An amputation being performed in a hospital tent during the Battle of Gettysburg. Courtesy of the Department of the Interior, National Park Service

Orthopedic Surgery during the American Civil War

Tony Forgione, CST, LPN

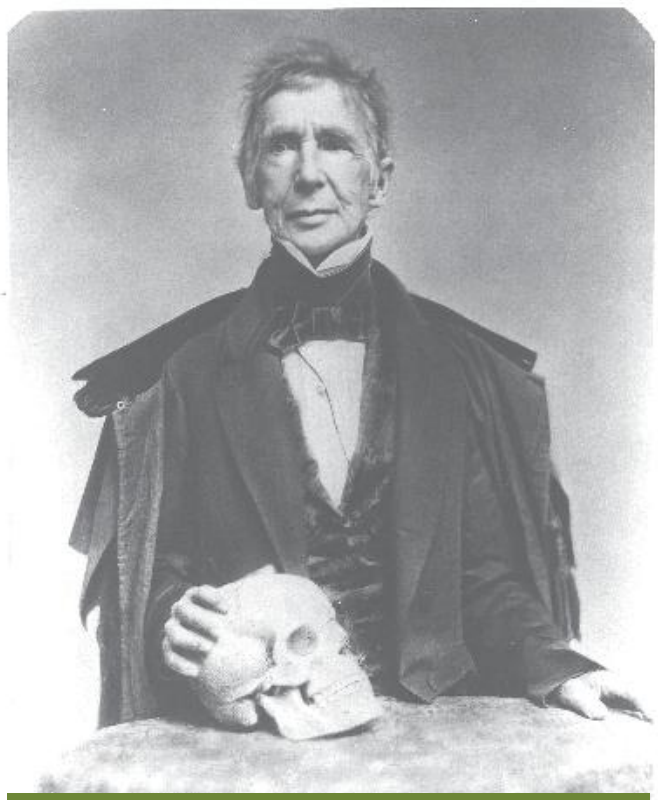
Surgery during the American Civil War, as portrayed in movies, was an exercise in torture. The scene from the movie "The Horse Soldiers" shows where the actor, William Holden, had to amputate the infected leg of a union soldier. The surgery took place on the hay-strewn floor of a horse stall and the only method of anesthesia that was available was a bottle of whiskey and four strong soldiers to hold the patient down. The film's portrayal was far from reality.

The use of anesthetic agents in surgery was first successfully introduced in 1846 at the Massachusetts General Hospital (MGH) when Dr William Morton used ether as an anesthetic while doctors John C Warren and Henry J Bigelow performed a neck dissection on a patient. The patient reported a complete absence of pain during the procedure. Dr Warren was quoted as saying, "Gentlemen, this is no humbug."

The use of anesthetics had a profound effect on the number of future surgical procedures. At MGH, during the years of 1839-1846 there were a total of only 39 surgical procedures performed. However, during the 10 years following, the number of surgical procedures increased to 189 cases.

LEARNING OBJECTIVES

- Learn about the battlefield conditions doctors had to deal with during the Civil War
- Identity the three categories doctors established to help treat patients
- Examine what caused the majority of injuries during the battle
- Discuss the various methods used by surgeons to mend gunshot wounds
- Read about the influential people who made anesthesia, orthopedic surgery and prosthetics what they are today



Dr John Collins Warren, (1778-1856) who co-founded Mass General Hospital with Dr James Jackson in 1811, was the surgeon at the first public demonstration of surgical anesthesia in 1846.

The 19th century has been described as the "medical dark ages." Surgeons during this time had no standards for what caused infections, effective sterilization techniques and proper sanitary conditions.

MEDICAL TRAINING

Medical training during the 19th century consisted of students attending a two-year program. In the first year, students attended lectures. The second year also consisted of lectures, and in many cases, the lectures were the same as the year before. Medical students received no laboratory training and had no hands-on clinical experience with patients. Once they graduated they had to find jobs working with a practicing surgeon who would agree to take them on as his apprentice. They were exposed to patients during this time and began assisting the surgeon with surgeries. Once they acquired an adequate number of years working with a surgeon, they were able set up their own medical practice.

