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On Roman military doctors and their medical instruments

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Summary:

The establishment of a standing Roman army during the reign of Augustus resulted in an increased demand for military doctors. The knowledge about the Roman military medicine comes primarily from the excavations at the *valetudinaria*. Medical instruments, medicine containers and remains of medicinal plants found there indicate that the Roman army strived to provide unwell legionaries with excellent care. Surgical instruments found in the grave of a Roman doctor from Bingen (2nd c. A.D.) and in the Surgeon's House in Rimini (2nd c. A.D.) confirm the hypothesis that medicine in the Roman army was at a high level compared to the medical care in other ancient armies. Probes and scalpels are among the medical instruments found most frequently by archaeologists during excavation works. Roman military doctors also used specialized instruments for specific procedures; those included a trepan called *modiolus* and a tool used to remove arrowheads. Doctors serving in the army would perform many procedures intuitively, relying on their own experience. Roman military medicine had been heavily influenced by the Greek doctors' views on health and diseases and also by Roman civil medicine.

Key words: health care in the Roman army, Roman military doctors, ancient medical instruments, history of medicine, *valetudinaria*.

Medical history textbooks usually mention three figures who have had an impact on the development of ancient Roman medicine: two — Asclepiades of Bithynia (2nd-1st c. B.C.) and Galen (2nd c. A.D.) — were physicians; the third one was Cornelius Celsus (1st c. A.D.), an encyclopedist, who wrote the eight books of the medical work *On Medicine*. They contain descriptions of surgical procedures performed at that time, along with descriptions of the instruments used. Written sources have enabled us to identify the medical instruments in the archaeological material.

In this article, we will focus on the activities of Roman military doctors, together with the medical instruments from the period of Roman influences. In the area of Poland, this period lasted from the beginning of 1st c. A.D. until about 4th c. A.D. [1]. During the modern-day archaeological excavations, carried out within and outside of the area of the Roman Empire, archaeologists encounter medical instruments and medicine containers. These artifacts provide us with the knowledge about the procedures performed by ancient physicians. Such a medical instrumentarium can be found in the graves of Roman doctors, in the wrecks of Roman ships, on the grounds of Roman legionary

hospitals (the so-called *valetudinaria*), owing to the ancient custom to equip the dead with everyday use items. The tools were made out of bronze and iron, occasionally out of gold and silver, sometimes ivory. They were used by physicians in ancient Rome and in its provinces.

The second objective of this work is to describe how the wounded and unwell legionaries were taken care of. However, we believe that, in discussing the medical care in the Imperial Roman army, some description should also be provided of the civil health care in Rome and its provinces.

The beginnings of military surgery can be dated back to ancient times. The development of the art of war was accompanied by an increasing demand for people who knew how to treat injuries and wounds which soldiers were most prone to. Initially, wounded and unwell warriors would be taken care of by their companions. Numerous works of art dating back to antiquity often depict warriors taking care of each other, as well as physicians dealing with injured soldiers. One of the vases recovered from a kurgan in the Crimea (5th c. B.C.) shows Scythians, most likely warriors, undergoing medical procedures. The first scene on the vase relates to extracting a tooth with fingers; the other depicts wound bandaging (Figure 1) [2,3]. One of the scenes on the relief of the Trajan's Column (early 2nd c. A.D.) portrays attending to a wounded Roman soldier [4].

In the armies of ancient India and Egypt, attempts were made to provide medical care to soldiers. Also among Celtic warriors there were people capable of dealing with injured companions. Medical instruments were identified in the archaeological material, which were most likely used by those individuals. They include probes, hooks and scalpels. However, based on that material it is difficult to conclude whether those people were typical military doctors which appeared in the Imperial Roman army. The type of grave from the La Tène period (the pre-Roman period – the period of Celtic influence in Europe, which lasted in Poland from 400 B.C. until the beginning of 1st c. A.D. [1]), where surgical instruments can be found next to weapons in the grave hole, is described in the literature as a "*warrior-surgeon*" [5]. These were most probably the graves of warriors who had some medical and surgical skills. Today, it is hard to identify unambiguously whether they used those surgical tools only for their own needs, or if they treated other warriors.

