

# Diseases and therapies in Ancient Egypt: what mummies and other human remains tell us?

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## Abstract

**Mummies and skeletal material of ancient Egypt constitute valuable sources for paleopathological studies when using classical methods or modern investigation tools such as imaging techniques or molecular biology. From these approaches, we improve our knowledge about the conditions and the duration of life, eating habits, or mummification techniques. A compilation of the main diseases found during these periods can be made. One must underline the similarity in health problems with present times concerning, for instance, tuberculosis, parasitic diseases (schistosomiasis, malaria, dracunculosis), osteoporosis, arteriosclerosis, skin diseases, or dental problems. Conversely, no case of syphilis was found. The real frequency of malignant tumours remains a controversial topic. Considering therapeutic armamentarium, findings such as amputations, prosthetic replacements or more sophisticated surgery must be combined with data provided by medical papyri or carvings. This approach contributes to a better understanding of the evolution of disease and the history of medicine.**

Examination of mummies or skeletons of Ancient Egypt reveals a wealth of pathological changes which constitute more objective data than art representations or medical papyri. From a literature review, we present herein a brief compilation of the main diseases encountered at that times and a comparative analysis with our major current public health problems.

## General data on population health

In Ancient Egypt, the estimated average life-expectancy based on necropoles surveys of various periods was at about mid-30's (shorter in females due to child bearing, marked social-class dependency, probable frequent neonatal deaths) (Dunand and Lichtenberg, 2002) which is comparable to 18th Century European populations or today Sierra Leone. The majority of health problems were occupation- or environment-related. Dental problems have been described but will not be considered within this review. Harris' lines (growing arrests of the distal extremities of femurs or tibias) constitute a good indicator of social and economical level in paleopathology as a marker of stress (undernutrition or severe disease). Here, the prevalence was estimated at about 50% in peasant populations (Dunand and Lichtenberg, 2002) and less than 5% among Royal Mummies (Harris and Wentz, 1980).

## Occupation-dependent disorders

We will consider occupation-dependent disorders from two examples.

### *Arthrosis in agriculturists and building workers*

Arthrosis was highly prevalent in low-class individuals submitted to repetitive physical constraints especially peasants and building workers as shown in many art representations. Lot of examples have been found in various bone remains (Smith, 1912; Dunand and Lichtenberg, 2002).

### *Traumas of the skull during warfare*

Because of the frequency of conflicts and the high number of individuals composing the army of Pharaoh, war injuries are important points to address. Skull injuries were prevalent because of the absence of head protection in Egyptian soldiers (they did not wear helmets), and the nature of weapons used during these periods (mainly sword, arrow, axe or spear). These injuries concerned nearly always the left side of the skull (frontal assault of a right-handed aggressor). One of the most informative

series comes from the sixty archers of a Middle-Kingdom cemetery unearthed in 1923 in Deir-el-Bahri (Filer, 1996). King Seqenenre Dynasty (Dyn) 17, demonstrates the most famous case of head injury. Six wounds due to axe and spear were evidenced on skull, face and neck. A right-sided injury induced a left hand palsy which may indicate that this man is not dead immediately. This episode is thought to have occurred on the battlefield against the Hyksos albeit some scholars have raised the possibility of a murder during his sleep (Smith, 1912; Filer, 1996; Brier, 1999). Cranial wounds were not always mortal as shown on a skull studied by Filer (1996) demonstrating a healing process within a frontal fracture. Rarely, a cranial fracture can be seen out of the military context. The skull of Meryrahasetef, Dyn. 6, an overseer of tenant farmers, presenting with a left parieto-occipital fracture without healing process is exposed at the British Museum. This was probably the cause of the death (Filer, 1996).

### Environment-related disorders

These included especially parasitic diseases, in relation with the waters of the Nile, the hygiene status or the desert.

