

SPECIAL FEATURE

Commentary on the Significance for Modern Neurology of the 17th Century B.C. Surgical Papyrus

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ABSTRACT: A 17th century B.C. Surgical Papyrus known as "The Edwin Smith Papyrus" was published in facsimile and hieroglyphic transliteration with translation and commentary by James Henry Breasted in 1930. The Papyrus was acquired by Edwin Smith in Luxor, 1862. This document was conceived in the Pyramid Age (3000-2500 B.C.) and remains in material form from the 17th century B.C. It is of importance to the history of Neurology as it contains the earliest mention in oriental literature of (a) the brain and meninges (b) calvarial and cervical vertebral injuries in details of pathology, symptomatology, treatment and prognosis and (c) functional localization in the brain and spine. Most importantly, Papyrus Smith is a statement of the medical ethic of its time.

RÉSUMÉ: Commentaire sur l'intérêt pour la neurologie moderne du papyrus sur la chirurgie datant du dix-septième siècle avant J.C. Un papyrus sur la chirurgie, datant du dix-septième siècle avant J.C. et connu sous le nom de "Papyrus d'Edwin Smith", a été publié en facsimile et en translittération hiéroglyphique avec traduction et commentaire par James Henry Breasted en 1930. Le Papyrus avait été acquis par Edwin Smith à Luxor, en 1862. Ce document a été conçu à l'époque des Pyramides (3000-2500 BC) et est demeuré sous forme écrite depuis le dix-septième siècle avant J.C. Il est important pour l'histoire de la neurologie parce qu'on y mentionne pour la première fois (a) le cerveau et les méninges (b) les blessures de la voûte crânienne et des vertèbres cervicales en détail, quant à la pathologie, à la symptomatologie, au traitement et au pronostic et (c) la localisation de fonctions au niveau du cerveau et de la moëlle épinière. Fait important, le Papyrus Smith est un énoncé des principes d'éthique médicale de son temps.

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In 1930, James Henry Breasted published his translation with commentary of "The Edwin Smith Surgical Papyrus".¹ While Breasted was aware of the document's importance to the history of medicine, he did not emphasize its role for neurologic science. Yet, the text significantly recognizes the brain and spinal column level as the site of control of body posture, movement, sensation, and continence. Before Breasted, no discussion of the pathologic knowledge displayed in the treatise had been attempted. In this paper I will summarize Breasted's concept of Papyrus Smith and then discuss the treatise's significance to neurology. In order not to change the meaning of Breasted's translation his words will be preserved with quotation marks through the text.

The Edwin Smith Surgical Papyrus dates in content from 3000-2500 B.C. and remains in material form from the 17th century B.C. It was obtained by Edwin Smith in eight fragments in Luxor, 1862. A pioneer in Egyptology, he was able to place 5 of the pieces in near order, but it was only later that Breasted, with permission of the New York Historical Society,

concluded the work of organizing the fragments and translating the text as a whole.

Breasted believed the treatise to be unique by way of content, philosophy and form. In content, other known medical papyri of ancient Egypt are "recipe" papyri containing few diagnoses and only one examination.² For example, Papyrus Ebers (early 16th century B.C.), Berlin Medical Papyrus (16th Century B.C.), London Medical Papyrus (11th Century B.C.), Papyrus Hearst (16th Century B.C.) and fragments of three other Egyptian medical documents dealing with diseases of women, children and cattle are collections of incantations and recipes (Table 1). Although in Papyrus Smith one finds references to additional medical treatises of its time, these are known only to its author, and have not yet been uncovered by archeologists: Treatise On What Pertains To His Wounds (Gloss A, Case 5)³ and Treatise On What Pertains To The Embalmer (Gloss A, Case 19).⁴ No comment as to their content can thus be made at this time.

The Edwin Smith Surgical Papyrus is fundamentally different from the other papyri. It contains 48 case descriptions of

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Table 1: Other Medical Papyri

Papyrus Ebers (University of Leipzig)	Early 16th Century B.C.	1 case exam and diagnosis, 47 diagnoses, 877 recipes
Papyrus Hearst (University of California)	16th Century B.C.	1 diagnosis, 260 recipes
London Medical Papyrus (British Museum)	11th Century B.C.	No diagnosis, 63 recipes
Berlin Medical Papyrus (State Museum of Berlin)	16th Century B.C.	2 diagnoses, 204 recipes
The Kahun Papyrus (Cairo and East Berlin)	May be as old as 2000 B.C.	No disease descriptions, all recipes; scanty remains of a treatise on diseases of women; fragments of veterinary manual treating diseases of cattle
Papyrus Beatty VI (British Museum)	14th Century B.C.	Recipes for diseases of women and children
Papyrus Carlsberg VIII (Copenhagen)	13th Century B.C.	Scanty fragments of diseases of the eyes

injuries to the body. In thirteen instances, the description leads to a diagnosis which in turn derives a logical mode of action to be taken by the physician.

