Medical and surgical care during the American Civil War, 1861–1865

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This review describes medical and surgical care during the American Civil War. This era is often referred to in a negative way as the Middle Ages of medicine in the United States. Many misconceptions exist regarding the quality of care during the war. It is commonly believed that surgery was often done without anesthesia, that many unnecessary amputations were done, and that care was not state of the art for the times. None of these assertions is true. Physicians were practicing in an era before the germ theory of disease was established, before sterile technique and antisepsis were known, with very few effective medications, and often operating 48 to 72 hours with no sleep. Each side was woefully unprepared, in all aspects, for the extent of the war and misjudged the degree to which each would fight for their cause. Despite this, many medical advances and discoveries occurred as a result of the work of dedicated physicians on both sides of the conflict.

The Civil War was fought in over 10,000 places and was the bloodiest war in the history of the United States. Two percent of the population at the time (approximately 620,000) died during the conflict (1). More Americans died in the Civil War than in all other wars combined. As hard as it is to believe, these numbers may actually be an underestimate of the death toll, given that much of the data regarding deaths of Confederate soldiers was destroyed when Richmond burned on April 2, 1865. More recent estimates based on comparative census data put the figure closer to 752,000 (2). Countless other soldiers were left disabled. The year after the war ended, the state of Mississippi spent 20% of its annual budget on artificial limbs for its veterans (3).

Many misconceptions exist regarding medicine during the Civil War era, and this period is commonly referred to as the Middle Ages of American medicine. Medical care was heavily criticized in the press throughout the war. It was stated that surgery was often done without anesthesia, many unnecessary amputations were done, and that care was not state of the art for the times. None of these assertions is true. Actually, during the Civil War, there were many medical advances and discoveries *(Table 1)*.

Twice as many soldiers died of disease during the war than in combat (3). This was a marked improvement compared with the Mexican War (1846–1848), where there were 7 to 10 deaths from disease for every death in battle. It was not until World War II that weapons killed more Americans than disease. The war left about 1 in 10 able-bodied Union soldiers dead or incapacitated, versus 1 in 4 in the Confederate Army (3).

Table 1. Medical and surgical advances during the war

Type	Advances
Medical	Use of quinine for the prevention of malaria
	Use of quarantine, which virtually eliminated yellow fever
	Successful treatment of hospital gangrene with bromine and isolation
	Development of an ambulance system for evacuation of the wounded
	Use of trains and boats to transport patients
	Establishment of large general hospitals
	Creation of specialty hospitals
Surgical	Safe use of anesthetics
	Performance of rudimentary neurosurgery
	Development of techniques for arterial ligation
	Performance of the first plastic surgery

WHY DID SO MANY DIE?

Soldiers died from two general causes: battlefield injuries and disease. Contributing factors to combat-related deaths were inexperienced surgeons; the lack of a coordinated system to get the injured off the battlefield quickly; wound infections, since sterile technique was not yet recognized as important; and battlefield tactics that did not keep pace with advances in weaponry. Contributing factors to disease-related deaths included poor sanitation and overcrowded camps; the ignoring of sanitation by line officers; inadequate pre-enlistment screening

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of recruits; poor diet; lack of immunity to childhood diseases; and few specific treatments for disease.

Army Regulation 1297 set out criteria for preinduction physical exams:

> In passing a recruit the medical officer is to examine him stripped; to see that he has free use of all his limbs; that his chest is ample; that his hearing, vision and speech are perfect; that he has no tumors, or ulcerated or extensively cicatrized legs; no rupture or chronic cutaneous affection; that he has not received any contusion, or wound of the head, that may impair his faculties; that he is not a drunkard; is not subject to convulsions; and has no infectious disorder; nor any other that may unfit him for military service (4).

That was the requirement; however, the reality was that many exams early in the war were of poor quality. Governors needed to fill quotas, and examining physicians were paid per recruit. If you could walk, carry a gun, and had front teeth and a trigger finger, you could enlist. Front teeth were needed in order to tear open the cartridge containing gunpowder and the bullet. Dental care was poor in the 1860s, and this was a frequent cause of rejecting a recruit. It was the origin of the term 4F (missing 4 front teeth). The system was so poor that it is estimated that about 250 women served as soldiers during the war (5). The quality of physical exams improved with the Civil War Military Draft Act of 1863, when fines and prison sentences were put in place for physicians who were derelict in their duties, resulting in many more recruits being rejected from service.

