

Neurosurgery in Egypt from ancient Egyptians to Modern Neurosurgery, African Perspective

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Abbreviations:

DNCh: Doctorate of Neurosurgery; PAANS: Pan African Association of Neuroscience; CAANS: Continental Association of Neurosurgical Societies; MENS: Middle East Neurosurgical Society; PANS: Pan Arab Neurosurgical Society; EJNS: Egyptian Journal of Neurosurgery; OCSCKE: Objective Structured Clinical Skills Examination

1 | ANCIENT EGYPTIAN NEUROSURGERY

Neurosurgery has been practiced for more than 12,000 years worldwide. Cranial and transnasal approaches to the brain have been practiced for variable religious, mystical, or therapeutic purposes in ancient civilizations of Africa and specifically in Egypt (1). Ancient Egyptian medicine is documented in the paintings on the walls of temples and numerous papyri (figure 1) (2-4).

Ancient Egyptian medicine dates to 3500 BC when Athotis (Hor-Aha), the second king of the first dynasty, was found to have in his tomb the first "Book of the Dead" that was later quoted with modifications till it reached "Practical Medicine and Anatomic Book" in Ani's papyrus (5, 6).



FIGURE 1. Ancient Egyptian Surgical tools, painting on KomOmbo temple wall, and display. Public domain picture.

The Rosetta stone was written in 198 BC during the Ptolemaic eras in hieroglyphic and demotic with ancient Greek translation. Bouchard discovered it in 1799. Its translation by Champollion in 1822 paved the way for understanding the hieroglyphic script on the walls of ancient Egyptian temples, on papyri, and for Egyptology. Several ancient medical papyri were later translated. The most renowned are Ebers and Edwin Smith's papyrus dating to 2900 BC.

Filler described how ancient Egyptian Mother Goddess "Isis" with the help of God "Toth" inventor of medicine; resurrected the God of the underworld "Osiris" repairing his damaged cervical spine, as the first reported neurosurgical operation in history more than 7000 years ago in Egypt (figure 2) (6). He believed that traction was successfully used to reduce Osiris' cervical spine injury. Ebers Papyrus 1550 BC described other neurosurgical treatments, including documented tumor resections.



FIGURE 2. The famous story of Isis and Osiris, The Djed column (temple wall painting). Public domain picture

The Edwin Smith papyrus (figure 3) covers anatomy, diagnosis, treatment, and prognosis of spinal injuries, among other lesions during 3000-1600 BC; it is a unique treatise containing the oldest known signs and symptoms of the spinal column and cord injuries. Based on a recent medical translation of Edwin Smith's papyrus, the documented rationale for spinal injuries in the papyrus still approximates state-of-the-art reasoning for modern clinical practice (7). The papyrus statement that some lesions cannot be treated can be treated surgically or medically, like the current triage of spinal injuries. Also, ancient Egyptian surgeons treated spinal injured patients.

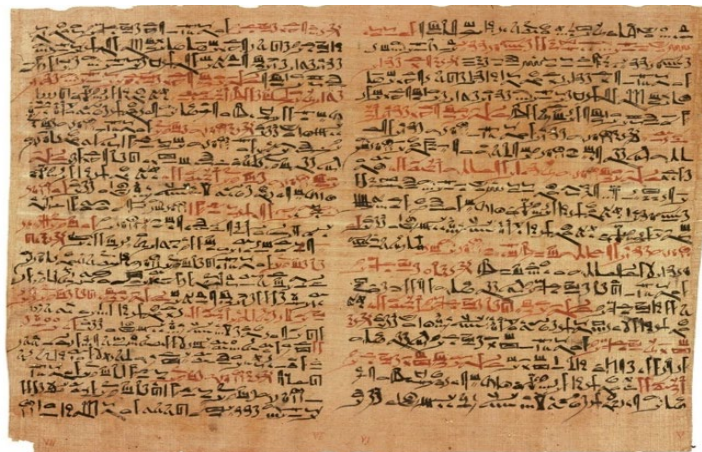


FIGURE 3. Edwin Smith's papyrus. Public domain picture.