Figure 1: A vase with scenes from the life of Scythians – wound bandaging.
Gold der Skythen aus der Leningrader Eremitage, München 1984 – quoted in the article.

In the period of the Republic, professional doctors were absent from the army. Assistance was provided by more experienced soldiers who, with time, learned how to handle the wounded. They would often form medical corps with the task to attend to the wounded and to transport them to tents specially prepared for the unwell soldiers. More heavily wounded soldiers requiring a longer treatment would be placed in the homes of private citizens. Affluent Roman families owned slaves, many of them from Greece, who had some folk medical knowledge. Their skills are likely to have been used also in treating other injured soldiers. A permanent, regular army was established during the reign of Augustus (27 B.C. – 14 A.D.) [6, 7]. This had an enormous impact on the direction of the development of Roman militarism as well as military health care. The need was noticed for the presence of educated physicians in the army, who would perform medical procedures and attend to ailing legionaries. The inscriptions: *medicus legionis*, *medicus cohortis*, found in the areas where legionary camps were located are proof that every legion, as well as cohort, had its

doctor. Medicus cohortis dealt with sick soldiers in specially designated tents. Those less severely wounded could remain in their quarters. In the Empire period, makeshift hospitals were built within legionary camps, which were composed of tents arranged as a square around an empty yard [6,8,9]. The builders of the first permanent military hospitals are likely to have made an attempt to model them on those early tent hospitals.

Valetudinaria – hospitals, clinics, "places where health is restored" were designed for two groups of people: slaves and soldiers. The former had a character of a care institution and did not enjoy good reputation; the latter aimed to provide care to wounded soldiers [9]. Meanwhile, the residents of Rome would seek healing in the temples of Asclepius and at the *iatreia* where physicians would attend to their patients. The cult of Asclepius developed in ancient Rome around 291 B.C. During an epidemic which broke out in the city, a statue of the god of medicine was brought from Epidauros in Greece. A temple devoted to Asclepius was erected on the Tiber Island [10,11,12]. Healing in the temples was based on prayers, dream interpretation, and was permeated with mysticism, though the priests probably also performed minor surgical procedures. Physicians with specialist education would visit the sick in their homes; in more severe cases, they would provide medical assistance at the *iatreia*.

Archaeologists date the early military *valetudinaria* to the beginning of the 1st c. A.D. The Roman army strived to restore a soldier to health as swiftly as possible in order for him to return to active service.

The looks of the *valetudinaria*, where soldiers would receive treatment, could be reconstructed thanks to the excavation works carried out at military camps within the Roman Empire. Those hospitals were identified in camps located in the strongholds along the Danube: Vindonissa (Vienna), Aquincum (Budapest), Novae (near Svishtov) in Moesia Inferior, as well as in the fortresses along the Rhine: Noviomagus (Nijmegen), Novaesium (Neuss), Vetera (near Xanten), and Bonna (Bonn). In the 1st c. A.D., the rivers Rhine and Danube became the borders of the Roman Empire. Therefore, attempts were made to provide medical assistance to the legionaries stationed there [4,13]. *Valetudinaria* were part of almost every legionary camp along the Empire's border. Based on the excavation data and modern-day reconstructions, we know that the architectural objectives – the arrangement of the buildings around a central, square-shaped or rectangular yard – were similar in all the *valetudinaria*. No two identical hospital buildings have ever been found; they differ in the room count and size as well as their layout inside the buildings. *Valetudinaria* comprised bathrooms (baths), maintenance rooms, sanitary facilities and operating rooms [4,14,15,16]. The latter are where numerous instruments are often found, which were used by military doctors to perform surgeries. The excavations carried out within the areas of the Roman legionary hospitals have revealed cases which had been used to store those tools. They were mostly made out of wood as well as ivory and bronze. They included smaller compartments for various types of tools [17]. A wide range of diverse surgical instruments can be found in this kind of buildings. Thanks to the use of: scalpels, probes, forceps, needles, scoops and spatulas, performing surgeries on wounded soldiers was made possible. Surgical procedures are likely to have been performed not only in specially designated rooms, but also in rooms where patients were kept [14,16]. According to the archaeological data, the number of patient rooms in a military hospital was about 60; one room comprised 3-8 beds. An average legionary hospital was capable of housing about 200 patients [18,19,20]. Efforts were made to ensure peace and quiet for wounded and sick soldiers. It is worth mentioning that this kind of buildings often encompassed separate places devoted to medicine-related gods: Asclepius and Hygieia. Prayers directed to those deities were likely an important component of the patient treatment process, although medical history textbooks claim that surgery was free from magic and incantations.

