

THE EDWIN SMITH SURGICAL PAPYRUS
AND THE DIAGNOSIS AND TREATMENT OF INJURIES TO THE SKULL
AND SPINE 5000 YEARS AGO*

By CHARLES A. ELSBERG, M.D.

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UP to the first quarter of the nineteenth century, the belief that Egypt was one of the oldest, if not the oldest, of civilized lands was, to a considerable extent, based upon surmise. When, however, in 1822, Champollion first deciphered two hieroglyphic inscriptions or "cartouches" of Ptolemy and Cleopatra on the base of an obelisk, and, a few years later translated the inscription on the famous Rosetta stone, the door was opened to the understanding of Egyptian hieroglyphic, hieratic and demotic writing. This made it possible for succeeding Egyptologists to decipher the papyri and the inscriptions found in tombs and on the walls of temples, which has given us the proof of the extreme antiquity of Egyptian civilization.

Professor James H. Breasted, the Director of the Oriental Institute of the University of Chicago has recently completed and published a translation of a papyrus which is of great importance not only to the student of Egypt and its history, but also to the medical profession and to those who are interested in the history of medicine.*

The Edwin Smith Papyrus carries back recorded surgery for almost five

* The work is, however, much more than a translation and a learned discussion of the meaning of Egyptian writing. The introduction and the commentaries by Professor Breasted give a comprehensive and highly interesting view of Egyptian history and of the period in which the papyrus was written.

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thousand years, for this document antedates all known medical papyri, chief among which is the Papyrus Ebers, probably by several centuries and possibly by many more years.

The story of the acquisition of the Papyrus by Mr. Smith is of no little interest. Edwin Smith was an American who was greatly interested in Egypt and had studied Egyptian hieratic writing. In 1858 he settled in Luxor, and there came into intimate contact with many of the leading Egyptologists of the day. In the year 1862, he bought from an Egyptian native a papyrus roll which, so he was informed, had been found in a tomb. The outer part of the roll was in tatters as if some of the layers had been stripped off. Mr. Smith studied the roll and appreciated that it dealt with a medical subject. A few months later, the same native brought him another roll, and Smith recognized that the outer part of this second one consisted of tattered fragments from the first papyrus, which had been pasted around the surface of a dummy. This second papyrus was also bought by Mr. Smith. It was fortunate that he did so, for in the fragments which he removed from this second roll, there was an extraordinary discussion of the heart and its vascular connections. Undoubtedly Mr. Smith devoted much time to the study of the papyrus; he removed the fragments from the counterfeit roll and attempted to arrange them in

their proper places on the genuine papyrus.

In 1906, upon the owner's death, the document was presented to the New York Historical Society in whose possession it remains.

The Edwin Smith Surgical Papyrus dates from the early Pyramid Age of Egyptian history, the period in which the step pyramid and the pyramids of Gizeh were built. According to Professor Breasted, it may well be possible that the document was written by Imhotep, the statesman-architect-physician at the court of the Pharaoh Zoser, that is, somewhere between 3000 and 2500 B.C.

Regarding its origin, I can do no better than to quote from Breasted's highly interesting and comprehensive introduction:*

There is good evidence that this surgical treatise was written in the old Kingdom (3000-2500 B.C.) and presumably . . . in the early part of that remote age. The manuscript nowhere hints at the name or station of the author . . . After circulating for some generations, more probably for several centuries, it was found that the book was antiquated in its terms. Not a few words and expressions were evidently no longer wholly intelligible . . . Probably not later than 2500 B.C., some "modern" surgeon, as unknown to us as the original author, equipped the document with a commentary in the form of brief definitions and explanations, . . . appended to each case. Thus he carefully explains all the terms describing the various injuries, or designating the condition of the patient or his symptoms. Similarly, the commentator added many anatomical terms and other designations drawn from nature or the arts . . . In a total of sixty-nine such brief discussions, forming a little dictionary of early Egyptian

medical terms, this unknown ancient commentator has given us invaluable revelations of his knowledge of anatomy, physiology, pathology, surgery, and therapeutics; while at the same time he has made clear many terms in the original treatise which would not have been intelligible to us without his little dictionary. This surgical treatise, as it has come down to us, is therefore a composite made up of the original author's text and the ancient commentary . . .