The 19th century has been described as the "medical dark ages." Surgeons during this time had no standards for what caused infections, effective sterilization techniques and proper sanitary conditions. Before the start of the Civil War many surgeons never had treated a gunshot wound. When the war started, surgeons were immediately faced with a lack of supplies, a lack of proper shelter and clothing and overcrowded conditions.

> "Hospitals were sometimes overwhelmed by the major battle casualties.
>
> The limited number of surgeons worked around the clock."

FIELD HOSPITAL CONDITIONS

To further compound the dire situation, many of those who were wounded on the battlefield remained there long after hostilities ended. This unfortunate condition was documented in a communication in August 1862 after the Second Battle of Manassas from the Surgeon General William Hammond to the Secretary of War Edwin Stanton:

> "Up to this date, 600 wounded still remain on the battlefield … .
>
> Many have died of starvation; many more will die in consequence
>
> Of exhaustion, and all have endured torments which might have
>
> been avoided."

To try to rectify this deplorable situation, Hammond selected Jonathan Letterman as the new medical director of the Army of the Potomac. Letterman established the Ambulance Corps. This service consisted of able-bodies soldiers who were assigned to three ambulances for a regiment of approximately 1,000 soldiers. The horse-drawn ambulances could carry a total of four soldiers on stretchers to field hospitals. The field hospitals were established in any available building and/or field that were considered to be a safe distance from the battlefield. The ride, though sometimes only a few miles, was extremely bumpy and painful for the wounded individuals.

However, the wounded soldiers were not any better than

A Re-enactment of the October 16, 1846, ether operation.

they were before they were removed from the battlefield. The field hospitals were overcrowded, lacked proper hygiene and sanitary conditions and held an inadequate supply of clothing, food and water.

CASUALTIES DURING THE WAR

The following table breaks down the total casualties during the armed conflict.[x]

Casualties	Confederate	Union
Battle Deaths	94,000	110,070
Diseases	164,000	250,152
Total	258,000	360,222

Most of the battle casualties were from small arms ammunition, resulting in 94% of the casualties inflicted. Artillery wounds accounted for 5.5%, and only 0.4% was caused by bayonet or saber stokes. The gunshot wounds produced large gaping wounds that resulted in massive soft tissue damage and shattered bones. Of all the injuries recorded, 70% involved extremities that usually included bone damage. The Minié bullet was to blame for this type of destruction. The Minié was developed by Claude-Etienne Minié and introduced in 1849. It was cylindrical in shape with a hollow base, weighed 1.05 ounces and was extremely accurate, although it was considered a slow-moving bullet, traveling only 950 feet per second when fired.

TREATING ORTHOPEDIC INJURIES

Casualties during the Civil War were broken down into three categories. The first involved injuries that did not require any surgical intervention. These patients were treated in a more conservative method. For an upper arm injury, the surgeon would apply a Velpeau sling. Patients with lower extremity injuries who did not need surgery would be placed in a Buck's traction. Soldiers would need to remain in traction for a number of weeks to allow their broken bones to heal.

ADVANCEMENT OF ARTIFICIAL LIMBS

The after-effects of the Civil War produced a vast demand for artificial limbs. It was reported that around 35,000 survivors were amputees.[1]

One soldier who was in need of a prosthetic was James Edward Hanger. James was a sophomore studying engineering at Washington College when the war started. At that time, he left college to enlist, joining a cavalry unit. During his second day as a soldier, in June 1861, a Union cannonball struck his left leg below the knee while he was camped out at a stable. The incident smashed his left leg. He was badly wounded and was captured and taken to a Union hospital where a surgeon had to amputate his leg. James Hanger became the first documented amputation of the Civil War.[2] A few months later, James was exchanged in a prisoner swap and was sent home.

Once at home, James isolated himself in his room much to the worry of his family. He kept asking for wood, leather and rubber and slowly developed an artificial leg with two articulating joints. A patent record for patent number 155, was noted by the Confederate Patent Office on March 23, 1863.[2]

His success with this limb led him to start his own company, the JE Hanger Company out of Richmond, VA. His unique design caught the attention of the Virginia legislature who commissioned him to provide artificial limbs for returning Virginia veterans.[2]

Today, the company is still in existence as the Hanger Orthopedic Group, Inc. It is a multimillion-dollar corporation with centers in 45 states.[2]

Reference

1. Oatman-Stanford, H. War and Prosthetics. How Veterans Fought for the Perfect Artificial Limb. October 2012. Collectors Weekly. http://www.collectorsweekly.com/articles/war-and-prosthetics/ Accessed October 2014.
2. James Edward Hanger. Find a Grave. http://www.findagrave.com/cgi-bin/fg.cgi?page=gr&GRid=86673541 Accessed October 2014.

