was not to mention, being trivial, and the special ones are only referred to – in both cases before the *ḥmm*-action. However, this treatment needed certainly a kind of typical management, other way the expression found in all three cases stipulated at the end of the prescription: *srwḫ sy mj srwḫ s3-ḥmm* / "*treat it as the son of the ḥmm-tool-treatment is*", would be meaningless.

In the Ebers papyrus the *ḥmm-tool-treatment* is also used concerning an *ꜥ3t*-abscess of vessels, probably a haematoma/haemangioma or aneurysm,[130] given as "*heat with fire*" (Eb872). The Eb876 says *expressis verbis*, that the *sft*-swelling (probably consequence of bastinado) shall be burnt after the incision is done (*jrj.ḫr=k n=s ḏw m swt jrj.t ḏw-ꜥ* / „*you shall do for it a bulrush-cutting as a cutting/knife-action*"), when the swelling grows and bleeds: *š3w.ḫr=k sw m 3ḫ.t* / "*you shall burn it with fire*". The protocol goes then on with the instruction: treat it according to the *s3-ḥmm* / "*son of the ḥmm-tool*" treatment.

As the expression *s3-ḥmm* is determined by a sitting man, the son of this instrument can only be a person, that is the patient or the healing person. As he can be both the passive (patient) and active (surgeon) agent, the direct genitive is not giving a univocal solution. That is, the patient or the doctor is closely connected to a treatment with a *ḥmm*-device, which needed special process after having been used. Taking in account the two options for interpretation, the person should be a doctor, as a special treatment needs special knowledge, which cannot be expected to own by any patient. There is also the possibility, that doctors only rarely did this treatment, being it a speciality of a practitioner, as the snakebite treatment, where usually a *ḫrp-Srḳt* handled the bite. The actual method applied in these cases is but not elucidated in the texts.

It seems that the *ḥmm* could be used both to cut and pierce, thus it has to have a sharp edge and a pointed tip, so it is thought to be a cautery or fire-heated lancet, where the heat produced on the tip of the instrument could be used to cauterize wounds. The Coptic name of the cauterion (ϩⲱⲙ), might be in connection with the word *ḥmm*. Janot 2000 suggests, that a metal instrument with knot at the middle separating a long symmetrical blade and a similarly long narrow handle might be a cautery. He identified it either by a *ḏw* or *ḥmm*.

130 Győry 2008c; Veiga 2008, 54-55, 97.

The ḏ3- fire-drill

Heating is the described therapy in the Edwin Smith papyrus case 39 (with the rarely used word *š3m.ḫr=k n=f ḥr ḳ3bt=f ḥr bnwt jpt=f …/ Heat for him on his chest on this bnwt-abscess …*) concerning the suppurating *bnwt*-abscess on the breast,[131] caused by striking, but the instrument to apply for this act is not the above discussed *ḥmm*, but a "*fire-drill*", as said in the preceding sentence: *mr, jrj=j m ḏ3* / "*painful illness, I do it with the fire-drill*". Thus, here we find an ancient Egyptian *terminus technicus*, which means clearly cauterisation. Its role was possibly to let out the pus and close the opening on the breast, so that infection could be avoided. The treatment after its application is called surprisingly *srwḫ-wbnw*, thus the usual "*wound-treatment*". The reason is unclear.

This appearance of the fire-drill in a medical text might hint at a well-known application of the tool, as there is no explanation given to it, thus the method was well understood. The unique appearance seems to point to an old method, preserved only in this text. The archaic way to express the practice also suggest it. In this case, a possible explanation might be that this method originates from a time, when no special treatment was still invented for cauterisation and after-treatment. The new method might be the *s3-ḥmm*-treatment, invented after the compilation of the Smith papyrus. Another possibility might be that the above *ḥmm*-tool was not a cautery, and its use resulted in another condition of the wound.

