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Anthropological Study of the Ancient Egyptian Mummy Based on the Computed Tomography Method

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Abstract

This work presents the results of complex paleoanthropological research using the method of computed tomography of the ancient Egyptian mummy, stored in the Pushkin State Museum of Fine Arts (Moscow, Russia) (Inv. No. I,1a 5301). According to the inventory, this is a mummy of Khor-ha, which dates from the VII-IV centuries BC. Over the mummy of Khor-kha lies a grid of blue faience beads, characteristic of the Late period of Egyptian history. For magnetic resonance scanning, Siemens Magnetom Verio magnetic field strength 3 Tesla magnetic resonance imaging (MRI) was used. Further, measurements of the skeleton were made on the frames. It was found that a number of morphological features of the pelvis and skull of the individual was a woman, her age was about 25 years. The skull of the mummy is close to the average size of the horizontal circle and transverse arc. A number of measurements suggest a medium-high skull. The sagittal arc is large for women, that is, the skull is quite elongated. Form of the cranium when viewed from above pentagonic, that is, the greatest width of the skull is shifted back. The facial part of the skull is narrow and relatively high. On the scales of the frontal bone has overgrown metopic suture. Unusually strong for women's development have the upper nuchal line (linea nuchae superior), which represent the massive structure. *In vivo* body length amounted to about 158 cm. relatively shortened upper extremities and especially the forearm. For this individual is characterized by a pronounced graceful skeleton of hands and feet. Muscle relief is moderately developed in general.

Keywords: Ancient Egypt; Mummy; Anthropology; Computed tomography; Craniology; Osteology

Introduction

Paleoanthropological studies are traditionally based on the research work with bone remains of people from the burials of past eras. As a result of such complex investigations, anthropologists can determine the craniological and odontological characteristics of individuals, calculate the proportions of the skeleton and the intravital length of the body, determine the general massiveness of the bones of the skeleton and assume the features of the physique of people from the different groups. The research data make it possible to understand the anthropological features of groups of people, the degree of homogeneity of populations, the genetic links with neighboring groups, as well as it make possible to assume the origin of certain groups in different regions and to draw conclusions about migration processes in antiquity. The research study of human bone remains also allows to describe illnesses, combat and domestic injuries which affected the skeleton. Biochemical study of bone tissue along with analysis of certain teeth features allow to assume the type of nutrition of people and the adequacy of food resources. Therefore, it is sometimes possible to indirectly assume the conditions for the existence of populations of people and the perspectives of anthropological groups in the demographic terms.

Such studies are traditional in paleoanthropology. However, in a number of cases research is complicated by the characteristics of the material being studied and by the impossibility to directly access the bones of buried individuals. It is a question of studying the mummified and frozen remains of ancient individuals provided with the condition that the mummies could not be destroyed. In practice, there are large regions where paleoanthropological history is represented exclusively by mummified remains and mummies. A vivid example is Ancient Egypt. Often such anthropological materials obtained as a result of excavation are stored or prepared for storage in museums and for demonstration at exhibitions. The research study of bones in this case becomes impossible and paleoanthropological information about these individuals becomes lost for science.

In last decades, the development of nuclear physics methods and technologies led to active use of radiations of different types in the study and conservation of cultural heritage. Modern methods of computed and magnetic resonance tomography are used for the non-invasive study of mummification techniques, the definition of procedures and ceremonies for mummification, the determination of the gender identity and causes of death, the measurement of the anthropological characteristics, the forensic and medical examination of mummies, the creation of three-dimensional stereolithographic reconstruction. Application of these methods provides possibilities to perform research studies of mummified remains without their destruction, defrosting, unfolding the windings of mummies and the corresponding destruction of information about the mummification process. Thus, such studies are conducted without the destruction of a precious museum exhibit. Another important advantage of computed tomography method is the ability to repeatedly examine mummies and to carry out the reconstruction of the appearance no less effectively than on the macerated cranium. Development of 3D models allows to visualize various pathologies and to conduct anthropometric studies of mummified remains [1].

