The evolution of military neurosurgery in the Turkish army

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The history of neurosurgery in the Turkish army is not long and complex. Neurosurgery was first practiced in the Ottoman army by Cemil Pasha, who was a general surgeon. After the fall of the Ottoman Empire, the Republic of Turkey was established and modern neurosurgical procedures were applied at the Gulhane Military Medical Academy (GMMA). Maj. Zinnur Rollas, M.D., was the founder of the Department of Neurosurgery at GMMA in 1957. A modern neurosurgical program and school was established in 1965 by Col. Hamit Ziya Gokalp, M.D., who completed his residency training in the US. Today, 26 military neurosurgeons are on active duty in 11 military hospitals in Turkey. All of these neurosurgeons work in modern clinics and operating theaters. In this paper, military neurosurgery in the Turkish army is reported in 3 parts: 1) the history of neurosurgery in the Turkish military, 2) the Department of Neurosurgery at the GMMA, and 3) the duties of a military neurosurgeon in the Turkish army.

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**Military** neurosurgery has a very long and proud tradition of service and innovation that comes to the forefront during periods of peace and war. Modern military surgery in the Ottoman army began with the establishment of Military Medical School in 1827. This school educated and trained the medical students in the European style. This was an evidence-based and secular education without the influence of traditions and religious rules. The history of military neurosurgery in the Ottoman army began with Cemil Pasha (Topuzlu) who was the general surgeon. This history can be divided into 3 consecutive periods: 1) 1890–1908, 2) 1909–1957, and 3) 1957–2009.

**History of Neurosurgery in the Turkish Military 1890–1908**

After the 17th century, Ottoman medical science began to turn to the West, although until the 19th century it may still be regarded mainly as the continuation of Islamic medicine, which refers to medicine developed in the medieval Islamic civilization and written in Arabic. This medical practice was based on Islamic traditions and religious rules. In the 19th century there were closer medical relations of Turkey with Italy, Austria, and France. Beginning in the second quarter of the 19th century, increasing numbers of physicians from European countries were invited to teach medicine or to be employed in the palace of the Ottoman Emperor or in royal medical institutions. The latter half of the 19th century is considered the formative period of what we now refer to as the era of modern surgical practice. In this era, although probably the most demanding of all the surgical specialties, neurosurgery was nevertheless one of the first specialties to emerge. The first period of military neurosurgery in the Turkish army began with Cemil Pasha. He graduated from military medical school in 1886 as a captain. In 1887, he was sent to Paris for further education and training in surgery. He worked as a resident under Professor Jules Pean, who was France’s most famous surgeon at that time. He also worked with other famous surgeons Dr. Verneuil, Dr. Tillaux, and Dr. Guyon before returning to Turkey in 1890 where he became an associate professor in surgery at the Military Medical School in the following year. In 1894, Dr. Pasha became a clinical professor in surgery and the chair of the Department of Surgery. While the developments of surgical techniques, antisepsis, and anesthesia occurred in the Western world, Cemil Pasha was sparking a new era in the history of military surgery in the Ottoman Empire. Starting in 1891, he operated on many patients with brain abscesses, spinal tuberculosis, and traumatic and neoplastic cranial and spinal disorders. He published the list of his cases in *La Gazette Medicale D’Orient* and later in his monograph, *Mémoires et Observations Médicales* in 1905. He published the full texts of operative notes recorded during his years at Military Medical School between 1893 and 1897. He became a general in the Ottoman army in 1905 and then resigned from the army in 1909. Dr. Pasha was
one of the pioneers and the founder of contemporary surgery in the Ottoman Empire. His principles became the landmarks of modern surgery in the Turkish Republic.