The second injury category involved the first attempts at saving limbs. The surgeon would remove the tissue in the immediate area of the gunshot wound, as well as damaged bone in an effort to allow healing to take effect. However, according to Julian Kuz, the resulting instability and pain would prevent soldiers from being able to walk.

The final category for treating broken bones was to amputate the affected limb. During this time, there was no viable method for the reduction of broken bones in field hospitals. Each potential case was reviewed by a panel of surgeons who would make a decision regarding whether or not to amputate. The procedure was performed by a senior surgeon who was separate from the decision-making panel. The military medical corps felt this method would eliminate needless amputations. Records indicate that there were at least 50,000 amputations performed during the war.

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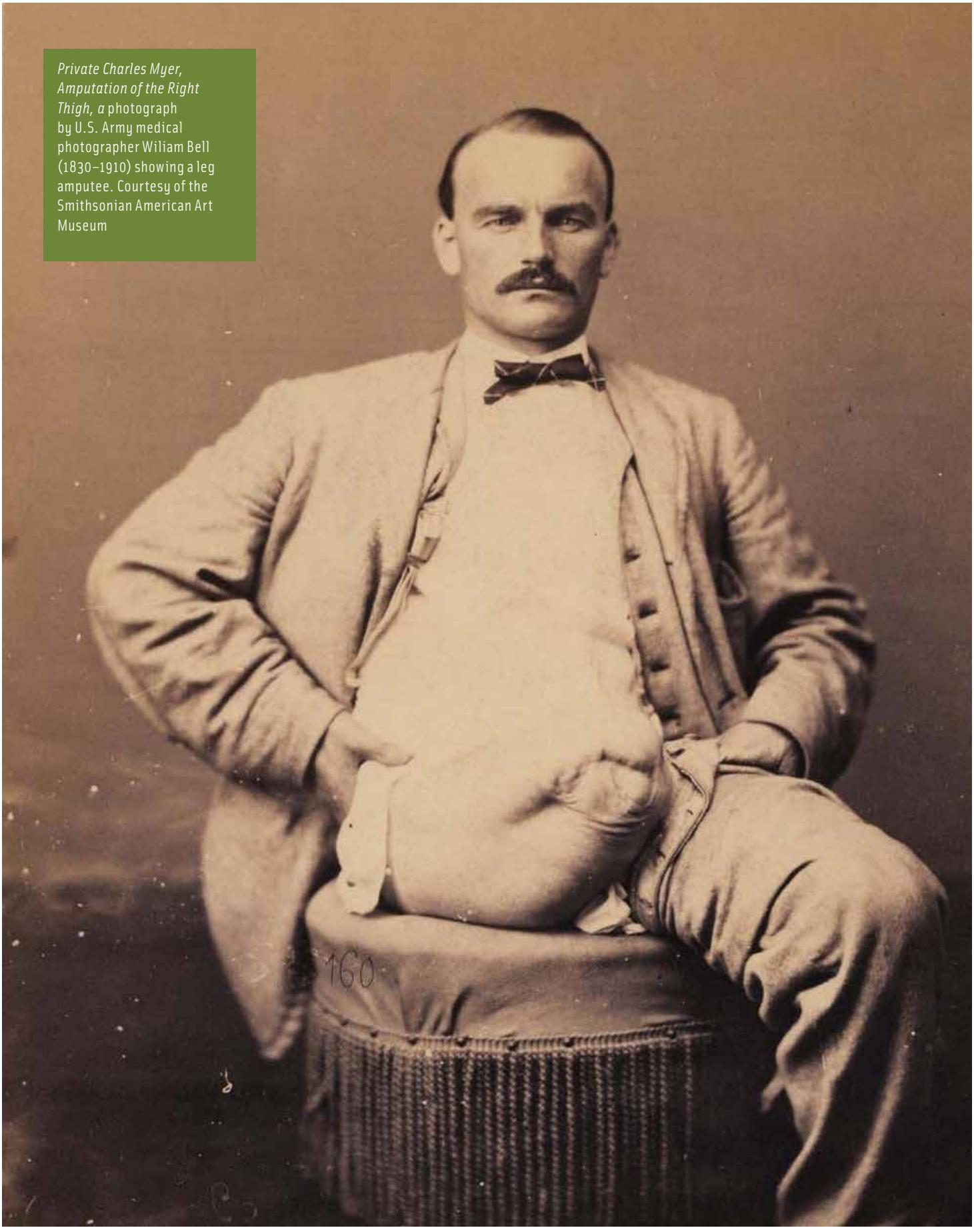
The procedure, by today's standards, was primitive. The surgeon would probe the wound with his fingers or a blunt instrument, and a tourniquet would be applied to reduce the loss of blood. The surgeon would use a Lister amputation knife and cut through the skin, underlying tissue and muscles to expose the bone. He would use an amputation saw to remove the bone, and retraction would be supplied by the hands of his assistants. A file was used to smooth sharp edges of the bone. Bleeding was controlled by tying off the ends of the blood vessels with cotton or silk thread. The muscles and tissue were then sewn over the end of the amputated extremity and the skin edges were loosely approximated together. The average length of time for an