Wilkins in 2009 described Edwin Smith's papyrus in detail; it is the oldest known complete surgical treatise describing cranial wounds, fractures, and the brain and correlates cerebral injuries to loss of movement. Hence, the papyrus proves that ancient Egyptians actively managed traumatic brain and spine injuries (8). They were also aware of the possible treatment failure like the current 21st-century neurosurgical literature.

Sanchez and Burrige believe that ancient Egyptians did not refrain from managing wounds in the context of skull base fractures, traumatic meningismus, skull perforations without neurological deficits, drowsiness, limited facial fractures, or depressed closed head injuries (9), describes a depressed comminuted skull fracture with hemiplegia, acknowledging the importance of otorrhagia and epistaxis in cranial base fractures. The papyrus' writer was aware that a fractured cervical spine might be associated with neck rigidity or conjugate eye deviation in addition to limb weakness. Treatment of hemiplegia was applied to only one half of the belly and not to the whole paralyzed side. King Amenophis Ikhnaton IV was hydrocephalic, and his physicians used helmets to control it.

Ancient Egyptians used local anesthesia for trephine, and the patients survived the interference, as evidenced by healed wounds over trephined skull performed 6000 years ago. Trephine was performed in a sitting position as was depicted in the drawings in the tomb of Bany Hassan (figure 4) (10). Georg Ebers in 1875 translated Ebers Papyrus which is 20,23 meters in length written in 108 columns of text during Amenophis' reign (1536 B.C.). The papyrus describes several surgical and neurosurgical problems, including spinal injuries and brain tumor management (11).

Modern technology enabled us to understand ancient Egyptian medicine through X-rays, CT scans, electron microscopy, and mass spectroscopy, in addition to forensic medicine of mummies' bones and organs.



FIGURE 4. Left: Ancient Egyptian Trephine in sitting position, Tomb of Many Hassan. Right: Ebers Papyrus. Public domain pictures

2 | ANCIENT EGYPTIAN MEDICINE INFLUENCE ON GRECO-ROMAN CIVILIZATION

Ancient Egyptian medicine influenced the occupying Persian civilization's medical practice from the fifth century B.C. till the Roman empire's supremacy through the Alexandria school of learning. The Greek Herodotus wrote about medicine in Alexandria when he visited Egypt in 440 BC. The father of medicine, Hippocrates (460 BC), invented the spinal bench used for spinal traction. He recognized medicine as distinct from theurgy and philosophy. Hippocrates, Herophilus, and Erasistratus were students at Alexandria school and transferred ancient Egyptian medical and surgical skills to the Greek.

Galen of Pergamon (124-204 AD) also attended the great medical school of Alexandria. He quoted much of Herophilus' anatomical dissection work. Through his ligation experiments proved that the brain is connected to muscles through nerves. Galen's teachings continued to influence medical theory and practice until the mid 17th century, spanning Byzantine and Arabic Islamic civilizations through the renaissance period to the 17th century.

3 | MEDIEVAL ISLAMIC EGYPTIAN MEDICINE (800-1300 AD)

Since human anatomic dissections were forbidden in Christianity and Islam, most developments during the medieval ages were translations. The Syrian Christian Hunayn Ibn Ishaq (Circa 830- 870) translated 129 works of Galen. Kitab ilaAgloocan fi ShifaAlamrad is exposed in the library of Ibn Sina Academy of Medieval Medicine and Science as a masterpiece of all works of Galen. It is a part of the Alexandrian compendium of Galen's work (12).

Arabic and Islamic scholars such as Rhazes (Muhammed Ibn Zakariya Razi 865-925 AC) continued to critically study Galenic writings in his book "Doubts about Galen" or "Shukuk' ala Alinutor" (12). Arab researchers Avenzoar, Abulcasis, and Avicenna, the great physician, all studied and worked for Alexandria school.