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The first computed tomography of the mummified remains of a boy and a young woman were performed in 1977 by Derek Harwood-Nash from Toronto [2]. This study showed the promise of the computed tomography method. An example of a brilliant complex paleoanthropological study of mummified remains by using the computed tomography method is the study of the so-called «Ice-man» or Otzi. Multiple use of computed tomography allowed to determine the probable cause of his death as an arrow tip was found in the soft tissues of the brachii [3].

Over time the number of mummies studied by using the computed tomography method increased significantly. Data on methods and techniques of embalming mummies were reconstructed and supplemented by computed tomography. In some cases it was possible to determine the causes of death of individuals. [4,5].

This paper presents the results of a paleoanthropological research of the one of the nine Egyptian mummies, stored in the Pushkin State Museum of Fine Arts (accession number I,1a №5301), using the data obtained on the computed tomograph of the National Research Center "Kurchatov Institute". The stages and research methods are described in detail and characterized.

In the last years, a Laboratory of Natural Science Methods in Humanitarian Sciences oriented to carry out complex analysis of museum pieces and archaeological artifacts, was organized at the National Research Center "Kurchatov Institute". A complex study of the mummies from the Egyptian collection of the Pushkin State Museum of Fine Arts (Moscow, Russia) became a new stage in the development of these research works. This mummy is a valuable Museum piece. To destroy it, to get direct access to the skeleton, we had no right.

Materials and Methods

The object of this study was the mummy (Inv. No. I,1a 5301) from the Department of the Ancient East of the Pushkin State Museum of Fine Arts (Moscow, Russia). According to the inventory this is the mummy of Khor-Kha which dates back to the VII–IV BCE. The mummy is kept in a wooden sarcophagus. A grid of blue faience beads lying above the mummy of Khor-Kha represents characteristic of the late period of Egyptian history (Figures 1 and 2).

The mummy in the sarcophagus is in the "lying on the back" position, the bones of the forearm are folded on the chest crosswise (right above the left), bones of the right arm are elongated, middle and nail phalanges almost touching the brachium, phalanges of the left arm bent at the joints; leg bones are elongated, knee joints are close together, the bones of the feet are in contact, the feet are slightly unbent.

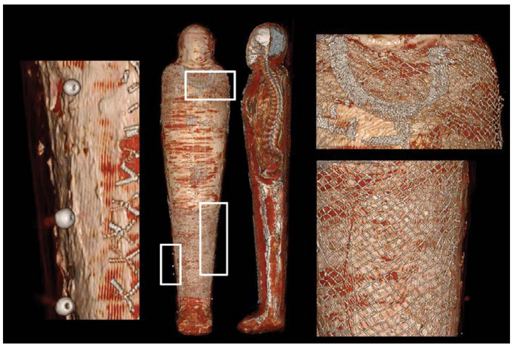

Figure 1: Computed tomography of mummy in sarcophagus with archaeological details.

Figure 2: The skeleton of the mummy (CT scan).

X-ray CT of mummies was performed on a Biograph mCT40 (Siemens) positron emission tomography – computed tomograph (PET–CT). The spatial resolution of the cut thickness during scanning was 0.6 mm, the increment in reconstruction was 0.3 mm, and the spatial resolution in the scanning plane in reconstruction was 0.88 × 0.88 mm. Two modes of reconstructing images proceeding from "raw" data were applied, which differ in the contrasting sensitivity to soft tissues and bone structures [6-9].

In a brief description of the software for paleoanthropological research of mummies two principal points have to be mentioned. First one includes the segmentation of bones, in other words, the separation of bone structures from the environment. In medical research this trivial task is solved quite simply through the use of preset filters, which "bare" the skeleton without any difficulties. In the case of mummies this is a rather complicated operation, since bone density is greatly altered, often, the distal epiphyses of long bones are either fragmented or decayed. Besides of that inside the mummy normally there are many objects with the density which does not differ from the density of bones. To solve this problem it is necessary to have software that provides not only the possibility of manual segmentation adjustment, but also the 3D modeling software tools (Figure 1). Second principal point includes the availability of measuring tools, which would allow to take measurements in both, linear and angular dimensions. In this case the main difficulty in performing measurements is the projection dimensions (the bone must be located in a strictly defined plane) and dimensions that do not have anatomical connection (for example, maximum and minimum diaphysis diameters).

