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History Elements of Campaign Surgery through the Ages

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Abstract

Human history is usually confused with conflagrations history. Since ancient times, wars have led to deaths and injuries, and this has been considered as a normal situation. What has evolved over time was the value of the human life for the army and society in general. Aid to the injured has evolved from comradely aid to the formation of specialized structures, in good part due to the increased 'value' of the soldier, through the investment in his preparation. Only recently, a soldier is regarded as a being with intrinsic value for society, military and family, who is performing a social service, and to whom society owes to protect and do everything it can to save his life or to mitigate the effects of his injuries.

Keywords History of Surgery; Military Medicine; Campaign Surgery

Campaign surgery is a specialty of surgery, adapted to the particular conditions imposed by the needs of the battlefield. The use of increasing military forces, the increasing destructive power of weapons from one era to the next one, as well as conducting warfare on more extended areas with high intensity, have led to the development of military medicine and especially campaign surgery. The basic principles of the surgery remain the same as for any specialty, but their level is continuously enriched by the accumulated experience. Campaign surgery has always been a rich opportunity to purchase precious assets, with the consequence of improving surgical techniques and therapeutic concepts with further application in civil life.

Campaign surgery has a number of particularities arising from its nature. When executing surgery on the battlefield we must primarily face the large number of injured soldiers with wounds and injuries that occur in a short time, the so-called "epidemic trauma", this was how it was called by Pirogov [1]. War surgery is a collective surgery, which applies in several stages, to a great mass of wounded soldiers aiming at saving the soldiers' lives and recovering the troops.

Another feature of the campaign surgery consists of the extremely difficult working conditions, conditions that are almost always aggravated by continuous fluctuation of the combat situation: varied health losses, always larger than initially estimated, lack of security, lack of comfort and silence, activity in leaps and continuous surprises, impossibility of subsequent continuous monitoring of the wounded and not least, the loss of medical personnel. Improving these conditions can be obtained through a judicious organization of the surgical activity, rapid evacuation of the wounded and their triage according to the category of emergency of their injuries. The history of medicine is closely linked to the military history of human civilization. Since ancient times, the complexity and the way medical health care was organized influenced the fate of the wounded and therefore the fate of the entire conflict. Medical attitude towards the wounded varied depending on the historical moment.

Ancient Times

In ancient times, the first written mention of the pathology of war was discovered by Edwin Smith in 1862, in an Egyptian papyrus dating from 1550 BC. 48 cases of trauma are presented in relation to the topographic regions, on cranio-caudal direction, with objective clinical description, as well as the diagnosis, treatment and prognosis. Most of the treatments were conservative, eventually with the use of burns, but without use of the "knife". In that time, the science of healing was "sent by the gods", which explains the close relation of the medical practice with the religious one. Only in the 5th century BC the first "specializations" on various diseases emerge [2].

The first laws of medical practice appeared in Mesopotamia in the "Code of Hammurabi", which included the civil, criminal and commercial code. Babylonian King Hammurabi stated that he received this set of laws directly from the sun god Shamash. Draconian punishments are enforced for those who break the law, the verdict depending upon the gravity of the conviction, and the social position of the perpetrator. The doctors were part of the priest caste, located in the upper middle-class society. Of the 282 laws of the code, five of them referred to the medical practice. Thus, prices for medical gestures were fixed, depending on the social position of the patients, while the element of risk for the surgical gesture was established, both for the patient and for the surgeon (if the patient died or lost his sight, the surgeon's hand had to be cut), that then will remain ingrained in the medical practice [3].

From the Greek period we have little evidence of transmission of medical knowledge from the Egyptians and Mesopotamians. The Iliad represents an important evidence of the medical practice of that time, where Chiron, the demigod, initiates Achilles, the hero, into surgery. There are given examples of evacuation of the wounded from the battlefield into tents located in the rear, where they were treated (hemostasis, extraction of foreign bodies, bandages), including the first mentions about the treatment of pain.