The possibility thus arises that an early special fire-drill-like device might have been used during dental treatment (Figure 4.D 5), explaining the famous Old Kingdom dental bridge. It was found in Giza (now in Hildesheim, Roemer und Pelizaeus Museum). It seems to be, however, a *post mortem* solution: weak gold wire is binding a loose tooth to the neighbouring sound tooth, similarly to the Quatna-bridge, also from this period,[132] which could not

131 Breasted 1930, 363-369. Sullivan 1996: "*tumours or ulcers in the breast, perhaps resulting from injury*". Concerning the *bn.t*, in plural in this case, the ancient Egyptian commentary clearly describes it: „*As for 'bn.wt-tumour with prominent head in his breast', it means that there are swellings spreading over his breast because of his injury, they produce pus and redness on his breast, (as) it is said: 'It is like (parti-colored) things jḫt-ḫkr', whose product is pus*." (translated by Breasted, p. 367) – thus it is speaking about infected injury spread all over the breast. *Bn.t* is a frequently used word for ulcers and boils, which Breasted summarised by the word tumour. According to the Book of the Dead, the deceased wished that it arise it in the eye of Atum. Breasted 1930, 368, referring to Naville 1909, 98, lines 5-6. See also Ebbell 1927, 71-75 (+115-121-): "gangränöses Geschwür" (abscess). Grundriss VII, 248-250: finds another translation „Geschwulst" (tumour) in this case, adding that abscess and tumour seem to be not strictly separated in ancient Egyptian language.

132 Forshaw, 4-6, and 6-7 for the Hellenistic one.

hold the tooth at place while in use. The aim could thus not be for the real world. At this latter set, we know, that it was found among the bones of a skull, thus it was certainly meant to be "used" in the Afterworld. In contrary, real use may be considered at a Ptolemaic appliance, found at Tura el-Asmant, which was fixed into the head with a silver wire. According to Zimmerman, patients could get their jawbone drilled to drain an abscessed tooth.[133]

But there is little in the papyri about dental operative techniques, although ancient Egyptians suffered all the dental ills seen in modern populations, including attrition, caries, abscesses, and periodontal disease. In many cases, the remedies for strengthening the teeth are the application of herbs or honey – likely they were helpful.

There might have existed thus two types of warm haemostatic instruments, the *ḥmm* and the *ḏ3*, and one of them may be equal to the bistoury-cautery, which word is sometimes said for the *ḥmm*.

For compression of vessels by heat, vegetal materials

are not applicable. There are, however other ways to reach similar result, without heating. One of them is the direct pressure, for which there is not any instrument extant, but could be good any piece of wood for instance, without a special shape, so not detectable. Moreover, being a trivial solution, it is not mentioned. Another way might be to use appropriate bandages, which were at that time linen-based, and copiously used, often soaked by drugs – this belongs however to drug therapy.

4. Retracting and exposing instruments

In modern surgery after incision of tissue, layers retracting instruments have to be used to hold a wound open, to explore the surgical field, to hold an organ or tissue out of the way in order to expose what is underneath. These surgical instruments are well adapted to the local anatomical situation of the surgical field. Retractors can be divided in two groups: the handheld retractors hold by the assistant and the self-retaining retractors.[134]

Specula / mirror

From retracting and exposing instruments, *speculum* (mirror) was certainly used as an exploratory tool by doctors in Roman Egypt. The *tri-valve specula* in Kom Ombo temple relief (Figure 4.D. 9) probably was applied primarily to provide tissue exploration through natural orifices (vagina, anus, etc). We do not know about similar instruments, however, from pharaonic time.

133 Zimmerman 2017,152.
134 Ferencz 2021

Hook

For retracting during *post-mortem* procedure, i.e. mummification process, we can find different sized hooks,[135] which were certainly used also for medical operations (Figure 4.D. 13). They were useful during smaller wound retraction (Figure 6, 4th and 5th tools from left), but the same devices could also be used at several non-medical activities as for instance at weaving or again mummification, which means that the find context is decisive in the identification of the purpose.

Piece of stick, cane or thorn

We know a New Kingdom representation, where an eye is treated by a piece of strait stick, presumably to take out some foreign body (tomb of Ipuy, TT217).[136] In this case, it is impossible to say what was the material of the tool; both copper alloy and wood, in fact, also cane, would be appropriate.

Different is the case, however, for dracunculiasis, for which treatment even two tools with vegetal origin are attested from the New Kingdom. Dracunculiasis is a tropical disease, present in humans since ancient times, still present in tropical Africa, in the area corresponding to present-day Sudan.[137] The name "Guinea worm" was coined after Europeans saw the disease in the 17th century on the coast of Guinea in West Africa.[138] This worm (*Dracunculus medinensis*) infection and the disease is also mentioned in the Old Testament, and attested by anthropological find from ancient Egypt. Namely, a calcified guinea worm was found in the abdominal cavity of a 3000 years-old Egyptian mummy, found in the tomb of Parennefer (TT188).[139]