#### *Urinary Schistosomiasis due to Schistosoma haematobium: «the Egyptian disease»*

Urinary schistosomiasis constitutes the emblematic disease of both ancient and present Egypt (Contis and David, 1996). The mode of contamination is well known and in direct relation with cutaneous contact with a larvae escaping from a fresh water shell-fish. Thereafter, there is a migration of the parasite toward the vascular system of the urinary tract (major symptom: hematuria). This disease is especially prevalent in peasants working in the wet grounds near the Nile. It has been frequently diagnosed among the Egyptian mummies by the finding of eggs (in kidneys of two mummies, Dyn. 20, Ruffer (1910); mummy of Nakht, Dyn. 21, Millet et al. (1980)) or larvae (in the skin, Marro collection, Rabino-Massa (1981)), the presence of urinary-tract calcifications on X-ray (David, 1997), or by specific immunoenzymatic testing (Deelder et al., 1990; Miller et al., 1992). Many thousand years later, this parasitic disease remains a major public health problem in today Egypt, where about 20% of the population is contaminated (Contis and David, 1996).

#### *Malaria*

Today, malaria represents the most devastating parasitic disease worldwide. This disorder seemed to be endemic in Ancient Egypt according to the use of an immunoenzymatic assay detecting *Plasmodium falciparum* protein 2 histidin-rich antigen in mummies from various periods (Miller et al., 1994). With this technique, an about 40% prevalence has been reported by the team of Turin in the predynastic mummies of Gebelen (3200 BC) studying

skin, muscle or bone samples (Cerruti et al., 1999). Interestingly, adaptive red cell disorders such as thalassemia (suspected on skull thickening) or sickle cell anemia (diagnosed by red cell morphology) have also been described on mummies (Rabino Massa, 1977).

### Other parasitic disorders

They include mainly infections due to helminths in relation with a low hygiene level: *Dracunculus medinensis* (guinea worm) (Mummy 1770, Manchester, Sandison and Tapp, 1998; Marro collection: abdominal calcification), hydatid cyst (Sandison and Tapp, 1998), *Strongyloides* (Sandison and Tapp, 1998), *Taenia* (eggs) and *Echinococcus* (cysts) (Sandison and Tapp, 1998), *Ascaris* (PUM II; Sandison and Tapp, 1998), filarial worms (Sandison and Tapp, 1998), *Trichinella* (David, 1997), *Fasciola hepatica* (cysts) (David, 1997). Thus, the same parasites as today were encountered at these periods.

#### *Sand pneumoconiosis*

This is a frequent finding in mummies because of the inhalation of sand blown away by Sahara winds. This respiratory condition is specific to desert populations and still encountered today (Filer, 1996; David, 1997; Sandison and Tapp, 1998).

### What about our major current public health problems in ancient Egypt?

We will consider now the distribution in Egyptian mummies of four of our most important current health problems: arteriosclerosis, cancer, osteoporosis which represent ageing-related conditions, and tuberculosis, an infectious disease of still obscure epidemiology.

#### *Arteriosclerosis*

Signs of arteriosclerosis have been reported among Egyptian mummies before the advent of the major known factors (tobacco, stress, hyperlipidemia or syphilis) (Ruffer, 1911). Aortic calcification or atheromatosis of the cerebral vessels are the most frequent features evidenced by macroscopic or histologic examination or by imaging techniques. The first cases of aortic calcification have been described in two mummies (Czermack, 1852) and in Pharaohs Merneptah (Shattock, 1909) and Ramses II (Smith, 1912). Carotidian and cerebral arteriosclerosis inducing stroke has also been diagnosed (Rabino-Massa and Chiarelli, 1976). Diffuse cerebral arteriosclerosis was evidenced in Ramses II mummy on xerography (Desroches-Noblecourt, 1996). A beautiful example of CT-scan showing microangiopathy of foot arterioles and macroangiopathy of the abdominal aorta (diabetes?) was reported in a 50-60 year woman who lived in the Thebes area about 1065-740 BC (Nerlich et al., 2000). Thus, our contemporary deleterial habits are clearly not the only causes of this disorder.