To better comprehend medical care delivered during this period, it is important to understand the medical infrastructure at the time. The first medical school was established in the United States in Philadelphia in 1765. There was no prerequisite preparation for admission, no entrance exam, and no state medical licensing boards. Medical school was 2 years in duration. In the first year, lectures were given in two 4-month semesters. The second year was a repetition of the first. Students did not have any clinical experience prior to graduation. Medical schools at the time were more like proprietary schools. There was a large entrance fee and as a result very few students ever failed (6). The Flexner Report was still 50 years in the future, which required 2 or more years of college and a 4-year curriculum. In 1862, there were only six colleges of pharmacy in the US. Most doctors prescribed, compounded, and dispensed their own medications.

The germ theory of disease would not be established until 1870 and Koch's postulates in 1890. Disease was thought to be a result of either direct or indirect inflammation (7). Indirect inflammation was thought to be caused by excess blood flow to a tissue, a theory promulgated by a prominent 18th-century physician, Benjamin Rush. This led to the concept that bloodletting might be beneficial. By the time of the Civil War, bloodletting had largely fallen out of fashion.

Before the war, the United States had a peace time army of 16,000 soldiers. There were 113 doctors in the army. At the start of the war, 24 went south and 3 were dismissed for disloyalty (8). At the end of the war, there were over 12,000 doctors in the Union Army and over 3000 in the Confederate Army. Before the war, the largest military hospital was at Fort Leavenworth, which had 40 beds. The only hospital in Washington, DC, before the war was a two-story six-room building used to isolate smallpox patients.

The first major battle of the war fought at Bull Run in Manassas, Virginia, on July 21, 1861, illustrates how woefully unprepared the Union was from a medical standpoint at the start of the war. Fortunately, at Bull Run, casualty figures were not large compared with future battles (North, 481 killed, 1011 wounded; South, 387 killed, 1582 wounded) (9). Despite this, many problems were encountered. There was no military ambulance corps. Ambulances were driven by civilians who fled when the first shots were fired. If they left the ambulances behind, healthy soldiers stole them to flee back to Washington, DC. Not a single wounded soldier returned to Washington, DC, in an ambulance (10). Tragically, wounded soldiers remained on the battlefield for days, the first two spent in the rain. Incredibly, Surgeon General Finley did not order medical supplies until after the battle was over.

ORGANIZATION OF BATTLEFIELD MEDICAL CARE

How medical care was delivered on and off the battlefield changed during the war. Early on, stretcher bearers were members of the regimental band, and many fled when the battle started. Soldiers acting as stretcher bearers rarely returned to the front lines. As the war evolved, stretcher bearers became part of the medical corps. At the battle of Antietam, there were 71 Union field hospitals. As the war went on, these were consolidated. There were ambulances here that were used to bring the wounded to temporary battlefield hospitals, which were larger, often under tents, and out of artillery range. Later in the war, patients were transported to large general hospitals by train or ship in urban centers. These did not exist when the war began. There was no military ambulance corps in the Union Army until August of 1862. Until that time, civilians drove the ambulances. Initially the ambulance corps was under the Quartermaster corps, which meant that ambulances were often commandeered to deliver supplies and ammunition to the front. Jonathan Letterman set up his own ambulance corps in the East under General George McClellan. Medical directors chose all the soldiers for their services. Ambulances could not be used for other purposes, and only the ambulance corps was allowed to remove wounded from the battlefield. Letterman was responsible for a number of organizational improvements within the Army of the Potomac and was given a free hand by McClellan to implement them.

Large general hospitals were established by September of 1862 (11). These were in large cities, and soldiers were transported there by train or ship. At the end of the war, there were about 400 hospitals with about 400,000 beds. There were 2 million admissions to these hospitals with an overall mortality of 8%. In the South, the largest general hospital, Chimborazo, was in Richmond, Virginia. It was built out of tobacco crates on 40 acres. It contained five separate hospitals, each made up of 30 buildings. There were 150 wards with 40 to 60 patients per ward. The census was as high as 4000. They treated about 76,000 patients with a 9% mortality (12).

