

A STORY OF SIX HEADS AND EMBALMING TECHNIQUES IN ANCIENT EGYPT*

P.F. Dijkstra

We will here deal with the investigations of six mummified heads (five severed from their bodies, one still part of an entirely wrapped, whole mummy) carried out by means of a CT-scanner.¹ This CT-scanner can produce thin slices of the body (0.6 mm) and reconstruct every conceivable plane. Thus, any part of the heads was open to investigation.

Embalming in Egypt

The level of embalming techniques in ancient Egypt was probably unsurpassed. Unfortunately, apart from the descriptions by Herodotus (writing in the fifth century B.C.), not much is known about these techniques. Herodotus says there were three basic modes of mummification, merely differing in the extent to which the techniques were applied. Which techniques were applied depended on the amount of money one wished to pay. With the most expensive mode, the intestines were manually removed through a cut in the left side of the abdomen, cleaned, embalmed and put in a jar to be placed in the grave. The brain was either removed through the nose by means of a hooked tool, or dissolved by a liquid poured into it. The body cavities, stuffed with clothes and raisins, were left to desiccate in a sodium salt bath for 70 days. Following desiccation, the body was wrapped in linen and put in an elaborately decorated coffin. With the cheapest mode, a liquid infused through the anus into the abdomen would dissolve the intestines. Then, the body was placed in the sodium salt bath and mummified but not enwrapped. After 70 days, it was returned to the relatives.

* We would like to thank all those who, in their spare time, have helped us, as well as the various institutes that enabled us to carry out this complicated project. The English version of our text is by Mr. J.J.M. Schepers (Amsterdam).

¹ Type ©Elscent, ©Oldelft. Compare also the contribution of R.J. Jansen/S. van der Berg-Faay in this volume, esp. Figs. 4 and 5.



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

Fig. 1. Drawing of a skull, viewed from the side, to show the lamina cribrosa (after Spalteholz 1953, Fig. 1).

Fig. 2. Drawing of the interior of a skull, viewed from above, to show the base of the frontal skull. The lamina cribrosa shows as a keyhole (after Spalteholz 1953, Fig. 2).

Fig. 3. Instruments used for embalming in ancient Egypt. The hook to perforate the nose is shown on the bottom.

Fig. 4. Replica of ancient hook, used for tests inside skulls.

Experimental research and medical analyses

So much for these modes. We will now focus on the heads, first having a look at the technique of brain removal via the nose. Allegedly, most of the bodies brought to the embalmers had been dead for more than four days. After such a period, a dead brain will virtually have liquefied. Thus, as confirmed by experiment, it cannot possibly be pulled out by means of a



Fig. 5. Head of mummy Allard Pierson Museum, inv. no. 13.010.

hook. Actually, lacking in cohesion, the brain cannot even be removed from a fresh body in this way. To try and do so is like eating porridge with a fork. The brain, in other words, cannot be pitchforked like a haystack. Even if it could, the hook 'pitchforking' it would only reach a small part of the interior of the skull.

Admittedly, in most skulls we found a hole forced through the roof of the nose cavity (the lamina cribrosa). From a radiologist's point of view, the hook most likely had a ceremonial context. Fluids, poured into the skull via the nose or orbital cavities, would then have dissolved the brain. This, however, is only a personal opinion not based on archaeological expertise.

For a better understanding of the way in which a hook was pushed up the nose and through the skull base, Figs. 1-2 show the frontal part of the skull base (Spalteholz 1953). The hook, pushed into the nose was driven through the thin plate separating the brain from the nasal cavity. Fig. 3 displays the instruments used by the embalmers; Fig. 4 shows a replica of an ancient hook, especially made for this experiment.

Fig. 6 is an X-ray of this replica in use, pushed via the nose and an existing hole into the skull of a man in his forties (cf. Fig. 5).² It clearly shows the nose to leave little room for the hook to reach all parts of

² Head of Egyptian mummy, Allard Pierson Museum inv. no. 13.010. See also the contribution in this volume of J.F.W. Koens, esp. his Fig. 11.

