

REFERENCES

- Augustine Sanctus Aurelius (1841 ed.) *Omnia Opera*. Paris; Sermo CCLXXI, Ch. XII, p. 1604
- Bellonius P (1553) *De Admirabile Opera Antiquorum*. Paris; Bk. II, Ch. 1, p. 20
- Celsus Aurelius Cornelius (1838 ed.) *De Medicinæ*. 3rd ed. London; Bk. I, Preface, p. 2
- Diodorus Siculus (1700 ed.) *The Historical Library*. London; Bk. I, Ch. vii, p. 47
- Granville A B (1825) *Phil. Trans.* 115, 269
- Rogers C L (1949) *Brit. J. Surg.* 36, 423
- Ruffer M A
(1910) *Cairo Sci. J.* 4, No. 40, 1
(1911) *J. Path. Bact.* 15, 453
- Ruffer M A & Ferguson A R (1911) *J. Path. Bact.* 15, 1
- Shattock S G
(1905) *Trans. path. Soc. Lond.* 56, 275
(1909) *Proc. R. Soc. Med.* 2, Sect. Path. p. 122
- Shaw A F B (1938) *J. Path. Bact.* 47, 115
- Smith G E
(1908) *Lancet* ii, 521
(1912) *The Royal Mummies*. Cairo; p. 52
- Smith G E & Dawson W R
(1924) *Egyptian Mummies*. London; p. 157
- Steinbach H L & Obata W G (1957) *Amer. J. Roentgenol.* 78, 39
- Steuer R O & Saunders J B de C M (1959) *Ancient Egyptian and Cnidian Medicine*. Berkeley, Los Angeles; p. 3

The Historical and Prehistorical Background of Ankylosing Spondylitis

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No, Time, thou shalt not boast that I do change:
Thy pyramids built up with newer might
To me are nothing novel, nothing strange;
They are but dressings of a former sight.
Our dates are brief, and therefore we admire
What thou dost foist upon us that is old,
And rather make them born to our desire,
Than think that we before have heard them told.
— W. Shakespeare.

In the early years of this century before the First World War, a member of the Geological Museum staff in Cairo, M. Fourteau (1920), was digging near Hateyet-el-Moghareh, a lake of the Mariut desert, when he found part of the remains of a crocodile. The specimen, probably *Tomistoma dowsoni*, was lying in a Burdigalian stratum of the lower Miocene period and was at least 900,000 years old. It consisted of two vertebræ which might have been the last lumbar or first caudal vertebræ and showed thick bands of osseous tissues, obviously pathological, firmly binding the two vertebræ together. Sir Armand Ruffer (1921), who subsequently examined the specimen, concluded that 'the pathological lesions which crippled the vertebral column of a crocodile living not less than 900,000 years ago are exactly similar to those of spondylitis deformans seen in modern human beings'.

By a coincidence a similar finding occurred in the early 1920s, when Dr Moodie found in the Pleistocene of Cuba some vertebræ of another moderate sized crocodile. In this specimen he describes 'a deforming arthritis, a typical example

of spondylitis deformans, occurring in the posterior thoracic and lumbar regions.' (Moodie 1931).

The disease described in the pre-historic remains of crocodiles has also been found in many other animals, including a cave bear (*Ursus spelaeus*) collected from the Sundrich caves near Iserlöhn by Saak in 1824 (Ruffer 1921), sheep and oxen of ancient Egypt, and the sacred monkeys of its ancient temples at Thebes. In all these typical ossification of the vertebral ligaments was seen identical with that occurring in human beings suffering from spondylitis deformans (Ruffer 1921). The situation is summarized by Moodie (1923, 1931) who writes 'apes, cattle, horses, the giant wolf, the sabre-toothed tiger, camels, eocene mammals, crocodiles and dinosaurs have all left evidence in their skeletons of an ankylosing spondylitis which in their lifetime thousands of years ago must surely have severely limited their movement and caused them considerable pain'. 'Thousands of years ago' is an understatement, for some of the animals he mentioned lived at least a million and a half years ago. They were discovered in 1911 by Merriam in the South Californian Pleistocene at Rancho la Brea, preserved there by the tar lake in which they had originally been trapped. Others, the dinosaur for example, lived in the Mesozoic era. The disease is known to have existed in the Triassic period and the remains of one animal with spondylitis deformans were recovered from the Comanchean of Wyoming.

