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Medicine in Ancient Egypt

Medicina en el Antiguo Egipto

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SUMMARY

Knowledge of the medicine practiced in Ancient Egypt is found mainly in the so-called medical papyri, of which the oldest is the Lahun papyrus (c. 1800 b.C) which mainly reveals knowledge of gynecology and obstetrics, including methods of contraception. Surgical cases, most of them related to trauma, are dealt with in the Edwin Smith papyrus. Specific medical and anatomical terms, such as brain, fracture, and seizure, appear for the first time in this treatise. Other important papyri include the Hearst papyrus and the Ebers papyrus. There are also valuable sources of information in the study of mummies and paleopathographic investigations. The most common types of pathologies detected in the ancient Egyptians were trauma in many forms that included wounds acquired in wars, animal bites, and work accidents in mines, quarries, and monumental constructions. In surgery, they practiced the amputation of limbs and circumcision. Molecular biology studies demonstrate the existence of tuberculosis, malaria, schistosomiasis, taeniasis, and ascariasis. They also suffered from atherosclerosis, tooth decay, and other dental conditions. Cancer was rare. Herbs, substances of plant origin (oils, resins, etc.), or minerals were part of the ancient Egyptian pharmacopeia. A well-established system of medical care existed, associated with a well-defined medical hierarchy.

Keywords: *Ancient Egypt, medical papyri, Lahun papyrus, Ebers papyrus, Edwin Smith papyrus, mummification.*

RESUMEN

Los conocimientos de la medicina practicada en el Antiguo Egipto se encuentran principalmente en los llamados papiros médicos, de los cuales el más antiguo es el papiro de Lahun (1800 a.C.) que revela principalmente conocimientos de ginecología y obstetricia, incluyendo tratamientos anticonceptivos. En el papiro de Edwin Smith se abordan casos quirúrgicos, casi todas víctimas de trauma. En este tratado aparecen por primera vez términos médicos y anatómicos específicos, tales como cerebro, fractura y convulsión. Entre otros papiros importantes se cuenta el de Edwin Smith, el de Hearst y el de Ebers. También hay valiosas fuentes de información en el estudio de las momias y en investigaciones paleopatográficas. Los tipos de patologías más comunes detectadas en los antiguos egipcios fueron trauma en muchas formas que incluían heridas adquiridas en guerras, mordedura de animales y accidentes laborales en minas, canteras y en las construcciones monumentales. En cirugía

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practicaban la amputación de extremidades y además la circuncisión. Estudios de biología molecular demuestran la existencia de tuberculosis, malaria, esquistosomiasis, teniasis y ascaridiasis. Se demuestra que padecían de aterosclerosis, caries dentales y otros padecimientos odontológicos. El cáncer era infrecuente. Las hierbas, sustancias de origen vegetal (aceites, resinas, etc.) o minerales formaron parte de la farmacopea egipcia antigua. Existía un sistema bien establecido de atención médica, asociado con una jerarquía bien definida.

Palabras clave*: Antiguo Egipto, papiros médicos, papiro de Lahun, papiro de Ebers, papiro de Edwin Smith, momificación.*

HISTORICAL INTRODUCTION

According to the criteria of most historians, the expression Ancient Egypt refers to the civilization that flourished along the Nile in the long period of about 2 800 years that ends with the conquest of Alexander the Great in 332 b.C. Some historians also include the Greek or Hellenistic period that elapsed between 332 and 30 b.C, when Egypt became a province of the Roman Empire (1). In general, according to conventional chronology, ancient Egyptian history comprises 26 dynasties grouped into the following periods:

1. Predynastic period (5000 - 3100 b.C)
2. Early dynastic (Dynasties I and II; 3100-2686 b.C)
3. Old Kingdom (Dynasties III to VIII; 2686-2160 b.C)
4. First intermediate period (Dynasties IX to XI; 2160 - 2055 b.C)
5. Middle Kingdom (Dynasties XII to XIV; 2055 - 1650 b.C)
6. Second intermediate period (Dynasties XV to XVII; 1650 - 1550 b.C)
7. New Kingdom (17th to 20th Dynasties; 1550 - 1069 b.C)
8. Third intermediate period (Dynasties XXI to XXV; 1069 - 664 b.C)
9. Late period (XXVI Dynasty and Persian rule; 664 - 332 b.C)