Table 2. Types of weapons and number of wounds treated*

Type of weapon	Number	% of recorded cases
Conoidal (Minié) ball	108,049	76.0%
Round or musket ball	16,742	12.0%
Fragment of shell	12,520	9.0%
Pistol or buckshot	3,008	2.0%
Grape, canister, etc.	1,153	1.0%
Solid shot	359	0.3%
Explosive musket ball	139	0.1%
Unknown missile	103,829	–

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COMBAT-RELATED INJURIES

Before interpreting the data regarding combat-related injuries, it is important to recognize limitations in the reporting. In order to be reported, a soldier had to be either transported to or make it back to a field hospital, and this may have resulted in an underreporting of deaths from cannon fire. As shown in *Table 2,* most injuries resulted from the Minié ball invented by the French officer Claude-Etienne Minié in 1849. The Minié ball is a 0.58-caliber bullet that is slow moving and is made from soft lead. It flattens on impact and creates a wound that grows larger as the bullet moves deeper into tissues. It shatters bone above and below impact and usually does not exit. Because of its relatively slow muzzle velocity, it brought bits of clothing, skin, and bacteria into the wound. The majority of gunshot wounds occurred in the upper and lower extremities, but the fatality rate from these wounds was low *(Table 3).* Only 18% of wounds were to the abdomen, but these were more often fatal from intestinal perforation in the preantibiotic era.

Commanders in the field were also slow to adjust their tactics in keeping with advances in weaponry. In the Revolutionary War era, smooth bore muskets were accurate only up to about 50 yards and were difficult to reload quickly, making rapid repetitive firing difficult. However, newer rifled muskets in use after the first year of the war were accurate up to 500 yards, and troops could easily fire them at a rate of 3 times a minute and sometimes faster. In the Revolutionary War, men could charge a fixed entrenched position with the possibility of success, whereas in the Civil War this same tactic was sure to fail. This was evidenced by the catastrophic failures of Picket's charge at Gettysburg in the East, and Hood's charge at Franklin, Tennessee, in the West. Six high-ranking Confederate generals were killed at the battle of Franklin, where over 1750 men died in a 5-hour period, with another 5500 wounded or captured (13).

Perhaps the most famous example of a lack of appreciation for the improvement in weaponry by those in high command occurred at the Battle of Spotsylvania Courthouse. John Sedgwick was the highest ranking Union general killed in the war. While directing troop movements at Spotsylvania Courthouse, he scolded his men for dodging bullets from sharpshooters concealed in the distant woods. "I am ashamed of you dodging that way. They couldn't hit an elephant at this distance" (14). Moments later a bullet fired from more than 500 yards struck him in the head, killing him instantly.

Table 3. Distribution of wounds among those listed as killed in battle or admitted to hospitals*

Site	Killed in battle	Wounded
Trunk	51%	18%
Head and neck	42%	11%
Lower extremities	5%	35%
Upper extremities	3%	36%

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SURGICAL PROCEDURES

Three of every four surgical procedures performed during the war were amputations. Each amputation took about 2 to 10 minutes to complete. There were 175,000 extremity wounds to Union soldiers, and about 30,000 of these underwent amputation with a 26.3% mortality. The further from the torso the amputation was carried out, the greater the survival *(Table 4).* As the war went on, it was noticed that if amputation was done within 24 hours, mortality was lower than if performed

Table 4. Deaths from amputation for the British Army in the Crimean War and the Confederate Army of Northern Virginia, 1863*

Amputation site	British Army in the Crimea: Deaths (%)	Confederate Army of Northern Virginia: Deaths (%) based on timing of amputation	
		Under 48 hours	After 48 hours
Hip†	100%	66%	—
Thigh†	56%	38%	73%
Shoulder joint	33%	31%	71%
Lower leg	30%	30%	49%
Arm	26%	14%	37%
Foot	23%	3%	12%
Forearm	5%	12%	22%

*From Bollet AJ, *Civil War Medicine: Challenges and Triumphs,* Table 5.5, p. 156. Copyright 2002 by Galen Press, Ltd. All rights reserved. Reprinted with permission of Galen Press, Ltd., Tucson, AZ. Crimean War data: Cantlie N, *A History of the Army Medical Department,* Vol. 2. Edinburgh: Churchill Livingston, 1973. Confederate Army of Northern Virginia data: Sorrel P, Gun-shot wounds—Army of Northern Virginia. *Conf States Med Surg J* 1864;1(10):153 and Chisolm JJ, *A Manual of Military Surgery for Use of the Surgeons in the Confederate Army*, 3rd ed., 1864; republished: Dayton, OH: Morningside Press, 1992, p. 361.

