

Research Article

Sanitation in Roman military hospitals

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ABSTRACT

Background: Sanitation, hygiene and an awareness of contagious diseases are essential factors in the successful operation of all military hospitals. The ancient, Roman physicians were aware of these factors and addressed them in the structure and system that they developed for their military hospitals.

Methods: This study was conducted within the parameters of system and structure analysis. Central to the analysis of hygiene and sanitation in military hospitals is the study of their structure and processes.

Results: Hygiene and sanitation were regularly practiced in Roman military hospitals. Roman physicians took steps to reduce sepsis and separated sick and wounded soldiers to minimize the spread of contagious diseases.

Conclusions: The Romans were the first army of antiquity to practice a significant level of hygiene and sanitation in their military hospitals. It is more likely than not, that Roman physicians knew through deductive reasoning that pathologic microorganisms existed.

Keywords: Sanitation, Hygiene, Public health

INTRODUCTION

Sanitation and an awareness of contagious diseases are essential factors in the successful operation of all military hospitals. The ancient, Roman physicians were aware of these factors and addressed them in the structure and system that they developed for their military hospitals. The main purpose of this article is to demonstrate that hygienic and sanitation practices in Roman military field hospitals (Valetudinaria) facilitated the convalescence of Roman soldiers and allowed the soldiers to return to the battlefield as quickly as possible. The key question being addressed is the effects of hygienic and sanitary conditions of the field hospitals in helping to revive minimally or moderately wounded legionnaires for reentry into military conflict. Crucial source information is extracted from Roman historians, physicians, Roman artifacts, monuments, paintings, archaeological discoveries and modern secondary sources. The main

inferences are that Roman field hospitals provided greater hygienic and sanitary conditions than those practiced by most Roman enemies, and that the Romans developed the first system of public health in its military hospitals. Roman field hospitals were a Roman innovation.

The key components to understand in this article are "community hygiene" and "sanitation." "community hygiene" means the practice of health of a large group of people such as in a field army.¹ "Sanitation" means the formulation and application of measures to promote and establish conditions favorable to health.² The main assumption is that without the role of excellent medical care in a hygienic and sanitary environment, the Roman army could not have forged and maintained an empire which encompassed two million square miles, 44 provinces and 40 million people. Following this line of reasoning, the implications are a better understanding of Roman military successes in warfare. Failure to take this

line of reasoning seriously, leads to a lesser understanding of Roman military successes in warfare. The main point of view presented in this article is that Roman public health practices in field hospitals employed between 27 B.C. and A.D. 476 was successful in providing effective medical care after wartime injuries. The thesis of this paper is that Roman physicians knew through deductive reasoning that pathologic microorganisms existed and that these microorganisms had to be taken into account in their medical practices or patients could become ill and even die from infections.

METHODS

This study was conducted within the parameters of system and structure analysis. Central to the analysis of military hospitals is the study of their structures and processes. System and structure analysis represents an attempt to assess the relationships of structure and process within contemporary and historical contexts. History is a vital ingredient, not merely as a basis for descriptive narrative but also as the crucially important means of discerning and comparing repetitive phenomena as they relate to sanitation in Roman military hospitals.³ This historical study is a way in which physicians and other health care professionals can better appreciate the fullness of their medical and cultural inheritance as practitioners, enabling them to become more conversant in the passing and advancement of about sanitation in military hospitals from an extinct civilization to sanitation techniques in modern, military hospitals. There are too many primary and secondary sources which relate to public health matters in *Valetudinaria* to list all of them in this section. The most useful primary source was the work of Flavius Renatus Vegetius (later 4th century A.D.) who discussed sanitation and hygiene at military encampments and the preservation the health of soldiers.⁴ Another valuable source was the discussion by Roman physicians, such as Cornelius Celsus (c. 25 B.C.-c. AD 50) and Claudius Galenus (Galen) (AD 129-c. 199) about the aseptic techniques they employed and their use of bacteriostatic and bactericidal medicines.⁵ The Roman concept of pathologic microorganisms is best expressed by Marcus Terentius Varro (116-27 B.C.), and Pedanius Dioscorides (A.D. 40-80) compiled an extensive catalogue of medicinal products and their uses.⁶ Among the more useful secondary sources used in this study are books by Davies' (1989), *Roman Service in the Army*, which is based on primary source documents, and Gabriel's (2012) *Man and Wound in the Ancient World*, which contains both primary and secondary sources. Also of value were Scarborough's (1969) *Roman Medicine* and the work of Gabriel and Metz' (1992) *A History of Military Medicine*.⁷ Arnold Blumberg has written an excellent article about the construction of Roman camps, while Richard A. Gabriel has written about Roman military hospitals located on Roman camps and forts.⁸ In addition, I conducted extensive research at ancient sites throughout Europe and at museums which contain Roman artifacts.