Papyrus Smith displays a scientific philosophy. By its descriptive nature and rationale for action Breasted notes the treatise to be the first written evidence of observation and conclusion. A case once examined is rated to be of favorable outcome "an ailment which I will treat" (Verdict I), of uncertain outcome "an ailment with which I will contend" (Verdict II), or of unfavorable demise "an ailment not to be treated" (Verdict III).⁵ The latter of the three verdicts reflects a desire to record observations for their interest and prognostic impact despite an inability to cure.

Finally, in form the text of Papyrus Smith is notable for the introduction of injuries in anatomical sequence from head downwards as one would approach a case today. Appearing in order of trifling to serious in nature each case presentation is in the form of title, examination, diagnosis and treatment followed by definitions (glosses) of terms used in the text presumably dating from its earliest version of 3000 B.C. which have been added by the original commentator of the text. These terms may thus date even further back than 3000 B.C. The document is a manual of state of the art "injury medicine" of Ancient Egypt and is referred to by the scribe of Papyrus Ebers as "The Secret Book of The Surgeon".⁶

In addition to Breasted's comments, further features of the document may be emphasized for neurologists today. To this purpose I will focus on cases dealing with the head (Cases 1-8),⁷ the temporal region (Cases 18-22),⁸ the cervical spine (Cases 29-33),⁹ and the lower spine (Case 48) (Table 2).¹⁰

In these cases the word "brain", a description of that organ and of the meninges (Case 6), of the skull's sutures (Case 7) and a case of tetanus (Case 7) appears for what is the first time in written form. Most importantly one finds in them the basic

Table 2: Cases

A.	Injuries involving the skull, overlying soft tissue, meninges and brain
Case 1	A wound in the head, penetrating to the bone (incomplete)
Case 2	A gaping wound in the head, penetrating to the bone
Case 3	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 compound comminuted fracture of the skull
Case 6	A gaping wound in the head with compound comminuted fracture of the skull and rupture of the meningeal membrane
Case 7	A gaping wound in the head, penetrating to the bone, perforating the sutures
Case 8	Compound comminuted fracture of the skull displaying no visible external injury
Case 9	Wound in the forehead producing compound comminuted fracture of the skull
B.	Injuries Involving the Temporal Region
Case 18	Wound in the soft tissue of the temple, the bone being uninjured
Case 19	Perforation in the temple
Case 20	Wound in the temple perforating the bone
Case 21	A split in the temporal bone
Case 22	Compound comminuted fracture of the temporal bone
C.	Injury to the Neck
Case 29	Gaping wound in a cervical vertebra
Case 30	Sprain in a cervical vertebra
Case 31	Dislocation of a cervical vertebra
Case 32	Displacement of a cervical vertebra
Case 33	Crushed cervical vertebra
D.	Injury to the Spinal Column
Case 48	Sprain in a spinal vertebra (incomplete)

structure for the neurologic approach to the patient and for ethical neurologic decision making.

First, the mature attitude required of the ancient physician is reflected in the principle by which he acts: know the limitations of your art. Know when you can do good for the patient (Verdict I: "an ailment which I will treat" [Cases 1, 2, 3, 18, 19, 30, 32, 48]), when it is less likely you'll do any good but you can relieve suffering and may have some influence on a case's outcome (Verdict II: "an ailment with which I will contend" [Cases 4, 7, 21, 29]), and when not to touch (Verdict III: "an ailment not to be treated" [Cases 5, 6, 7, 8, 20, 22, 31, 33]). A sophisticated knowledge of the prognostic significance of symptoms and signs is necessary to form the above judgments and to order cases from less to more serious as one finds them in the text. Level of seriousness does not equate naively to outward bloodiness or tissue damage of an injury. Thus, a head injury or a cervical vertebral injury displaying no outward visibility can cause dysfunction and unfavorable demise (Cases 8, 31 and 33). Our ancient physician knew that a case might evolve in alternate ways, each demanding a different verdict depending on the presenting signs of the patient. For example, whether afebrile or febrile, with pallor or rubor, exhaustion or "ty" "a patient with tetanus or the patient with a wound to the temple if hemiplegic or with extruding brain beneath an intact integument may have poor or no recovery (Cases 7 and 8). Not only did the ancient physician know when or when not to intervene, he had the mission to alleviate suffering. For the tetanus patient with clamped jaw heat is to be applied locally "until he (the patient) is comfortable" and if pale and exhausted, he is fed a