I examined the fossil amphibians and reptiles in the Natural History Museum to try to verify some of these observations. This wonderful collection is so well displayed and many of the animals are so big that by walking round one can inspect the backbone and pelvic girdle very thoroughly. I found that only a few of them had spinal osteoarthritic outgrowths, but one was most interesting. This was the fossilized skeleton of an armoured dinosaur, *Polacanthus foxi*. It is a British dinosaur, excavated in the Isle of Wight in 1865. The armour consists of a series of spines along the neck and tail and a heavy bony plate on the back. Beneath this plate, about the middle of the backbone, five or six of the vertebræ are united by what must have originally been calcification of the spinal ligaments. They have that same bamboo-like appearance, though fossilized and probably 140,000,000 years old, which one associates with ankylosing spondylitis. The opinion of the Keeper, Dr Swinton (1958), however, is that it may also have been a normal development, comparable to fusion of the sacral vertebræ in man occurring to provide increased strength of the spine beneath the armour.

It is not easy to envisage at what periods in the

long history of animal evolution these animals lived, nor to guess when the diseases first occurred. Table 1 provides a brief guide showing that spondylitis deformans is millions of years older than mankind. It existed when the world was largely inhabited by fish, amphibians, giant reptiles, toothed and other birds, dinosaurs and a few small mammals. Many ages were to elapse before even the earliest Miocene man (*Telanthropus capensis*) emerged in the Cenozoic age.

Table 1

A geological chart showing when spondylitis deformans first occurred

Proterozoic Over 2,000 million years	Oldest fossils and marine invertebrates	
Paleozoic 500-200 million years	Cambrian: Marine fauna Ordovician: Armoured fish Silurian: First air breathers Devonian: Land vertebrates Carboniferous: Amphibians First reptiles Permian: Armoured amphibians	Osteomyelitis, parasitism, caries
Mesozoic 200-70 million years	Triassic: Dinosaurs Jurassic: Birds, small mammals Comanchean: Giant reptiles Cretaceous: Toothed birds	Osteomata, osteo-sarcomata, arthritis <i>Spondylitis deformans</i>
Cenozoic 70 million years onwards	Eocene (70 million): Higher mammals Oligocene (50 million) Miocene (35 million): Miocene man (<i>Telanthropus capensis</i>) and anthropoidal apes Pliocene (15 million - 1 million): Pleistocene (1 million onwards): Australopithecene man Pithecanthropic, Atlanthropic, Neanderthal, Cro-magnon	Osteomyelitis, actinomycosis, <i>Spondylitis deformans</i>
Recent	Egyptian Peruvian and other civilizations	Many diseases, including <i>spondylitis deformans</i>

The disease which was so widely spread throughout the animal kingdom in the past may also be found amongst present-day animals.

In the osteological section of the Natural History Museum in South Kensington there are skeletons from a wide variety of vertebrate animals. These specimens are chosen as being good examples of normal animals and diseased skeletons might not therefore be expected. Nevertheless an examination revealed two typical examples of ossification of the spinal ligaments. The first is that of an ox (*Bos indicus*) brought from India and shows very well the rigidity of the spine at the mid-thoracic level with damage of the costovertebral joints.

The second example is of a young monk seal (*Monachus monachus*): born on the shores of the Canary Islands its normal habitat is the Western

Mediterranean. Here there is quite marked ossification of the anterior and lateral spinal ligaments. As frequently occurs in ankylosing spondylitis the intervertebral joint spaces and the vertebral bodies are normal. No osteophytic outgrowths can be seen. Indeed the vertebræ compare well with those of the other specimen of this animal in the Museum which show severe lumbosacral osteoarthritis with destruction of the lumbar-sacral joint. The disease, prevalent in the animal kingdom for so long, has also been widespread in man and he too is known to have suffered from it in early times.

Many physicians in the past have written on this ankylosing spondylitis, but one of the earliest attempts at a pathological account is by Connor who in 1694-5 described a skeleton found in a French churchyard or charnel house in which the vertebræ and ribs 'were so straightly and intimately joined, their Ligaments perfectly Bony, and their Articulations so effaced, that they really made but one uniform continuous Bone; so that it was as easy to break one of the *Vertebræ* into two, as to disjoint or separate it from the other *Vertebræ*, or the *Ribs*'.