Remains of medicinal plants can be often found during the excavation works carried out at the former *valetudinaria*. At one of them, the following plants, described by ancient physicians, were found: common centaury (used for digestive problems), black henbane (contains alkaloids: atropine, scopolamine, L-hyoscyamine; used as an anesthetic), St. John's wort (cholagogue, anti-inflammatory and disinfecting properties), ribwort plantain (anti-

inflammatory and expectorant qualities) [21]. They were used for treating wounds and injuries as they would alleviate the pain and accelerate healing. Black henbane, with its poisonous and hallucinogenic properties, might have been used as a sedative and an anesthetic. Another medicine was also used to alleviate the pain, which included the extracts of two plants: black henbane and poppy [22]. It may be emphasized that anesthesia began in the Roman army. Celsus recommended that the diet of sick soldiers should be rich in fruit and vegetables. For this reason, they were fed peas, lentils and figs [21]. In some *valetudinaria*, sick soldiers' diet might have been more varied than that of healthy legionaries.

The person responsible for all the issues related to military health care in the fort was *praefectus castrorum*; he was in charge of hospital administration and educated doctors (medici), while the legionary hospital itself was supervised by *optio valetudinarii*. *Medici capsarii* were likely responsible for looking after a chest containing bandages and for bandaging the injured [6,7]. Roman military doctors dealt with surgery, medicine preparation, and used an appropriate diet to more rapidly restore soldiers to health. Hygiene rules were complied with both in the fort and in the military hospital. It was important that the environment and the soldiers' outfits be clean. The great density of soldiers in a small area was conducive to the spread of infectious diseases. It is likely that all the soldiers were given first aid training. Many of the soldiers serving in the Roman army were of Greek descent.

Roman military doctors were armed with a *gladius*, a short sword [22].

Among the sources of knowledge about the medical instruments used at the *valetudinaria* are also the burials of Roman military doctors. Two findings related to Roman surgery and military medicine will be described in detail in this article. The first one is the cremation grave of a Roman military doctor from Bingen (Germany). It is dated to 2nd c. A.D. It contained about 60 artifacts, which were described as medical instruments [23]. The most numerous group in the surgical kit is composed of instruments with a spatula probe on one end and a scalpel on the other (Figure 2). The latter have varied blade geometry. Usually only the spatula-shaped handle is found by the archaeologists, as scalpels were a replaceable part of this medical instrument.