1909–1957

The next period in Turkish military neurosurgery began with the neurosurgical operations that were performed at GMMA by Dr. Julius Wieting and Col. Mim Kemal Öke. The GMMA was established in 1898 as a training hospital of the Military Medical School. After constitutional rule was reinstated in 1908, a major reform initiative was started in the Ottoman army. From 1898 to 1914, the German physicians Robert Rieder and Franz Deycke, and following them, Julius Wieting, were the doctors who played a great role in the development of medical education in the GMMA and military hospitals. In 1908, Ottoman physicians were sent to Germany for specialization. In the same year, Dr. Wieting conducted the first Foerster operation, which was the surgical treatment of spastic paralyses by sectioning of the posterior nerve roots, at GMMA. World War I was a disastrous event for the Ottoman Empire. The Turkish army fought against many countries over a large geographical area. During this war, the medical branch of the Ottoman army consisted of doctors, surgeons, veterinarians, pharmacists, dentists, chemists, wound-dressers, and nurses. Armies, corps, and divisions had medical units and the main centers of healthcare were the Red Crescent hospitals, field hospitals, and mobile hospitals (Fig. 1). There were no special facilities for the treatment of head injuries until it was recognized that early operations and the avoidance of slow and distressing evacuations resulted in significantly better surgical outcomes with less infection rates of the wounds. Hospitals located a few miles from the front were therefore designated for the reception of soldiers with head wounds, and postoperative cases remained there for 2 or 3 weeks before being released. There were very few surgeons who were experienced in the treatment of cranial and spinal wounds during the war; however, the need for a thorough exploration and the removal of all bone fragments was slowly appreciated, and meticulous primary closure of the wound prevented herniation of brain into the skull defect and scalp wound. The postoperative mortality rate was approximately 50% but many patients died before reaching a surgeon.

By the end of World War I, Dr. Wieting returned to Germany, and Col. Professor Mim Kemal Öke (1884–1955) became the head of the Department of Surgery in 1918. But the wars were not over for the Turkish army. The Turkish War of Independence is the common name of the multifront political and military struggles that occurred between 1920 and 1922 against the victorious countries of World War I in an effort to protect the Turkish nation and help it flourish. Despite the deficiencies in terms of medical equipment and organization, the humble efforts and endeavors of the military surgeons enabled the Turkish army to receive proper medical care. The Turkish War of Independence stimulated the progress of neurosurgery and taught the surgeon innumerable lessons, which were subsequently applied in civilian practice. Military surgeons were faced with the need to treat large numbers of contaminated wounds in improvised medical facilities, and they performed necrotic tissue debridement; the operations were performed mostly during infectious conditions.

Before 1923, few general surgeons performed neurosurgical procedures at the GMMA, as a result of the influence of European surgeons, especially those from France, Germany, and Switzerland. Among them, Col. Mim Kemal Öke was an especially brilliant surgeon. He wrote the first Turkish brain surgery textbook *Dimağ ve Cümcüme*.
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Among Turkish surgeons who visited western neurosurgical centers, Capt. Mustafa Sakarya was the first to visit the US. He was trained in general surgery, and was then sent to the US for additional neurosurgical training in 1938. Capt. Sakarya was the fellow of Dr. Walter E. Dandy and worked for 9 months at Johns Hopkins Hospital. He wrote his daily observations, operation schedules, information regarding illustrative cases, and some theoretical reviews in his notebook. Capt. Sakarya performed a limited number of neurosurgical procedures for meningioma and neurotrauma. However, he could not work effectively as a neurosurgeon because he was sent to local army hospitals as a general surgeon, as well as to Afghanistan. Between 1940 and 1950, Professors Recai Erguder and Naci Ayral performed many neurosurgical procedures in the Department of Surgery at GMMA. During the Korean War, they treated many patients with cranial and spinal injuries. They removed foreign bodies from the cranium and performed laminectomies for spinal traumas and infections. There were great advances in technique and equipment in the years between the Turkish War of Independence and the Korean War. The mortality rate decreased even more during the Korean War, primarily because surgical personnel were present in forward military hospitals and antibiotics were largely introduced. However, the operative approach was largely the same, that of radical debridement. But neurosurgery remained a very small specialty practiced by men who also had to care for general cases. The main precepts concerned segregation of cranial and spinal injuries, adaptability, and early neurosurgical treatment, including the total removal of bone fragments and decompression of the neural tissues under direct vision, followed by primary wound closure. These requirements remain for the most part today.