In general, the functional of Inobitech DICOM allows carrying out a full osteological study of the bones of mummies, but this, unfortunately, concerns only the postcranial skeleton. To our knowledge none of the modern programs allows to fully implement craniometric programs on 3D models derived from CT data. Therefore, craniological measurements were made on models printed on 3D printers with analog instruments.

Results and Discussion

Gender and biological age

Gender identity was mainly determined by the morphology of the pelvic bones and the signs on the skull. The following features as the triangular shape of the locus of the pelvic bones, the obtuse sub-angle and the obtuse angle of the large sciatic incision of the pelvic bones tell us that this particular individual is female. In addition, this is also indicated by a small mastoid appendage of the cranium, a pointed upper edge of the orbit, a weak supraorbital relief and slightly pronounced relief of the occipital bone of the skull. Therefore, for a number of morphological signs of the pelvis and cranium we can conclude the female identity of studied individual.

The age was determined by standard anthropological methods, namely, taking into account the degree of overgrowth (obliteration) of the seams of the cranium, the signs on the pelvic bones, the signs on other bones of the postcranial skeleton and the degree of abrasion of the teeth. However, it should be noticed that anthropologists determine precisely the biological age according to skeletal and odontological criteria. Biological age is a category which corresponds to the rates of growth and development, as well as for the rates of aging. The relationship between indicators of biological age and chronological age is determined by the correlations of different strengths, which magnitudes depends, in part, on the stage of ontogeny. Namely, the biological age, determined by a number of morphological (and also physiological) criteria may be younger or older than the chronological depending on the rate of growth or aging in a given organism.

Determination of biological age according to overgrowth (obliteration) of the seams of the cranium: The beginning of the overgrowth of the lower edge of the coronal suture is marked on the cranium of the individual, while the sagittal suture in the region of the obelion is not overgrown. Venous and sagittal sutures in the bregma area are open. The metopic suture is open. The wedge-occipital suture is overgrown. The general evaluation of biological age according to obliteration of the seams is 20-25 years.

Determination of biological age according to the dental abrasion: According to our observations, all the teeth of the individual were appeared including the third molars. As far as we could see, there was no abrasion on the chewing surface of molars and premolars. The tops of the central and lateral incisors have been slightly erased. The general evaluation of biological age according to the dental abrasion is 20-25 years.

Biological age according to some features of the postcranial skeleton: Study of the pelvic bones shows that comparison of the patterns of the symphyseal surface on both bones corresponds according to anthropological schemes to the age of 20-30 years. The ear-shaped surfaces according to the degree of development correspond to the age of about 25 years. Also iliac crests and sciatic mounds have already grown to the pelvic bones, which indicate the age of over 23-25 years.

Therefore, the features associated with the overgrowth of the seams on the cranium, odontological indications and signs on the pelvic bones, indicate the biological age of death of 20-25 years, or more precisely, of about 25 years.

Craniological study

The cranium of the mummy (Inv. No. I,1a 5301) has a relatively good preservation. The study was performed according to the classical craniological program. The results of the craniological study are presented in Tables 1 and 2. The order of measurement features in the tables corresponds to the traditional order of measurements made by the program. The numbers of the measuring features in the tables correspond to the numbers of Martin's program, generally accepted in the world anthropology, which is stated in the methodical manual of Russian anthropologists V. Alekseev and G. Debets "Craniometry".