If a person becomes infected with drinking water that contains water fleas infested with pearlworm larvae, after ingestion, the worms enter the digestive tract where they develop over a year. Eventually the adult worm migrates to an exit site, usually to the lower limb, and causes an intensely painful blister on the skin. When the infected person immerses the wound in water to relieve the pain, the blister bursts and the worm spits its larvae into the water, slowly crawling out of the wound over a few weeks (Figure 10. A-B). The wound will remain painful for the duration of the worm's incubation and will immobilise the infected person for the three to ten weeks necessary for the worm to hatch. During this time, the open wound

135 Janot 2000.

136 Győry 2003b.

137 Cairncross et alii 2002.

138 Nunn – Tapp 2000; Ledger – Mitchell 2019.

139 Ziskind – Halioua 2005, 127, note 29; also in Manchester: David 1979, 99 and 146.

can become infected with bacteria, leading to death in about 1% of cases.[140]

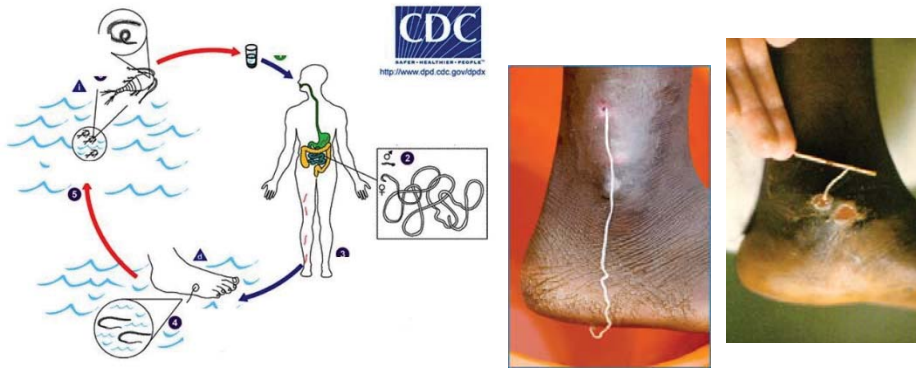


Figure 12.A Life cycle of Guinea worm (Source: www.cdc.gov/parasites/guineaworm/biology). 12.B The worm's head comes out from the skin (Source: https://en.wikipedia.org/wiki/Dracunculiasis). 12.C The worm curled up on the stick and slowly pulled it out (Source: https://en.wikipedia.org/wiki/Dracunculiasis)

Already the Egyptians knew that the worm had to be removed. The method for removing the worm is described in Eb875.[141] They tied a small stick to the worm's head and slowly pulled it out by winding slowly around a stick, and taking care to avoid breaking its body. It takes about one month to finally get it falling out (Figure 10.C). The process went on very gently, because they knew that if the fragile body is broken, it would cause blood poisoning with a fatal outcome, as also, if it got stuck, as written in the papyrus. For this reason, they tried to take the worm out with a flint knife (*ds*), and if any part remained there, then the *šȝs*-grass was to be used as a U-shaped bent blade put between the flesh and the worm skin, to take the piece out – the *šȝs* was conceived as a cutting tool because it was classified by a knife. Its indirectly given characteristics are, however, not enough to identify the plant.[142] Thus, for retracting the remains of the worm they found the best a vegetable tool, whose shape could be adapted to any deformation of the worm-passage, and the edge of which is sharp enough to cut it out.

140 Despommier et alii 2019.

141 Adamson 1988; Győry 2001a. The interpretation shall be cautious, however, as similar behaviour is attested at another parasite, namely the *Onchocerca volvulus* was retrieved similarly in Cameron a few years ago. (Mbong et alii 2015)

142 The sharp cutting edge, elasticity (Eb875), the red colour, which is compared to the redness of the sick eye (pSmith Case 19, glosse A.), and a root applied to treat the unknown *nsj.t*-disease (Brl.112).

The worm, which once affected millions of people in Africa, India, and the Middle East, is now almost eradicated, with only 27 cases documented in 2020.[143] It will probably and hopefully be the first parasitic disease to be eradicated globally in the world. As dogs can be infected, the eradication programme also monitors and treats dogs. The contaminated drinking water is treated with a chemical called *temefos*, which kills the water flea larvae. In addition, part of the eradication programme is educating people not to drink contaminated water. Here also vegetal tool can help in avoiding the infection: special filtered suction tubes or straws are recommended, which filter out the waterballs containing the larvae, so that they do not enter the body. This is something the natives can make themselves, as a tightly woven textile is suitable.