In particular, the Old Kingdom period is known as the Age of the Pyramids (1). One of the most powerful pharaohs of this period was Zoser or Djoser (second pharaoh of the III dynasty) who ruled from 2665 to 2645 b.C, established the capital of the empire in Memphis, south of the Nile delta, and ordered the construction of the famous stepped pyramid of Saqqara, the first large-scale stone construction that would serve as eternal rest. This was designed by the sage Imhotep, who in addition to being an architect, was a renowned physician who lived between 2690 and 2610 b.C (Figure 1). He was an important person, occupying the positions of the high priest of Heliopolis and chay of the pharaoh (chay or vizier is the royal official of the highest degree in the court). A commoner by birth, Imhotep's intelligence and determination enabled him to become Djoser's most trusted advisor (1). After his death, he was deified as the god of medicine and wisdom, his main cult being in Memphis and Thebes.

Figure 1. Imhotep representation.

DOCUMENTARY SOURCES

The documentary sources of Ancient Egyptian medicine are found mainly in the so-called medical papyri, in the hieroglyphic writings found in monuments, temples, tombs, and sarcophagi, and in the accompanying drawings (1,2). These sources are complemented by paleopathographic or paleodiagnostic studies, carried out with

modern techniques of biomedical research applied to human remains (mummies) from different periods, which has made it possible to identify the diseases they suffered and the cause of death of mummified individuals. The first two sources are written with hieroglyphic symbols or hieratic symbols; the latter represents a simplification of hieroglyphs, specially adapted for writing on papyrus. A papyrus is usually identified with the name of its discoverer, the place where it was found, or the city or museum where it is kept (2).

THE MEDICAL PAPYRI

The main Egyptian literature is represented by the hermetic books of the god Thoth, although many of them have been lost. The so-called medical papyri (about 15 are known) are fragments of these books that are in custody in the main museums and libraries of the world (2). The most important, in order of its antiquity, are:

1. The Lahun or Kahum papyrus, which deals with gynecological diseases and dates from 1820 b.C. It is kept in London (England).
2. The Edwin Smith papyrus, 1550 b.C., is kept in New York and deals mainly with surgery and trauma.
3. The Ebers papyrus, 1500 b.C., is kept in Leipzig; it is about general medicine.
4. The Hearst Papyrus, dated 1450, is kept in California, and deals with general medicine.
5. The Berlin Papyrus, 1200 b.C. deals with general medicine.

THE LAHUN PAPYRUS

The Lahun papyrus (found in the town of the same name in 1889) is the oldest of the medical papyri known to date, having been dated to around 1800 b.C. (Between 1840 and 1792 b.C) (2-4); is primarily a gynecology and obstetrics text, restored and translated by Egyptologist Griffith and published in 1898. In its content there are 17 descriptions of diseases of women with their respective treatments (enemas, medications, massages, etc.); it also mentions procedures for the prognosis of fetal sex, to determine the fertility of women as well as methods for birth control and to promote conception, as well as the beneficial influence of music on the human body. The prognosis of fetal sex was carried out as follows: the pregnant woman urinated on a stack of wheat and another of barley, if the wheat germinated the concept was male, and if the barley germinated it would be female. Birth control was carried out by introducing crocodile excrement mixed with sour milk or acacia resin into the vagina. The fertility prognosis was carried out by introducing garlic or onion into the vagina, if the next day the woman's breath was garlic or onion, it indicated a fertile woman. Egyptian women in Ancient Egypt gave birth squatting seated on a chair with a large hole and the fetus would fall through said hole in the floor or a table as evidenced by low relief engravings on one of the walls of the Temple of Kom Ombo (2-4) Figure 2. It is kept currently in the Museum of Archeology at the University of London.

Figure 2. Fragment of the Lahum papyrus (left) and squat delivery engraved on a wall of the Kom Ombo temple (right).