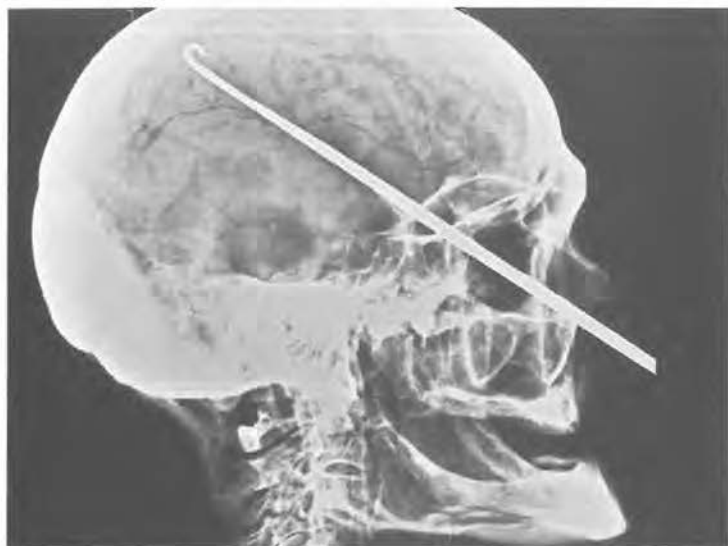


Fig. 6. X-ray of skull of head of Fig. 5, showing the hook inserted in the nose. Only a small portion of the interior of the skull can be reached by moving the hook (not demonstrated here).



Fig. 7. Four coronal CT-scans of the head of Fig. 5, showing a hole in the lamina cribrosa.

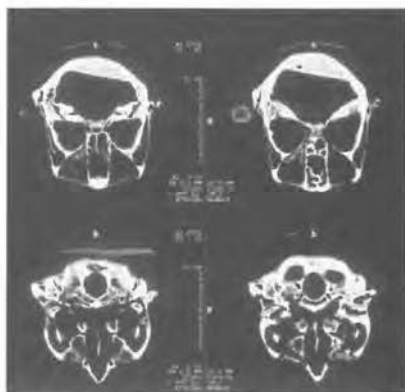


Fig. 8. Four axial CT-scans of the head of Fig. 5, showing a hole in the lamina cribrosa and the material at the bottom of the skull.



Fig. 9. Head of mummy Allard Pierson Museum
inv. no. 13.011.

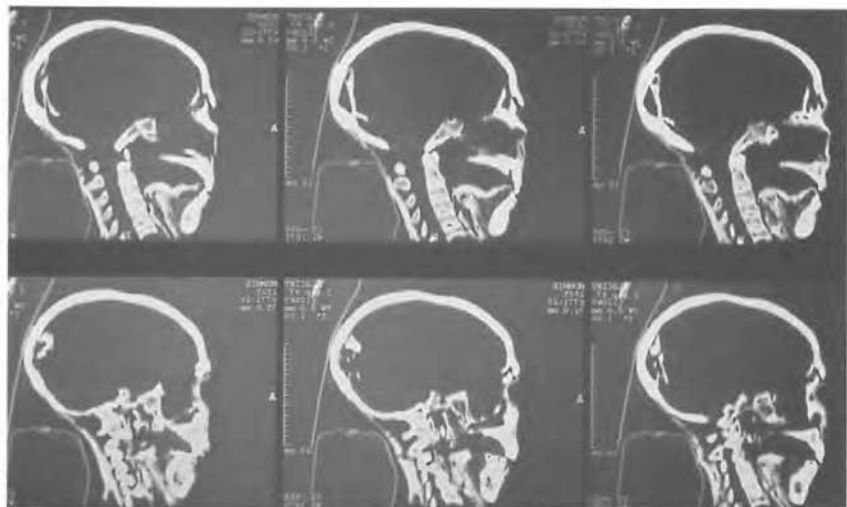


Fig. 10. Six sagittal CT-scans of skull of Fig. 9. There is a large hole in the lamina cribrosa. A piece of bone, the remnants of the lamina cribrosa, lies in the back of the skull.



Fig. 11. Head of mummy from a 4-year-old child, Allard Pierson Museum inv. no. 13.009.