It was not, however, until the latter part of the last century that the disease came to be regarded as a separate entity, and more accurate attempts to understand its pathology were made. Davies-Colley (1885) Wilks, and Fagge (1877) had already described the disease in patients attending Guy's Hospital. It was a few years later that Bechterew in Russia, Strümpell in Germany and Marie in France reported cases. Bechterew (1892) described an upper dorsal type of case, but one which was complicated by meningeal involvement with degeneration of the spinal cord and in which there was degeneration of the intervertebral discs. Strümpell (1884) briefly referred to 2 cases which he had seen 'of a remarkable and unique disorder leading very gradually and painlessly to a complete ankylosis of the entire spinal column and hip joints'. But it was not by any means so detailed an account as that which followed in 1898 by Marie. Until this time no very clear differentiation had been made between this and other forms of spinal arthritis. Indeed, Pierre Marie in his memoirs remarks that the first of the 3 original cases which he described whilst working in Charcot's clinic suggested the possibility of Paget's disease of bone. In these cases there was complete fixity of the chest, the spine being 'fait rigide comme un baton'. Marie obtained an autopsy on 2 cases and then showed that the lesions present in the spine consisted essentially 'en une ossification tout particulièrement localisée aux ligaments; aux bourrelets et aux menisques articulaires'. Connor's account two hundred years earlier is perhaps even more des-

criptive: 'a layer of new bone may be seen covering the whole length of dorsal and lumbar spine as if some soft liquid osseous material had been poured over them and this had subsequently hardened' (Connor 1694).

The disease is also known to have occurred in very much earlier times. There are many excellent accounts of its occurrence in ancient man, some written as long ago as the early part of the last century, but most of them within the last fifty years. It has been found in Swedish skeletons of neolithic times (Fürst 1914), in a middle-aged male Jute of the Bronze Age (Parsons 1913), in Germans of pre-Roman days (von Hölder 1895) and in skeletons from a Viking ship of the tenth century A.D. (Nicoloyson 1882).

Pizon (1956) has recently given an account of an examination of the bones of four members of the Medici family in 1945 during their removal and replacement in the church of San Lorenzo in Florence. Cosmo the Elder (1439–1464) was found to have ankylosing spondylitis of the spine and his son Pietro (Peter the Gouty) was likewise affected, there being also extensive arthritis in the limbs in his case. The disease cannot, however, have caused much obvious deformity during the lifetime of Pietro; at least none is evident in the portrait of him by Angelo Bronzino (Florentine School 1503–1572) which I found stored in the National Gallery basement. His head is held erect and turned towards the painter, though the rigid kyphosis so often seen in ankylosing spondylitis may have deliberately not been shown.

By far the most detailed and extensive inquiries, however, into the history of the condition are those of Elliot Smith & Wood-Jones (1910) in Nubia and of Ruffer (1913) in Egypt.

Ruffer (1921) gives an excellent description of ankylosing spondylitis as it occurred in ancient Egypt and Nubia during predynastic, dynastic, Greek, Roman and Coptic times, that is, in the last 8,000 years. He describes in great detail the appearance of many skeletons and mummies which he examined, the earliest being from the predynastic period (i.e. before 4500 B.C.). In one specimen of the III Dynasty (2980–2900 B.C.) the spinal column had been converted into a rigid block. Several bodies were examined from the tombs of the soldiers of Alexander the Great and Ptolemy I (332–330 B.C.) at Chatby near Alexandria. Forty bodies had been buried in rock-hewn graves, closed with a stone slab and hermetically sealed with mortar. Many of them showed ankylosing spondylitis, but as they were not lying together and the bones had become separated, only an estimate of this number is possible. It seems to have been almost a quarter of them. From a later period still, in two tombs of the Roman Period of Egyptian Civilization (A.D. 200) four

out of eight skeletons showed marked lesions of arthritis deformans. One of these Ruffer (1921) describes as being very like and just as severe as a III Dynasty specimen of 3,000 years earlier.