THE EDWIN SMITH PAPYRUS

The Edwin Smith papyrus, purchased by his eponymous from an Egyptian merchant, has been dated to around 1550 b.C. It is considered the oldest surgical book in the world (5-7). Its 17 pages describe 48 surgical cases, most of them traumatic (fractures, dislocations, wounds), but also include observations on tumors, ulcers, abscesses, and their consequences (Figure 3). The presentation is organized in the form of a clinical history, where the location of the disease, the diagnosis, and the treatment are systematically indicated (except in fatal cases). Physiological processes such as blood return, the nervous system, and the importance of the spine as a center of control and movement are described. Methods of fracture and dislocation reduction and procedures for their containment are described for the first time. The reduction of jaw dislocation is described in much the same way as it is currently done. Instructions are given for patients with open head wounds with an exposed brain (the brain is macroscopically described with corrugations such as those that form in molten copper and somewhat softened); if blood flows from the nostrils and there is neck stiffness, the recommendation is that these patients should not be treated. They describe complications after a stroke such as dragging gait or foot drop. The meningeal irritation in cases of meningitis is described in the form of "stiffness" of the neck or the inability of patients to "look at their shoulders".

Regarding wounds and lacerations: the first day they were treated with bandages and dressings made of fresh meat and then with oil and honey (The sugar in the honey exerts an osmotic effect and drains fluids from the wound and bacteria do not grow on the honey). In other cases, surgical sutures, cauterization, splints, crutches, and supports were used to keep the patient erect. Wound complications, including infection and tetanus, are also described. As a treatment for a bleeding nose fracture, they used oil-soaked linen swabs in each nostril or placed a rigid roll of linen, followed by a bandage. Treatment for clavicle and humerus fractures and reduction in jaw dislocation are described. Smith et al. in 1908 studied 2 mummies from V Dynasty tombs at Naga-ed-dêr with wooden splints preserved *in situ*; the patients apparently died due to open fractures (Smith 1908), one with a compound fracture of the femur treated with wooden splints and another with a compound fracture of the forearm with wood bark splints. For pain, fever, and inflammation, it mentions the decoction of willow bark (giving origin after several centuries to aspirin). Precise anatomical and medical terms such as brain, meninges, fracture, and seizure are mentioned for the first time. This medical text contains detailed anatomical observations, but shows no understanding of organ functions, along with the oldest known reference to breast cancer. It is currently kept at the New York Academy of Medicine. In summary, the text of the Edwin Smith papyrus is based on the observation, collection, and classification of the facts and the application of an inductive mental process, exposing the emerging surgical semiology and contains a vision of the clinic, of the anatomy, of the physiology as well as the pathology and treatment prevalent at that time (2,5-7).

Figure 3. Fragment of the Edwin Smith papyrus (left; available at http://archive.nlh.gov.), and Edwin Smith oil painting by Francesco Anelli, from the collection of the New-York Historical Society (right).

THE EBERS PAPYRUS

The Ebers Papyrus, the best known and most extensive of the Egyptian medical papyri, is in the Library of the University of Leipzig. Its name comes from the German Egyptologist George Moritz Ebers, who acquired it in 1872; It is 20.25 m long and 30 cm wide with 108 columns or pages, each containing 20-22 lines of hieratic writing (8). It was written around 1536 b.C. in the reign of Amenhotep I (18th Dynasty), it contains 877 sections on medicine with mention of some 700 drugs. It deals with diseases of the eyes, of the skin, of the extremities, and the respiratory, digestive, and urinary systems, as well as the first sketch of clinical depression and dementia and of the various treatments of these affections, which in many cases include religious invocations.