4 | RENAISSANCE AND EGYPTIAN MEDICINE (1300-1900 A.D.)

Egypt was a Welaya under the Byzantine and then the Othman empire. During that regression time, core science and medical knowledge moved from Baghdad and Alexandria to Europe in Naples, Peza, Salerno, and Montpellier and later to Constantinople (Istanbul). The modern history of Egyptian medical education began in 1827 under the French occupation. As a military teaching hospital in Abu Zaabal, to the northeast of Cairo, was established as the first Medical school in Egypt. The medical school was later transferred to Kasr Al-Ainy palace under Dr. Clot Bey in 1837 (13). Kasr El-Einy included a midwifery school from the 1820s to 1922 (i.e., the end of the British occupation).

5 | EGYPTIAN MEDICAL EXPERIENCE 1900-1950 A.D. / BIRTH OF MODERN EGYPTIAN NEUROSURGERY 1950 ONWARDS

The second medical school was established 115 years later in 1942, at Alexandria; the third was Ain Shams, Cairo's east in 1947. Here, neurosurgery was a subspecialty practice of surgery (1). The fourth Egyptian medical school was established at Assiut in Upper Egypt in 1960. Several medical schools have been established since then, primarily dependent on those first four schools for faculty and curricula. Neurosurgery was in its childhood at these schools, being sporadically practiced at surgical wards principally for managing head, spine, or nerve injuries (13-15)

6 | EGYPTIAN NEUROSURGERY PIONEERS

AbouZikry was trained in neurosurgery at Mayo and Lahey clinic for three months in 1949. He performed few neurosurgical operations, but quite Neurosurgery for poor social acceptance of results. Samuel Boctor was well trained in Neurosurgery in England and gained his FRCS in 1954. Boctor managed at first an 8-bed neurosurgical ward in 1956 in Alexandria Main University Hospital surgery department. The ward was later expanded to 53 beds on the 4th floor of the new hospital extension. Simultaneously, Osman Serour (resident of AbouZikry) continued to perform successful neurosurgery in Cairo University Kasr El-Einy hospital with his registrar I. El-Shafei. Major Ezzat Tawfeek, trained at Karolinska and the U.K., engineered creating Neurosurgery in the military hospitals in the mid-1950s, followed by General Sayed El-Gendy in 1967. IbrahiemHegazy performed neurosurgical operations in the Ministry of health and Ain Shams University during the 1950s, followed by A. El-Banhawy, who trained in Germany and the U.K. There were only seven qualified neurosurgeons in 4 neurosurgery centers in Egypt up to 1960 (13-16) (figure 5). El-Nadi and a. El-Deeb pioneered Neuroradiology in Cairo and Alexandria. Kamal Kamel and S. El-Morshedi were the pioneer neuropathologists in Egypt. Rapid expansion followed in succeeding years.



FIGURE 4. First Board of ESNS 1967

From the 1960s, A. Mussa started neurosurgery in Assuit, S. Ezat started at El-Azhar and H.Gawiesh in Zagazig, A. Nabil in Tanta, and N. Hasan in Suez Canal universities. Currently, there are more than 100 public, private, and military specialized Neurosurgery centers in Egypt. Major development occurred when Herbert Olivecrona was appointed at El-Maadi military hospital with Sayed El-Gendi during the mid-1960s to establish a modern military Neurosurgery center. They were joined by M. Salama, A. El-Shawarby, G. Azab, and others. Support from Neuroradiology, neuro-anaesthesia, and neuropathology was pivotal in further progress. The first C.T. was introduced in 1975, the first MRI in 1985, and the first open MRI in 1995. Radiosurgery was started in Mustafa Kamel Alexandria Military Hospital with a linear accelerator and later at Naser institute with a Gamma knife machine. Multiple modern Gamma Knife machines are currently operating in Egypt. Countless neuroradiology centers are spread all over Egypt, including modern top-of-the-line neuro-interventional suites. The first Egyptian neurosurgery specialty degree was granted from the University of Alexandria as a Doctorate of Neurosurgery (DNCh) in 1982 to A. Eissa and I. Ramadan. Other universities later were authorized to grant Doctorate degrees in Neurosurgery.