†"Hip" meant an amputation high on the femur, near the hip joint. "Thigh" usually meant an amputation near the middle of the femur, although sometimes the location was specifically described as "upper third" or "lower third."

after more than 48 hours. Only about 1 in 15 Union physicians was allowed to amputate. Only the most senior and experienced surgeons performed amputations. These changes were put into effect because of the public perception that too many amputations were being performed. Amputations were not carried out using sterile technique, given that Lister's classic paper on antisepsis did not appear until after the war in 1867 (15).

Anesthesia was first introduced in the United States in the 1840s. During the Civil War, it was used in over 80,000 cases. Chloroform was preferred because it had a quicker onset of action, could be used in small volumes, and was nonflammable. During the war there were only 43 anesthesia-related deaths. Anesthesia was fairly light (stage II) leading to the misperception that it was not being used.

Postoperative wound infections, when they developed, were a serious problem in the preantibiotic era. Laudable pus was thick and creamy (thought to be due to *Staphylococcal* infection) and associated with a better prognosis than malignant pus, which was thin and bloody (thought to be due to *Streptococcal* infection). Hospital gangrene was a peculiar type of necrotizing fasciitis that was first seen in the larger general hospitals. It was probably a result of a *Streptococcal* infection since nurses taking care of these patients occasionally developed erysipelas, but the exact organism remains unknown. A large percentage of patients with it died (45%) (8). Treatment was to dissect away dead tissue and inject the wound margins with bromine under anesthesia. The wound was then packed with a bromine-soaked dressing and the patients isolated in separate tents with a separate bandage supply. Nurses dressed these patients' wounds last and washed their hands in chlorinated soda between patients.

NONCOMBAT-RELATED DEATH AND ILLNESS

A variety of factors contributed to a high rate of noncombat-related illness, including overcrowded and filthy camps. Latrines were often not used or were drained into drinking water supplies or not covered daily. Food quality was poor from several standpoints. It was poorly stored, poorly cooked, and lacked enough vitamin C to prevent scurvy. The Army of the Potomac eventually added a number of rules: camps had be pitched on new ground and drained by ditches 18 inches deep, tents had to be struck twice a week to sun their floors, cooking had to be done only by company cooks, all refuse had to be burned or buried daily, soldiers had to bathe twice a week and change clothing at least once a week, and latrines had to be 8 feet deep and covered by 6 inches of dirt daily.

There were few useful medications at the time, and about two thirds of all drugs were botanicals. In 1860 Oliver Wendell Holmes stated at the annual meeting of the Massachusetts Medical Society, "I firmly believe that if the whole materia medica, as now used, could be sunk to the bottom of the sea, it would be all the better for mankind,—and all the worse for the fishes" (16). Medications that were helpful included quinine for malaria, morphine, chloroform, and ether, as well as paregoric. Many others were harmful. Fowler's solution was used to treat fevers and contained arsenic. Calomel (mercurous chloride) was used for diarrhea. Mercury is excreted in high concentration in saliva. This led to excessive salivation, loss of teeth, and gangrene of the mouth and cheeks in some patients. There were several famous cases of calomel toxicity. One involved Louisa May Alcott, the author of *Little Women,* and the second Carleton Burgan. He was one of the first people to undergo plastic surgery in the United States. Dr. Gurdon Buck performed a series of five operations using skin from his forehead to rebuild his cheek and side of his nose.