Some of the plant products mentioned in the Ebers papyrus for their medicinal effect are saffron, myrrh, aloe, castor leaves, lily extract, poppy juice, coniferous resin, hemp, and frankincense. Raw garlic was prescribed for asthma and bronchopulmonary conditions, onions to treat gastrointestinal problems and for colds, coriander against flatulence and cystitis, cumin against flatulence and in a poultice with wheat flour and water against joint pain, cumin with lard as an anal suppository for anal itching, basil for the heart, aloe for parasites, belladonna for insomnia and pain, colchicine for rheumatism, cardamom as a digestive, and garlic and onion to increase physical strength. The leaves of many plants, such as willow, sycamore, and acacia, and tree resins were used in poultices. The papyrus also mentioned drug treatments of animal origin such as honey, milk, blood, urine, placenta, bile, fat, meat, and liver extract; animal excrement from cats, birds, crocodiles, and also human excrement was used in medical treatments. Honey was mainly for internal use although was also recommended for the treatment of open wounds for its anti-inflammatory and healing effect. One remedy for gray hair was an extract of cat's placenta, and fat from lion, hippopotamus, crocodile, cat, snake, and other animals were prescribed against baldness. Animal fat was also used to make ointments in the hope of transferring some desirable characteristics of the animal. Ass penis prepared as a powder is mentioned for the treatment of impotence (a precursor to today's Viagra). They are used as a laxative: castor oil, figs, and dates. Infestation with tapeworms was treated with an infusion of pomegranate root (it is known now that the alkaloids present in this infusion paralyze the nervous system of the tapeworm and promote its expulsion). Ulcers and stomach ailments were treated with yeast. Cases of ocular pathology are mentioned: chalazion and stye, blindness, trachoma, pterygium, blepharitis, ectropion, trichinosis, ocular hemorrhages, corneal leukoma, corneal ulcers and scars, cataracts, and conjunctivitis. Figure 4 shows the painting of a doctor extracting a supposed foreign body from the eye of a patient with an ophthalmological instrument. This is the treatment of a labor problem, and it must have occurred frequently in the workers who built the pyramids, temples, and monuments. The painting is in the tomb of the sculptor Ipuy, in Deir el-Medina located south of Sheikh Abd el Qurna. The sculptor of Ramses II captured a series of scenes of what today we understand as work accidents in the catafalque of Ipuy.

Regarding treatments with drugs of mineral origin, natron (a mineral formed by sodium carbonate and bicarbonate and sodium sulfate and chloride), common salt, malachite, and lapis lazuli are mentioned; the latter is not absorbed, and its use was restricted to ocular pathologies (8).

Figure 4. Physician extracting a foreign body from the eye of a patient (painting on the catafalque of Ipuy, a sculptor, in Deir el-Medina).

THE BROOKLIN PAPYRUS

The Brooklyn Papyrus is a medical papyrus dealing with medicine and ophidiology; it has been dated around 450 b.C and is preserved in the Brooklyn Museum in New York. It describes 21 snakes, their characteristics, habits, the appearance of the bite, and its effects, such as fever for 7 to 11 days, weakness, tremors, tetanization, eye muscle spasms, bleeding, and inflammation. The papyrus also describes the prognosis of patients according to the species of snake involved. Survival was conditioned by the number of days after the bite and the treatment. Uncontrollable emesis was a sign of poor prognosis. The treatment was usually local with drugs, herbs, and spells, incision of the wound with a knife several times the first day to remove necrotic tissue and alleviate the edema, and then they applied salt or natron and bandage. The onion was widely used, associated with an invocation to Horus, God of Heaven, and the origin of life; they also invoked Serket, goddess of scorpions with powers over snakebites (2). Open wounds were often treated with honey, but sepsis was one of the most common causes of death (2).

THE PRACTICE OF SURGERY

Surgery was widely practiced in Ancient Egypt as demonstrated by Dupras et al. in 2009 when they reported four cases of amputation in mummies discovered in Dayr al-Barshā, an important necropolis and quarry of the First Intermediate Period and the Middle Kingdom (9). Two of the cases are of individuals who have amputations in both feet, one through the metatarsophalangeal joints and the other a transmetatarsal amputation. They show the particular pattern of healing and pseudoarthrosis formation where the metatarsal heads are shown to have fused. Another case represents a healed amputation of the left ulna near the elbow, dating from the Old Kingdom and another mummy with the distal end of the right humerus amputated, but given the multiple fractures that this mummy had, the individual must have died from trauma. All four cases support the hypothesis that the ancient Egyptians used amputation as a therapeutic surgical treatment, especially in cases of trauma (9).

Zaki et al. in 2010 studied 204 skeletons and 2 287 long bones from the Giza Cemetery and found a mummy with limb amputation dating from the III-VI Dynasty (2700-2190 BC) and the second case of another skeleton with ulna and radius amputation (10). It is interesting to note that in the temple of Edfu (dedicated to Horus, equivalent to the Greek Apollo), located in the homonymous city that was known as Apolinópolis Magna during the Hellenistic period, a bas-relief represents the amputation of a leg as a testimony to the practice of this surgical method in Ancient Egypt (Figura 5). This temple is the second largest temple in Egypt after that of Karnak and one of the best-preserved. In the Egyptian Museum of Cairo, a prosthesis that replaces the big toe of a foot, found in Thebes, in the year 2000 is exhibited (Figure 6). The skull of Pharaoh Seqenenrade of the 17th Dynasty from 1600 b.C is also exhibited there. The skull shows a perforation. By using X-rays, it was shown that there was bone growth around the perforation indicating that the pharaoh lived at least several months after the accident, probably treated by doctors (Figure 7).