7 | ORGANIZED NEUROSURGERY

In 1959, the Middle East Neurosurgical Society was established, Sorour was one of the founding members, together with S.Boctor and F. Hadad. He became the president for two consecutive years. Egyptian doctors joined this society as individuals.

The Egyptian Society of Neurological Surgeons was founded in 1967 during a Maadi Military Hospital meeting. Prof. Boctor was appointed president, Dr. Sorour secretary, and Dr. Sayed El Gindi treasurer. They were joined by seven qualified neurosurgeons and 30 doctors in training. The number of neurosurgeons in society is now more than 1000. The Egyptian Society of Neurological Surgeons joined the World Federation of Neurosurgical Societies in 1969, with Dr. Boctor and Sorour as delegates.

Egyptian neurosurgeons have participated in numerous international conferences with many publications. In 1993, El Gindi was elected as the second vice president of the World Federation of Neurosurgical Societies and an honorary president in 1997. El Banhawy was one of the founding members of the neurotrauma committee. Several Egyptian neurosurgeons are on the editorial boards and serve as reviewers of international neurosurgical publications.

Several Egyptian neurosurgeons are linked to the joint neurological science societies' foundation in continental African and regional Arab countries. All pioneer Egyptian neurosurgeons held leading posts in continental, Arab, and Middle Eastern neurosurgical societies as well as continental Africa bodies such as the neurosurgical section of PAANS (Pan African Association of Neuroscience) (figure 6). Sorour was the president of PAANS. El Gindi held the chairmanship of the Pan Arab Society of Neurological Sciences' neurosurgical section and its representative in the European Association of Neurosurgical Societies.

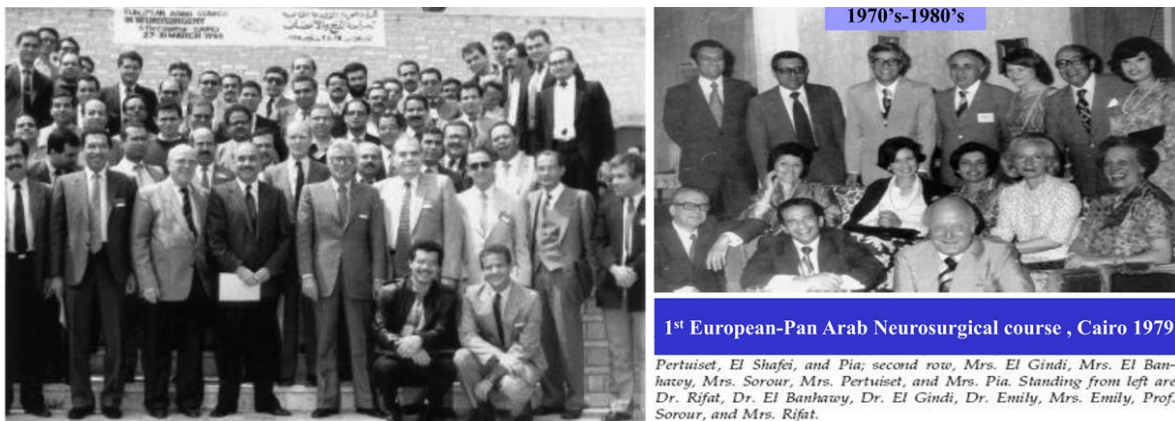


FIGURE 6. Left: European Pan Arab Neurosurgical Course, Cairo, 1981. Right: First European Pan Arab Neurosurgical Course, Cairo, 1979.

