

SURGERY



*Portable Surgical Hospital,
Bougainville, New Guinea*

1943 ©National Archives

The Surgical Legacy of World War II

Part 1: Pearl Harbor, Preparation and Portability

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AUTHOR'S NOTE:

As our nation remembers the 75th anniversary of the Japanese attack on Pearl Harbor on December 7, 1941 – “a day which will live in infamy” – we should acknowledge the contributions of the outstanding World War II medical personnel, whose incredible vision, intensive planning and heroic efforts gave the wounded an extraordinary chance of survival. Among them are distinguished military surgeons, whose experiences inspired them to invent and implement methods and instruments we know the names of because they are used every day in modern ORs. Yet, there are countless names not mentioned here – men and women of all races, ranks and occupations, whose contributions are no less important to the effort to mitigate human suffering, and who are profoundly worthy of being remembered. Why should we, as working CSTs care about this increasingly distant history? Because, the surgical technology profession can trace its inception to this period in American history – as the military planned for, and then entered – the first truly global conflict.

This series of articles will provide an overview of the key surgical developments of World War II. The story begins with the tactical and medical planning and build-up prior to America's formal entry into the war following the attack on Pearl Harbor. Despite the political necessity of maintaining a congressional-led national policy of neutrality, President Franklin D Roosevelt and his cabinet quietly, but unswervingly, worked to prepare the nation for war. While much has been made of the nation's industrial base shifting into the manufacture of weapons and vehicles, little is commonly known about the preparations for the massive number of expected casualties.

LEARNING OBJECTIVES

- ▲ Review the medical advancements that were made as a result of the Pearl Harbor attack
- ▲ Explore how WWII impacted the surgical profession
- ▲ Recall how the role of the surgical technologist became to be
- ▲ Discuss how the MASH unit was created
- ▲ Learn about the logistic complications that confronted medical personnel during the wars

SNAPSHOT: THE FIRST SURGICAL TECHNOLOGISTS

The Medical Department Enlisted Technicians Schools from 1940 until the end of the war trained more than 43,000 men and women as surgical "technicians." MDETS around the country prepared the STs for their role in the ORs as well as the basics of being in military service.



Surgical technicians in training at Letterman General Hospital in San Francisco in 1943

In 1942, an advanced program was established for the highest-skilled techs. They were sent for another three months of surgical training in a hospital setting, in a curriculum that looks a lot like today's programs with class-



A surgical technician is shown sterilizing instruments in a portable autoclave

room time and hospital hours where students logged a variety of surgical cases and time in the wards. The program was a huge success and was intended to supplement or replace nurses in the forward areas of battle and in the hospital units.

Although there were thousands of women STs who were highly praised for quickly learn-

ing skills and excelling on the job, the Army relied heavily upon male STs near the front line. They could be sent alongside platoons to function as company aidmen when not in the operating room, and were responsible for carrying enormous amounts of heavy equipment.

During WWII and to this day, STs represent an essential part of the fixed and mobile hospital systems in all theatres of operation.

GEO-POLITICS BEFORE WWII: AN UNSTABLE TIME

The years preceding the surprise attack on Pearl Harbor (and other bases) represent a highly unstable time across the globe. The period between 1918 and 1936 saw the rise of destructive international leaders in both Europe and the Pacific and failure of the World War I peace treaties. Memories were still fresh of a devastating war that had just ended, which had ravaged much of continental Europe. The Japanese-Russian War (1904-1905) was still reverberating in the Pacific, as this was the first time an Asian nation had defeated one of the European powers since the dawn of European colonialism.

War was brewing even though US citizens were strongly opposed to getting involved. By the 1930s, naked aggression and outright atrocities by recently aligned Germany, Italy and Japan created unbearable political tensions in Asia and Europe. The United States' historic allies, France and England, were unable to remain neutral despite repeated capitulation to Germany and others' incursions across Europe. In September 1939, they found themselves at war with Germany over the Germans invasion of Poland.