The ancient history of our document as a whole illustrates the hazards which beset such records and their meager prospects of survival. It is now without doubt thousands of years since the complete disappearance or destruction of the original copy of this surgical treatise, as penned by the hand of the nameless author himself, probably nearly 5000 years ago. In the same way, the copy to which the ancient commentator appended his explanations, long ago perished. At least one copy of the treatise and commentary together, however, survived the fall of the Old Kingdom (3000-2500 B.C.) and, as transmitted, probably through successive copies, survived . . . the early 18th Century B.C. . . . It was at this time, . . . that a Theban scribe sat down to copy our ancient treatise on surgery. In content the book was then probably over a thousand years old. It was as if a man sat down today to copy a manuscript written in the reign of Charlemagne . . . The scribe was master of a stately and beautiful book hand, but he was totally ignorant of medicine . . . He was excessively inaccurate, but occasionally noticed and corrected his errors—in one case placing an omitted word in the margin, and calling attention to it by a cross, *the earliest known asterisk in the history of book-making* [The italics are my own] . . . When he had copied the old treatise on surgery from the beginning (the human head) down to the thorax and the spine, he stopped in the middle of a case, in the middle of a line, in the middle of a

* Volume I on pages 9, 10, 11, 19, 20.

sentence, and leaving the end of the long roll bare of all writing for some space, he turned it over and copied on the unwritten back a series of incantations against pestilence, to which he added three recipes, one for female troubles and two for improving the complexion . . .

Eventually the unknown owner handed on the roll to some later worthy of the same craft. The last owner was much attracted by a roll containing a recipe for "transforming an old man into a youth," and he, or some scribe for him, took pains to copy this at the end of the older material collected by his predecessors, adding a totally unrelated remedy for some ailment of the anus. [In a tomb, the roll] reposed in perfect safety throughout a vast sweep of human history for some three and a half millenniums, from the migrations of the Hebrew patriarchs and the prehistoric wanderings of the Greek barbarians to the American Civil War.

The Papyrus contains 48 "cases," in 29 of which there are added one to ten explanatory notes by the ancient commentator. With possibly two exceptions, all of the cases contain descriptions of injuries or conditions secondary to injuries which affect the head, throat and neck, clavicles, humerus, sternum and chest, shoulders and vertebral column. The first and last cases are incomplete, and there is no mention of any injury of the abdomen or lower extremities. The subject matter of the entire document is arranged in so orderly a manner, beginning with the head and passing successively to the neck, shoulders, upper limbs and chest, that it is more than probable that the original treatise contained also cases illustrating injuries to the lower parts of the body. The ancient copyist never realized how great would be the loss to future generations of his failure to finish the transcription of the papyrus.

There is much of absorbing interest in each case described in this ancient document; we shall consider here mainly the injuries to the head and the vertebral column, with a brief discussion of the neurological signs and symptoms described and the treatment recommended by this "surgeon" of five thousand years ago. There is full justification for the appellation "surgeon," for the ancient author deals almost exclusively with injuries and their results. From Herodotus we know that there were, in ancient Egypt, "specialists" of all kinds and for different parts of the body.

In the history of the development of medicine, the knowledge of injuries was almost always far in advance of that of internal diseases. The former were recognized to be due to direct external causes, while for untold ages disease was believed to be caused by evil spirits. Therefore, at a period in which internal medicine was still demonic and medical therapy was still empirical and interwoven with magic and incantations, surgical lesions were already accurately observed and described, and a rational therapy advised. Thus, there is a striking difference between the surgery of the Smith Papyrus and the medical therapy found, for example, in the Papyrus Ebers.

In 14* of the 27 cases of trauma to the head, described in the Smith Surgical Papyrus, the injury involved only the soft tissues of the scalp, ear, nose, chin or cheek, or was complicated by a fracture of the nasal bones or maxilla, and caused no "neurological" disturbances. Space will not permit a discussion of these minor injuries, but a few of the recorded facts are deserving of mention:

* Cases No. 1, 2, 10, 11, 12, 14, 15, 16, 18, 23, 24, 25, 26, 27.

