

Case Report

The “Queen of the Moors”. Paleopathological investigation of a natural mummy from Scicli, South-Eastern Sicily

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Summary

A natural, well-preserved mummy belonging to a 45-55 year old female was found in the Church of Santa Maria della Consolazione in Scicli, south-eastern Sicily. The body was submitted to external examination, digital radiology, and computed tomography scanning. Paleopathological investigation allowed us to detect pulmonary pathology related to tuberculosis, atherosclerosis, and phleboliths. The presence of the latter, along with good dental condition with focal caries and obesity indicates a subject belonging to a high social class in good nutritional status. Along with other examples, this case allows to infer that tuberculosis was a common disease in that area, if not in the whole island, prior to the antibiotic era. Mummies need to be properly surveyed and protected, but also adequately studied by multidisciplinary teams of experts. The presence in such a team of at least one skilled anatomic/surgical pathologist, as long as well trained in the study of ancient human remains, represents an undeniable condition.

Key words: paleopathology, Sicily mummies, pulmonary tuberculosis, phleboliths, nutritional status

Introduction

Sicily is the Italian region with the largest number of mummies, dating back especially to the late Modern Age. Beside the well-known series of Palermo, Savoca, and Comiso ^{1,2}, additional collections were listed mainly in the province of Messina (north-eastern Sicily) during the last decade ^{3,4}. Recently, we had the opportunity to survey new examples of mummified remains in the south-eastern area of the region. Some of these mummies were also studied by a conservative approach, yielding significant information about the diseases affecting the ancient inhabitants of the island.

The church of Santa Maria della Consolazione in the town of Scicli (Ragusa province, South-Eastern Sicily) dates back to the 16th Century. After surviving undamaged to a major earthquake in 1693, it was expanded in a Baroque style and finished in the beginning of the 19th Century. The funerary character of the church is suggested by the name itself (Saint Mary of the Consolation, where consolation is intended for the dead) and

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witnessed by several discoveries of human remains, mortuary chapels and crypts, located outside and inside the building. In the years between 1935 and 1940, a single mummified body was found in a room beneath the frontal staircase of the building. This mummy, named by local people the “Queen of the Moors”, was recovered and subsequently moved to the nearby Collegio del Carmine. After our intervention, the body went on display in a glass/wooden case inside the church of Santa Maria della Consolazione.

Aim of the present study was the paleopathological investigation of this mummified body.

Materials and methods

The study was carried out by a conservative approach. The mummified body underwent external inspection, digital radiology, and computed tomography (CT) scanning. The mummy was wrapped in clear plastic film in order to secure it to a cardboard layer and minimizing the risks during its recovery and transportation. The body was moved to the Maggiore Hospital in the nearby city of Modica, to be submitted to digital X-ray examination and CT scanning.

Direct radiograms in different projections were obtained

with the digital system GMM (General Medical Merate) OPERA T. The CT scanning was performed using a General Electric LightSpeed Pro 32 scanner with 1 mm thick sections, obtained at reconstruction intervals of 1.25 mm, at 200-700 mA and 120-1100 kV, with maximum FOV 40.2 x 40.2 cm. The entire body was scanned generating a total of 1269 scans. Tomodensitometric evaluations were made according to the Hounsfield scale (-1000 = air; 0 = water; +1000 = bone). Volumetric (3D) rendering was carried out to obtain reconstructions of external and internal aspects of the mummy.

Sex determination was evaluated by visual inspection of external genitalia and by radiological features of hip-bone and skull sexual characters⁵⁻⁷. Age at death was assessed through the evaluation of cranial sutures closure and dental wear patterns^{6,8,9}.

Results

At visual inspection the body was almost complete (feet were lacking) and appeared in a very good state of preservation, without external signs of anthropogenic manipulation (Fig. 1). The preservation conditions of the body were evaluated by visual inspection and CT scanning. The presence of internal organs



Figure 1. The natural mummy from Scicli: (A) frontal aspect; (B) posterior aspect.