El-Hakim, M and El-Fiki are founding members of the African Federation of Neurosurgery (AFNS) and the Continental Association of Neurosurgical Societies (CAANS) as well as honorary presidents (figure 7). N. El-Ghandour is the current secretary of CAANS and the editor in chief of the Pan Arab Journal of Neurosurgery. S. Ezzat is the president of the Middle East Neurosurgical Society (MENS). H. El-Husieny and A. El-Shawarby recently served as presidents of the Pan Arab Neurosurgical Society (PANS). Diverse Neurosurgery subspecialty societies are dedicated, such as the Egyptian skull base society, and the Egyptian scoliosis society, or the Egyptian Spine Society with fellow orthopedic surgeons. MENA-SINO is the endovascular society, and a pediatric African subsection is about to be

announced ESNS and CAANS partnership. Special sections for these subspecialties are operational in the ESNS and the section for functional neurosurgery.

Several Egyptian graduate Neurosurgeons are active in international neurosurgical societies; they actively participated in yearly meetings. Many joins in neurosurgical educational activities in Morocco, South Africa, Algeria, Tanzania, Yamen and Gulf Staes, and Europe and the USA (17,18). Egyptian neurosurgeons have many YouTube educational and promotional videos, have been instrumental in establishing neurosurgical departments in Arab countries (especially Saudi Arabia, Lybia, Kuwait, and other Gulf states), such as Dr. Mahdi, A.W. Ibrahim, and A. Ammar.



FIGURE 7. Founding members AFNS

Scientific activity of ESNS included annual international meeting workshops in recent trends, yearly summer meetings, annual departmental meetings, current topics update meetings, special section meetings, and joint meetings with ENT, Endocrinology, Orthopedics, Faciomaxillary, Neurology, Pediatrics, Critical care medicine, radiology. During the current Covid-19 pandemic, social distancing weekly online webinars with international and national and leaders in every neurosurgical sub-specialty occurs with high attendance rates (figure 8). Egyptian Journal of Neurosurgery (EJNS) is the official journal of ESNS. The internationally refereed journal is published quarterly in electronic and hard copy formats.

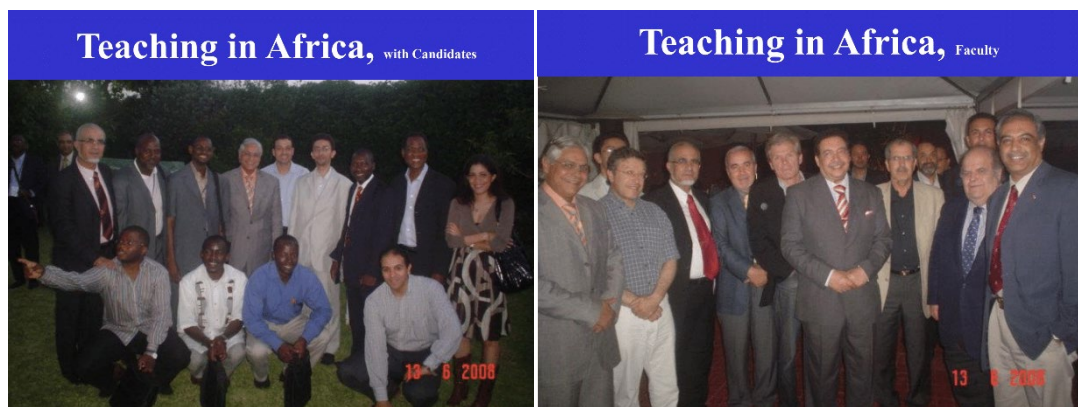


FIGURE 8. Leaders Teaching in Africa

8 | CURRENT NEUROSURGICAL PRACTICE IN EGYPT

Technological and social progress helped neurosurgery to progress as a surgical subspecialty in Egypt rapidly. The current Egyptian health care system provides neurosurgery service through six main venues:

1. The government provides free treatment through existing university teaching hospitals.
2. The National Health Insurance Service serves the insured workers through an expanding system of National Health

- Insurance hospitals; that system currently covers all public school and public university students towards a minimal yearly fee. All preschool children are covered for free.
3. Military and police hospitals restricted to military or police service personnel and their dependents and privately paying civilians or contracting bodies.
 4. Ministry of Health hospitals and specialized national treatment institutes (like Naser Institute)
 5. Charity funds hospitals.
 6. Privately-owned clinics and hospitals provide paid services for those who can afford it.