5. Closing instruments

The last phase of the operation is the closure of each layers of the wound. Nowadays we try to fix or stitch to each other, muscle to muscle, fascia to fascia, etc. during tissue reconstruction. For this purpose, we use most commonly stiches with suture materials, apply clips or staplers, or rarely tissue adhesive etc.).

For closing wounds, many materials have been tried by humankind during its existence from the Palaeolithic age, including tied up tree bark, camel's or horse's mane, leather strips, and catgut threads (sheep or cattle intestine), flax, hemp, silk or linen strip, but even the heads of giant black ants (*Dorillus species*),[144] until needles were invented, appropriate to sew living flesh with the various suture materials.

Needles and tapes

There are only 7 cases in the Smith Papyrus (Case 3, 10, 14, 23, 26, 28, 47) where the instruction is to "*draw together the wound*" (*ndry wbnw*) by the *jdr*-act, which is translated as "*stitching" (suturing*).[145] According to the texts, most lacerations were treated with bandages and topical remedies.

Causing wound (incision, cut) on the body was forbidden and therefore the most probable explanation might be, that they avoided to describe it when possible. A nice example could find, however, Ruffer[146] on an old lady with fine stitches, sewing "a sinus extending transversely from the left pudendal labium outward into the gluteal area", which operation seems to be performed during

143 https://www.nature.com/articles/d41586-022-00385-z

144 Saber 2010; Gudger 1925.

145 Breasted 1930, 226-33.

146 Ruffer – Rietti 1912, quoted by Sullivan 1996, 470.

her life.[147]

Needles were first made of bone, ivory and copper.

The Smith papyrus also mentions wounds being brought together with adhesive tape, which was made of linen. Linen was also available for bandages, ligatures, and sutures. Egyptian doctors distinguished between sterile (clean) wounds and infected (purulent) wounds. Although no antibiotics were known, the liberal use of honey and copper-based ointments, both bactericidal, were effective in wound management. The Egyptian physicians knew and made effective herbal ointments also to heal burns – probably similar ones were used again after cauterisation.

Thorn

Searching for plants, we can find the use of the acacia thorn (Figure 13.A) for a piercing process. Ethnographical analogies are teaching but other possible use for strong thorns of various bushes. In Egypt and the Middle East, due to deforestation, there are a lot of dry lands and areas of bush and scrub. For this reason, thorny, spiny species are very widespread in the area, with about 125 known species. One of these is the Egyptian acacia (*Acacia nilotica*), with succulent, soupy legumes, much loved by grazing animals. This plant is a common savannah tree throughout Africa, and in biblical times, it was certainly found in the now deserted areas of the Sinai Peninsula. In East-Asia,

Figure 13.A. *Acacia nilotica* (Source: www.identify.plantnet.org).
13.B. Blister puncture (Source: www.dr7physioandpod.com)

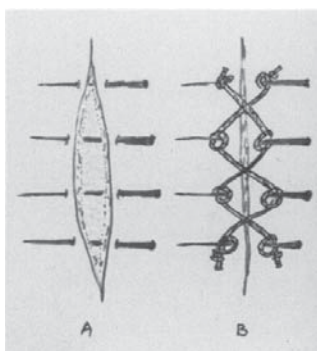
the thumb-sized palm branches of the shingle tree (*Acrocarpus fraxinifolius*) could be used to make a deeper, more powerful stab.

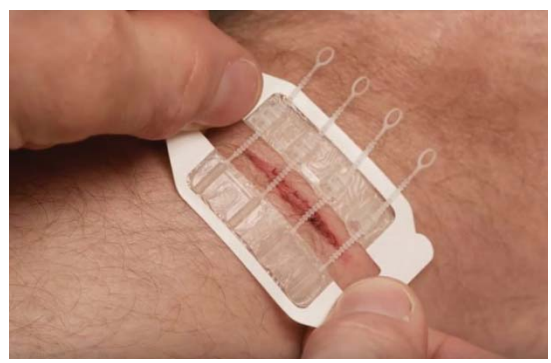
Presumably, thorns may have been used by the Egyptians to treat superficial blisters. The blister develops mainly on the skin of the feet and soles, when it is hot, mainly due to pressure and rubbing against sweating skin. These conditions were given in the Egyptian climate during

147 Sullivan 1996, 470.

everyday life or craft activities. The reason is that simultaneous pressure and friction effects separate the top layer of skin, the *epidermis*, from the underlying *dermis*. The cytoplasm of the cells comes out and accumulates in the *stratum corneum* to form the bladder. If a blood vessel is damaged during the rubbing, a blood blister is formed, which is essentially the same category. What can be done? It is not good if the blister spontaneously opens or ruptures, because then the sensitive surface can be damaged, and it will be painful. It can be punctured with a needle or acacia thorn; the fluid is drained then out and the blister wall is stapled down. It usually sticks to the wound base and heals without leaving a trace in about one weeks. Presumably, other blistering skin lesions of e.g., infectious origin have also been treated in this way with acacia thorns (Figure 13.B).