In some of the bodies, notably those of Coptic times (A.D. 400–500), the process of mummification had still preserved the lungs. They were black and shrunken, about six inches long and half an inch in thickness. Often they were held to the back or side of the chest wall by pleural adhesions. The bronchi were recognizable under a microscope and the alveolar structure, about one-fifth of normal size, could be made out. Ruffer described them as 'of Lilliputian appearance'.

The disease was even more prevalent in the Lower Nile. Indeed Dawson (1929) remarks that it was so extremely common in Egypt and Nubia that it was rare in earlier times to find any adult skeleton that did not reveal its effects. The papyrus records say that the 'stiffness' was seated in the limbs, joints, spine and pelvis.

Elliot Smith & Wood-Jones (1910) were so impressed by the frequency with which the disease had occurred in that area that they thought it must be related to conditions of life in the lower Nile. 'The causal factor of the disease is essentially one of environment and not of race; it is the conditions of life in the Nile Valley. . . . At all periods the Nile itself was the chief factor in their lives. It gave them all their livelihood and supplied their wants and it probably gave them, as it does now, the bulk of their disease.' It is not easy, however, to accept this theory. The disease occurred commonly in both Alexandria and in the upper Nile, that is, in two completely different climates – one moist and temperate, the other dry and hot by day and cold at night. It seems unlikely that wet and cold can have played much part when the disease can be found so readily in specimens from both man and animals at Thebes where it rains barely once a year. After examining all the Egyptian and Peruvian mummies in the Field Museum, Chicago, Moodie (1923) wrote 'so far as habitat is concerned, strongly developed lesions are known in man and animals from the hot dry desert of Nubia, from the caves of Europe and from the lagoons of Cuba, and this distribution would seem to rule out the climatic factor'.

The more one reads about 'ankylosing spondylitis' in Ancient Egyptians the more difficult it becomes to be sure what the various writers meant by the term and how frequently the disease did, in fact, occur. I thought it worth while, therefore, to try to form a first-hand opinion by examining the available human remains in the Egyptology Department of the British Museum.

Some of these, described simply as sun-burials, consist of bodies buried in the hot dry sand and hence desiccated but otherwise excellently pre-

served. Others consist of unwrapped mummies, rather damaged by water; but in neither group was there any outward evidence of deformity or fixity. Most of the specimens are mummies about which little is known except their site and probable date of burial. None of these had ever been X-rayed and although an examination of all the mummies would have been most interesting it was too extensive an undertaking. However, with the help of Dr George Simon and by the use of his portable X-ray apparatus it was possible quite successfully to examine the spine and pelvis of eight of these mummies.

The later mummies, those from the Roman period, are of unknown persons whose ages and occupations are unknown, but the earlier ones include a young Priestess from Thebes (No 8) and an official from the Palace of one of the Pharaohs. Care had evidently been taken to preserve the contours of the bodies and some had been decorated with ornaments and a 'criss-cross' arrangement of glazed beads attached to the exterior of the wrappings. Through these wrappings the spine and pelvis of eight were radiographed. In all of them the sacro-iliac joints were well seen and no evidence of ankylosing spondylitis was found. There was slight osteoarthritic 'lipping' of the thoracic or lumbar vertebrae in four. In one the spinal appearances were most unusual and were suggestive of alkaptonuric arthritis. Indeed, Dent (1958) considers the radiograph to be pathognomonic. The illustrations show that such a method of examining the skeletons of mummies is quite satisfactory and may provide useful evidence of their condition without destroying their preserved state. That no evidence of ankylosing spondylitis was found may be a matter of chance. I think it is more likely, however, that by 'spondylitis deformans' osteoarthritis was really meant and not ankylosing spondylitis (in its modern usage).

The following notes were made on the mummies X-rayed in the British Museum:

No 1 Mummy of an unnamed person. Care had been taken when wrapping the body to preserve its contours. Gilded finger and toe nails were represented and brown leather straps imitating a belt, amulets and anklets have been affixed. A metal plate had probably been placed over the pubic region before wrapping.

From Roman Period after 30 B.C.

Discovered at Thebes (Egypt).

Radiograph of spine and pelvis: The left sacro-iliac joint could just be made out suggesting that ankylosing spondylitis was not present.