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Cyprus has long been a source of conflict in Turkish-
Greek relations. In 1974 when a military coup in the name of union with Greece took place, the Turkish Peace Operation partitioned the island. Helicopters were used in the casualty evacuation during the Cyprus Peace Operation. Once the principles of military surgery were relearned in this operation and applied to modern warfare, mortality and morbidity were reduced to levels previously unattainable. Surgical specialization and teamwork reached new heights with the creation of units to deal with the special problems of injuries to different parts of the body. But the most revolutionary change was in the approach to wounded soldiers brought about by the use of the helicopter for transportation (Fig. 3). Rapid evacuation of severely injured soldiers from the point of injury provides extreme challenges for neurosurgical teams. Military neurosurgery in the Turkish armed forces, whose capability of diagnosis and treatment continuously increased, proved its power and capabilities once more during the Cyprus Peace Operation. After this war, advances came rapidly, with the initial emphasis on microsurgery. The scope of neurosurgery was further expanded by the introduction of the operating microscope. This introduction brought the benefit of magnification, particularly to neurosurgery. The laboratory of microsurgery was established in the Department of Neurosurgery by Col. Erdener Timurkaynak, M.D., in 1984.18 This laboratory trained all neurosurgeons in the Turkish army in microsurgery and microsurgical techniques. Today, 26 military neurosurgeons are on active duty in 11 military hospitals in Turkey. All of these neurosurgeons work in modern clinics and operating theaters. The GMMA is the main education center of military neurosurgeons in Turkey.

**Department of Neurosurgery at GMMA**

The Department of Neurosurgery at GMMA was established in 1957 by Maj. H. Zinnur Rollas, M.D., and is an independent department. The residency program began in 1965 and it has become a nationally recognized center of excellence (Fig. 4). The GMMA Neurosurgery Residency Program is the only neurosurgery training site in the Turkish army. Residency training in neurosurgery at the GMMA is 5 years and the program accepts 1 resident per year. Currently, there are 5 residents and 3 of them are military medical school graduates. The goal of the residency program is to train neurosurgeons who will become leaders in military and academic neurosurgery. The program has a long and proud tradition of training surgeons who have made major clinical and scientific contributions to the field of neurosurgery in Turkey. The philosophy of the program is to expose residents to a large number of high-quality cases spanning the entire range of neurosurgery. As training progresses, residents gain more responsibility in performing surgery and in managing cases. After finishing their residencies, they work only in military hospitals. But military neurosurgeons can work in civilian hospitals after finishing their obligatory military duty, which is 15 years after military medical school. In the Turkish army, all military officers are paid approximately the same for the rank and time in service. Although there is a wide pay gap between the civilian and military physicians in Turkey, it is not difficult to retain neurosurgeons because of the obligatory duty. Most of the military neurosurgeons make their career in the military, especially in GMMA.

The faculty of GMMA specializes in the surgical treatment of adults and children with diseases and disorders related to the brain, spinal cord, and peripheral ner-
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Subspecialization among the attending staff fosters broad patient referrals requiring a wide range of surgeries. Nationally renowned areas of expertise exist in neurotrauma, brain tumors, cerebrovascular disorders, pituitary disorders, spinal reconstruction, epilepsy surgery, and neuroendoscopy. The neurosurgeons have expertise in the latest diagnostic and surgical techniques including intraoperative MR imaging and CT, neuroendoscopy, and stereotactic and computer-assisted image-guided neurosurgery. The objectives of the Department of Neurosurgery are to develop special techniques and expertise in neurosurgical procedures and standardize the practice in the Turkish army; to develop the quality and quantity of human resources in the field of neurosurgery for military hospitals; to develop interhospital coordination for activating research/projects such as head trauma, spinal trauma, spine surgery, neurooncology, and neurovascular disorders; to encourage physicians to undertake courses on microsurgery as a part of their training curriculum; and to provide orientation training for neurosurgeons from various medical institutions in Turkey. Most of the patients are from the Turkish army. In addition, approximately 5% of the inpatients are drawn from the civilian population. The Department of Neurosurgery also provides quality emergency and trauma care. The casualty and emergency services are run 24 hours a day, staffed by junior and senior residents and a member of the faculty. Outpatient services for non-emergency cases operate daily from 8 a.m. to 5 p.m. On average about 100 new and returning patients are cared for each day in these services.