The acacia thorn may also have been used as a fastener by the Egyptians to close wounds. In such a case the thorn is not used as a needle, but the skin is pierced in several places (as if impaled), it is fixed, and the skin strips are wrapped around the needles, or strong, fibrous grass is wrapped around the gaping wound (e.g., after accidental injuries), and finally to close the wound edges. The technique is shown on drawings collected in 1936 from native bushman people living in Kenya (Figure 14.A).[148] ZipStitch wound dressing is practically its modern version. There is no suturing of the wound,





but the edges of the wound are glued with a structure that fits the size of the wound and then adjusted with these small screws so that the edges of the wound are lying together (it can also be thought of as a zipper, as the name suggests). After 1 week to 10 days, the structure is peeled off like a bandage and the healed skin is underneath (Figure 14.B).

Figure 14. A. Wound closure with thorns and fibre from Kenya collected in 1936 (Source: https://www.netvike.com/dark-age-military-medicine.html / Ferencz 2021; Kirkup 1986, fig. 34). 15.B. Wound closure with modern ZipStitch (Source: www.ns-

148 Kirkup 1986.

healthcare.com/analysis/zipstitch-wound-closure-device/)

Anthropological studies suggest that prehistoric man used various techniques to close skin wounds. The jaws of termites or beetles were used to bite across wounds and hold skin edges together in India and South America, and in East Africa acacia thorns were stuck along the two wound edges and then plaited together.[149] Suture materials used included horsehair, fibres from tree bark, cotton and, in ancient Rome, human hair and catgut (made from sheep's intestine),[150] which was used until recently in the UK. The sutures used in modern surgical practice are almost exclusively synthetic materials.

6. Special instruments

Nowadays, there is a wide range of instruments used by only each of the different operative professions called special instruments. Hammer and chisel are the special instruments of bone surgery (traumatology, orthopaedics), rib scissors or oscillation saw are thoracic surgical tools, while heparin needle and Nabatoff stripper set are the instruments of vascular surgery. Ancient Egyptians used everyday instruments also for special purposes, often taken from nature with a small modification.

Splint and bandage

The treatment of fractures and dislocations of joints have been described in the Smith papyrus, and a few bone fracture bandaging in Ebers papyrus, in addition, actual material was also found on some human remains. Using a wooden splint and canvas, ancient Egyptians had a working knowledge of how to fix broken bones and repair dislocations.[151] There were also special bandages used for other types of wounds. We discuss them in another article in this volume.[152]

Peg

In the Smith papyrus (case 7, III,14) the use of a wooden peg (*md̲3t*) is described, which padded with clothes, facilitated the liquid filling into the parallelised mouth. [153]

149 Ellis 2001.

150 Bush – Ardeshir 2007, refering to Burnand – Young 1998.

151 E.g. Strouhal et alii 2014, 89, fig. 26.

152 See Fehér et alii in this same volume.

153 In pBerlin 3038, in recipe no. 189, it is made of *bj3 n pt* "*meteorite iron*", though the determinative remained the wood. It might refer to a change realised during the time passed suggested by Deines – Westendorf, VII, 415. Piccione argues, however, that the writing of both materials for the same instrument means a real material (wood) and a religious-symbolical (meteorite iron).

Probes

Besides the use of the probes by the embalmers, it is likely that doctors used it on the wide range to examine fistulas, to fill the abscess cavity' size, or to reposit bone fragments, but even to extract foreign bodies or projectiles. During the Roman period, these included scoop-ended, blunt-ended, spherical-ended or pointed probes (Figure 4.D. 4, 14 and 30; Figure 16. 3rd and 6th tools

from left).[154] They might be substituted even by thorn or cane. As palpation was an important part of pharaonic medical examinations, it is certain that at least some of the tools common to mummification have been used to palpate parts that are inaccessible to the finger.