draught of fruit thru a "wooden brace padded with linen and put into his mouth". Finally, when faced with a hopeless case our physician did not prolong suffering. If with "fever in his wound", "ruddy" face, "ty" and "head wound smelling of urine", a tetanus patient receives verdict III (Case 7).

Second, inspection by vision, palpation, elicitation of signs by maneuvers or commands formulate our treatise' neurologic exam. Conclusions of diagnostic import concerning the severity and location of injury and derivation of one of the three verdicts follow from the examination.

By visual means the physician notes the posture of the injured patient, the type and size of his wound, his bloodiness and general countenance. Postures of diagnostic importance include the fixed position of the neck and head, the chin lifted, which is seen in injuries to these areas. A patient with tetanus has a drooped posture of the head, thick saliva hanging from his lips or a tightly closed mouth with drawn eyebrows, a facies of weeping (Case 7). When there is pressure on the brain in a closed head injury the patient walks with "feeble turned over shuffling sole, toes contracted to the ball of the sole", fisted hand and "eye askew" (Case 8). With temporal bone perforated, the patient is speechless with "copious tears" unaware of posturing of his arms where "the backs of his hands approach his eyes as if to wipe them" (Case 20). Cervical vertebral injuries may cause an erected phallus with or without emissio seminis and distended abdomen, incontinence with dribbling of urine and paralysed limbs (Cases 31, 33). Finally, the patient with spinal (? thoracic) vertebral injury holds his legs preferentially flexed (Case 48) (Table 3).

Wound characteristics and bloodiness befit the type of injury. Soft tissue wounds are seen to have contracted lips (Cases 1 and 18) or to be gaping as in Cases 2, 3, 4, 5, 6, 7 and 29. Blood shot eyes are seen in injuries to the temporal bone (Cases 19 and 20) or cervical vertebra (Case 31). Blood drips from both nostrils (Case 6 and 20) or from the nostrils and ears in more serious head injuries (Cases 4, 5, 7, 8, 21 and 22). Most importantly one finds the visual description of the brain and its gyri in Case 6. Here it is depicted as the "corrugations which form in molten copper . . . like [wrinkles]. It is said: It is like ripples of pus."

Finally, visual cues denote the general countenance of the patient: skin color, pallor or rubor, sweatiness or appearance of exhaustion in the case of tetanus (Case 7). "Ty" may be seen in this patient but whether the term denotes tetanic spasms, convulsions or delirium is not certain for Breasted was unable to translate this term.

Table 3: Abnormal Postures Noted in Papyrus Smith

Case	Posture
3, 4, 5, 6, 8, 19, 20, 22, 29, 30, 32	Fixed neck, head and face
31, 33	Erected phallus
8	Adducted shoulder, turned over feeble shuffling sole with toes contracted to ball of sole and fisted hand
31, 33	Paralyzed arms and legs
48	Preferentially flexed legs
7	Drooping head with thick saliva dripping from lips
7	Clenched teeth, bound mouth, drawn eyebrows, facial expression of weeping
20	Arms coming up to face as if to wipe eyes with back of hands

Palpation is used to gage the depth of an injury. Does a wound reach to the bone and is the bone perforated (Gloss A, Case 3), split (Gloss A, Case 4) or smashed (Gloss A, Case 5)? Is the brain exposed, the meninges broken? Under the physician's fingertips the brain is felt to be "throbbing (and) fluttering like the weak place of an infant's crown before it becomes whole" (Case 6). Palpating, the physician feels and counts the pulse of the head, neck and extremities (Gloss A, Case 1). Feeling the pulse may indicate, if weak, a "feeble heart" as described in Case 7. When touching a wound of more serious prognosis, shuddering may be elicited. The patient with tetanus (Case 7) may feel clammy.

The ancient physician uses maneuvers to elicit signs in the examination. When, as in Case 22, the physician manipulates the patient's jaw to release blood from the nostrils and ears and at the same time cleans his ear out with a swab to which bone fragments adhere, a hopeless case of compound comminuted fracture of the temporal bone is diagnosed.