The approximation of the lips of an incised wound by strips of tape, which may have been a kind of adhesive plaster, is clearly described. One of the cases (Case 10) contains the earliest mention of the approximation of wound edges by means of sutures. Stitching must, of course, have been well known to the embalmers of the time, for many mummies have been found in whom the incision made during the embalming process had been closed by continuous suture. It is known from the Talmud, also, that the earliest rabbis were acquainted with sutures for wounds and they probably gained this knowledge from the early Egyptian embalmers and medical men.

In another case (Case 25) there is a description of the method to be used for the reduction of a dislocation of the lower jaw, which is the same as that in use in modern times:

If thou examinest a man having a dislocation in his mandible, shouldst thou find his mouth open [and] his mouth can not close for him, thou shouldst put thy thumbs upon the ends of the two rami of the mandible in the inside of his mouth, [and] thy two claws [meaning two groups of fingers] under his chin [and] thou shouldst cause them to fall back so that they rest in their places.

In Case 12, advice is given concerning the treatment of fracture of the nasal bones: how the fracture should be reduced, the manner in which the nose should be splinted by means of plugs in the nostrils and rolls of linen bound on the outside. In its essential principles, nothing better than this has been devised by the modern surgeon!

In Case 1, the ancient commentator gives an explanation of what is meant by the "examination" of a patient,

which is very illuminating. He pictures the surgeon as placing his hands or fingers at various points along the body of the patient to feel the pulsations of the heart. Professor Breasted raises the question whether the surgeon may have been "counting" the pulse, and he goes on to say:

If this is so, it is the earliest reference in the history of medicine, for the counting of the pulse was unknown to early Greek medicine and is not mentioned until Democritus and the Hippocratic treatises. If this were so, it would be of great interest also in the histories of instruments of time measurement . . . The earliest known counting of the pulse with a time measurer was done by the distinguished Herophilus of Alexandria in the third century B.C.

FRACTURES OF THE SKULL

The papyrus contains short clinical descriptions of thirteen cases of skull fracture, divided into "splits" or fissured, "smashes" or comminuted, compound comminuted, and comminuted and depressed fractures. From the symptoms mentioned by the ancient surgeon, there are a number of cases of undoubted fracture of the base.

The titles of the cases are the following:

Case 2. "A gaping wound in the head penetrating to the bone and perforating the skull."

Case 4. "A gaping wound in the head, penetrating to the bone and splitting the skull."

Case 5. "A gaping wound in the head with a comminuted fracture of the skull." A compound comminuted fracture.

Case 6. "A gaping wound in the head, with compound comminuted fracture of the skull and rupture of the meningeal membranes."

Case 7. "A gaping wound in the head

penetrating to the bone and perforating the sutures."

Case 8. "A comminuted fracture of the skull displaying no visible external injury." (Described through error as a compound fracture [C. A. E.])

Case 9. "A wound in the forehead producing a compound comminuted fracture of the skull."

Case 13. "A compound fracture in the side of the nose."

Case 17. "A compound comminuted fracture of the bone in the region of the maxilla and zygoma."

Case 19. "A perforation in the temple."

Case 20. "A wound in the temple perforating the bone."

Case 21. "A split in the temporal bone."

Case 22. "A compound comminuted fracture of the temporal bone."

Each of the cases is discussed under several headings: Title, Examination, Diagnosis, Treatment, and Ancient Commentaries (Glosses).

The "Title" is sometimes specific and at other times rather general, without any indication of the exact location of the injury. The "examination" addressed to a second person, describes the symptoms and sometimes alternate groups of symptoms, and either implies that a certain examination has been made or instructs the reader to make such examination. It is of no little interest that advice and recommendations for surgical treatment are most often included under the "examination" as if only medical measures were considered as therapy. This, as Breasted states, makes one suspect a sharp distinction between the surgeon and the physician. The "diagnosis" sums up and often repeats the facts mentioned under the "examination," and often adds a statement whether the case is one to be or not to be treated,

while the "treatment" consists in a few instances of recommendations for actual surgical therapy, but most often gives recipes or advice for external applications of medicaments.