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In Homers' Epopee, 140 injuries are described, thus proving actual knowledge of anatomy; they were grouped according to topographic regions and vulnerable agent with an overall mortality of 77%. There is no mention about the practice of magic, incantations or amulets. Therapy was achieved through a mixture of surgical techniques and topical applications of medicine. It is also noteworthy that "doctors" were not part of the caste of priests, but they were combatants and even leaders (ex. Patrocle) [3,4].

A big step in the history of medicine is the Hippocratic medicine, which includes a series of writings of Cnidos and Cart schools, between 430-380 BC. It represents the first rational and natural interpretation of diseases and the cancellation of the supernatural origin. Doctors are considered descendants of Asclepius. He was a mortal, son of the sun god Apollo and the nymph Coronis, which he kills before childbirth, finding that she deceived him with a mortal. The child is removed from the womb of his mother and given to the Centaur Chiron for care, who teaches him the secrets of surgery and healing remedies. Asclepius dies, killed by Zeus, for having committed the sacrilege of curing a patient doomed to die. The tripod diagnosis-treatment-prognosis is established as well as the Hippocratic Oath with "primum non nocere". It explains in detail the treatment for military injuries: sprains, fractures (reductions, splints immobilizations), hemostasis techniques, along with chronic conditions such as bladder stones, inguinal hernia, cataract treatment, tracheostomy, treatment of cataract with a needle. Rules of conduct for doctors are establish, they have to be healthy, clean, and to inspire trust. Discussion with the patient becomes confidential, home visits are performed for internal conditions that do not require surgical maneuvers. Surgery is performed at the "cabinet" – Iatreion, which needs to have enough light, to be ventilated, equipped with clean water and minimal furniture [3,4].

The Roman period represents a period of development for medicine, by assimilating knowledge of Greek medicine in parallel with a better organization of military medicine. In the imperial period the first - Valetudinarium military hospitals are established, with operating rooms, baths and toilets with running water, heating water and enclosures systems. On the other hand, anyone could state that he was a doctor and earn a lot of money due to people's credulity. Medicine is no longer the prerogative of men, because there were also women who have gained fame. These are the reasons why Pilniu the Old, in "Historia naturalis", expresses a deep distrust in the medical corps. Many doctors were actually among the slaves and some, due to their successes in medical practice, gained their freedom. Medical practice is divided into many specialties and it is viewed as a business from which a lot of money can be earned. Most prominent representative of that era is Galen of Pergamum, a theorist, who systematized and a follower of the Hippocratic medicine, with studies of anatomy and physiology. The Galenic humoral concept, with the 4 humors associated with certain viscera, will dominate Western medicine until the nineteenth century. Paradoxically, his dogmatism in considering surgery as a lower chapter of the medical practice will block the upsurge of Hippocratic medicine in the Middle Age.

Middle Age

In the Middle Age, despite the medieval dogmatism, medicine continues to grow and health became an issue of public accountability. Universities for training doctors are created and the hospital gradually becomes the place of choice for the treatment of patients. However, a lot of counseling and therapeutic maneuvers are performed at the patient's home, in the absence of aseptic conditions. In the Middle Age, the influence of previous civilizations is felt.

In the middle period, the progresses of medicine are determined by the Arabs, where the doctor enjoys a high esteem. In the tenth century, Abulcasis writes a surgery treaty that contains theoretical and practical considerations. Abulcasis influences European medicine in later centuries, especially in hospitals that were organized near the military orders of the Crusaders and the Templars [3,4].