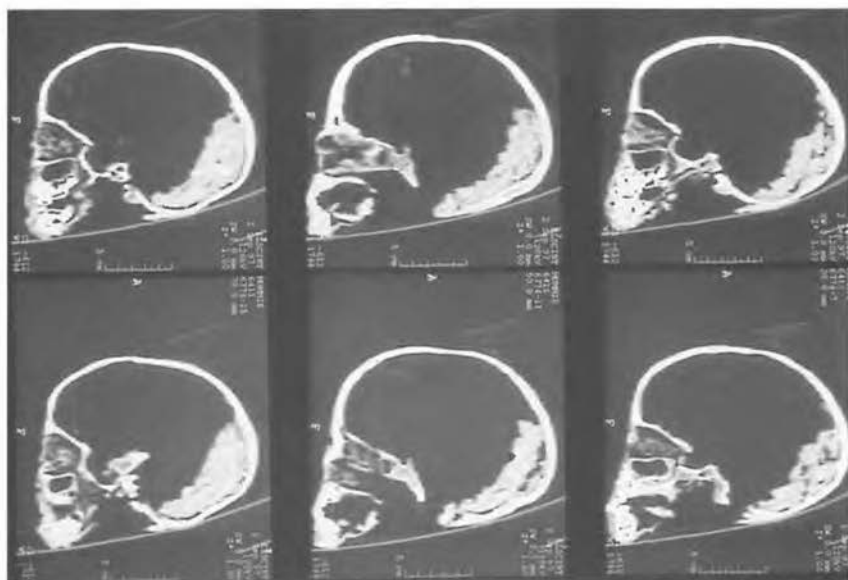


Fig. 12. Six sagittal CT-scans of head of Fig. 11. The eyes are replaced by folded linen. Upon histological examination, the spongy mass in the back of the skull appears to be composed of bitumen, plant debris and oval egg-like structures of 2-5 μ in diameter. The lamina cribrosa is intact.

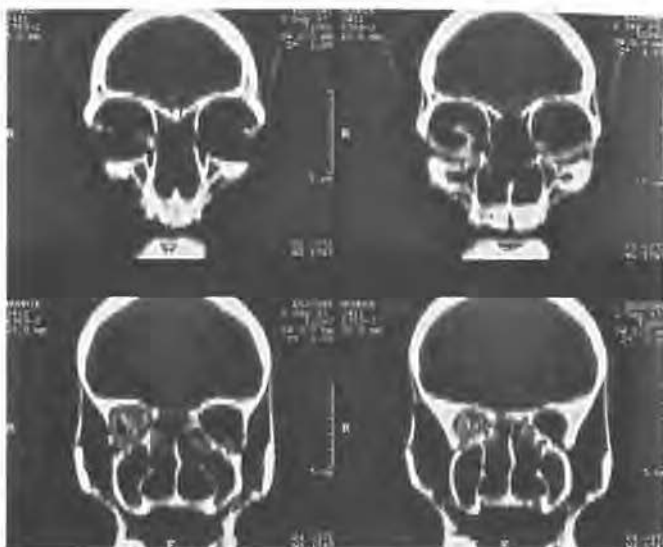


Fig. 13. Four axial CT-scans of the mummy head, Allard Pierson Museum B 12.983. There is a hole in the lamina cribrosa, linen in the back of the skull and a fracture on its right lateral wall.

the brain. The CT-scans (Figs. 7-8) of the present head show a hole in the lamina cribrosa and a fluid level on the bottom of the skull. The fluid tenaciously sticking to the skull, we found ourselves unable to remove any of it even with a surgical instrument. To ascertain whether it is a resin, bitumen or some other (solid) substance, further investigations will follow.

The next head, of a young man 20-25 years old (Fig. 9),³ rattles when moved. The CT-scans (Fig. 10) reveal a big hole in the lamina cribrosa and a large piece of bone, chopped off the lamina, lying on the base of the skull. The CT-scans also show the medial bony structure of the orbital socket to be broken. The head must have been pierced with great force. Quite interestingly, it is otherwise empty.

We will now look at the head of a 4-year-old child (Figs. 11-12).⁴ The head, plated with gold, betrays no poor relatives. The CT-scan shows no hole in the lamina cribrosa. Instead, the eyes have been removed. Inside the skull, there is a spongy substance, apparently brought into it via the orbits. Curious to know what the substance, looking like mum-

³ Head of Egyptian mummy, Allard Pierson Museum inv. no. 13.011. See also the contribution in this volume of J.F.W. Koens, esp. his Fig. 10.

⁴ Head of Egyptian mummy, Allard Pierson Museum inv. no. 13.009. See also the contribution in this volume of J.F.W. Koens, esp. his Fig. 7.



Fig. 14. Three-dimensional reconstruction of the head of Fig. 13.

mified brain, might be, we took out a tiny portion with a surgical instrument. Not surprisingly, its histology shows it to be some kind of bitumen, a substance imported into Egypt and once in common use for mummification. In it, we found a material which proved hard to diagnose. At first sight, it looks like plant tissue. Electron microscopy, however, suggests otherwise. Among long, birefringent filaments, there are oval egg-like structures measuring 2-5 microns. We have not yet determined what it is, and will continue examining it.