RESULTS

Hygiene and sanitation were regularly practiced in all military hospitals. Roman physicians took steps to reduce sepsis and separated sick and wounded soldiers in the hospitals to minimize contagious diseases from spreading among the hospital patients. Roman military hospitals were located inside Roman camps (*Castrae*) or forts (*Castella*). The camps and forts occupied an area of five acres to 18 hectares, in addition to fortified ditches, stockades and other defensive devices that surrounded them, including a ditch five feet wide and three feet deep.⁹ They were laid out in a square or rectangle with rounded corner angles. They were located in an area with plentiful wood and forage and not be overlooked by higher ground whenever possible. The average field hospital occupied an area of 6000 square feet and could accommodate between 250-500 patients. In the event of mass casualties, ward tents could be set up near the hospitals. Roman army camps were situated near streams or rivers, away from marshes, swamps and standing water. Arid plains and hills were avoided whenever possible. Every hospital had wards, corridors, administrative offices, a dining hall and a drainage system. In addition, there was an operating suite, lavatories, sewers, mortuary, kitchen, set of baths and storage rooms for medical instruments and medicinal agents. The bath area was attached to a gymnasium for exercise or massages. Hospitals contained roofs designed to provide adequate cooling and ventilation, and a heating system to provide warmth during cold weather. Roman military hospitals stressed hygiene, cleanliness and sanitation.¹⁰

The Roman military selected only the healthiest, intelligent, available men for service as legionnaires.¹¹ Roman military physicians advocated a regimen designed to promote the health of soldiers. Celsus recommended recreation, rest, a varied diet to include fruits, vegetables, and wine diluted with water, boiled meat, exercise, daily gargling the mouth with cold water and frequent bathing.¹² Soldiers were required to shave daily and bathe regularly. Healthy legionnaires first took a hot bath in the *caldarium*, then in the lukewarm *tepidarium* and then they dipped in the cold *frigidarium*.¹³ Every night, while others slept, a detachment of soldiers performed HP (hospital police) duties. The detail cleaned the entire hospital, including the kitchen, baths, latrines, and surgical suite. The *medicus tesserarius* (officer of the watch) monitored cleanliness, and a *medicus decanus* (sergeant or corporal) ordered the specific tasks of the workers of the policing detail. Mosquito netting was furnished to all patients and hospital staff whenever necessary. Daily exercises, drills and marching helped to keep the soldiers fit. Legionnaires were subject to periodic medical examinations. Soldiers with serious physical or psychiatric illnesses were medically discharged with retirement benefits. The dead were cremated outside the camp walls.^{14,15}

A complex system of drains and sewers emptied into rivers or streams well below the watering point for animals. Wooden seats were situated over the main sewer running round three sides of the building. A smaller channel, fed from the water tank was for washing the sponges used instead of toilet paper. When it was not possible to drain refuse into a moving waterway, a large soak-away was constructed. Latrines were continuously flushed by water from the bath house, and sewage was removed far from the fort or camp. Latrines were dug to a depth of ten feet and covered with wooden tops to discourage disease-carrying insects. Latrines had basins for washing one's hands.¹⁶