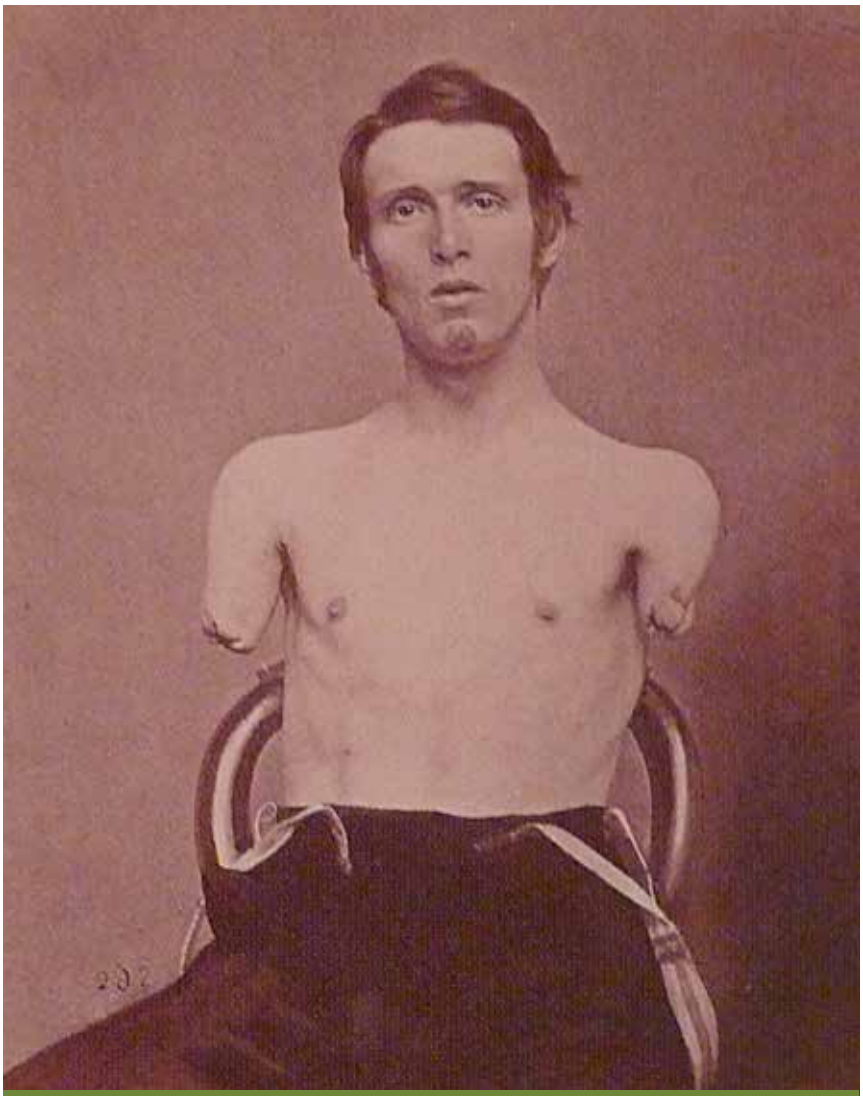


Private Charles Myer, Amputation of the Right Thigh, a photograph by U.S. Army medical photographer Wiliam Bell (1830–1910) showing a leg amputee. Courtesy of the Smithsonian American Art Museum

amputation was 10 to 15 minutes.