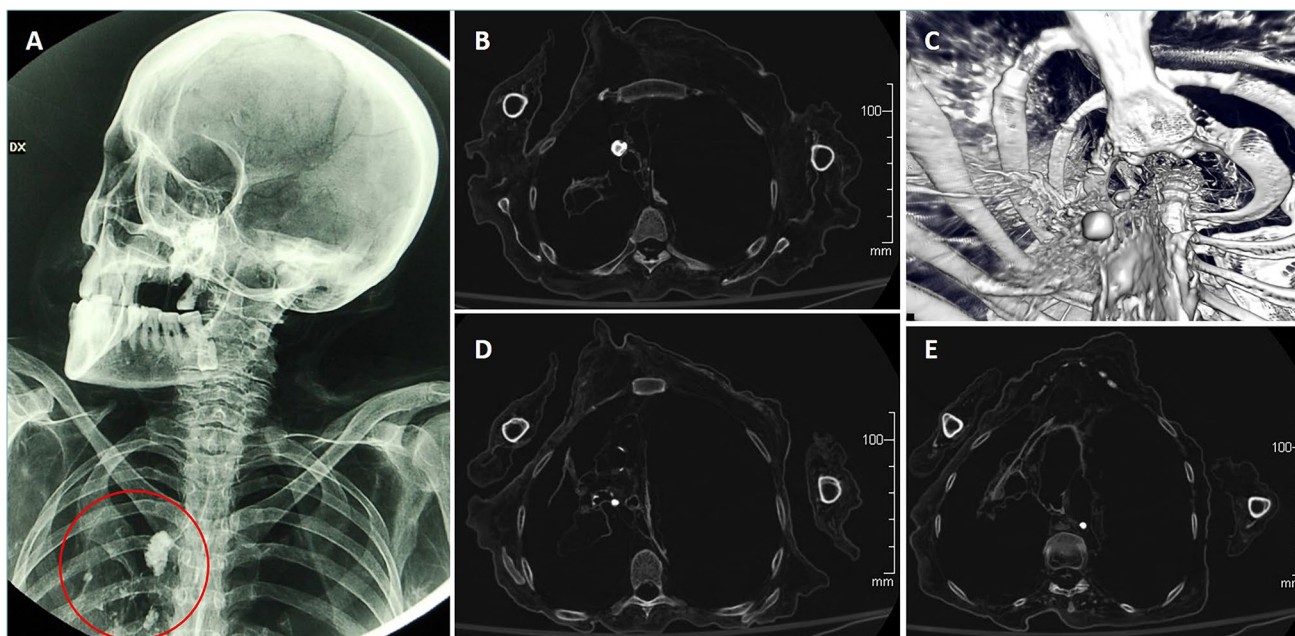


Figure 2. Imaging of the thoracic lesions: (A) digital radiography showing multiple opacities of the right lung (red circle); (B) CT scan of the right calcified paratracheal nodule; (C) virtual endoscopy of the thoracic cavity showing lung remnants and paratracheal nodule; (D) multiple tiny nodules and pulmonary adhesions of the right lung; (E) single calcified nodule of the left mediastinum.

and the absence of filling materials or skin cuts allowed us to define a well-preserved, natural mummy. These findings confirmed the natural mummification process, obtained by a rapid dehydration mechanism in dry environment, possibly related to a chamber burial in hot climate. Despite the total absence of clothes, objects, and documents related to the subject, it could be postulated that the mummy belonged to a female subject, probably dead at the very beginning of the 20th Century, and dated back to the second half of the 19th Century. Determination of sex revealed female features. The age at death was 50 ± 5 years. The mummy measured 141 cm in length, and the right femur was 38 cm long. Given the absence of the feet and the dehydration effects, the estimate of her stature was 152-155 cm.