Figure 5. Bas-relief of the amputation of a leg, on a wall of the Temple of Edfu.

Figure 6. Prosthesis for replacing the big toe of a foot was found in Thebes in 2000.

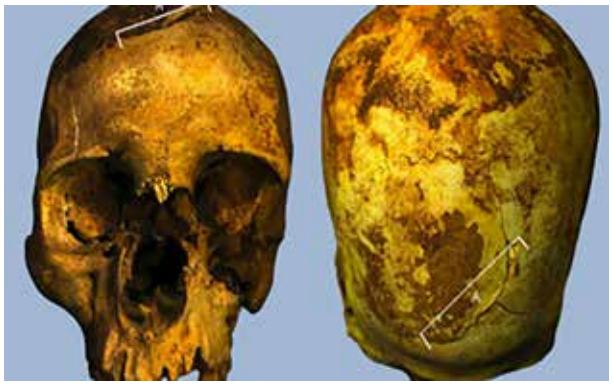

Figure 7. Skull of Pharaoh Seqenenre (17th Dynasty, 1600 b.C), showing a perforation.

In the temple of Kom Ombo (dedicated to the gods Horus and Sobek, located 45 Km north of Aswan), the destination of thousands of pilgrims who consulted Horus, the healer, about their health, there is a bas-relief representing ancient surgical instruments such as bone saws, suction cups, knives and scalpels, retractors, lancets, chisels, and dental tools (Figure 8).

The tomb or mastaba of Ankh-Mahor, visir or chatty ("First after the Pharaoh", "Overseer of the Great House") during the reign of Pharaoh Teti of the VI Dynasty, located in the necropolis in Saqqara, is known as the tomb of the physician because it includes famous surgical scenes: operation of a toe, a thumb, and circumcision.

Figure 8. Surgical instruments from Ancient Egypt were carved into the Kom Ombo temple wall (left) and temple facade (right).

The best-known images are found on the door of the Hall of Columns. There is the bas-relief of the circumcision of a boy destined for the priesthood, an initiation ritual that included the shaving of the entire body (11; Figure 9). The tomb also shows multiple scenes with artisans at work, jewelry, metallurgy, sculptures, funeral rites, and dancing women). Traumas because of industrial accidents were frequent in mines, quarries, and in the construction of tombs in the necropolis, war wounds, animal bites, fever, burns, itching, stings, pain.

Figure 9. Representation of circumcision in an adolescent in a bas-relief in the tomb of the physician Ankh-Mahor in Saqqara.

INFECTIOUS AND PARASITIC DISEASES

It has been possible to demonstrate the existence of tuberculosis among the ancient Egyptians; signs of Pott's disease have been observed in a high proportion of mummies. Accurate evidence of tuberculosis has been demonstrated by PCR (polymerase chain reaction) of bacterial DNA (12-16). Figure 10 shows the mummy of priest Ammon of Nes-Perenhep, with signs of vertebral spondylitis and secondary cold abscess in the right psoas muscle.

Figure 10. Remains of the Egyptian priest Ammon (21th Dynasty) showing signs of Pott's disease.

The existence of schistosomiasis or bilharziasis, a parasitic infection caused by trematodes of the genus *Schistosoma*, has been proven in Ancient Egypt (17-20). The most important species in human pathology are *S. haematobium* (responsible for urogenital disease), *S. mansoni,* and *S. japonicum* (responsible for intestinal and liver disease). Schistosomiasis was a common cause of anemia, female infertility, susceptibility to other diseases, and ultimately death. The Ebers Papyrus addresses some aspects of the disease and in two columns discusses the treatment and prevention of bleeding in the urinary tract (hematuria). The Hearst Papyrus cites the therapeutic effect of antimony disulfide. The first archaeological evidence of the existence of schistosomiasis in Ancient Egypt was the discovery of calcified eggs, in 1910 by Sir Marc Armand Ruffer, pioneer of paleopathology and confirmed by Miller et al. in 1982 in Nakht in a dissected non-embalmed mummy (18).