To accommodate the patients for admission and surgery there are a total of 56 beds available. There is also a separate 8-bed facility for postoperative patients. A modern fully equipped intensive care facility is available and can treat 16 neurosurgical patients at a time who require respiratory and critical care. This facility also has modern ventilators, monitors, and equipment to monitor intracranial pressure in each patient in all beds, with an ideal nursing staff ratio. Additionally, there is 1 fully equipped operating theater for elective operations, and 1 theater reserved 24 hours a day (every day) only for emergencies. The latter theater has specialized apparatuses and equipment required to deliver quality neurosurgical care (Fig. 5). The list of various instruments includes modern operating microscopes, intraoperative MR imaging for brain surgery, intraoperative CT for spine surgery, intraoperative ultrasonography, intraoperative electrophysiological monitoring for spine and peripheral nerve surgery, fluoroscopy, neuronavigation, neuroendoscopy and skull base instruments, stereotactic apparatus, and an ultrasonic surgical aspirator. Facilities and expertise for the following subspecialties are available in the department: cerebrovascular surgery, cranial base surgery, spinal reconstructive instrumentation, neuroendoscopic procedures, stereotactic procedures, epilepsy surgery, pediatric neurosurgery, and peripheral nerve surgery. Most of the above-mentioned clinical areas have a direct bearing on enhancing patient care and adapting to the particular and specific needs of our soldiers. Thus, the focus of clinical studies is not only to concentrate on various neurosurgical conditions but also to emphasize those conditions common in our army such as landmine explosions, cranio-cerebral gunshot injuries, spinal injuries, and peripheral nerve injuries due to missile wounds. In addition, we have 1 microsurgical education laboratory that has been developed to perform neurosurgical anatomical dissections, to learn skull base anatomy and other approaches, to train residents and other military surgeons in various microsurgical techniques, to use the drills and microscope for bone and brain dissections, and to perform animal studies. The laboratory has 4 training stations, an operating microscope, and microsurgical instruments.

Duties of the Military Neurosurgeon in the Turkish Army

Neurosurgeons are a small fraction of the health care providers in the Turkish army, but they are distinguished by the unique services that they provide and their unwavering commitment to those they serve. Military neurosurgery in the Turkish army exists as a distinct entity and is not just the practice of neurosurgery in a uniformed service. While there are specific individual operational requirements for all 3 services (Army, Navy, and Air Force), military neurosurgical care is delivered across the 3 branches by individuals, regular and reserve, of any one of the armed forces—for example, army or air force neurosurgeons on land operations.

Military neurosurgery differs from civilian neurosurgery from many points of view. The duties of a military neurosurgeon are too numerous to be mentioned and are mostly suggested by circumstances of war. With slight differences, the duties of the military neurosurgeon during peacetime are almost identical to those of a civilian neurosurgeon, while the duties during war are unique, and therefore deserve a special and closer consideration. Spinal disorders in young recruits, skull and brain tumors, and closed head traumas are the most frequent problems encountered by a military neurosurgeon in the Turkish army during peacetime. Low-back pain is a common complaint of young recruits during basic military training. Low-back pain has a direct (increased medical care) and indirect (loss of workdays) impact on the training of soldiers.