CT scanning allowed to display amorphous material in the posterior cranial fossa, indicating remnants of encephalic tissues. Portions of the meningeal wrappings were highlighted endocranially, and were also visible within the entire vertebral column. Tissue remnants were also present inside the orbits. Post mortem right-convex deviation of the nasal septum with an osseous spur, along with subluxation of the first two cervical vertebrae were observed.

Thoracic and abdomino-pelvic organs appeared extremely well preserved and readily recognizable. Dif-

fuse right pleural adhesions were observed, along with multiple tiny calcifications of the lung and a paratracheal calcified nodule measuring 21 x 16 x 12 mm (Fig. 2A-D). Such findings were consistent with pleuritis and post-primary pulmonary tuberculosis. A left mediastinal tiny nodule was also observed, with the left lung appearing collapsed (Fig. 2E).

Calcifications were also noted in the wall of the abdominal aorta and both iliac arteries, as a possible sign of atherosclerosis. Small (2-3 mm), round calcifications (phleboliths) were identified within the pelvis (Fig. 3A). Subchondral pseudocystic areas in sacroiliac joints could be related to sacroileitis or previous pregnancies. Abdomino-pelvic viscera appeared well-preserved. The rectosigmoid tract was easily recognized, and appeared distended by endoluminal fecal material. A relative hyperdense zone could be noted in the rectovaginal space (Fig. 3B). Neither growth arrest (Harris) lines, nor bone fractures could be noted in the standard radiograms of the long bones.

Plain films and 3D reconstructions of CT scans were also useful to accurately define the dental status. All the superior incisors and canines were present, along with the left third molar. The left second molar was lost after death and appeared dislodged into the larynx. The remaining elements were lost *intra vitam*, with

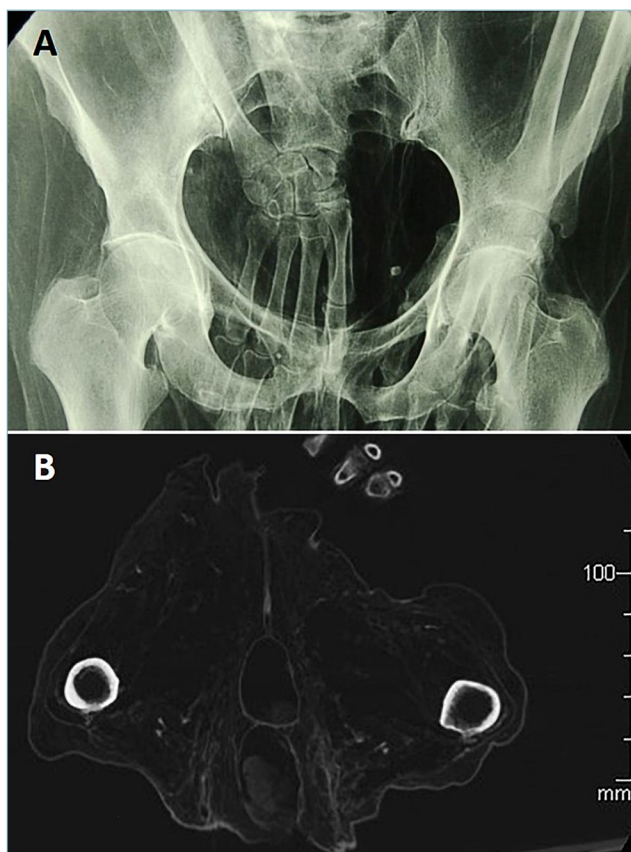


Figure 3. (A) Digital radiography of the pelvis showing a paravesical phlebolith; (B) CT scan of the pelvis with evidence of fecal material within the rectum.

marked resorption of the alveolar cavities. All the inferior elements were present, except the right third molar, dislodged posteriorly in the medial aspect of the mandibular angle.

The dislodged left second molar showed caries of the tooth neck. Focal deposits of tartar were observed on the anterior teeth, which also displayed mild periodontitis and severe dental wear. Transverse lines on the superior anterior teeth were reconducted to enamel hypoplasia (Fig. 4).