DISCUSSION

Roman military physicians used a variety of techniques to prevent or inhibit the growth of causative microorganisms. All surgical instruments, lint, fibulae, and bandages were boiled in water prior to use for every operation. Sick soldiers were housed in separate wards from wounded soldiers, and there were a few rooms for patients requiring isolation.¹⁷ Roman physicians employed a number of techniques and pharmaceuticals to minimize infections. Picking out decayed or foreign matter from wounds after repeated cleansing with rain water or other fresh water mixed with ammoniacum (*Dorema ammoniacum* D.) helped to reduce the rate of tetanus, gangrene and infections. Loose bandaging, surgical clips for closure drains and regular changing of dressings also helped reduce infections.¹⁸ When the benefits outweighed the risks gangrenous tissue was either cauterized or surgically removed.¹⁹ Roman physicians had a number of antiseptics available for the treatment of wounds and use during and after surgery. Acetum (vinegar) and mel (honey) were among the favorites. Galen recommended a poultice of honey, lint and aloe vera, after sponging the wound or sutured area with a mixture of acetum and Glaucium (*Glaucium flavem*). The wound would then be covered with an absus (woolen bandage).²⁰ Linen bandages were the most common type of bandage used for binding wounds. Celsus preferred to cover treated wounds with a plaster of barbarum.²¹ The maintenance of hygiene and sanitation would have been impossible without training, discipline and an organizational structure through which military authority was exercised. A legatus (general) supported by six tribunes (colonels) commanded each legion. Second in command of a camp or fort was the praefectus castrorum (prefect of the camp). He had overall responsibility for the organization and operation of a camp or fort. His duties included the maintenance and update of equipment and the training of soldiers.²² The medicus primus (hospital commander) reported directly to the prefect.²³

The medicus primus commanded a Valetudinarium and had the final word in all medical decisions. He had a staff of medici, nurses several other specialists and orderlies. He also served on the staff of legatus as medical advisor.

The medicus primus was assisted by two lieutenants, the optio valetudinarius (hospital executive officer) and optio convalescentium (physician's assistant in charge of convalescence). The overall responsibility for the hygiene and sanitation of the hospital was with the staff of the optio valetudinarius.²⁴ The chain of command was strictly enforced and transgressors or malingers were severely punished.

The Romans practiced military medicine in field hospitals that surpassed the medical systems of Rome's enemies in the areas of hygiene and sanitation. Sanitation and hygiene helped many wounded soldiers to heal more quickly and enhanced the survival rate of the wounded. Roman physicians practiced a number of measures to prevent sepsis in their patients. They boiled all surgical instruments, lint, fibulae and bandages in water prior to use before every operation. They separated sick and wounded soldiers in separate wards and isolated soldiers with highly contagious diseases. The physicians also used a number of antiseptic products in their work. In addition, field hospitals had remarkably high standards of hygiene and sanitation. Would Roman physicians have used these sanitary procedures unless they had some knowledge of pathologic microorganisms? Marcus Terentius Varro (116-27 B.C.), a Roman scholar, provides the answer. the First, consider the standard definitions of "pathologic microorganism" and "microorganism". A pathologic microorganism is "any disease-causing microorganism".²⁵ A microorganism is a "minute living body not perceptible to the naked eye, especially a bacterium or protozoon".²⁶ Second, consider the theory of contagion developed by Varro: "the pathogen is alive, too small to be seen; it enters the body through the mouth and nose, propagates, and produces many diseases resistant to treatment".²⁷ Varro's theory of disease fits the definition of pathologic microorganisms.

CONCLUSION

The Romans were the first army of antiquity to practice a significant level of hygiene and sanitation in their military hospitals. The findings of this study make it more likely than not, that Roman physicians knew through deductive reasoning that pathologic microorganisms existed, and that these microorganisms had to be taken into account in their medical practices or patients could become ill or even die from infections. Much of the medical knowledge and skills employed by the Romans was temporarily lost after the collapse of the Western Roman Empire in 476. The Eastern Roman Empire (Byzantine Empire) maintained these skills and practices until it collapsed in 1453. The Germanic tribes which overran the Western Empire and Ottoman Turks which conquered the Eastern Roman Empire lacked the expertise of the Romans in medicine, engineering, hydraulics, hygiene and sanitation.²⁸ Roman practices in hygiene and sanitation did not reemerge in European and American military medicine until the 1800s, when Louis Pasteur (1822-1895) demonstrated through the use of a

microscope that microorganisms caused diseases in humans and animals.

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