In the last part of the Middle Age, European medical schools appear at Salerno, Toledo, Montpellier, Paris, Padua and Bologna. The basic campaign principles of treatment are established here, with indications of achieving haemostasis by using tamponade, ligature or cautery, guidance regarding the treatment of pain (potions or vapors of opium), the use of restraining devices for fractures, drainage systems for pus as well as discussions concerning the time to suture the wound. If the aseptic conditions are not known, the only chance of survival was the amputation of the wounded limb and for major visceral lesions nothing could be done. For the wounded enemies there was no compassion, and thus, with a decision of the Swiss Diet in 1499, it was decided that most prisoners are to be killed and care for their own wounded was to be provided only after the cessation of hostilities. The term felcer (medical assistant - feldscherer - field surgeon) has its root in the German nations' vocabulary. There were few instruments used: amputation knife, razor, sponge, scissors, forceps to extract foreign bodies, pins [4].

With the advent of firearms, injuries produced by them became the majority of overall injuries in the fifteenth and sixteenth centuries. Thus, Giovanni Andrea Della Croce of the Venetian Republic writes a treaty on wound treatment with projectiles extraction indications as well as wound cleaning instructions, reduction of pain and treatment of complications. There were appropriate extracting tools for projectiles from various anatomical regions. The establishment of mercenary armies determined the improvement of medical services with the designing of separate protected areas for treatment. The chief physician of the military was an internist, which graduated an important medical school, who would oversee the work of surgeons [4].

In France, Henry of Navarre (later King Henry IV), has established mobile and stationary surgical rooms, which in Spain are called "AMBULANCIAS". Paré Ambroise writes a campaign surgery treaty with small indications regarding neurosurgical techniques, visceral sutures, and amputations of limbs with cautery or left free. However, large visceral lesions still remained lethal. It is worth mentioned that surgeon "doctors" had to participate in battle, and only after the battle were they to provide healthcare. Only in 1629 each regiment is manned with its own surgeon, who is dressed with a distinct uniform, has his own supply of materials, organizes the evacuation of patients from the battlefield and is exempted from military duties in battle [3,4].

Modern Era

In Modern Era, in 1731 the French Royal Academy of Surgery and Traumatology is established, which separates the surgeons from the barbers, giving them equal status with internists doctors. In Prussia, the same is done by King Frederick the Great in 1788, who mans field hospitals with surgeons along with internists and pharmacists that impose rules regarding food hygiene, waste and prevention of infectious diseases. In the same period, other military medical schools are established in Berlin in 1724 and in Vienna in 1784. However, most of the wounded continue to wait for the end of the fight in order to be evacuated and provided treatment [3].

A major step is the battle of Dettingen Am Main from 1743, where the first agreement between the warring parties (French and English) is made, which states the neutrality of hospitals and the requirement not to attack them [3].

In the nineteenth century, there is a tendency to exaggerate with the injured limb amputations. Thus, Jean-Dominique Larrey, chief surgeon of the Napoleonic armies, was performing not less than 200 amputations of limbs per day, with an average time of 4 minutes, but with a mortality of 80%. He is also the one who set up the first ambulance system that evacuated the wounded from the battlefield before the end of the fight [5,6].

Regarding the Navy, where surgeons initially received their knowledge through apprenticeship on board of the ship, when only few of them had solid medical studies, it was only after 1805 that only those licensed in medicine were accepted. England had the best naval medical service organization and the notes of Sir William Beatty, the surgeon of Lord Nelson flagship, the greatest admiral and hero of the British nation, whose victory at Trafalgar over the French- Spanish fleet secured a naval hegemony century for England, were of great historical value. After multiple injuries in earlier battles, in which Nelson lost his right arm and an eye, at the Battle of Trafalgar he is advised by his surgeon not to present his chest decorations on the deck. The admiral refuses and he is hit by a French sharpshooter, the bullet destroying his left shoulder and left lung. The bullet stops in his spine producing lower body paralysis. Despite extremely serious injuries, the admiral lives long enough to learn the news of his victory. After death, Lord Nelson's body was preserved in a barrel of brandy, until he was returned to England where a national funeral was held [7].