Discussion

Collections of mummies have been frequently found in Italy, and single mummified bodies are even more numerous^{1,2}. Such burials date back from the medieval period, through the Renaissance, and up to modern times. Italian mummies represent an extremely valuable material for anthropological and paleopathological investigations. Sicily is the Italian region hosting the

largest collections of mummified bodies, and the Sicilian mummies are among the most numerous in the world¹⁻⁴.

Mummification of the corpses became a diffuse practice in the island since the 17th Century, among priests and laymen^{10,11}. Most Sicilian mummies are the result of particular treatments, obtained by drying the body in favorable microclimatic conditions, without evisceration^{4,11}. This method allowed to achieve a good state of preservation, almost equal to eviscerated, embalmed mummies^{3,4}. Following the taxonomy proposed by Aufderheide, the mummification process may be classified into anthropogenic (artificial), spontaneous (natural), spontaneous-enhanced, and indeterminate forms¹². In mummies from Capuchin Catacombs of Palermo and Savoca, the mummification methods vary from spontaneous-enhanced to anthropogenic, whereas in the series from Comiso the bodies may be considered spontaneous-enhanced as no trace of artificial mummification was found. The “Queen of the Moors” represents a rare example of true spontaneous (natural) mummification in the Sicilian scenario, characterized by huge numbers of artificial or spontaneous-enhanced mummies. Her naturally mummified body allowed to obtain abundant data about her life and health, permitting to identify different diseases and to understand social status and health conditions of the subject.

A point of great interest is that the subject was affected by pulmonary tuberculosis. This finding would add to our current knowledge of the disease impact on the island population during the last centuries. A definite diagnosis of pulmonary tuberculosis depends on the demonstration of typical lung lesions with histologic detection of acid-fast bacilli (*Mycobacterium tuberculosis*) or molecular evidence of microbial DNA. Despite limitations due to the lack of histologic confirmation, the radiologic and CT scanning of the “Queen of the Moors” provided evidence for post-primary tuberculosis. The radiological demonstration of pulmonary and/or mediastinal calcifications may yield sufficient evidence for tuberculosis in mummies, especially when physical sampling is prohibited by institutions^{13,14}. The presence of pleural adhesions and multiple calcifications definitely amounts to post-primary disease rather than a healed case of pulmonary tuberculosis, as erroneously stated by Kim et al. in their extremely invasive study of a 17th Century Korean mummy¹⁵. None of the differential diagnoses considered in the literature (chronic hemorrhage, histoplasmosis, coccidiomycosis, pneumoconiosis, sarcoidosis, amyloidosis, hemosiderosis, primary or metastatic cancer, hamartoma, hypercalcemia, mitral stenosis, and alveolar microlithiasis) seems relevant to our case^{13,15}.