Malaria was detected in 4000-year-old mummies in Abydos. *Plasmodium falciparum* DNA was identified in bone tissue by PCR (amplification of a 134 bp fragment) in 2 of 91 mummies. Smallpox, diarrhea, dysentery, typhoid, jaundice, and relapsing fever were responsible for many deaths (21) (Figure 11).

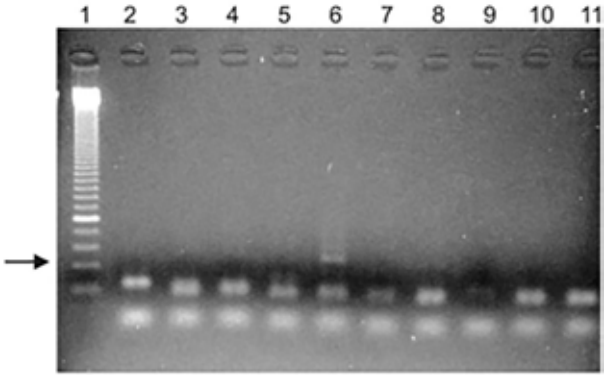

Figure 11. PCR amplification of a 134 bp fragment of ancient Plasmodium falciparum DNA in an Egyptian mummy. Lane 1, molecular marker; Lanes 10 and 11, 2 negative controls. One (lane 6) of 8 samples shows a positive amplification product (arrow). The specificity of the product was verified by sequencing. (Nerlich A.G. Emerg Infect Dis. 2008;4:8).

Smallpox was another prevalent disease in Ancient Egypt. The earliest evidence of the disease dates from the time of Pharaoh Ramses V, who died unexpectedly young after a 4-year reign, according to radiological studies, in 1157 b.C. His mummy in the Cairo Museum shows pockmarks (22).

Trichinosis was present, affecting pigs and humans. The ancient Egyptians suffered from tapeworm infestation as evidenced by the mummy of Nakht, a twentieth dynasty weaver, and was found infested with the tapeworm *Trichinella spiralis* which causes cysticercosis; schistosome infestation was also detected in this mummy.

It has been observed in ancient Egyptian tombs drawings of men with male genitalia suggestive of filariasis. Illustrations possibly depicting elephantiasis (23) can be seen at the funerary temple of Queen Hatshepsut (1501-1480 BC) near Luxor. In the scrotum skin of the mummy of the priest Natsef-Amun (XIX Dynasty), found in the Nesyamun Museum in Leeds, England, the presence of filariae was reported.

The ancient Egyptians suffered from strongyloidiasis infestation as demonstrated by the presence of *Strongyloides stercoralis* larvae in the intestinal wall of Asru's mummy (21st Dynasty), which is in the Manchester Museum (24). The intestines of the mummy had been placed between her legs and not in the canopic jars, as was customary. They found evidence of *Ascaris lumbricoides* infestation in the PUM II mummy (24), which is housed in the Museum of Archeology and Anthropology of the University of Pennsylvania, USA.

The ancient Egyptians probably suffered from polio. The papyrus of the priest Rom shows a drawing in which he makes an offering; it is observed that his right leg shows a lesion that could represent the oldest testimony of this disease.

OTHER DISEASES

Pulmonary silicosis from breathing airborne sand particles was a probable cause of lung disease and death (25). The ancient Egyptians suffered from hernias and hydroceles and there was also malnutrition (26). Cancer was extremely rare (26); however, a team of researchers, including a group of anthropologists from the University of Granada, has discovered the oldest cases of breast cancer and multiple myeloma in two mummies found in the necropolis of Qubbet el Hawa, near Aswan. Both belonged to the ruling class, or at least were wealthy, of the families of the Egyptian governors of Elephantine, present-day Aswan. A mummy with metastatic prostate carcinoma has also been reported. Figure 12 shows the computed axial tomography of the column of a 2150-year-old mummy, preserved in a museum in Lisbon. A mummy from 2200 b.C with breast carcinoma was discovered in the Aswan necropolis (26).

