Syrinx in Spinal Cord in Mummified Individual from West Thebes (Egypt)

Jesús Herrerin[1], Albert Prats[2], Lidia Ledesma[3], Albert Isidro[3]

Key words
- Egypt
- Mummies
- Paleopathology
- Spinal cord
- Syringomyelia

Abbreviations
CCSC: Central canal of the spinal cord
CT: Computed tomography
SC: Spinal cord

From the [1]Department of Physical Anthropology, Universidad Autónoma de Madrid, Ciudad Universitaria de Cantoblanco, Madrid; [2]Department of Human Anatomy and Embryology, University of Barcelona, Barcelona; and [3]Department of Orthopedics and Trauma Surgery, Hospital Universitari Sagrat Cor, Barcelona, Spain

To whom correspondence should be addressed: Albert Isidro, Ph.D. [E-mail: aisidro.cot@gmail.com]

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We analyzed a total of 36 partial or complete mummies containing neural structures from Sharuna and Qarara (Middle Egypt) and Dra Abu-el Naga, West Thebes (Upper Egypt).
Individual TT16 13.3-B06-Ind07 corresponded to a partial mummy from T2 to T11. At distal levels, it showed a structure compatible with the lower spinal cord (SC). Under magnification, the structure presented an absence of meningeal remains and a butterfly-like substructure resembling the anterior and posterior horns of the gray matter of the SC. Meanwhile, the central canal of the spinal cord (syrinx) was considerably enlarged. Field radiograph confirmed a structure compatible with the SC with a syrinx that shows a maximum diameter of 3.2 mm measured by digital caliper. Bearing in mind the normal shrinking mechanism at work in mummification, a pathologic condition such as syringomyelia during the individual's life is a distinct possibility. After a thorough review of the literature, this would be the earliest report of syringomyelia.

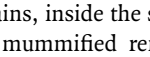
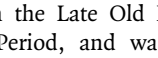
INTRODUCTION

After death, the organs with high metabolism during life such as the pancreas, liver, and spleen are usually the first to undergo autolysis. In contrast, central nervous system organs, such as the brain (despite its high metabolic rate), can be found in preserved bodies and remains of these organs, normally shrunken and shapeless, are commonly found in mummies. Meningeal structures also appear in mummified individuals, though less frequently inside the spinal canal than inside the skull. Preserved spinal cord (SC) remains are rarely found in archaeological remains.

Our aim here was to study the presence and frequency of meningeal structures, as well as SC remains, inside the spinal canal of a group of mummified remains. The study sample belonged to a broad range of periods, from the Late Old Kingdom to the Roman Period, and was compared with other series from the same and different periods of Ancient Egypt. When present, we analyzed whether the mummification process had an effect on preservation of the remains. We concluded that, in anthropological mummies, the use of preservative substances can act to reduce conservation.

CASE REPORT

A total of 36 partial or complete mummies from the archaeological sites of Sharuna and Qarara (Middle Egypt) and Dra Abu-el Naga, West Thebes (Upper Egypt) were analyzed. All showed neurologic structures compatible with meninges inside the vertebral canal. One of them, exhumed near Luxor, presented remains compatible with the SC inside the canal.

The tomb of Panehsy and his wife Tarennu (TT16) is located in Dra Abu el-Naga (West Thebes, Upper Egypt) in the west bank of the River Nile near the modern-day city of Luxor (Figure 1). Their tomb dates from the reign of Ramses II (1279–1213 BCE, in the 19th dynasty). Panehsy had 2 titles: *ḥmnTr n Imn-Htp n pAwb A* (Prophet of Amenhotep of the Forecourt)  and *HrySmawdHw n Imn* (Overseer of the Chanters of the Offering Table of Amun).  . His wife Tarennu was a *Smayt n Imn* (Chantress of Amun). 

Between 2011 and 2013, a corridor 50 m long and 80 m deep was cleaned. Various human remains were found, either skeletonized or mummified. Most were incomplete and scattered due to both postmortem changes and the actions of tomb robbers searching for jewelry.

Nine sets of mummified remains were specially examined for the presence of intracranial or spinal prostheses, inserted in order to preserve shape of the individual in the Afterlife.[1]

The individual TT16 13.3-B06-Ind07 corresponds to a partial mummified back torso from T2 to a noncompleteT11 (Figure 2). Given the absence of anthropological markers, it was impossible to establish gender and age. At first glance, the patterns of the mummification allowed us to date the individual to between the Ptolemaic and the Roman era (fourth century BCE to third century CE). In view of the widespread presence of "black mummies" (those that Herodotus placed in his "second category") during the Roman era, we dated the individual to this period. This was supported by the lack of grave goods, since during the Roman period the practice of mummification was no longer the preserve of the rich and had spread to lower social strata.[2] The black color may be due to bitumen from the Dead Sea or to preservative substances made from plants.[3]