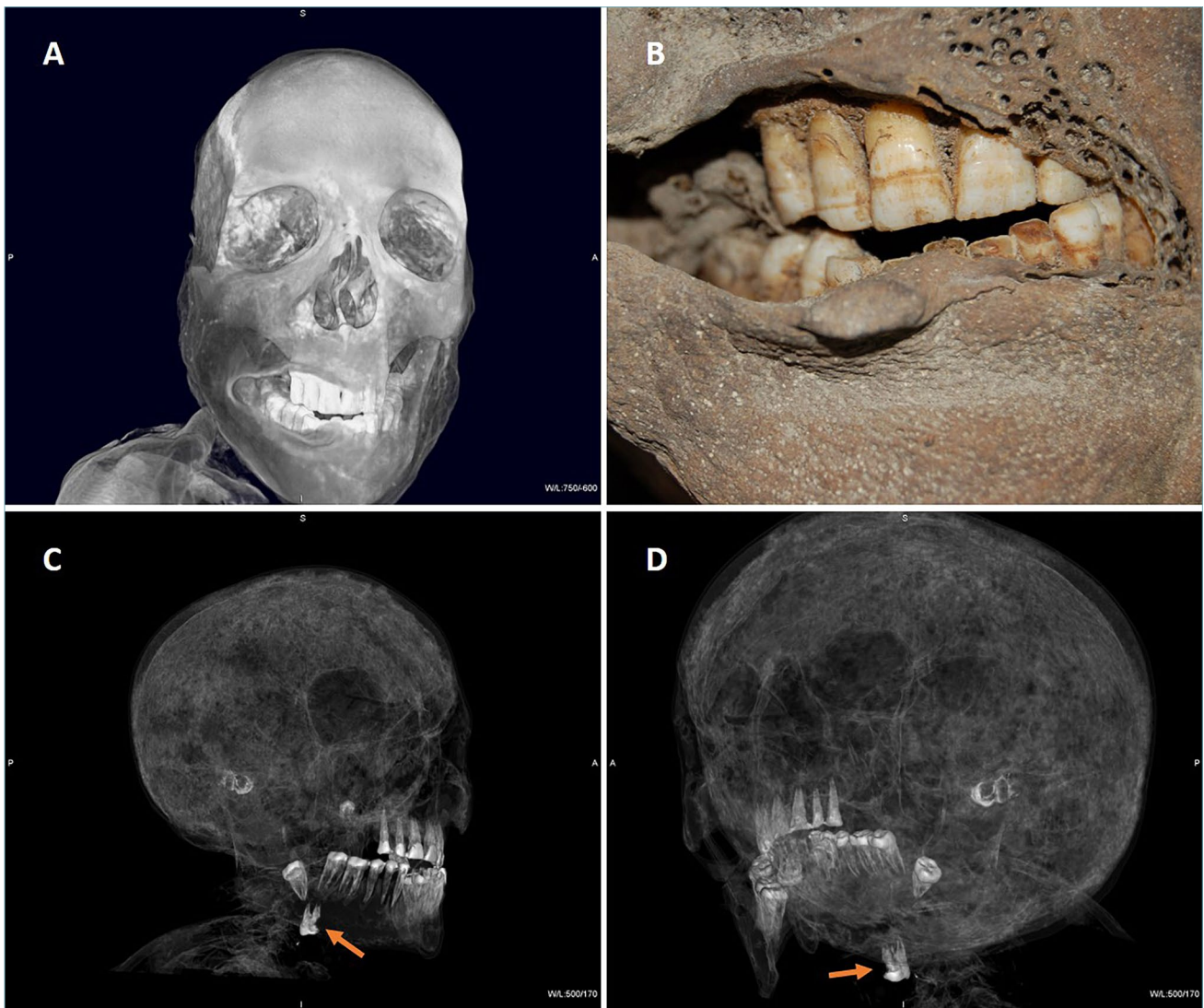


Figure 4. (A) 3D reconstruction of the head with evidence of soft tissues covering the skull; (B) close-up of the anterior teeth affected by dental wear and enamel hypoplasia; (C) (D) 3D reconstructions of the skull highlighting the dental formula; note the neck caries affecting the dislodged left second molar (red arrows) and the hyperdensity of the ear ossicles.

As for the demonstration of pulmonary tuberculosis in Sicily during past times, additional examples were detected in mummies from the nearby Comiso (40 km away) and Modica (10 km away). A 30-35 years old male from Comiso, dating back to 18th-19th Century showed pulmonary fibrosis with multiple, apical calcifications¹. Two male subjects from Modica, dating back to 18th and 19th Century presented clear signs of post-primary tuberculosis, also with phtisis in one of them¹⁶. Recent investigations on north-eastern Sicily mummies dating back to the same period failed to find out examples of a disease so frequent in southern areas. In the series from Savoca, 17 bodies dating