When America declared war on Japan after its brutal attack on the US at Pearl Harbor in the Hawaii Islands and on the Philippines on December 7, 1941, the world was already embroiled in violence and turmoil. Within days, there were counter-declarations of war across the globe, and Americans entered into war for the second time in a generation.

The decades after World War I had produced significant advances in blood banking and the preservation of plasma. Doctors were gaining a better understanding of how to use morphine and antibiotics. Recognition that, historically, more soldiers died from disease than from battle, rapid improvement in vaccination programs and the discovery of antimalarial drugs were lifesaving advances, also. Yet, combat surgery had enormous hurdles still to overcome, and so the Surgeon General had decided that recruiting the best doctors in the US would be a priority in the war on casualties.

PREPARING FOR CASUALTIES

World War II would bring fighting to all reaches of the globe, and the US found itself facing significant questions as to how to treat casualties in several distinct geographical areas. War in Europe would provide access to interconnected roads, bridges, ports, railways and airfields that could be used to move patients within hospital networks. Going to war with Japan meant fighting across one-third of the Earth's surface, the vast majority of which was water, from tropical islands and Asian jungles to the Alaskan peninsula. A huge, adaptable and mobile force of medical personnel and material would be required to treat the wounded, and it was a monumental task to determine how to get them and all of their equipment to each far-flung battle zone. As was important in earlier parts of the century, the Hawaiian Islands had become a critical staging area for military and medical preparation. Pearl Harbor and the island of Oahu was home to more than 100 ships, dozens of aircraft and 51,000 Army, Navy, Marine and Air Corps personnel between 1936 and December 1941. These numbers grew exponentially during the war years.

THE PEARL HARBOR TRAGEDY

The two-hour attack by the Japanese on Pearl Harbor killed 2,403 Americans, sunk or damaged almost 20 US Navy ships and destroyed almost 200 US planes at the Naval and Army air bases nearby. The coordinated assault began at 7:45 am on a Sunday morning, and by 8:15 am, massive numbers of casualties began pouring into hospitals near the bases. Soon the wounded would arrive at other treatment centers around the island. Quick access to treatment in the golden period of time (then thought to be six hours) is cited as a leading factor in achieving a 3.8% postoperative mortality rate following the attack — a remarkable accomplishment given the surprise nature of the attack.

Thankfully, the Naval Hospital Pearl Harbor (NHPH) was only slightly damaged in



On December 7, 1941, the Japanese military launched a surprise attack on the United States Naval Base at Pearl Harbor, Hawaii

the attack, and the Navy Mobile Hospital #2 (NMH) had been unloaded on the base and was partially uncrated. The NHPH alone received 546 casualties and 313 dead in the first three hours after the attack, and by the end of the day, would treat almost 1,000 patients.

Impressively, 110 patients were treated in the swiftly-completed mobile hospital. While not comprised of canvas tents, the Navy Mobile Hospital was essentially a kit containing lightweight walls and portable versions of necessary equipment. The entire NMH was assembled by the doctors, nurses and enlisted men who would soon be working inside the mobile facility. The lessons learned from labeling,



Mobile Hospital #2, Pearl Harbor, Hawaii
Navy Medicine Historical Files Collection

unpacking and setting up the mobile hospital following the attack on Pearl Harbor became invaluable during the fighting in the Pacific islands and in Europe.

Any non-injured military medical personnel, from any branch of service, reported to the NHPH to assist in caring for the wounded. Civilians from all over Oahu disregarded their own safety to help transport the wounded. Serendipitously, the Honolulu Medical Society was hosting a con-

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ference on trauma surgery on the weekend of the attack. More than 300 civilian and military medical personnel had gathered to hear John J Moorhead, a prominent WWI surgeon speak. Dr Moorhead and every one of the assembled doctors rushed to the NHPH to help when they heard the news, and then rapidly made their way to the base and the other hospitals on the island and spent the next several days

operating around the clock.