During the Crimean War (1854-1856), the extraordinary devotion of the nurse team headed by Florence Nightingdale is recorded, as well as the first use of chloroform by the chief surgeon of the Russian army, N. Pirogov. At the same time, he attempted to preserve injured limbs by restraining them with plaster splints. In this conflict, the Anglo-French troops used Minnie type bullets that were empty at their base and had a much higher output speed, with lethal effect at 400-500 m [1,6].

The discovery of ether as an anesthetic agent by William Thomas Green Morton in 1846 represents a major step in the surgical treatment of the wounded, allowing execution of complex operations [5].

During the Second Italian War of Independence (1859), former doctor Larey's son - chief of the armies of Napoleon is the first who utilizes the train to evacuate the wounded behind the lines. At the same time occur the first injuries that are characteristic to the guerrilla war conducted in various areas, including the cities [8].

After the Battle of Solferino (January 24, 1859) Henri Dunant, a Swiss rich man, horrified by what he saw, funds the formation of the Red Cross Society, an international organization for humanitarian aid to all military personnel and civilians.

U.S. Civil War (1861-1865) was the biggest struggle hitherto, with 3.7 million combatants and more than 600,000 deaths. Most of these deaths were not due to the wound itself, but mainly to secondary infections. At the same period of time hospitals are based on boats or trains, special tents - operating rooms, and triage system and organization of hospitals according to affections. This conflict loomed the trenches war that will be taken to the extreme in the First World War, with specific pathology [8,9].

In 1876 Friedrich Esmarch wrote a pocketbook with campaign surgical techniques and created the first surgical individual package with bandages and also the aphorism that the fate of the wounded depended on this package [5,6,10].

World War I

During the First World War, along with the introduction of antisepsis in campaign surgery and progress in anesthesia, antisepsis and bacteriology, an aggressive type of surgery is required on the battlefield, similar in magnitude to that performed in hospitals. Due to the appearance of shrapnel wounds, hemorrhage, traumatic and septic shock, aggressive and early executed surgical wound processing is required, along with ample interventions on abdominal viscera, resulting in the first significant decline in mortality, approximately 21%. The evacuation, transport and medical assistance system was also developed according to evacuation stages in terms of the static war at that time. Such conditions were also favorable for severe epidemics that occurred in the front lines and also behind the lines, especially when these conditions were responsible for a large number of casualties [5].

First World War represents the moment when war gas was introduced. This produced a shift in the pathology of war, but also induced changes in the soldier's psychology as well as changes regarding the means of protection required [4].

Overall principles and logistics associated with the evacuation were clearly established, associated with the stages of the treatment [3].

World War II

The Second World War was the first total war, with massive involvement of all kinds of forces, land, aviation and marine. German Blitzkreig's tactics led to the apparition of large spaces for maneuver with rapid deployment and many wounded on large areas that require greater flexibility in providing medical care to troops. Thus, as a novelty, German troops accompanied by tanks were accompanied by buses serving as operation rooms and evictions were carried on all possible ways. Specializations as neurosurgery, urology, oral-maxillofacial surgery, ophthalmology, otolaryngology, hematology, radiology, and laboratory appeared. All wounds are considered as infected wounds and therefore primary surgical processing is very important under conditions of well-managed anesthesia, associated with antibiotics. Anti - shock treatment by blood transfusion is also used. The theory of promptitude and complexity of the medical treatment in stages and evacuation according to destination is finalized. Overall mortality was 37.66% [11].

Present Times

In the major conflicts after the Second World War, due to the intensive use of aviation and bombing on a wide scale, the strict delineation of the medical care definition in the combat zone and the inner zone disappeared. This is why the proportion involving civilians in conflict changed, as shown in the TableI, where the reference is made for 100 wounded. This has led to the disappearance of differences in the organization of treatment between military and civilian, with the advent of military hospitals with humanitarian nature, with treatment of the civilian population caught in the conflict [12].