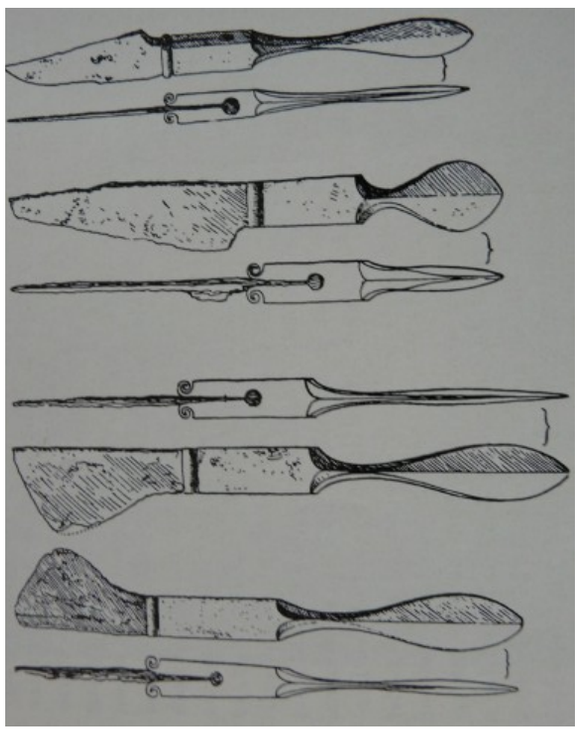

Figure 2: Examples of Roman scalpels with replaceable blades from the grave of a doctor from Bingen.
Davis 1998 – quoted in the article.

Physicians operating across the Empire also used probes as separate tools. They can be divided into three groups, according to the shape of the working part: spoon probes (the working part was spoon-shaped), spatula probes (the working part was spatula-shaped) and ear probes (with a small head on one end) (Figure 3). Medical instruments used by military doctors included also spatula probes. They could have been used to determine the wound depth and to apply medicament to the wound. The toolkit of the Bingen physician also comprised hook-ended needles as well as hooks used to widen the wound opening. Forceps were used to grab and hold tissues (two of them have toothed edges) and also to remove foreign bodies. It is possible that the kit also included tools for cauterization (burning wounds). Unfortunately, their bad condition prevents their complete identification.

However, we do know that such instruments must have been used by Roman military doctors. The kit also comprised three bronze cupping vessels (one bigger and two smaller ones).

According to ancient physicians, cupping was performed to restore the balance of bodily fluids, or in headaches and joint pains. Albucasis claimed that large, medium and small vessels were used in treatment, depending on which part of the body they were being used on [14].

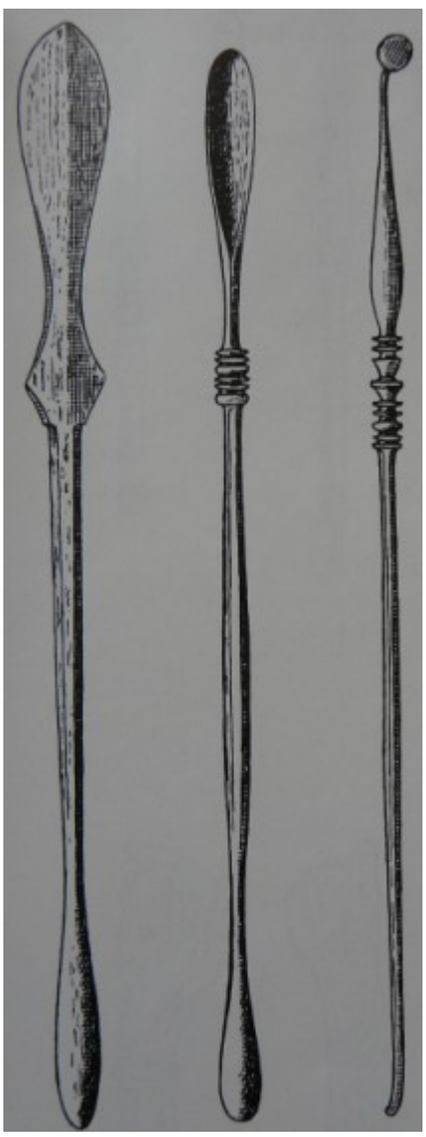

Figure 3: Examples of probes. From the top: ear probe, spoon probe, spatula probe.

Künzl 1981 – quoted in the article.

One of the tools (*modiolus*) was used to perform skull trepanation by means of drilling. The auger would be put into rotation by a string attached to its arched handle. Skull fragments removed during the procedure were round in shape [24]. In ancient times, trepanation was performed for magic and medical reasons. It was often thought that an evil spirit, a demon, inhabits the head and causes the disease; headaches, vertigo, coma, faintings and epileptic seizures were perceived as evidence. Drilling a hole in the skull was an attempt to release the spirit. Cranial cavity would not be opened to perform neurosurgical procedures, though it could have been a method of evacuating hematomas. Skull trepanation was performed in adults; less frequently among children. Various ointments were also used to prevent wound infection.