Physicians at the time had an extraordinary workload. The following was excerpted from a letter Dr. Daniel Holt wrote to his wife, Euphrasia:

> You cannot imagine the amount of labor I have to perform. As an instance of what almost daily occurs, I will give you an account of day-before-yesterday's duty. At early dawn, while you, I hope, were quietly sleeping, I was up at Surgeon's call and before breakfast prescribed for 86 patients at the door of my tent. After meal I visited the hospitals and a barn where our sick are lying, and dealt medicines and write prescriptions for one hundred more; in all visited and prescribed for, one hundred and eighty-six men. I had no dinner. At 4 o'clock this labor was completed and a cold bite was eaten. After this, in the rain, I started for Sharpsburg, four miles distant, for medical supplies (17).

The soldier's diet consisted of fresh or pickled beef. It was heavily salted and frequently needed to be soaked prior to cooking and was often spoiled. Salt-cured pork was often rancid and mostly fat. Coffee and hard tack were staples of the diet. Hard tack was a large biscuit that was often dipped in coffee to make it more palatable. There was very little in the way of fresh fruits or vegetables. Desiccated vegetables were often substituted, but the process led to the loss of biologic activity of vitamin C and unfortunately to many potentially preventable cases of scurvy. Scurvy had been known to result from lack of fresh foods and greens in the diet based on an observation made by Johann Bachstrom in 1734. The case fatality rate of many diseases worsened as the war went on, perhaps as a result of malnutrition and dietary deficiencies.

The most common sickness among soldiers was gastrointestinal disorders. There were 711 cases per 1000 soldiers per year (18). The rate was higher in the West, where sanitation was worse. The mortality rate of acute diarrhea and dysentery was 3 to 17 per 1000 per year, while that of chronic diarrhea and dysentery was 126 to 162 per 1000 per year (19). There were no cholera outbreaks.

Malaria was also frequent: 224 of every 1000 Union soldiers seeking medical treatment were diagnosed with the disease (20). It was particularly common in southern states such as Arkansas and Mississippi. William H. Van Buren discovered in 1861 that quinine could be used prophylactically to prevent malaria. Southern states did not have a large enough supply to use it in this way. Although the cause of malaria was unknown at the time, it was known that its incidence could be reduced by locating camps away from stagnant water, sleeping in closed rooms, and sleeping on elevated ground or upper floors of buildings.

Digging ditches or canals and sleeping outdoors were known to increase risk.

Yellow fever was a major problem in the South, killing over 10,000 people (21). There were more outbreaks in Texas during the war than in any other state. Epidemics occurred in summer and autumn months. It was known as the stranger's disease since it often affected newcomers to the area. Those that were infected and survived acquired lifelong immunity. Outbreaks would often occur after a ship arrived from a Caribbean port. It could be prevented by quarantining newly arrived ships in most cases. Attempts at its prevention by Benjamin Butler in New Orleans may have been the first example of a medical incentive plan. Butler, with urging from his superior officer Rear Admiral David Farragut, told Dr. Jonathan M. Foltz: "In this matter your orders shall be absolute. Order off all you may think proper [ships to quarantine], and so long as you keep yellow fever away from New Orleans your salary shall be one thousand dollars per month. When yellow fever appears in this city your pay shall cease." Dr. Foltz quarantined all ships for 40 days 70 miles below the city, and this virtually eliminated yellow fever in New Orleans (22).

There were over 75,000 cases of typhoid fever in the Union Army during the war. It resulted from exposure to fecally contaminated food and water, as well as flies. It killed 17% of affected soldiers in 1861 and 56% by 1865 (23). Typhoid fever was especially common in Washington, DC, where it claimed the life of Abraham Lincoln's son Willie.

Measles outbreaks were also common. There were at least 67,000 cases in the Union Army, with more than 4000 deaths. Of the 1200 soldiers in the 12th North Carolina, 800 developed measles during a 4-month period in 1861 after arriving in a West Virginia camp (24). Farmers made up 48% of the Union Army, and rural populations often had very little immunity to childhood diseases. Epidemics were common at the time of an influx of new troops, especially early in the war. The death rate was almost twice as high in African Americans as in whites, 11% versus 6%.

A smallpox vaccine had been invented by Edward Jenner 70 years before the war, but a large percentage of the population was not vaccinated. The annual incidence of smallpox was 5.2 cases per 1000 in whites and 35.1 per 1000 in African Americans (25). Cases were quarantined. Because vaccine material was in short supply during the war, material was aspirated from the pustules of vaccinated people. This unfortunately resulted in the transmission of many cases of syphilis.

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