Burn victims dominated the casualties during the morning of the attack. Sixty percent of the injuries were either flash burns (analogous to a bad sunburn with widespread first- and second-degree burns from exposure to extreme heat) or more severe burns from being thrown into the harbor where fuel flamed on the surface of the water. The viscous fuel oil covered the men from head to toe and contributed to the severity of the burn and made treatment extremely difficult. Many of the burn victims were treated on a Navy hospital ship in the harbor.

Dangerously, the admitting process was skipped entirely at shore hospitals because such an enormous number of casualties arrived simultaneously. The burn wounds created a great challenge of identification. Since the attack occurred on a Sunday, many of the men were off or enjoying a slower pace to their when the raid began. Many of them didn't have their personalized uniforms or metal ID tags on them when they were brought in for treatment. Their clothing was burned off, and so too were their fingerprints as their hands were scorched. Many of the injured arrived in an unconscious state, to a facility not near their assigned duty station and did not survive their surgeries. The US Navy had to create "unknown" graves, but recently has been exhuming remains and applying DNA technology to properly identify those who died and give their gravesites respective markings.

Compound fractures, shrapnel wounds and amputations were the other significant categories for the remainder of the injuries. Those were the cases to which civilian

SNAP SHOT: BIRTH OF MODERN ANESTHESIOLOGY

Ether was an important anesthetic agent in frontline surgeries of WWII. It was easy to carry and administer, but it was highly flammable and known to cause respiratory paralysis. Often times, supplies were interrupted and ran desperately low.

IV Pentothal was widely available, but had its own hazards. By the end of the war, endotracheal intubation would become the enduring standard in anesthesiology. The Miller (1941) and MacIntosh (1943) laryngoscopes advanced tracheal visualization for airway management for the anesthetist.

The year 1942 brought another development when Harold Griffith, MD, of Montreal, Canada, introduced the use of Intocostrin (curare, a muscle relaxant) during surgery. Longer surgeries became possible and surgery became safer than ever before. Although it would take time for these advancements to get to the front lines of battlefield medicine, the homefront scientists were contributing enormously to a body of knowledge that would become essential to the restorative surgeries returning GIs would need when they returned to the States.

surgeons were assigned. Though the intentions of these doctors were admirable, several critical errors resulted in a number of deaths or complications which would not likely have occurred had more specially trained personnel been available. Significant lessons were learned from hundreds of adverse outcomes regarding amputation skin flaps, but there were even more serious errors made. A staggering number of deaths related to anesthesia during the surgeries at Pearl Harbor's medical facilities were reported immediately subsequent the attack. This resulted from the lack of knowledge of how patients in shock would respond to the Pentothal (sodium thiopentone) IV anesthesia. Anesthesiology was not, at this point in medical history, a recognized or well-regarded specialty in the United States. The fact that, at the time of the attack, the Army provided a small number of nurses a woefully inadequate three-month training program to become "anesthetists" gives evidence of the lack of awareness of the demands of this specialty. The limited cadre of trained anesthetists inside the Naval Hospital were overwhelmed by the volume of casualties. The result: scores of volunteer doctors improvised with Pentothal in order to allow surgeons to perform the necessary operations. And despite their intentions, the result was tragic. Deaths by cardiovascular collapse were the repercussion of using only intravenous Pentothal during the entire procedure. Though the exact number of deaths attributable to this cause has not been firmly calculable, this incident is still being investigated and the example is frequently taught as a cautionary tale to anesthesiology students around the world.

A WOUNDED SOLDIER'S BEST CHANCE

While Americans on the homefront prepared for involvement in the war, doctors and logistics experts were planning the best ways to deliver treatment to wounded soldiers. This quickly evolved into bringing life-saving care as close to the front lines as possible. Since the rugged terrain of the Pacific islands was very different from the cities and well-mapped countryside of Europe, American Surgeon General Percy J Carroll, knew that doctors would have to carry in what was needed to treat the wounded. Previously, the customary treatment facility was the 400-bed or 750-bed "evacuation hospital," but that was too large and impractical for most of the tiny, mountainous Pacific Islands, even though adequate medical care was as necessary to winning a battle as ammunition. Allocating a huge amount of time and resources to set up a hospital complex wasn't practical, and the swampy or jungle-covered terrain meant that a large scale on-land

medical unit simply wasn't possible. Carroll's solution was the revolutionary Portable Surgical Hospital, or PSH. The name PSH was changed late in the war to the more familiar Mobile Army Surgical Hospitals, famously known as MASH.