A range of surgery methods were used. The external table, the diploë and the internal table would be removed; a hole would be cut in the skull using a sharp tool or drilled with an auger. Trepanation was also performed in head injuries, in an attempt to remove a cracked fragment of the skull. Soldiers were particularly prone to head injuries; thus, trepanation surgeries in the Roman army were mostly performed for curative purposes. Special scalpels (blades) can be found in the burials from the La Tène period, with a semicircular cutting edge for performing trepanations by incision [5]. In the Roman army, they were performed by drilling but also by scraping. Trepanation procedures were described by Hippocrates (5th c. B.C.) but also by Roman physicians. The former recommended that trepanation be performed within the first three days after a head injury; he also mentioned complications after the surgery and the way the wound should be dressed afterwards [25]. Galen (2nd c. A.D.) included in his work the techniques for the surgery, listed the indications for its performance and also described the required medical instruments. He thought that trepanation should be performed following skull injuries; the damaged fragment of the bone should then be removed and the sharp wound edges should be smoothed out using a chisel-like tool. Galen provided a description of a method for drilling and scraping bones. The surgery was supposed to bring relief to the patient, alleviate their pain and lower the intracranial pressure [26]. Apart from the *modiolus*, medical instruments used by Roman physicians for trepanations probably included specific scalpels, chisels and hook-shaped tools for lifting bone fragments. Chisels were also used for the trepanation of the skull of the child whose burial is dated to 1st-2nd c. A.D., which comes from the excavation works carried out in the suburbs of Rome [27]. It is interesting that in Greece, in the period before Hippocrates,

also iron scrapers, scalpel-like knives and iron forceps would be used for trepanation [28]. Throughout centuries, scraping was considered to be the safest method of performing the surgery due to a lesser risk of brain damage.

The physician whose burial was discovered in Bingen is likely to have been educated in Alexandria, proof of which is the figurine of a hippopotamus with a cobra on its back [23]. It was there that he became familiar with Greek and Egyptian medicine. Between 3rd and 2nd c. B.C. Alexandria was the main academic centre of the ancient world; it was the place where Greek medicine, the foundations of which had been laid by Hippocrates, was developing. Herophilus and Erasistratus, two popular ancient physicians, were active there. They put great emphasis on the study of anatomy. Autopsies and vivisections were carried out in Alexandria; the results are likely to have influenced the development of surgery [11].

Plenty of information related to medical tools used by military doctors in ancient times can be obtained by analyzing artifacts from the site in Rimini (Italy). The Surgeon's House (*Domus del Chirurgo*), discovered by archaeologists, and dated to 2nd c. A.D., is where about 150 medical instruments were found [29,30]. Most of them had been used for bone surgeries and medical procedures [31]. The house, comprising a surgery, belonged to Eutyches, who was a military doctor.

The use of a bow in military operations resulted in the need for physicians to learn the safest way to remove arrowheads from wounds. This kind of wounds was described in the works of the ancient Indian surgeon Susruta (4th c. B.C.) and was also mentioned by Hippocrates. In the Iliad, Homer pointed out how important it was to deal with such injuries correctly. Celsus described a special tool for this kind of operations, named "the spoon of Diocles" (after its inventor, Diocles of Carystus); an example was found in Rimini [32]. In their practice, Roman military doctors had to deal with specific wound types, hence specialist tools were developed to tackle battle wounds. It was also here that instruments were found with a blade on one end and a leaf-shaped probe on the other.

Eutyches also used forceps and tweezers to remove foreign bodies and fractured bone fragments from the body. Among the artifacts related to medicine, also dental forceps were identified. The surgical toolkit also included chisels and gouges. They might have been used to lift the skull bones in case of some injuries. It is possible that the physician would also perform trepanations.

The proof that Eutyches had links to the Roman army is the votive sculpture of a human hand, also found in the Surgeon's House. It is related to the cult of Jupiter Dolichenus, which was widespread among Roman soldiers [29,30].