Number by Martin	Features	p-value
1	Length	186
8	Breadth	146
17	Height	137
5	Skull base length	105
9	Breadth frontal minimum	98.5
10	Breadth frontal maximum	124
11	Skull base width	118
12	Nape width	108
29	Forehead horde	114
30	Cranial horde	110
31	Nape horde	99.5
26	Forehead arch	128
27	Cranial arch	118
28	Nape arch	121
23a	Horizontal circumferenc via ofrion	518
24	Cross arch	302
25	Sagital arch diaphise diameter	368
7	Cranial opening length	32.4
16	Cranial opening width	27.2
45	Cheek-bone diameter	128
40	Face base length	94
48	Upper face height	71
47	Full face height	112
43	Upper facial breadth	107
46	Middle facial breadth	98
55	Nose height	53.4
54	Nose width	23.5
51	Orbit breadth of maxillo frontale	40.2
52	Orbit height	32.5
77	Nose-molar angle	131°
<zm	Zygomaxillar angle	122^{0}
SC (57)	Symotic width	10
	Symotic height	3.3
MC (50)	Maxillofrontal width	21.8
MS	Maxillofrontal height	9.2
	Jugal bone bend height (according to Wu)	7.2
	Jugal bone width (according to Wu)	51
75 (1)	Protrusion nose angle	22°
71a	Branch width minimum	33.5
65	Condyle width	120
66	Angular width	89.5
67	Front width	49
69	Symphysis height	24.9
69 (1)	Body height	27.5
69 (3)	Body thickness	14

Table 1: Craniological characteristics.

The cranium of the mummy (Inv. No. I,1a 5301) has close to the average values dimensions of the horizontal circle through the ophryon and the transverse arch. Sagittal arch has a large size for female, i.e., the cranium is quite elongated. Metopic suture which is not overgrown is present on the scales of the frontal bone.

Description of the cranium: The shape of the cranium when viewed from above is pentagonoid (pentagonal) the largest width of the cranium is shifted backward and falls to the rear third. Frontal and especially parietal tubers are quite strongly developed. It is their development that determines the pentagonal shape of the cranium. The cranium can be described as elongated and relatively wide - mesocranial. The altitude-longitudinal index has an average value and

8/1	Skull index	78.5
17/1	Heght-Length index	73.6
17/8	Heght-Breadth index	93.8
29/26	Forehead curvature index	89.1
30/27	Cranial curvature index	93.2
31/28	Nape curvature index	82.2
9/8	Cross forehead index	67.5
12/8	Cross nape index	74.0
48/17	Vertical cranial facial index	51.8
45/8	Cross cranial facial index	93.4
9/45	Frontomolar index	76.9
40/5	Face profile index	89.5
48/45	Upper facial index	55.5
48/46	Upper middle facial index	72.4
54/55	Nose index	44.0
52/51	Orbit index	80.8
	Symotic index	33.0
	Maxilliar-frontal index	42.2

Table 2: Indicators of craniofacial characteristics.

indicates the ortocrania. The altitude-longitudinal index indicates the metriocranial category of the cranium. Both indexes show that the cranium is medium tall.

The metope is straight and visually quite wide. Absolute sizes of the smallest and largest metope width are included in the category of large and very large widths. According to the metope-transversal index (average metope width) the cranium is mesogenic. The fronto-zygomatic index is large. The metope-zygomatic index is large. Due to sufficiently low index of the curvature of the frontal bone it can be concluded that its bend is quite strong. Development of the glabella area is estimated at two points on a six-point Broca scale. Superciliary arches (type II): there are barely noticeable elevations to the right and left from the glabella.

The parietal tubers are located high. A relatively low index of curvature of the parietal bones indicates of a small radius of their curvature. Mammillary tubercles representing female characteristic have a length of less than 2 cm and evaluated with the index of 1. The nape is wide, it has a rounded shape. The upper nuchal lines (linea nuchae superior), which represent spindle-shaped massive structures, have a strong unusual for women development.

Description of the facial skeleton: The facial part of the cranium is narrow and relatively high, the upper facial index shows that it belongs to leptinous category (high lytic index). The angles of horizontal profiling belong to the category of very small angles, i.e., the face is sharply profiled even by the measures of the Europeid representatives. Prognathism of the face is weakly expressed, which is confirmed by the values of the face-pointing indicator (Flower index). The craniofacial vertical index has an average value for Homo sapiens, i.e., there is a tendency of a combination of a tall face and a sufficiently high cranium. The craniofacial transversal index is relatively small, which demonstrates a combination of a narrow face and a relatively wide cranium.