Upon the eve of a battle or an operation, the military neurosurgeon has much to do to prepare the facilities for the treatment of the wounded. The military neurosurgeon should examine the instruments and stores, and should reassure himself or herself that nothing that will be required for the care of wounded has been omitted or forgotten. The military neurosurgeon should also examine the means of transporting the wounded from the place where they are injured to the field infirmary. All the wounded must undergo a thorough examination by the neurosurgeon and all necessary operations must be performed as soon as possible under optimum medical conditions.

Injuries have and will continue to become more complex in military neurosurgery. As we increasingly confront the threat of terrorism and low-intensity conflicts, the battlefield and the enemies are often less well defined. We must anticipate less traditional threats. Military neu-
rosurgeon need to be highly trained and to have experience with complex surgery and trauma. Today, bayonets and lower velocity slugs have been replaced by nuclear, biological, and chemical weapons, and computerized ordnance delivery systems. Cranioencebral trauma is still common during military conflicts.\(^1\),\(^6\),\(^8\),\(^14\) Today, with advances in head armor, resuscitation in the battlefield, rapid evacuation, and surgical treatment in the operating theater, patients with traumatic brain injuries have an increased chance of survival, but the majority of patients suffer a penetrating head injury from an explosive blast. Now, landmine explosions cause most of the injuries in terrorist actions and also pose a public health risk.\(^6\),\(^15\) Additionally, warfare also causes a large number of peripheral nerve injuries.\(^1\),\(^13\),\(^14\) Despite the considerable progress in diagnosis and treatment of peripheral nerve injuries, morbidity after such injuries is still unacceptably high. This is especially important for war injuries that are frequently associated with severe local damage of soft tissues, blood vessels, and bones. Military grade weaponry has resulted in the highest concentration of peripheral nervous system injuries to the Turkish army since World War I. Injuries that were previously considered expectant are now salvageable secondary to rapid initial interventions coupled with persistent control of secondary injury.

Currently, the practice of military neurosurgery in the Turkish army must respond to the new demands and the neurosurgeons must be adequately resourced if lives are to be saved. Preparations are made to combat and respond to a wide variety of terrorist tools, including explosives and weapons of mass destruction. To meet this challenge, military neurosurgery has engaged not only the technological advances well known to the 21st century neurosurgeon, but has also continued to develop and perfect methods to care for the soldier who may be injured in a firefight and must be transported from a remote location. During relatively peaceful times, it is easy for those outside the military to overlook the requirements for providing a surgical capability to the armed forces. However, it is imperative to have a well-trained, competent neurosurgical cadre to provide high-level surgical care for operations. These operations can be of unexpected intensity, requiring the surgical teams to be permanently at a high state of readiness.

Currently, military neurosurgeons are treating casualties of terrorist violence against the Turkish army.\(^15\),\(^16\) Most of these casualties have cranial and spinal injuries due to landmine explosions prepared by terrorists near the Iraq border and the patients are primarily treated in local military hospitals. Turkish military neurosurgeons are not deployed and not involved with conflicts today. But, in the past, they were involved in the Cyprus Peace Operation in 1974. Turkish neurosurgeons have not been sent to Kosovo, Iraq, or Afghanistan.

There are some disadvantages to being a military neurosurgeon in the Turkish army. The most prominent disadvantage is the pay gap between civilian and military neurosurgeons, followed by low numbers of patients and operations per neurosurgeon when compared with civilian neurosurgeons. It is difficult to perform complex surgeries such as those for brain tumors, intracranial aneurysms, and children in military hospitals because of lack of support infrastructure and technology. Low case volume is a major problem for the maintenance of competency in neurosurgery.

**Conclusions**

Injuries of the nervous system are common during military operations. Currently, blasts and fragmentation from explosive devices are the most common mechanisms of injury for troops serving on the battlefield. Today, military neurosurgeons are proud to serve the troops and help them to better heal both neurologically and emotionally, provide a faster return to normal life, and improve their quality of life after injury by exhibiting immense skill, compassion, and professionalism, continually upholding the core values of the Turkish army.

**Disclosure**

The author reports no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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