The record of each case is very short, and much is left to the supposed knowledge of the reader, as the following typical case will demonstrate:

CASE FIVE*

Title: Instructions concerning a gaping wound in his head smashing his skull.

Examination: If thou examinest a man having a gaping wound in his head, penetrating to the bone, (and) smashing his skull; thou shouldst palpate his wound. Shouldst thou find that smash which is in his skull deep (and) sunken under thy fingers, while the swelling which is over it protrudes, he discharges blood from both his nostrils (and) both his ears, (and) he suffers with stiffness in his neck, so that he is unable to look at his two shoulders and his breast, (conclusion in diagnosis).

Diagnosis: Thou shouldst say regarding him: "One having a gaping wound in his head, penetrating to the bone (and) smashing his skull, while he suffers with stiffness in his neck. An ailment not to be treated."

Treatment: Thou halt not bind him, (but) moor (him) at his mooring stakes, until the period of his injury passes by.

Gloss: As for: "Smashing his skull," it means a smash of his skull (such that) bones, getting into that smash, sink into the interior of his skull. The "Treatise on What Pertains to Wounds" states: "It means a smash of his skull into numerous fragments, which sink into the interior of his skull."

Gloss: As for "moor [him] at his mooring stakes," it means putting him on his

* As translated by Professor Breasted in his volume. I have, however, added the second "gloss" from another case (Gloss₁D, Case 3) so that the meaning of one sentence is made clear.

customary diet, without administering to him a prescription.

THE SYMPTOMS OF CRANIAL INJURIES

These thirteen cases of fracture of the skull give the reader a good idea of what was known of such injuries five thousand years ago. Most of the wounds were probably received in battle, and therefore most of the fractures were compound and not a few were comminuted. The ancient surgeon aptly likens a comminuted fracture to the cracks of a broken pottery jar, and he makes a clear distinction between a simple fracture and one in which the fragments are depressed. From the symptoms he describes, some of the fractures extended into the base of the skull, for bleeding from both or from one ear is mentioned in a number of instances. The hematoma in the soft tissues of the scalp is described as "a swelling which protrudes" over the location of the injury, and in one of the cases is to be found the first recorded mention of the cranial sutures, those irregular lines which the ancient Arabs believed were the patient's destiny written by the hands of Allah.

The first mention in human records of the word "brain," as well as of the meningeal membranes and of "the fluid underneath them" is to be found in Case 6. The surface appearance of the brain is likened to the film and corrugations to be seen on the surface of molten copper as it is cooling. It is difficult to understand why some word for brain had never before been met with, for parts of that tissue must have been commonly seen by the embalmers who, according to Sprengel, Bass, Garrison, and others, evacuated the contents of the cranial cavity by means of a hook passed into the inter-

ior of the skull through the cribriform plate of the ethmoid.

The occurrence of crepitus in fractures is mentioned for the first time in this papyrus, although in at least one instance (Case 13) the crepitation felt by the fingers may have been due to a gas bacillus infection of a wound.*

Several of the patients must have been seen a number of days after their injury for there was clear evidence of meningitis which, as we know, occurs as a complication some days after a cranial injury. The patient is "unable to look at his shoulders and his breast," i.e., he is unable to approximate his chin to his sternum. This stiffness or rigidity of the neck was not always, however, a sign of meningitis, because it is mentioned also, in a case of tetanus complicating a sloughing and necrotic wound (Case 7) and, as we shall see later on, in a case of injury to the muscles of the neck and the cervical vertebrae.

Disturbances of speech are described, amounting in at least one instance (Case 20, a wound in the temporal bone) to aphasia. It is fair to assume that in this case the fracture of the temporal bone was on the left side, and the "aphasia" was due to injury of the temporal or frontal lobes of the brain. If this is correct, then this is the first description known in medical history of a cranial injury complicated by a lesion of the brain and aphasia.