Figure 15. Various applicators and probes from the Cairo Museum (https://www.sutori.com/en/story/ancient-egypt-background--Jjsuuv39PP3BWtKzS1gaHRjh)

Catheters

Evidence has shown that the Egyptians were skilled in copper and silver soldering, and the Kom Ombo reliefs confirmed that catheters were created and used (Figure 4.D. 10 and 11.) at Graeco-Roman times, but there is no catheter extant from earlier periods, although they might be useful, as

Piccione 1981, 78-81.

154 Brier – Wade 2001; Dawson 1927.

urinary retention might be documented in the Papyrus Ebers with a medical treatment, if the interpretation of Gordetsky and O'Brien is accepted. According to them, Eb 282 = H 68: *pḫrt nt sȝḳ mwy.t* is a remedy to "*force out the urine*" by the use of the various vegetal materials listed in.[155]

Storage

Medical accessories were probably from the beginning stored together by doctors to be ready with their kit, when needed. We know that the papyri were kept in rolls put into boxes, jars or leather pouches. Some smaller units were kept together, as we can see for instance the kit from Thebes in the Metropolitan Museum,[156] bone etuis for needle keeping them together,[157] small cosmetic boxes for the ointments[158] prepared to distribute among the patients or carrying when visiting them. All of them were then put into a medical bag, an excellent example of which is Berlin 1176, from the 11th Dynasty.[159]

Attested by the Kom Ombo relief, cylindrical carrying case was a storage tool for surgical and/or medical instruments in the 2nd century AD (Figure 4.D, 26; Figure 10. 7th and 8th instruments from left), which has parallels, revealed at Damascus, Syria in 1970.[160] It seems to be practical for storing small surgical instruments, mainly used by travelling doctors in ancient era.

4. Conclusion

Since ancient time, parts of plants that were at man's environment have been suitable to perform certain simple operations. Overviewing the surgical instruments, we could find almost for all classes of tools possible vegetal equivalent, which might contribute to the development of metal devices. Some tools were, however retained in plant material, being better adjusted to the aim of the process this way. The elasticity and the very thin thickness seem to be the main reason in cases such as the *šȝs*-knife, the razor-like sharpness at other occasions such as the *ḏw n swt*, elasticity at the *ḥnw*-forceps, the multifunctionality at the very pointed acacia thorn, but also the easy availability

155 Gordetsky – O'Brien 2009. The verb *sȝḳ* meant during the Old Kingdom „*put together, gather together, hold together*" (HW.I.1068), and in the Middle Egyptian period also "*melt, pour*" (HW. II.2093), although without the crocodile present in the above recipe. For other treatments of urinary disorders see Blázovics et alii in this volume.

156 Hayes 1959, 64, fig. 33.

157 E.g. British Museum EA62282 – needle-case from Mostagedda (https://www.britishmuseum.org/collection/object/Y_EA62282 also https://www.donsmaps.com/egypt1.html)

158 E.g. British Museum EA5897 (https://www.britishmuseum.org/collection/object/Y_EA5897), or The Metropolitan Museum 26.7.1438 (https://www.metmuseum.org/art/collection/search/543955), for further examples see Killen 1994 among others.

159 Reeves 1992, 61, fig. 61.

160 Source: Museum of Fine Art Boston, www.collections.mfa.org/objects/470270

played always an important role.

The Ptolemaic period may be considered as marking the end of pharaonic Egypt, but it also transferred its knowledge to the flowering Hellenisitic medical school in Alexandria, which merged the knowledge of the classical antiquity with that of ancient Egypt. Under the Greek guise, the Alexandrian school continued millennia old tradition in updated and developed form. Academic experimentations were carried out, new results built in. Although it prospered during the Hellenistic period, it contributed also to the Roman medicine, and with Galen as its most illustrious former student to the medieval European healing tradition.

Abbreviations

Eb = papyrus Ebers
H = papyrus Hearst
Sm = papyrus Edwin Smith
TLA = Thesaurus Linguae Aegyptiae – https://aaew.bbaw.de/tla/servlet/TlaLogin
Wb = Adolf Erman – Hermann Grapow, Wörterbuch der ägyptischen Sprache I-VI. Berlin: Akademie-Verlag 1926-1961.
HW.I. = Hannig, Rainer, Wörterbuch, Altes Reich und Erste Zwischenzeit. Mainz: Philipp von Zabern 2003.
HW.II. = Hannig, Rainer, Wörterbuch, Mittleres Reich und Zweite Zwischenzeit. Mainz: Philipp von Zabern 2006.

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O. Hagerup.

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Original collection
1809

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