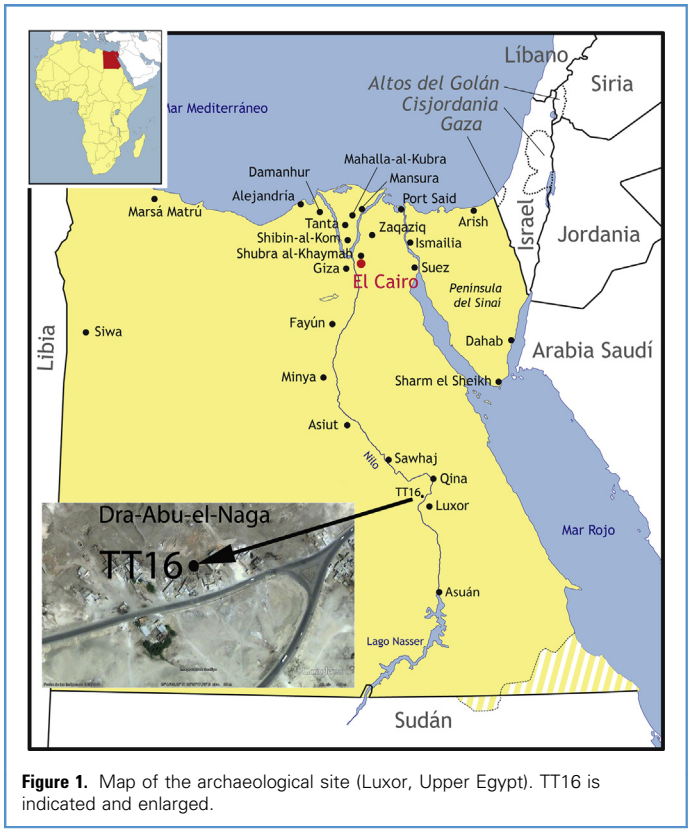


Figure 1. Map of the archaeological site (Luxor, Upper Egypt). TT16 is indicated and enlarged.

After the examination, the individual presented no obvious pathologies. At distal levels and inside the spine canal, however, a structure was observed, which was compatible with the lower SC (Figure 3). Under magnification, the structure presented highly unusual features. First, there were no meningeal remains attached to the inner side of spinal canal (neural structures are usually much more abundant inside the spinal canal in mummified remains) (Figure 4). Second, there was a butterfly-like substructure resembling the anterior and posterior horns of the gray matter of the SC. Third, and finally, the syrinx cavity (larged central canal of the spinal cord/CCSC) was considerably enlarged (Figure 5).

Field radiograph were performed to establish whether the entire thoracic vertebral canal was filled with a structure compatible with the SC. We used ClaroX Equine 810 portable digital veterinary equipment in combination with Metron-CVM-View Station software.

We took frontal and lateral images of the individual (Figure 6A and B). In addition to the presence of the anterior longitudinal common ligament of the thoracic spine, the lateral image showed the presence of preserved SC from T2 to the partial T11 inside the thoracic vertebral canal. The whole structure was broken at certain points due to postmortem damage.

DISCUSSION

The first report of mummified brain remains was by Lamb in 1901.[4] Shortly thereafter, and dating back to the Middle Kingdom, Elliot Smith provided information on patterns of natural preservation of the brains from the El Amrah necropolis near Abydos in Upper Egypt.[5]

The preservation of brain meningeal structures in both natural and artificial mummies is not uncommon, although less frequent in the latter. Meningeal remains found inside the spinal canal are less common. Inside the skull, some of these structures are present even if the individual underwent partial or total extraction of the brain through the nostrils by means of a hole made in the cribriform plate of the ethmoid and vomer bone. Most of this tissue was melted by preserving substances like resin. However, in almost all cases, the meninges can be differentiated from brain tissue using radiographs and computed tomography (CT) scans, and these images usually reveal the position of the brain remains in the posterior fossa of the skull due to gravity.

Until now, there have not been many cases in which the meningeal structures have been analyzed directly. Most cases correspond to adults that have undergone autopsies. Examples include a female mummy known as "Lady Mawangdui" of the Western Han Dynasty (third century BCE to third century CE) in China,[6] and a Korean mummy from the Joseon Dynasty (14th–15th century CE).[7] Meningeal structures also appeared in several pre-Columbian mummies from the Atacama Desert in Chile, dating from between 1000 BCE and 1500 CE,[8] and traces of the middle meningeal artery were visible in a cerebral mass from the Ptolemaic Period in Egypt (sixth to third century BCE).[9] In all these cases, the meninges were directly in contact with the encephalic masses, which varied in terms of size, shape, and consistency.

Only 1 child mummy has been found with structures compatible with meninges: an 18–month-old boy, excavated in the group of T.52 and T.69 tombs from the Quimper archaeological site in Brittany (France), dated from the 13th century.[10] In children, the isolated presence of cranial meninges in mummified individuals with no brain remains has also been recorded, though less frequently.[11]

Although, as mentioned earlier, coarse structures of the central nervous system are often found in mummies, the presence of meninges in the spinal canal is less frequent. The presence of a more or less complete SC in Egyptian mummies is an exceptional find.

Radiologic analysis is used to detect soft tissues inside the spinal canal. The SC is probably easiest to identify in the frozen mummies. In a nonhelical CT study performed at the Catholic University of Salta, Argentina, all 3 mummies recovered from the Llullaillaco site in the Andes at a height of 6739 m above sea level and dated from circa 1500 CE presented SC remains.[12]