In another instance (Case 8) for the first time in the history of science, the ancient surgeon has noted the effects of the cranial injury upon the

* Crepitation is mentioned also in a case of fracture of the ribs with probable puncture of the lung; in this case, the crepitation was probably caused by a subcutaneous emphysema.

upper and lower limbs. As the loss of power in the limbs and the facial paralysis ("his eye on that side is askew") were on the same side as the cranial injury, one has the right to conclude that the cranial disturbances were due to an injury of the brain on the other side, due to a bursting fracture on the side opposite to that in which another fracture existed: in other words what for many years was called a fracture by "contrecoup." The patient was evidently seen by the surgeon a considerable time after the injury had been sustained for he (the patient) already had hemiplegic contractures, "with nails in the middle of his palm," "shuffling with his sole," "walking with his sole dragging." This is the first written record of hemiplegic contractures.

THE TREATMENT

In some of the cases, therapy is recommended; in others, the advice is given to wait treatment until it is possible to conclude whether the patient will recover, "putting him on his customary diet without administering to him a prescription"; in still others, the injury is considered so severe that it is regarded as fatal: the surgeon considers the condition a hopeless one and declares it "a condition not to be treated." In a few of the patients in whom a hopeless verdict is given, there is no mention of any treatment, but in others applications are suggested, evidently as an alleviation and without much hope of doing the patient any good.

As already mentioned, the part of the treatment which may be considered "surgical" is, with a few exceptions, recorded under the heading of the examination. There is nowhere any suggestion of operative

treatment, excepting where the surgeon instructs his reader to suture the wound, and in two instances where blood clots are to be removed from the nasal cavities, and fragments of bone from the external auditory canal. In some of the patients the edges of the wound are to be drawn together with adhesive strips; in others, the reader is specifically instructed not to draw together the wound edges, the ancient surgeon intimating that drainage was necessary. The wound shall be first dressed with meat, and later with honey or grease on lint.

From one case, in which the advice is given to obtain the bandages from the embalmers, it is clear that the latter, who both made bandages and were very expert in applying them to the dead body, were expected to supply bandages for the use of the surgeon.

In only one case in the entire papyrus, and that a skull fracture, the "treatment" consists of a curious mixture of superstitions: a poultice for drying up the wound is to be made from the eye of an ostrich, and a charm is to be said over the wound, followed by the application of a compress composed of figs, grease, and honey "cooked, cooled, and applied to it." The treatment of this case is very unlike that described in any other part of the surgical papyrus, and reminds one of what is regularly found in "medical" papyri of a later age.

The ancient surgeon recommends that, in fractures of the skull, the patient is to be kept in the upright position: "His treatment is sitting. Make for him two supports of brick until thou knowest he has reached a decisive point." This suggests to the modern reader, the idea that the ancient practitioner had observed that

patients with skull fractures got along better if the head was raised. The sitting position would certainly keep intracranial pressure lower and would be of aid in the prevention of intracranial hemorrhage.

DISLOCATIONS AND FRACTURES OF THE VERTEBRAE

The papyrus contains 6 cases* of injuries to the spine, of which one, the last in the document, is incomplete. If the ancient scribe had copied the entire work of the surgeon, there would, no doubt, have been a number of instances of injuries to the thoracic and lumbar vertebrae, "the vertebrae of the backbone."

The titles of the cases follow:

Case 29. "A gaping wound in a vertebra of the neck."

Case 30. "A sprain in a vertebra of the neck."

Case 31. "A dislocation in a vertebra of the neck."

Case 32. "A displacement in a vertebra of the neck."

Case 33. "A crushed vertebra in the neck."

Case 48. "A sprain of a vertebra in the spinal column."

As there was a wound of the soft tissues in only one instance, it is fair to conclude that most of the injuries were sustained in civil life. In Case 33, the mechanism of the impacted fracture is indicated by the explanation given: "His falling head downward has caused that one vertebra crush into the next, it means that he has fallen head downward upon his head, driving one vertebra of his neck into the next."

