The Civil War (1861-1865) and the Familiarization of

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The Civil War occurred during a lull in the progress of medicine in the U.S. Thus, it was not until 1867 that Joseph Lister published his paper on "The Antiseptic Principle of Surgery." Later still, Louis Pasteur in 1880 and Robert Koch in 1882 demonstrated their revelations leading to the germ theory of disease. In this Civil War interim of four years, probably more than 700,000 deaths among the Union and Confederate military occurred. Infectious diseases (including enteric disorders) outnumbered battle wounds by a 2:1 ratio. Of course, battlefield wounds were also a terrible problem.

Although the clinical use of ether (ETH) was employed in 1842 (Crawford Long) and 1846 (William Morton), and chloroform (CHL) in 1847 (James Simpson), the use of these two agents was not generally popular in the medical cultures in the U.S. prior to the beginning of the Civil War. Rapid surgeons, the use of alcoholic drinks, the employment of physical restraints, opioid-bearing compounds and varied types of bite blocks were the conditions under which surgery was performed. It was also felt that the stimulating power of "cold steel" would have a salutary effect and not cause depression found with anesthetics. An important psychosocial factor present in the 19th century was that the female and child were more susceptible to the effects of anesthetics, while the male was more resistant to the side effects and complications. It was thought to be "unmanly" for a male to undergo an anesthetic and even complain or cry out as the knife begins to cut its way through tissue. In terms of the choice of anesthetic agents in military history, sulfuric ether was used by both the American and Mexican forces in the Mexican-American War (1846-1848). In the Crimean War (1853-1856), CHL was the agent of choice used by the British and French forces, with the French reporting the use of CHL in more than 25,000 cases without a single death, while the British noted 20,000 surgical procedures under CHL with but one fatality. On the other hand, the Russian opponents favored the application of ETH. Even though more than 30 different inhalers and vaporizers were developed since Morton's use of ETH in 1846, during the Civil War, both ETH and CHL were delivered with the agent dripped over a cloth in the shape of a cone held lightly over the nasal-oral cavity. Since the overwhelming number of interventions were amputations, a very light plane of anesthesia was required.

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Fortunately, for both the Union and Confederate medical corps, many manuals by outstanding surgeons, both national and foreign (translated into English), were available. Some of these manuals contained descriptions on the use of these agents. An eminent Confederate surgeon, John Julian Chisholm, published a book in 1861. Titled *Manual of Military Surgery for the Use of Surgeons in the Confederate Army*, it had a chapter on the use of CHL. This had a counterpart on the Union side. A well-written essay on CHL by the famous surgeon Valentine Mott was available to the Union Army surgeons.

Progress in the use of anesthetics during the Civil War can be noted in the chapter on anesthetics found in one of the most important medical studies ever published, the *Medical and Surgical History of the War of the Rebellion* (MSHWR), published under the aegis of the Union Surgeon General, William

American Medicine With Anesthesia and Anesthetics

A field hospital during the Battle of Williamsburg, Virginia, May 4-8, 1862. In this battle, there were 1,866 Union and 1,570 Confederate casualties. A patient is being prepared for amputation of his right leg, below the knee. Anesthesia is given using a cloth or towel and is probably just beginning as the left fist is clenched and the left extremity still retains its tone, since it is elevated. The surgeon at the lower left hand of the picture appears to be holding a wound probe, while the surgeon next to him is holding an amputation saw.

Hammond. Started in 1862, its first edition was published in 1870. This work has long been considered a masterpiece in the annals of medical literature, comprising two volumes with three medical and three surgical parts, each part approximately 1,000 pages and consisting of many thousands of drawings and photos in black and white as well as hand-tinted in color. It contains charts delineating most all of the surgical procedures, as well as complications, examples of wound injuries, examples of pathological specimens, hospital design, marine and land transportation units for the wounded, epidemiological data on diseases, therapeutics, epidemics, statistical analysis of trauma, and many hundreds of case histories.

What I have just noted above very barely touches but a fragment of the contents of this medical monument. In Volume II, Section III of the MSHWR is a chapter of nine pages titled "Anaesthetics." It mentions the use of 80,000 anesthetics given to Union troops during the Civil War, without supplying where the figures originated. Based on other primary sources, it has been calculated that more than 120,000 Union and Confederate anesthetics were carried out during the Civil War, with the 80,000 listed in the MSHWR being considered as a shortfall. Using casualty figures and case reports, the MSHWR examined the records of 8,900 wounded Union soldiers having an anesthetic for a major procedure where the anesthetic used was identified. These agents included ETH, CHL, or an azeotropic mixture of ETH and CHL. It is to be remembered that CHL was generally used under field conditions in both armies because it was not explosive, did not support combustion and hence could be used near candles and other flammable sources of light. CHL was potent and it produced a rapid induction. The relatively small volume needed to produce an analgesic-anesthetic state allowed its light weight not to impede an army's mobility. In this study, CHL was used in 6,784 cases (76.2 percent), ETH in 1,305 (19.7 percent) and the CHL-ETH mixture in 811 (9.1 percent). In terms of anesthetic mortality, the rate was quite low, with 37 deaths using CHL (0.54 percent), four with ETH (0.30 percent) and two with the mixture (0.24 percent). Description of the low

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mortality rate using CHL was also described by the Confederate surgeon of the Stonewall Brigades, Hunter Holmes McGuire, who noted that in the use of CHL for 28,000 procedures, there was no loss of lives attributed to the agent. Similarly, another Confederate surgeon, John Julian Chisholm, stated that he never had a single death from chloroform in more than 10,000 anesthetics.

A prospective study was also reported in the MSHWR, in which the total anesthetic dose needed to maintain the anesthetic state over time was calculated, as well as the incidence of vomiting, excitation or circulatory depression. In the 595 cases studied, there were 332 in which ETH was used, 152 were exposed to CHL and 108 to the azeotrope. There were three deaths, one for each of the agents used. Vomiting had a higher incidence rate with ETH; there was less excitation with CHL. ETH caused the least amount of circulatory depression. Because the potency of CHL allowed for more rapid induction, a comparatively smaller quantity of this agent was needed.

Approximately 15,000 physicians enrolled in the Union and Confederate armies, and many of these came from disparate educational and medical backgrounds. One can note that the first-hand exposure to anesthetic agents and techniques, as well as to their side effects and complications, gave these physicians an insight into the world of anesthesia that might never have been possible without this conflagration occurring, whose sesquicentennial we now celebrate. After the termination of this horrendous conflict, these doctors would return to their practices, hospitals, clinics and medical schools. They would be all the richer for being exposed to, or using, this most unique American contribution to the life-easing quality of mercy – the discovery of anesthesia!

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