back to 18th-19th Century were investigated by on-site plain X-ray study¹⁷. This approach was considered a valid alternative to autopsy by the authors, but definitely failed to detect any extraskeletal disease. Another contribution dealt with 23 mummified bodies dating back between 1773 and 1858, found in Piraino¹⁸. The study was focused on skeletal pathology and mortuary behaviour, using only portable radiography and visual inspection. No professional pathologist appeared in the authorship. Once again, no trace of extraskeletal disease was noted, and the contribution is far from an ideal paleopathologic approach to human mummies. A truly innovative, up-to-date paleoradiologic study

cannot turn down CT scanning of mummified bodies. The ancient cases in SE Sicily allow to infer that tuberculosis was a common disease in that area, if not in the whole island, prior to the antibiotic era. Urbanization, population growth, and trade improvement after the 1693 earthquake might have fostered its spread. The present case also highlights that infected people may remain healthy for years, as demonstrated by the good nutritional state of our subject. Future research is planned in order to confirm the presence of microbial DNA and investigate the molecular features of ancient mycobacteria in this peculiar area.

Pelvic phleboliths represent an under-recognized condition in paleopathology. They are venous calcifications representing the end product of thrombosis. In modern patients they are frequently observed within the pelvis, in the veins outside the posterolateral regions of urinary bladder, prostate, uterus and rectum¹⁹. Phleboliths are generally considered of no clinical significance, and for this reason they are neglected in modern radiology and histopathology reports. They are common in people from economically developed countries, and represent a marker of western pattern of diseases¹⁹. Their presence has been only incidentally considered in mummies²⁰, and in paleopathological literature phleboliths are barely cited in differential diagnosis²¹⁻²³. They share pathogenesis and location with their modern counterparts, and can be easily distinguished from ureteral calculi or calcified lymph nodes by the classic concentric calcification pattern seen in radiology, CT, and histology. In ancient remains, they may represent a useful marker of age at death, social class, and nutritional status, and a clue to the respective diseases. In the present case, the coexistence with cutaneous folds related to obesity, aortic atherosclerosis, and good dental condition with focal caries is not a mere coincidence. All these findings suggest a well-nourished subject of medium/high social status.

Unfortunately, no definite cause of death could be established, but most likely factors involved in the demise of the woman may be related to obesity and vascular disease. From the pathologist's viewpoint, autopsy or endoscopy of the mummified body, as well as histologic examination of tissue samples, would have provided further details²⁴⁻²⁶. Unfortunately, they were not authorized due to conservative reasons. Despite the lack of inner cavities examination and microscopical/molecular tests, the diagnosis of relevant skeletal and extra-skeletal diseases was made possible by a multidisciplinary investigation. Good quality radiological approach performed by skilled professionals in radiology and pathology is of paramount importance in detecting internal organs pathology. The use of fine

resolution radiologic devices is to be preferred to portable machines and appears fundamental in obtaining virtual reconstructions of the bodies^{24,27}. However, the importance of digital X-ray examination as a basic diagnostic tool was confirmed²⁸.

Conclusions

Paleopathological investigation of the mummy belonged to this anonymous woman provided valuable information about life and times in early 1900's Sicily. Non-destructive, non-invasive analyses coupled with a multidisciplinary approach revealed considerable data about her health state at time of death.

Sicilian mummies have been widely reported and investigated mainly by non-pathologists, paying no special attention to extra-skeletal diseases. We believe they would deserve a better approach, in order to properly classify and fully understand their pathocenoses.

The historical and biological heritage of Sicilian mummies needs to be properly surveyed and protected, but also adequately studied by multidisciplinary teams of experts. The presence in such a team of at least one skilled anatomic/surgical pathologist, as long as well trained in the study of ancient human remains, represents an undeniable condition.

CONFLICT OF INTEREST

The Authors declare no conflict of interest.

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None.

AUTHORS' CONTRIBUTION

Conceptualization: LV, VP. Methodology: LV, GR, BG. Analysis & investigation: LV, AC, CC, GV. Writing: LV. Supervision: LV, VP.

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