Military doctors serving in the army also prepared medicines for their patients. Proof of the above are not only remains of medicinal plants, found at the *valetudinaria*, but also small containers, used to store and make medicines, discovered in the Surgeon's House in Rimini. Dioscorides (1st c. A.D.), who most likely was a military doctor, described, in his numerous works, plant-derived medicaments, their properties and applications [11].

The instruments used by Roman military doctors included general surgery instruments, such as probes, scalpels, hooks, hook-ended needles, as well as specialist tools used for trepanation (modiolus) or to remove arrowheads from wounds ("the spoon of Diocles"). Gynecological instruments (vaginal specula, gynecological probes) have not been found among the medical instruments discovered during excavations at the *valetudinaria* as well as at cemeteries comprising the graves of Roman military doctors. Vaginal specula were discovered in Pompeii; they are also part of the collections of a number of European museums.

Physicians working at the *valetudinaria* are likely to have been dealing with a range of wounds: cuts, stabs, contusions; they would remove foreign bodies and arrows from soldiers' bodies. Improper or incorrect wound handling might have resulted in gangrene and patient death. Outbreaks of infectious diseases were also likely in military camps; therefore, efforts were made to maintain an appropriate level of hygiene.

Greek medicine, the medicine of other ancient armies, along with civil medicine in Rome's provinces influenced the entire Roman military medicine. When comparing medical instruments used by a "*warrior-surgeon*" with later tools used by Roman military doctors, one can identify the same types of instruments. However, Roman

ones were made with greater precision. Civil physicians with specialist knowledge who worked in Roman provinces used the same medical toolkit as Roman military doctors. Certainly they were not as experienced in dealing with wounds and injuries as the doctors at the *valetudinaria*. Civil physicians also used special cases or etuis to carry medical instruments. Thanks to that they could perform some surgeries in the homes of their patients [33]. In addition, the cult of Asclepius (called Asklepios in Greece) was widespread among Roman military doctors.

Most trepanations in the Roman army as well as those performed by civil physicians would be carried out for curative purposes or to remove a fractured bone fragment. Such surgeries were often performed intuitively. Lifting and removing the fragment(s) of a fractured bone, as well as smoothing out sharp wound edges may have resulted in an immediate effect in the form of abating neurological irregularities or regaining consciousness due to the fact that the fragments of a damaged bone had been prevented from applying pressure on brain tissue. For this reason, the surgery was repeatedly attempted. Efforts were also often made to remove the cause of pain, which could result from various pathological changes: injuries, related episcleral and subdural hematomas, inflammatory changes, benign and malignant brain tumors. It was not easy to perform such a procedure; it is likely that a physician with relevant expertise and tools was required. Most historical trepanations were episcleral. Related complications would include wound infection, operational bleeding, as well as damage to the meninges and the brain. Those would result from an improper use of tools and poor surgery technique.

Due to the lack of X-rays, the most common instruments used by Roman military and civil doctors were probes. They could be used to identify the wound depth and the location of a foreign body in it. The second largest group of tools were scalpels, used to make cuts of various depths. Incisions of skin, soft tissue and bones were possible.

Health care began and was developing in the Imperial Roman army. It reached a high level compared to medical assistance provided to wounded soldiers in other armies of the ancient world. The demand for professional medical assistance across the Empire was high. Military doctors probably constituted a large part of educated physicians; they worked permanently for the army, but some of them also ran a private practice.

Archaeological artifacts identified as medical instruments, along with the remains of Roman legionary hospitals, enable us to expand our knowledge about military medical service.

Human body was not penetrated. This was due to the lack of knowledge of anesthesia, antiseptics and blood loss replacement. It was only in the second half of the 19th century that all those methods were introduced to surgery. Surgical procedures in the Roman army related mostly to external injuries. However, the diversity of instruments used by Roman military doctors indicates that they were very good practitioners. There was relatively little anatomical knowledge in the ancient period; thus, Roman physicians had to rely rather on their experience, gained during the work in the army.

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