Figure 12. Computerized axial tomography (CAT) of the spine of an Egyptian mummy.

In Ancient Egypt, congenital diseases, or malformations such as a sixth toe, spina bifida, and achondroplasia have been shown in some mummies (24). Figure 14 shows the sculpture of the dwarf Seneb, priest of the funeral cults of Khufu with his priestess wife of normal height and two children. Seneb presented disharmonic hypochondroplasia dwarfism as observed in the proportion of the limbs and the trunk. He was an official of the pharaoh's court, head of the wardrobe dedicated to the cult of Cheops, and in charge of the funeral cults of Khufu. In Figure 15 we have a bas-relief with Seneb receiving reports from the scribes. This bas-relief is found in Seneb's tomb in Giza. It is important to emphasize that the dwarves of Ancient Egypt were highly respected and appreciated and some of them could occupy high positions in the government (27-29).

Thompson et al. (30) and Allam et al. (31) detected arteriosclerosis in mummies from Ancient Egypt by computerized axial tomography. The authors of the investigation of atherosclerosis considered the presence of atherosclerosis as positive if they visualized a calcified plaque in the arterial wall or calcifications along its course by tomography. Thus, they detected 34 % of 137 mummies and 38 % of 76 non-mummified Egyptians with atherosclerosis (31,32). Vascular calcifications have also been detected in the mummies of Ramses II, who died at the age of 90, Ramses III, Ramses V, and Ramses VI. Regarding the relationship between diet and atherosclerosis in Ancient Egypt, it has been established that the

Figure 13. The priest Rom making an offering; his lameness could be the oldest testimony of polio. Copy of a vignette dated around 1403-1365 b.C.

Figure 15. Seneb receiving reports from the scribes. Bas-relief of the Tomb of Seneb in Giza.

Figure 14. Representation of Seneb, dwarf priest of the funeral cults of Khufu with his priestess wife of normal height and two children.

diet consisted of beef, wild birds, goose, bread, fruits, vegetables, bread, cereals such as barley or wheat, onion, lettuce, eggs, cakes, wine, and beer. The diet consisted of more than 50 % fat of the saturated type. The ancient Egyptians of the lower classes followed a vegetarian diet while royalty consumed high levels of fat (32,33).

In Egyptian mummies, dental alterations such as cavities, ablation of the occlusal surfaces, infection of the dental roots and alveoli with abscess formation, and periapical cysts have been detected (34). In some cases, the spread of chronic infection to the bone causing osteomyelitis has been observed, with the possible occurrence of septicemia. The mummies of the pharaohs Amenophis III and Ramses II show teeth in poor condition; that of Ramses II presents large cavities within the maxilla due to bone reabsorption caused by the infection. Figure 16 shows a denture with ablation of occlusal faces in a young mummy from 2100 b.C, and in Figure 17, a denture with deep cavities.

Figure 16. Denture with ablation of the occlusal surfaces in the mummy of a young man (2100 b.C).

Figure 17. Jaw from an Egyptian tomb (3000 years b.C).

Treatments for inflamed gums with a mixture of cumin, frankincense, and onion are mentioned in some of the medical papyri. They used opium for severe toothaches. Holes were sometimes drilled in the jaw to drain abscesses. But tooth extraction was rarely practiced.

MEDICAL ORGANIZATION

In Ancient Egypt, the term to name the physicians was Sun-Nu, which meant "the man of those who suffers or are sick" (1,35). At the time of Pharaoh Zoser and his physician Imhotep there was a medical organization in which the following classes of doctors could be distinguished:

El'wn (ordinary physician)

Imyr swnw (supervisor of physicians)

Wrswnw (Chief Physicians)

Smsw swnw (oldest of physician)

Shdswnw (Medical Inspector)

Imy-rt-swny (director of physicians)

Physicians were specialized in Ancient Egypt, and in principle, there was a distinction between doctors (using drugs or invocations) and surgeons. Sekhetnankh was a word applied to a doctor treating nasal diseases, and Iry was the name for the royal doctor of the intestines. There were also exorcist doctors, who healed by means of charms and amulets. The surgeons considered themselves as priests of the goddess Sekhmet, "the great mother goddess", symbol of strength and power. She was considered the goddess of war and revenge, but also the goddess of healing.