A few questions are left unanswered here. Why was the substance brought into the skull via the eye-sockets? Was it common practice not to use the passage through the nose with young children? Could the substance, found in one skull only, point to another period? Clearly, this and much more remains to be investigated.

Finally, there is the head of a complete mummy (Figs. 13-15).⁵ To judge from the teeth and penis on the X-rays, it is the mummy of a man about 25 years old. The skull has a small hole in the lamina cribrosa and contains some linen, pushed in via the nose (Fig. 14). Quite

⁵ Egyptian mummy, Allard Pierson Museum inv. no. B 12.983, on loan from the Rijksmuseum van Oudheden, Leiden, inv. no. RMO L.XII.1. See also the contributions in this volume of J.F.W. Koens, Fig. 14, and of R.J. Jansen/S. van der Berg-Faay, Fig. 7 (scarab from this mummy).



Fig. 15. Artist's impression of the head of Fig. 14, with the help of a CT computer.



Fig. 16. Head of mummy, Allard Pierson Museum, inv. no. 10.842.

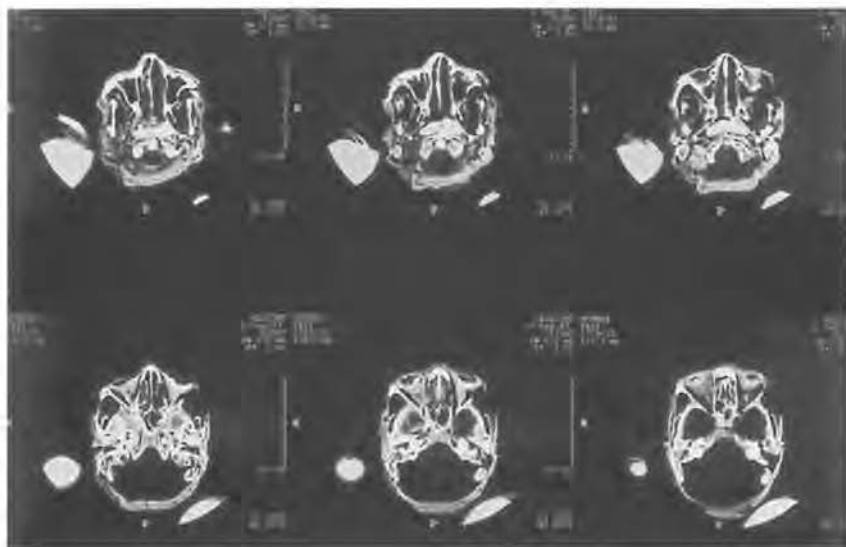


Fig. 17. Six axial CT-scans of the head of Fig. 16. Fracture of the skull base.

remarkably, the eyes are well preserved and still in the sockets. Even the ocular nerve and muscles are preserved. (We found the eyes also with three other skulls). The wall of the right temporal bone shows a fracture. There are also indications of rib and neck fractures, not shown here. The man involved probably died of an accident. Fig. 15 gives a computerised artist's impression of the head based on the CT-scans. In the skulls, a few instances of fractures were found. Thus, the CT-scan of Fig. 17 shows a fracture of the skull base of a young woman.⁶ As the top of the skull is missing (Fig. 16), we looked inside it but did not see the fracture. It appears to be below the surface in the temporal bone. Such fractures, hardly conceivably inflicted after a person's death, can be fatal.

Medical care in ancient Egypt

It would seem proper to add a word on fractures and medical care here. In ancient Egypt, there were quite many physicians, organized according to the anatomical regions of the human body. The organization was carried to a point where one pharaoh even had a physician for his left and another for his right eye.

⁶ Head of Egyptian mummy, Allard Pierson Museum inv. no. 10.842. See also the contribution in this volume of J.F.W. Koens, esp. his Fig. 9.

The papyrus best suited to the study of surgical practice in ancient Egypt is the Smith papyrus, dating to around 1600 B.C. and probably a copy of another papyrus. It is a dictionary and instruction book for surgeons. Practising their art, physicians strictly observed certain criteria. Thus, they first examined a patient, then decided either upon treatment or to tell him or her there was no cure. They observed these criteria because a physician would be in serious trouble if a patient in his care died. A patient's examination was done amazingly well. Here follows a shortened translation of case 6 (Smyth papyrus) by Rutkow (1993):

[Title] - Instructions concerning a gaping wound in his head, penetrating to the bone, smashing his skull, rendering open the brain of his skull.