There were three different techniques utilized for amputations: the oval technique, the circular incision and the flap operation. Most surgeons used the flap technique because it provided a cushion for future fittings for a prosthetic device.

When the patient was strong enough to travel, they were sent to a military hospital or returned to their home for recuperation.



Alfred A Stratton lost both his arms at age 19 on June 18, 1864, by a cannon shot during the American Civil War. The amputation was performed by AS Coe. Stratton died as a father of two at the age of 29.

OPEN REDUCTION INTERNAL FIXATION

According to Kuz, during the Civil War the first attempts to perform an open resection internal fixation of fractured bones were performed by Dr Benjamin Howard. He has been credited with performing three of the four recorded such cases. To further complicate his efforts, he performed the surgery while the wounded soldier was still on the battlefield. Dr Howard felt there was too much pain experienced by wounded soldiers as they were transported to the field hospital. He also felt that there was the potential for further damage if soldier's broken bones were not stabilized. He proposed his method would help prevent, "Such painful and dangerous motion of the fractured ends of the bone en route to general hospital."

His method consisted of enlarging the wound for adequate access, and then he "removed all the detritus and loose fragments … ." Dr Howard then matured the ends of the fractured bones by using a metacarpal

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Instrument case for amputation during Civil War. Courtesy of Naval History & Heritage Command

saw to remove the ends of the bone that created "the least possible shortening compatible with clean-fitting surfaces." Using a device of his own making, Dr Howard drilled two pairs of holes through the proximal and distal bones and passed a suture of stout annealed iron wire to reduce and secure the bone edges. The amount of bone that Dr Howard had to excise was considerable, yet effective.

Though an open reduction internal fixation procedure is a standard orthopedic operation today, Dr Howard's methods were not embraced by the medical profession. His colleagues objected to placing a foreign substance into a wound.

Orthopedics was not officially recognized until 1887 when the American Orthopedic Association was founded. However, the foundations of this specialty were practiced by many pioneering surgeons who recognized the importance of restoring proper function to patient's broken bones, foundations that still influence today's orthopedic protocols.

ABOUT THE AUTHOR

Tony Forgione, CST, LPN, has almost 40 years of experience as a surgical technologist. His career has spanned from the US Navy to the Massachusetts General Hospital, where he continues to work. Tony is also the Supervisory Operating Room Nurse for the International Medical Surgical Response Team (IMSuRT), a federally mandated disaster team. In addition, he earned a Bachelor's degree in history from the University of Massachusetts at Boston. Tony spent 20 years demonstrating his interest in history as a Civil War reenactor.

REFERENCES

1. Bull, W; Bull, M. Something in the Ether: A Bicentennial History of Massachusetts General Hospital, 1811 – 2011. Memoires Unlimited, April 2011.
2. Cohen, D. Orthopedics at War. www.CivilWarMedicine\OrthopedicsatWar.html Accessed September 2014.
3. Freemon, FB; Gangrene and Glory: Medical Care during the American Civil War," University of Illinois Press. Chicago. 2001.
4. Hammond to Stanton, September 7, 1862. Secretary of War Correspondence, National Archives. Reproduced in MSH. Surgical Volume (3): 394.
5. Howard, B, MD. "The Application of Sutures to Bone in Recent Gun-Shot Fractures." Medico-Chirugicall Transactions, 1865; 245-253.
6. Billings, JS, MD. Letter to his wife from the field hospital in Gettysburg. Pennsylvania.
7. Kuz, J, MD; Bengtson, B, MD. Orthopedic Injuries of the Civil War. Kennesaw Mountain Press. Kennesaw, 1996.