No 2 Mummy of an unnamed person. Said to be a female. Decoration rather crude. From Roman Period after 30 B.C.

Radiograph of spine and pelvis (Fig 1): No ankylosing spondylitis but condensation of shadows round

intervertebral discs, femoral heads, acetabula strongly suggests alkaptonuric arthritis. The femoral epiphyses are not yet fused and suggest that the person was about 16 years old, probably a female.

No 3 Mummy of an unnamed person. A wire frame containing gilded gods and amulets was placed on the breast. From Roman Period after 30 B.C.

Radiograph of spine and pelvis (Fig 2): The sacro-iliac joints are well seen. Slight spinal osteoarthritic 'lipping' is present, but there is no evidence of ankylosing spondylitis.

No 4 Mummy of an unnamed person. From Roman Period after 30 B.C.

Radiograph of spine and pelvis: No ankylosing spondylitis or osteoarthritis seen.

No 5 Mummy of Ta-Kheb-Khanem from XXVI Dynasty (about 600 B.C.).

Radiograph of spine and pelvis (Fig 3): No ankylosing spondylitis. No osteoarthritis. Sacro-iliac joints very well seen. The mummy had glass beads sewn over the outside wrappings.

No 6 Mummy of Ata-neb. XXVI Dynasty (about 600 B.C.).

Radiograph of spine and pelvis (Fig 4): No ankylosing spondylitis or osteoarthritis seen.

No 7 Mummy of Amen-ary-art, an official in the Palace of Queen Amenardas the sister and wife of Pharo Pi-anklin. XXV Dynasty (about 700 B.C.).

Radiograph of spine and pelvis (Fig 5): No ankylosing spondylitis; sacro-iliac joints well seen. Some osteoarthritic 'lipping' of vertebrae is present and in the past this would probably have been referred to as spondylitis deformans.

No 8 Mummy of an unnamed Priestess. XXI Dynasty (about 1050 B.C.) from Thebes.

Radiograph of spine (Fig 6): Slight osteoarthritis of spine is present.

These notes on the history of spinal arthritis were made during an enquiry into the state of the lungs in ankylosing spondylitis (Zorab 1959). Whilst investigating this problem it seemed worth considering the length of survival in their natural surroundings of the men and animals whose remains have just been discussed. Most of the skeletons suggest that death did not occur until full adult life or middle age. Ankylosing spondylitis commonly appears in early adult life and osteoarthritic 'lipping' of the vertebrae somewhat later. Both conditions as we know them, even when associated with restriction of thoracic movement by costovertebral joint degeneration, are compatible with life for many years and probably were so in the past. This argues that respiratory function must have been moderately good. The presence of the conditions amongst warriors, such as the soldiers of Alexander the Great and the