Most patients are treated in university-affiliated and teaching hospitals where Neurosurgery residency training programs exist. In these hospitals, centers of excellence are established for treating patients with complex cranial, skull base, and cerebrovascular pathologies, advanced spinal, peripheral nerve lesions, and trauma and pediatric problems. Seven radiosurgery units are available, one linear accelerator and six gamma knife machines. The first was introduced in 2001 at Naser Institute in collaboration with Karolinska institute. It is currently updated with the recent version under the Egyptian team. Endovascular surgery is widely available in university teaching, military, ministry of health, and many private hospitals. Advanced spine surgery is widely available. Neurosurgeons perform most spine surgeries; however, well-trained spine orthopedic surgeons have their share. Navigators and ultrasonic aspirators, and ultrasonic guidance are standard equipment in most operating rooms. Most complex surgeries are performed in university teaching hospitals (18).

The schedule of Egyptian neurosurgeons is busy. The university staff and consultants' time is spent in outpatient and clinical rounds in addition to operating times. Fellows and residents work under consultants and professors' supervisors, despite a marked increase in the number of ICU beds to compensate for the increasing complexity of procedures performed. The time allowed for research is limited, in my opinion, in addition to the lack of adequate clerical supporting staff and editorial offices in most university settings (19).

It is tough to get research funds except working in a research institute seeking a Neurosurgery specialty degree. However, scholarships are available for several African and Arab students through several channels. International students seeking Neurosurgery training or degrees in Egypt must contact the Egyptian Agency for Partnership and Development, Ministry of Foreign Affairs, or the Egyptian Embassy's educational attaches in their own countries. Foreign Muslim students may find it easier to apply at Al-Azhar University for a scholarship (20).

Different postdoctoral training programs are available in Egypt. The first and most common is applying for a Doctorate of Neurosurgery in a university or military academy setting. The residency training program is 3-5 years (master of Neurosurgery degree) followed by another five years (Doctorate of Neurosurgery DNCh) (21). By the end of the training, a board of senior examiners grades the applicants via clinical oral and written exams in Neurosurgery, surgical neuroanatomy, neuropathology, and Neuroradiology. The exam questions are Objective Structured Clinical Skills Examination (OSCKE), MCQ, long and short essays and commentaries with short and long clinical cases, and operative sessions (22). Either credit hour and thesis system or regular thesis and training systems are mandatory for both degrees. This system is most applied to university-affiliated students. Students on the credit hour system defend their thesis after completing their credit hours. The second program is the Egyptian fellowship of Neurosurgery for five years after obtaining a master of Neurosurgery degree. This program is a training program like the British FRCS (N.S.) program. This program is suitable for the Ministry of Health and private physicians. Graduates of both systems must have licensure from the Egyptian Medical Syndicate (23-27)

The WFNS sponsors the Africa 100 program initiated by Professor Majid Samii in 2011. Egypt was able to fund some candidates despite the volatile political situation in the following years. Currently, more than 20 African neurosurgery trainees attend different Egyptian neurosurgical training centers. Ignatius Esene, the first graduate of the Africa 100 program, Egyptian-trained African neurosurgeon, is currently the WFNS Young Neurosurgeons committee chair with an outstanding academic output. Dr. Japhit was called back to Tanzania before finishing his thesis because of a shortage in his home department.

Egyptian Neurosurgery is committed to bolstering the capacity of neighboring Arab and African countries. African Neurosurgery still has a long way to go. It needs the support of international and local bodies (21-23). The work of the first generation is paying off thanks to the effort of young African neurosurgeons (24). The Egyptian neurosurgical society promotes excellence in performance and education reflected by the enthusiasm of the highly motivated new generations.

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