EMBALMING AND MUMMIFICATION

Embalming or mummification is the process or procedure used for the conservation or preservation of human remains or other animal species, counteracting the natural process of decomposition or putrefaction. It can occur naturally or be the result of an artificial process (36-38). The Egyptians' belief in the immortality of the pharaohs led to the embalming and mummification process, as a way to preserve their integrity in the afterlife, a procedure that was extended to other people, and in general, to whoever could pay for it. Mummification was performed in Egypt from ancient times to the Christian era, in an effort to preserve the body for use in the afterlife with the Ka (life force) and the Ba (personality) (39). Death was considered not the end of this life but an interruption to move to a better life. They thought that the soul of the deceased traveled to the afterlife where it would meet Osiris, God of Death, and lord of a paradisiac region (Aaru), with eternally fertile fields, abundant food, and recreations such as hunting and fishing. After this transitory life, the person went to another more permanent life, better than Egypt, an underground region called Campo de Larus or Campo Reds, ruled by Osiris where the deceased could live with the gods; for this transit to occur the physical body was indispensable (40,41).

In the Predynastic Era, about 6 000 years ago, the corpses were buried in the desert, wrapped in animal skins, under conditions that favored the desiccation of the bodies and their natural mummification. From the observation of this phenomenon and the belief in another life for the soul of the deceased, the process of artificial mummification began. The Egyptian word for mummy was Sah; the modern word mummy is believed to come from the words "muum" and "mumia", from Persian and Arabic, respectively, which mean wax, resin, or bitumen. Bitumen, which is found naturally and abundantly in much of this region, was used in the mummification process at first sporadically. During the dynastic period, the use of the process increased. For this,

a wide variety of substances were used such as acacia oil, pistachio tree resin, frankincense, natron (a mineral that contains sodium carbonate), honey, herbs, cedar oil, gum, etc. The Greek historian Herodotus of Halicarnassus, (484 - 425 b.C) wrote that embalmers formed an organized group with different functions in the various stages of mummification. After the mourning that lasted 3 to 4 days, the relatives handed over the corpse for mummification and the embalmers proceeded to thoroughly clean it with plenty of water and then perfume it. In a second stage, they proceeded to extract the brain and eviscerate the trunk. The cranial cavity was filled with a resinous fluid from conifers, beeswax, and scented vegetable oils. Only the heart, the seat of the soul, and the kidneys were left inside the corpse or were put in their place after embalming. One of the embalmers marked on the left side of the abdomen the place where the abdominal cavity had to be opened with a sharp stone to extract the organs, which were deposited in the so-called canopic vessels (40). The abdominal cavity was washed with palm wine and aromatic essences, filled with sawdust, crushed myrrh, cinnamon, moisture-absorbing substances, fabrics, and perfumes. The drying process was favored by the dry climate of the region. In a third stage, the corpse was washed with natron, which acted as a dehydrator and degreaser, and served to avoid or delay decomposition. The natron had to be changed regularly since once it was saturated with bodily fluids, its action ceased. The corpses were placed on a slanted wooden plank that allowed constant drainage of body fluids, and then the natron-covered body was allowed to dry for several weeks. After about 40 days, the body was completely dehydrated. During this time, the skin would shrink, wrinkle and become leathery. In a fourth stage, after removing the fabrics from the corpse, it was washed with palm wine and water, anointed with sacred oils and resins, to make the skin soft and flexible. The head and body were covered with herbs and sawdust and then wrapped with fine linen bandages soaked in oils so that the body would regain its size (40-42). Bandaging was a complicated job that took almost a week and required about 900 meters of linen 5 to 20 cm wide (43). The body was thus ready for the burial ceremony (44).

CONCLUSIONS

The Egyptian papyri, as well as the pictorial representations of temples and funerary monuments of Ancient Egypt, demonstrate the existence of important medical knowledge as well as a hierarchical professional organization of medicine. Although such knowledge is closely related to magical-religious practices and supernatural conceptions and can be considered rudimentary, they constitute a first approach to the development of a more rational medical practice that arises mainly in the Greek culture of the pre-Christian era, whose top representative is Hippocrates. Therefore, it can be considered that the practice of medicine in Ancient Egypt and the organization of the knowledge acquired empirically represent one of the fundamental bases on which Western medicine will develop.

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