The orbits are not high and relatively not wide (mesoconchic). The upper edge of the orbit is pointed. Supraorbital channels are not closed (in the cutted form). The shape of the upper edge of the eye-pit is rectangular. In absolute terms the nose is high and relatively narrows (leptorinous), which is also confirmed by a nasal index. The nasal protrusion angle has an average value. Simotic and maxillo-frontal indexes are included in the average category, which indicates a not significant height of the noseband. Zygomaxillar area is narrow, gracile. The lower edge of the piriform opening represents anthropina, that is, the lateral edges of the piriform opening directly pass into the lower edge, which has a sharp shape.

Osteological study

Postcranial skeleton is well preserved, it is almost complete. The bones of the postcranial skeleton were measured according to the standard osteometric program. The method of certain measurements of the bones of the skeleton was based on the rules described in the work [10]. The main osteometric form with the results of measurements of the postcranial skeleton is shown in Table 3.

Proportions of limbs: The intermembral index corresponds to the

Number by Martin	Right	Left
Clavicle		
1. Length maximum	129	130
6. Circumference middle diaphysis	30	28
Humerus		
1. Length maximum	301	299
2. Length	298	297
3. Upper epiphyseal width	-	47
4. Lower epiphyseal width	53.8	54.5
5. Maximum width mid-diaphysis	21.2	20
6. Minimum width mid-diaphysis	14.8	14.2
7a. Circumference middle diaphysis	52.6	56
Radius		
1. Length maximum	214.7	210.8
3. Minimum circumference diaphysis	36	33.8
Ulna		
1. Length maximum	-	248
2. Physiological length	-	225
3. Minimum circumference diaphysis	29	30
Pelvis		
2. Maximum width pelvis	253	
1. Height pelvis	191.5	-
9. Height Ilium	125	-
15. Height sciatic bone	67.5	-
17. Length pubic bone	78	-
12. Width Ilium	144	-
Femur		
1. Length maximum	416	420
2. Length in natural position	413	417
6. Sagittal diameter mid-diaphysis	25.8	25.4
7. Transverse diameter mid-diaphysis	23.5	24.5
10. Upper sagittal diameter	35	33
9. Upper transverse diameter	26	25
8. Circumference middle diaphysis	79	76
Tibia		
1a. Length maximum	356	354
1. Full length	349	348
8. Sagittal diameter mid-diaphysis	26.2	25.5
9. Transverse diameter mid-diaphysis	21.2	19.5
10. Circumference middle diaphysis	75	73

Table 3: Results of some measurements on the post-cranial skeleton's bones (mm).

shortened upper limbs in relation to the lower extremities. The brachial-femoral index is very high, which indicates a relative elongation, more precisely, a strong elongation of the brachium compared to the femur, or vice versa, a strong shortening of the femur in comparison with the brachium. Wherein the radial-shinbone index is small. Therefore, the relative shortness of the arms provides a significantly shortened forearm relative to the shin. The radial-brachial index shows the ratio of the proximal and medial segments of the arms. The value of the radial-brachial index is minimal for the individual studied within the range of the index variations of the modern human type. Therefore, one can speak of a strong relative shortening of the forearm in comparison with the brachium. This result is unusual for the population of Ancient Egypt as in the proportions of segments of the limbs supposedly should be a morphological adaptation of the tropical type, while, on the contrary, the medial segments must be elongated. The ratio of the lengths of the shin and femur according to the value of the shinbone-femoral index is closer to the average values. It is slightly above the average. One can assume that it indicates some adaptation to the hot and dry climate. The values of the absolute and relative lengths of the clavicles indicate a small size of the width of the brachium. The calculated shoulder width is 31.4 cm, which corresponds to a very small value. The absolute width of the pelvis is not large. The pelvic index demonstrates that the pelvis of the individual is low enough, which, precisely, is typical for female (Tables 4 and 5).

The length of the body during life determined using the formulas of Bunak, Dupertuis and Hedden, which take into account the length of the femoral bone and shinbone, resulted with the value of about 158 cm. Therefore, the growth was slightly below the average.

Skeleton of the upper limbs: There are rather gracile clavicles, humerus and ulnar bones in the case of mummy. The radial bones are also gracile. The humerus bones have an average degree of flatness, while the deltoid tuberosity is well pronounced.