[Examination] - If you examine a man having a gaping wound, you must palpate his wound. If you find that smash which is in his skull something therein throbbing and fluttering under the fingers, like the weak place of an infant's crown before it becomes whole, and he discharges blood both from his nostrils and he suffers with stiffness in his neck.

[Diagnosis] - You should say: "an ailment not to be treated".

[Treatment] - You must anoint that wound with grease. You must not bind it, you must not put two strips on it, until you know that he has reached a decisive point."

The author of the papyrus recognised the connection between the skull fracture, fluid from the nose, stiff neck and the patient's imminent death. In other words, he describes a case of lethal meningitis. However, he will not have known the actual cause of the disease: bacteria from skin and nose entering the skull. Less serious wounds could be treated with ointments. Even adhesive strips were used to close and treat wounds.

On the age of mummies

Can we establish how old bodies were when they were mummified? The answer is in dental surgery.⁷ Our dental surgeon made X-rays of the six heads, inferring the ages from the state of their teeth. In one particular case (Figs. 18-19),⁸ the state of the erupted teeth points to the

⁷ See also the contribution of J.F.W. Koens in this volume, esp. his Fig. 3.

⁸ Head of Egyptian mummy, Allard Pierson Museum inv. no. 10.841. See also the contribution in this volume of J.F.W. Koens, esp. his Fig. 8.



Fig. 18. Mummy head of a 7-year-old child,
Allard Pierson Museum inv. no. 10.841.

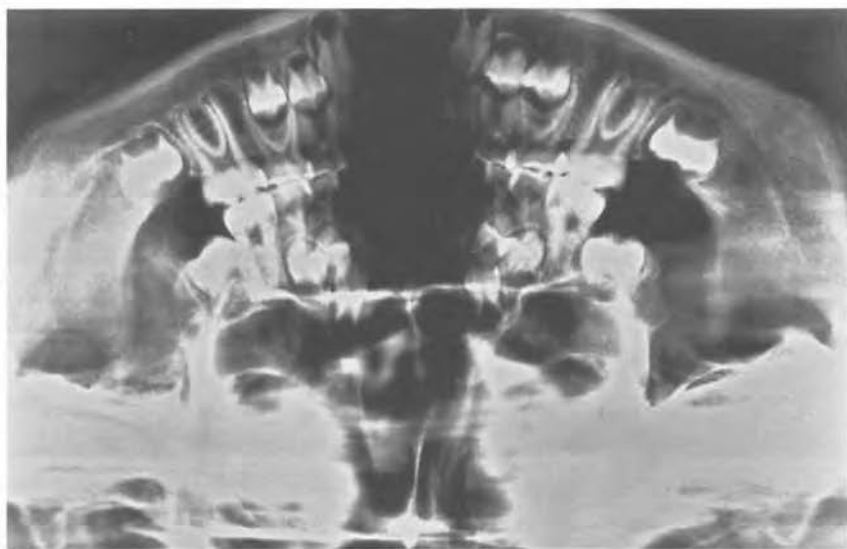


Fig. 19. The teeth of the child of Fig. 18, X-rayed with an OPG,
showing the child to have been 7 years old.

age of seven years. One head being toothless, its age at death could not be ascertained. The ages of the other heads were determined by means of their dentitions. The age of the complete mummy appeared to be 25 years (Figs. 13-15).

Conclusion

To conclude with, we 'scanned' six heads and looked at various aspects of mummification. Quite reasonably, the heads can be assumed to be from different parts of ancient Egypt and from different periods. Any investigation proceeding from this assumption would be beyond the scope of the present article, the charm of which is that it raises so many more questions than we anticipated. We found that not all of Herodotus' rules were obeyed and that there probably were different styles of mummification. We deflated a few mystifications and clarified a few facts of mummification methods. In the material examined, we came across several signs of trauma, which is no great surprise, considering life must have been pretty rough at the time. Following Herodotus' track, we found empty skulls, skulls with eyes, with a layer of bitumen, with cloth and with a spongy substance. Some laminae cribrosae were broken, others intact. Some eyes were removed. Clearly, it will take a lot of time and energy to answer the many questions evoked.

BIBLIOGRAPHY

- Rutkow, I.M. 1993, *Surgery. An illustrated history*, London.
Spalteholz, W. 1953¹⁵, *Handatlas und Lehrbuch der Anatomie des Menschen*, Amsterdam.

P.F. Dijkstra, Department of Radiology, Academic Medical Center, Meibergdreef 9, NL-1105 AZ Amsterdam, The Netherlands.