A sharp distinction is made between the cervical, "the vertebrae of the neck," and the lower parts of the

bony spine, "the vertebrae of the backbone."

In only two instances, both of no little interest, the ancient surgeon goes into considerable detail regarding the symptoms of what was evidently an injury to the spinal cord, although he says nothing that would permit one to conclude that he knew that there was such a structure.

The surgeon states that an injury to the cervical vertebrae caused a paralysis of both upper and lower limbs, a loss of sensation and of control of the bladder so that "his urine dribbles without his knowing it." He attempts to differentiate between the symptoms of an injury of the lower and of the upper cervical vertebrae: in both instances the patient has lost power and sensation in the upper and lower limbs, but in the injury of the higher vertebrae, "the middle vertebrae of the neck," there is urinary incontinence, priapism, and involuntary ejaculation of seminal fluid.

These anatomical and pathological details, antedate by thousands of years, anything concerning loss of function of the spinal cord previously recorded. The earliest known references to spinal cord localization of function had, before this, been found in the Hippocratic treatises (about 400 B.C.), in the writings of Celsus, and in those of Aretaeus, who lived in the second or third century of the Christian era.

There are a few other symptoms to which the ancient medical man makes reference. In several of the cases the patient is described as unable to flex his chin on his chest, no doubt due to the nature and especially to the local effects of the injury upon the bones and the muscles and other soft tissues of the neck. Abdominal dis-

* Cases 29, 30, 31, 32, 33, 48.

tension is mentioned as a symptom of dislocation of a cervical vertebra. We now know that, although abdominal distension may occur in injuries of the spinal cord at various levels, it is especially frequent when the middle and lower thoracic segments are involved.

In one interesting case, that of a crushed or impacted fracture of the bodies of the cervical vertebrae, the patient was "voiceless," that is he probably was hoarse and able to speak only in whispers from a trauma to the recurrent laryngeal nerve.

The meagerness of detail regarding the "neurological" symptoms of injuries of the vertebrae, is probably due in part to the fact that in only a few cases was there a lesion of the spinal cord, and in part to the fact that the copying of the manuscript by the ancient scribe was unfinished and therefore the injuries of the greater parts of the spine not described. This is the explanation, also, why so little is said of treatment which consists in the main of external application of meat, and of honey and other substances. It is of interest that in the case of "displacement of a cervical vertebra" the recommendation is made that the patient should be kept in a sitting position, while in the case of "a sprain of the spinal column," by which was probably meant an injury of the thoracic spine, the patient is to be placed in a horizontal position.

Withington, in his artistic and philosophical "Medical History," makes the statement that the ancient Egyptians were "essentially a matter of fact race; types of those practical people of whom it has been well said that they practice the errors of their fathers." To the Greek, he says science was "a majestic goddess, a

clear-eyed Pallas Athené: to the Egyptian she was a domestic cow, good only for what could be got out of her." Breasted acknowledges that before his translation of the Edwin Smith Papyrus, most Egyptologists, himself included, had believed that Egyptian medicine and surgery were purely utilitarian and materialistic. The ancient author of our Papyrus certainly was an exception, even if his writing does not directly contradict the beliefs once held by Withington and most other students of the subject. The author and the ancient commentator, both describe and explain facts concerning hopeless injuries, apparently for their scientific interest alone. The conclusion arrived at by Professor Breasted is therefore fully justified: that even at this early period, almost five thousand years ago, knowledge was cultivated for its own sake. We have therefore the picture of this ancient surgeon as the earliest known example of the scientific doctor.

The investigations in paleopathology that have been made in the past decades have given us much evidence of the antiquity of human disease, and it is reasonable to believe that dawning civilization gradually brought with it the recognition of human ailments, the desire to treat injuries and diseases, and the urge to transmit to others the knowledge gained.

This papyrus demonstrates conclusively that at the most remote period of which we have a written record, medical science was recorded for its own sake. The Edwin Smith Surgical Papyrus is the oldest milestone yet discovered on the long road to modern medicine; it is a document of great human interest as well as an important contribution to the history of medicine and surgery.