Skeleton of the lower limbs: The indices of robusticity and strength were determined only for femoral bones and shinbones.

Femoral bones: The degree of strength resulted below average. At the same time, the bones are well developed sagittally and the rear pilaster is well expressed (however, a rough line on it is not present). In the upper layer, the femoral bones are expanded (or platimeric), the right bone is hyperplatimeric.

Shinbones: The robusticity was found to be below average according to the index of the ratio of the circumference of the middle of the diaphysis to the length of the bone. The average degree of flattening of the bone in the middle part of the diaphysis could be also assumed.

5.3.4 Osteoscopy: The results of osteoscopy, which demonstrate a description of the degree of development of bone relief for attaching some of the most important muscles. In addition, the indices of the phenetic description of the characteristics of bones are presented as well. We have used a scheme of V.N. Fedosova for the description of development of the muscular relief [11].

The phenetic description was based on the schemes proposed in the work of V.P. Alekseev "Osteometry" [10]. The muscular relief on the brachial bone is generally has an average level of development. The supinator crest with the attachment of the brachioradial muscle is well expressed. This muscle flexes the forearm at the elbow joint and establishes the radial bone in the middle position between pronation and supination (position with freely lowered arms). On the radial and ulnar bones, the relief of the interosseous edge with the attachment of is the interosseous membrane, which giving rise to some muscles of the hand, is well developed. It should also be noted the presence of the radial roughness, i.e., the relief of the flexor of the arm in the elbow joint, that is the place of attachment of the biceps, which bends and pronates the arm. Therefore, the muscular relief of the upper limbs gives indication to the occupation of more or less heavy physical labor of individual with rather normal level of development of the relief for female.

Index	Right	Left
Intermembral	67.68	66.61
Brachial-femoral	72.88	71.65
Radio-brachial	71.33	70.55
Tibial-femoral	84.50	83.45
Radio-tibial	61.52	60.57
Clavicular-brachial	43.29	44.29
Shoulder width (cm)	31.4	
Shoulder-growth index	19.89	
Pelvis width (cm)	25.3	
Pelvic index	75.69	
Pelvic-growth index	16.02	
Pelvic-brachial	80.57	
Stature according to Bunak, Dupertuis and Hadden	157.9 cm	

Table 4: Indices of proportions of limbs, pelvic, shoulder width. intravital length of the body.

Index	Right	Left
Robusticity of clavicle (6/1)	23.26	21.37
Cross section diaphysis brachial index (6/5)	69.81	41.0
Robusticity of radius (3/1)	16.77	16.03
Robusticity of ulna (3/2)	14.04	13.78
Robusticity of femur (8/2)	19.13	18.23
Pilastri femur index (6/7)	109.79	103.67
Strength femur index(6+7/2)	11.94	11.97
Platimery femur index (10/9)	74.29	75.76
Robusticity of tibia (10/1)	21.49	20.98
Expansion mid-diaphysis tibia index (9/8)	80.92	76.47

Table 5: Indices of limb bones massiveness and strength.

Muscular relief on the femoral bone in a number of cases in general corresponds to that for female, especially taking into account the degree of development of greater trochanter. The relies is very well expressed in some cases. In the first place the presence of interstitial line, to which the iliofemoral ligament attaches, pulling the leg to the pelvis when walking, should be noted. However, the value of this relief, especially as a certain bone base (as well as in a number of other cases), strongly depends on the genetic component. In addition to the described structure, the gluteal tuberosity with the attachment of coxae extensor, the dorsal gluteal muscle and the femoral epicondyles with the starting position of third head of the triceps muscle of calf, which is of great importance for walking, running, jumping, as a significant flexor of the knee and foot, is weakly developed. The linea aspera and a pectineal line, where the muscles leading the femur to the median plane and the hamstrings biceps, involved in flexing the knee joint, are attached, have an average degree of development. Therefore, the relief of the muscles on the femur is expressed much better than one could expect for the female case in general, and it indicates a certain genetic predisposition and considerably high physical exertion on the femoral muscles [12].