## Cancer

Was cancer as prevalent as today in Ancient Egypt? According to Strouhal (1994) sixty cases had been reported in the literature up to 1994. The majority are bone-localized neoplasms: metastases of unknown origins, osteosarcoma or myeloma (Pahl, 1986). Zink et al. (1999) estimated the rate at these times (4 cases among 415 mummies or skeletons from Thebes West, 1500-500 BC) as intermediary between the distribution of the beginning of the 20th Century in England and that of today. Of note, very rare cases of tumors have been evidenced in soft-tissues, this fact being not explained by preservation problems (Zimmerman, 1977). For instance, it seems that no case of breast cancer, the current most prevalent malignancy in woman, have been described so far. However, in the series of Zink et al. (1999) a specimen from a 40-50 year woman exhibiting cranial metastases with osteoblastic reaction could suggest this diagnosis. Importantly, the short mean duration of life in Ancient Egypt represents a major bias to take into account before drawing firm conclusions. Nevertheless, the role of environmental changes is probably significant in our current marked prevalence of cancer.

## Osteoporosis

Osteoporosis is a major problem in our current societies especially in the elderly woman and seemed also to be present during Pharaonic Egypt. On mummies, this diagnosis can be made by the finding of complications: the head of femur fracture, vertebral compression, or from various indicators of decreased bone mass (weight, cortical measurements, trabecular structure) (Dequeker et al., 1997). Femoral fracture was often lethal except in high class individuals benefiting from adequate nutrition and care. Evidences for a remodelling process of the broken bone have been seen, for instance, in a female skeleton from Lisht, Dyn. 12, 1990-1786 BC (Dequeker et al., 1997), or in the obese Pharaoh Merneptah who had fractures of both femurs (Filer, 1996). Thus, osteoporosis is not a "modern" disease.

## Tuberculosis

Many cases of tuberculosis have been described in Egyptian mummies. One of the most typical presentation is Pott disease, representing vertebral osteomyelitis (anteroposterior angulation), as in the famous case of Nesperehan, priest of Amen, Dyn. 21 who presented also with psoas abscess (Filer, 1996). Facing less typical presentations, the diagnosis is not always straightforward, and, furthermore, one must remember that only about 10% of patients with tuberculosis demonstrate bone lesions. X-ray may evidence pulmonary, pleural or nodal calcifications. Using PCR, a 25% positivity rate for *Mycobacterium tuberculosis* has been found in two populations of probable high economic status, living during various periods of the Pharaonic Egypt (Thebes-West, 2120-500 BC and Abydos,

3000 BC) (Zink et al., 1999). With this technique, a French team has identified *Mycobacterium* DNA in a skeleton of more than five thousand years with Pott disease (Crubezy et al., 1998).

## Two brief examples of therapies

### Trepanation

Trepanation, as treatment of severe head injury, was probably not performed in Pharaonic times but seems to have been introduced by the Romans. An example was found in Giza and dated from the late Roman period (600-300 BC) (Filer, 1996).

### Prostheses

Prostheses were often used post-mortem in order to reconstitute the most perfect body appearance for after-death life as shown by Dunand and Lichtenberg (2002) who described a child foot prosthesis from the Queens Valley. However, prostheses were also proposed to palliate therapeutic amputations in living individuals. The most spectacular example was the case of a mummy of a 50-60-year-old woman (1065-740 BC, Thebes-West) extensively studied by Nerlich et al. (2000). This woman suffered from ischemic gangrene and presented with a wooden prosthesis perfectly shaped like a big toe including the nail and fixed by a broad textile. Clear marks on the sole are indicative of use during lifetime.

## Conclusion

Paleopathology studies on mummies contribute to a better understanding of disease profile and medicine history from Ancient Egypt but also of our current societies. Interestingly, there are important similarities between the public health problems of Ancient Egypt and those of our modern times.

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