In addition to manipulation, the physician elicits signs by command. He may ask the patient to extend his legs (Case 48) or look at his shoulders and breast (Cases 3, 19, 30 and 32). Inability to do so may be observed or the patient may find it painful (Case 30). In Cases 20 and 22, the physician calls to the patient only to find him unresponsive and speechless. Speechlessness is an ominous prognostic sign in cases of head and neck injury in our text.

Pain is recognized by unknown means by the physician in Papyrus Smith; ones does not know if the patient verbalizes suffering or uses some other means to communicate his discomfort. Other signs emphasized in the examination elicited by unknown means are unawareness of the limbs (Cases 31 and 33) or of posturing as in Case 20. Speech may be painful to the patient with a temporal bone fracture (Case 21). How the physician of ancient Egypt sees and feels the exposed brain and ruptured meninges under intact tissue (Case 8) is not revealed in our treatise. Did the physician make an incision to expose the cranial contents?

Third, the above methods of examination and observed signs are followed by inductions of diagnosis the most noteworthy of which concern localization in the nervous system. In Case 8, the presence of a hemiplegic gait denotes despite lack of external evidence for injury that "something entering from outside presses on the side of him having the injury . . . which is in his skull." Likewise, the level of cervical vertebral injury correlates with the patient's signs. At a higher cervical level the patient's phallus is erected and emits semen, dribbles urine, his abdomen is distended and he is unaware of his arms or legs. At a lower cervical level, the injury produces all of the above without emissio seminis (Case 31). A vertebral sprain at the "spinal" level, as seen in Case 48, causes the patient to keep his legs flexed for comfort although he is able to move them.

In Case 33 alone the history is used to deduce the diagnosis. Here, the patient is quadriplegic and voiceless and has fallen head first. The physician concludes that the patient has a crushed vertebra impacted into its neighbor.

Finally, certain treatments and prognostic signs found in Papyrus Smith must be emphasized. Severe head injuries, including those with no external visibility, are treated by sitting as is done today to decrease intracranial pressure. In Case 4, the reader is told "his treatment is sitting. Make for him two supports of brick, until thou knowest that he has reached a

Table 4: Signs Seen in Cases of More Severe Nature Receiving Verdicts of II and III

Case	Sign
7	ty'
3, 7, 8	Abnormal posture
20, 31	Abnormal posture
32, 33, 48	Abnormal posture
7, 20	Inability to speak
22, 23	Inability to speak
4, 7, 20, 29	Shuddering
20, 31, 33	Unawareness
20	Hyperacusis
6, 8	Rupture of meningeal membrane and exposure of brain
4, 5, 6, 7	Blood from nostrils and ears
8, 20, 21, 22	Blood from nostrils and ears
20	Bone fragments in ear
19, 20, 31	Blood shot eyes
7	Rubor and fever in tetanus case

decisive point . . . Thou shouldst do likewise for every man whom thou findest having a split skull." In Cases 2 and 3 where bone injury is minimal, strips of linen or stitching are employed to approximate the two lips of a soft tissue wound. In Case 7, the physician applies heat to contracted jaw muscle to relax it and comfort the patient. When pale and exhausted the physician is instructed feed him through "a wooden brace put into his mouth . . . a draught of fruit" for he is a case of "undertake ([him]), do not desert ([him]), in view of exhaustion".

Prognosis is revealed indirectly through the verdict applied to a case or through making the comment "until thou knowest he has reached a decisive point" (Cases 4, 6, 7, 8 and 21). The latter implies uncertain guarded outcome and is defined in Gloss C, Case 4. Signs and symptoms seen in doubtful or hopeless cases are abnormal posture, unawareness of limbs, speechlessness, shuddering, hyperacusis, blood streaming from

nostrils and ears, bone fragments in the ear, "blood shot" eyes, rupture of the meninges with exposure of the brain and abnormal color, clamminess, fever or "ty'" (Table 4).

To conclude, this most remarkable Papyrus contains a philosophy of scientific interest, of neurologic practice to do no harm, to alleviate suffering and to act according to the prognostic and diagnostic significance of the patient's symptoms and signs. The idea of localization of function the central nervous system emerges in this text. Finally, the neurologist finds here the ground rules for his exam: the elicitation of signs through inspection, palpation, maneuvers and commands. By these our ancient physician was able to quantitate and qualitate level of responsiveness of the patient, of injury and remaining nervous functional reserve. Upon these the ethical grounds for his action is based.

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