Table I: Civilians Casualties in Different Wars (reported to 100 wounded) [12]

Mexican war 1910-1920	50 soldiers	50 civilians
First World War	60 soldiers	40 civilians
Second World War	24 soldiers	76 civilians
The War In Vietnam	2-50 soldiers	98-50 civilians
Iraq War	60 soldiers	30 civilians

In the twentieth century the topography of injuries has changed, depending on the affected regions, type of war, the tactics used, weapons and terrain. Table II depicted this situation [13].

Table II: Topography of Injuries [13].

	WW I	WW II	Korea	Vietnam	Borneo	Ireland	Malvinas
Head	17	4	17	14	12	20	2
Thorax	4	8	7	7	12	15	7
Abdomen	2	4	7	5	20	15	4
Limbs	70	75	67	54	56	50	76
Other	7	9	2	20	-	-	11

The proportion of injuries in different regions is different, yet there is a preponderance of limb affections associated with lower mortality compared with wounds in other regions. Injuries to the thorax and abdomen exponentially increased during the war in Borneo (rainforest, small arms, and short distances) and in urban warfare conditions in Northern Ireland. Injuries were produced by various types of projectiles and according to the campaign type [13].

Wounds produced by fragments represent the majority of wounds in the modern conflagrations, as shown in the Table III [13].

Table III: Wounds etiology [13].

	WW I	WW II	Korea	Vietnam	Borneo	Ireland
Fragments	61	85	92	44	9	25
Bullets	39	10	7	52	90	55
Other	-	5	1	4	1	20

Despite the increased effect of modern lethal weapons, due to the good organization and complexity of medical care, in modern campaigns a steady decrease in mortality has been achieved (25% in Korea, 24% in Vietnam). The Korean War is the turning point in the management of the wounded, by introducing advanced medical teams, with the role of obtaining hemostasis and painkiller treatment, and subsequently rapid evacuation by air (with helicopters) so that the wounded would arrive at the Mobile Army Surgical Hospital (MASH) in the gold range of up to one hour (the average of 20-30 min) [13,14].

It was in Korea that vascular surgery, sutures and vascular grafts that eliminated amputations of limbs gained momentum. Until then, this was considered inevitable, and transfusions were widely practiced, and blood ceased to be a problem. Very low temperatures which the troops had to face made the infusion solutions unusable. This resulted in entirely original therapeutic ideas, and the realization of mixtures with vodka infusion [3].

Recent conflicts (Iraq, Angola, Somalia, Bosnia, and Afghanistan) involved the participation of Romanian troops, both with fighting forces as well as medical troops, who went from battalion medical points to campaign hospitals. These missions that were carried out far away from the country, in areas with different climates, topography and socio-political situation were very different from the Romanian ones and posed serious problems. However, these problems were overcome as experience was gained. Health care was particularly complex, being given both to fighting Romanian troops as well as local population caught in the middle of fighting. Most often, professional medical aid was granted especially to civilians of all ages and sexes, with injuries caused from a wide range of weapons. This highlighted the deeply humanitarian nature of the Romanian mission and explained the friendship with which the Romanian soldiers were surrounded by the locals and thus the low loss of life compared to other nations involved in this conflict [15,16].

Currently, all armies of civilized countries are working hard to provide the highest possible survival rate of their wounded soldiers. To achieve this, rapid evacuation and the doctrine of granting medical aid according to evacuation stages was imposed (20 minutes after injury until the first surgery). Each evacuation stage involves another kind of specialized medical aid, starting with vital functions to the execution of lifesaving and limb surgical procedures. The end state is to have finalized surgical procedures performed as further as possible from the front line. Of course, this procedure involves logistics and very high costs, but the results are noticeable. We also have to take into consideration the financial burden that the state has to carry further on, considering that the mutilated wounded will require specialized care for many years. A soldier who knows that his country will do everything it can in order to save or restore his health will fight more efficiently [16].

Conflict of interest

Authors have no conflict of interest to disclose.

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