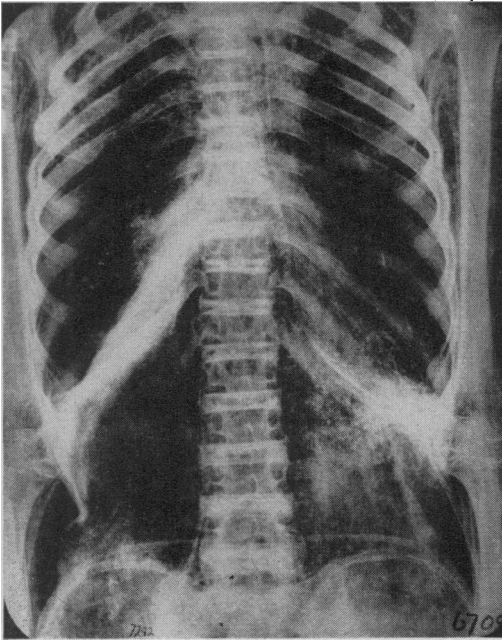


Fig 1 Mummy from Roman Period (30 B.C.) showing alkaptonuric arthritis

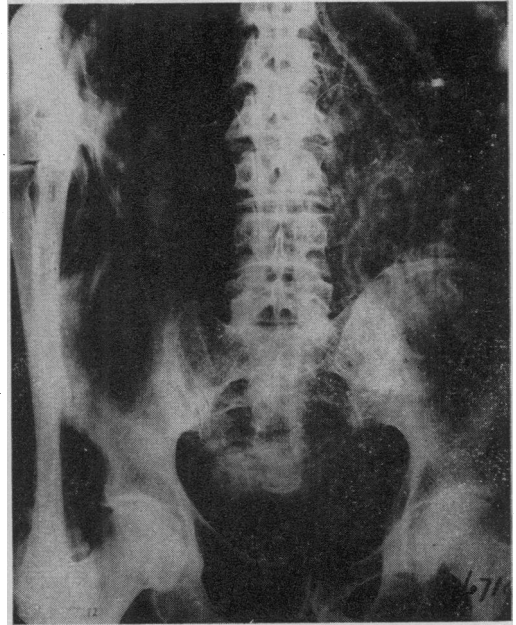


Fig 2 Mummy from Roman Period (30 B.C.) showing slight spinal 'lipping'

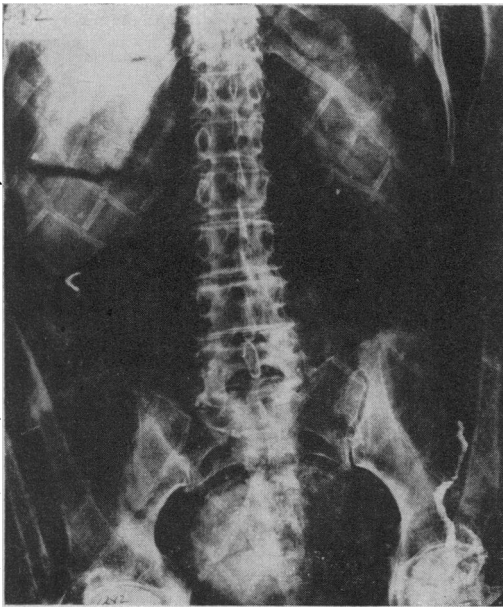


Fig 3 Mummy of Ta-Kheb-Khanem XXVI Dynasty (600 B.C.)

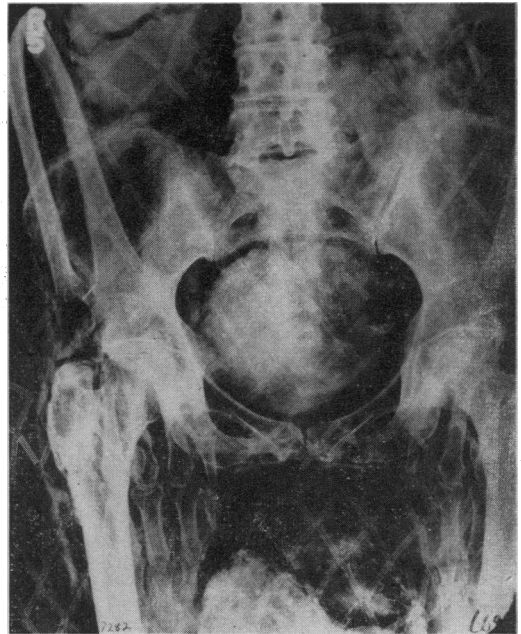


Fig 4 Mummy of Ata-neb XXVI Dynasty (600 B.C.)