The degree of development of the relief on the shinbones corresponds to the one on the femoral bones. However, the level of the prominence of the shinbone tuberosity, as well as the level of the prominence of the greater trochanter on the femurs, invariably indicates the female belonging of the bones. Thus, the development of the shinbone tuberosity is weak, as it should be in the case for female. It is interesting to note that the soleus muscle line (third head of the triceps muscle of calf which is of great importance as a significant flexor of the knee and foot, as it was discussed above) on both shinbones is quite well developed.

Conclusion

In general, it can be concluded that the muscular relief of the upper limbs has an average level of development, as it should be for female engaged in some kind of physical labor associated with bending and pronating the arms in the elbow joint. Muscular relief of the bones of the legs is expressed quite well and indicates a significant load on the corresponding muscles.

As a result of complex paleoanthropological study of mummy (Inv. No. I, 1 a 5301), stored in the state Museum of fine arts named after A. S. Pushkin in Moscow (Russia), the images obtained as a result of computed tomography, it was found that the gender of individual being studied is determined as female by a number of morphological characteristics of the pelvis and cranium. The biological age at the time of her death is defined as 20-25 years according to such characteristics as the overgrowth of the seams on the cranium, odontological indicators and signs on the bones of the postcranial skeleton including pelvic bones.

The description of the craniological characteristics clearly demonstrates the belonging of the mummy (Inv. No. I, 1a 5301) to the Mediterranean anthropological type. Exactly this type is characterized by dolichocrania and mesocrania, gracilis, narrow-facedness, a sharp horizontal profiling and a relatively high and narrow nose.

The observables of the postcranial skeleton indicate a growth below the average - 157.9 cm, a narrow pelvis, a small width of the brachium, an elongated brachium relative to the femur and a significantly shortened forearm. The skeleton of the upper limbs can be characterized as gracile with the development of a certain muscular relief associated with a relatively intense bending of the arm in the elbow joint and its pronation. At the same time the bones of the lower limbs are quite massive and strong with the well expressed muscular relief on them.

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References

1. Alekseev VP, Debets GF (1964) Craniometry. Nauka, Moscow. p: 128.
2. Alekseev VP (2014) Osteometric indices of the middle phalanges of the human foot and their sexual differences. Morphological Newsletter p: 252.
3. Fedosova VN (1986) General evaluation of the development of the mesomorphic component according to osteological data (osteological method). Questions of anthropology. 76: 104–116.
4. Cesarani F, Martina MC, Farraris A, Grilletto R, Boano R, et al. (2003) Whole-body three-dimensional multidetector CT of 13 Egyptian human mummies. American Journal of Roentgenology 180: 597-606.
5. Harwood-Nash DFC (1979) Computed tomography of ancient Egyptian mummies. Journal of Computer Assisted Tomography 3: 768-773.
6. Marx M, D'Auria SH (1988) Three-dimensional CT reconstruction of an ancient Egyptian mummy. American Journal of Radiology 150: 147-149.
7. Nedden DZ, Knapp R, Wicke K (1994) Cranium of a 5,300-year-old mummy: reproduction and investigation with CT guided stereo-lithography. Radiology 193: 269-272.
8. Mackova A, MacGregor D, Azaiez F, Nyberg J, Piasetzky E (2016) Nuclear physics for cultural heritage. Nuclear physics division of the European Physical Society p: 84.
9. Karlik SJ, Bartha R, Kennedy K, Chhem R (2007) MRI and multinuclear MR spectroscopy of 3200-year-old Egyptian mummy brain. American Journal of Roentgenology 189: 105-117.
10. Panzer S, Gill-Frerking H, Rosendahl W, Zink AR (2013) Multi-detector CT investigation of the mummy of Rosalia Lombardo. Ann Anat p. 401.
11. Portridge RB (1996) Faces of Pharaohs. Royal mummies and coffins from Ancient Thebes. The Rubicon Press. London, UK. p: 242.
12. Posh JC (2015) Technical limitations on the use of traditional magnetic resonance imaging in the evaluation of mummified remains: A view from a hands-on radiologic technologist's perspective. The Anatomical Record 298: 1116-1124.