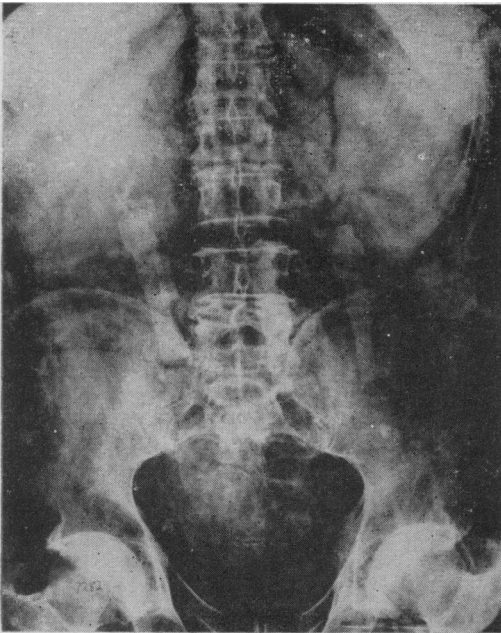


Fig 5 *Mummy of Amen-ary-art XXV Dynasty (700 B.C.)*

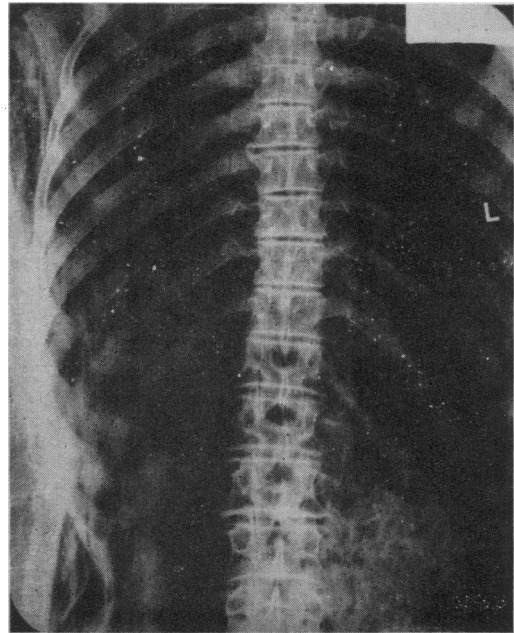


Fig 6 *Mummy of unknown Priestess XXI Dynasty (1050 B.C.)*

Vikings, amongst the inhabitants of an agrarian land such as Lower Nubia whose livelihood was usually wrought from the soil by hard physical toil, and its presence amongst animals suggest that, whatever the physical discomforts may have been, severe shortness of breath could hardly have been a prominent feature. It is reasonable to conclude, therefore, that even in the days before modern medicine, indeed, before man himself existed, spinal ankylosis and restriction of thoracic movement did not severely damage the lungs and that backache may have been just as common a hundred million years ago as it is now.

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REFERENCES

- Bechterew V
(1892) *Vruch. Spb.* 13, 889
(1893) *Neurol. Zbl.* 12, 426
Connor B (1694–5) *Phil. Trans.* 19, 21. See also *Phil. Trans.* (Lowthorp's abridged version), 3, 299 (published 1749)
Davies-Colley N (1885) *Trans. path. Soc. Lond.* 36, 359
Dawson W R (1929) *Magician and Leech*. London; p. 105
Dent C E (1958) Personal communication
Fagge C H (1877) *Trans. path. Soc. Lond.* 28, 201
Fourteau R (1920) Contribution à l'étude des vertébrés miocène de l'Égypte. Geol. Survey Dept., Egypt.

- Fürlst C M (1914) *Fornvännen* 9, 18
Hölder H von (1895) Untersuchungen über die Skelettfunde in den vorrömischen Hügelgräbern Württembergs und Hohenzollerns. Fundberichte aus Schwaben. Stuttgart; Vol. 2
Marie P (1898) *Rev. Médecine* 18, 285
Moodie R L
(1923) *Paleopathology: An Introduction to the Study of Ancient Evidence of Disease*. Urbana, Ill.; p. 128
(1931) *Roentgenologic Studies of Egyptian and Peruvian Mummies*. Chicago; p. 21
Nicolaysen N (1882) *The Viking Ship Discovered at Gothstadt in Norway*. Christiania
Parsons F G (1913) *J. R. anthrop. Inst.* 43, 550
Pizon P (1956) *Pr. Méd.* 64, 1483
Ruffer M A
(1913) *J. Path. Bact.* 18, 149
(1921) *Studies in the Paleopathology of Egypt*. Chicago; pp. 187, 188, 189
Smith G E & Wood-Jones F (1910) *Archeological Survey of Nubia. Report for 1907–1908*. Cairo; 2, 273
Strümpell E (1884) *Lehrbuch der speciellen Pathologie und Therapie der inneren Krankheiten*. Leipzig; Bd. 2, ii
Swinton W E (1958) Personal communication
Zorab P A (1959) M.D. Thesis, London

Meeting December 7 1960

Mr A DICKSON WRIGHT (*London*) read a paper entitled **The History of Opium**

Meeting March 1 1961

Dr RICHARD A HUNTER (*London*) read a paper entitled **English Psychiatric Writings of the Seventeenth and Eighteenth Centuries**