The portable surgical hospital was a simple, but effective and logistically flexible idea: the most urgent care would be provided immediately behind the front lines, using a few canvas tents and all necessary equipment in conjunction with the mandate that it be carried by the 29 men who would staff the unit. This strict weight limit would assure it remained truly portable, but it would also severely limit the supplies available and which surgical personnel could be



Portable Surgical Hospital in the Philippines

1943 US Army Office of Medical History

assigned to operate there. This also meant that women (ie, nurses) could not be engaged in the delivery of care in these front-line units. This was a radical departure from earlier directives regarding treating the injured. Youth, vigor and adaptability were the main considerations in deploying the PSH. The necessity of mobility would come to override the surgical experience. This upended the chain of command, yet Percy gambled that it would give wounded soldiers the best chance of survival. This policy decision also served to cement the development of the medical "technician" positions in the US Army units and on ships where women were not allowed to serve. Hence, the establishment of stateside training programs to address the demand for these occupational specialists for deployment.

A chart depicting the battle casualties of the front line list the rank of the wounded, and how to proceed with each patient's care. The "Surgical Hospital" is shown to float between the second and third echelon. The first echelon were the medical aid personnel ("medic!") at the front lines, where combat medics or Navy corpsmen run to attend to a wounded man. Second echelon is the first safe place, an aid station that is under a red cross "no fire" symbol, where medical treatment can be given. Second echelon placement is how

close to the “front” the portable surgical hospitals were most often placed - just outside the range of artillery fire.

Consideration had to be given to phasing the treatment of critical injuries. Only the most necessary surgery would be done this close to the front line, and this concept was another groundbreaking idea. Determining how to direct

Burn victims dominated the casualties during the morning of the attack. Sixty percent of the injuries were either flash burns (analogous to a bad sunburn with widespread first- and second-degree burns from exposure to extreme heat) or more severe burns from being thrown into the harbor where fuel flamed on the surface of the water.

commonly general/ thoracic/orthopedic, neurosurgical and maxillofacial) and consisted of a chief surgeon, assistant surgeon, an ‘anesthetist,’ a surgical nurse and two surgical technicians. The ASGs were assigned as a separate unit attached to a field hospital. The surgical teams stayed and operated at the field hospital under the direction of the

chief of surgery at the hospital, but were dispatched to medical clearing stations during times of heavy casualties. When out at the front lines with the troops, the ASGs reported to the commanding officer of the battalion to which they were assigned.

After doing only the most crucial procedure and stabi-

lizing a patient for transport, the goal was for the ASGs to transfer the wounded to 400-bed field hospitals. Field hospitals were technically still mobile, usually functioning inside of tents or portable buildings, but with more substantial equipment. Field hospitals and evacuation hospitals also were considerably safer because they were many miles interior from the battle zone. There, surgeons could perform functional and definitive repairs rather than focus on basic survival. Forward surgeons left extremity wounds open and usually delayed the primary closure of surgical sites, except for abdominal walls that were closed with large, looping sutures. Plaster casts were split and then taped, with a circle penciled over the fracture site. The next surgical revision was a primary consideration and a standing military order for the ASG surgeons, and this could be frustrating for them. However, the combination of quick access to surgery, wound management for infection control and phased treatment of injuries worked as designed. The Pacific ASGs were so successful that recruitment for additional teams went full steam ahead, and they played important roles in Europe after D-Day. ASG personnel also would come to be highly regarded because the doctors documented and analyzed the effectiveness of the front line procedures and how those procedures impacted the outcomes of subsequent surgeries. Their observations contributed to medical directives from the SDC that could correct harmful or ill-advised practices. The clinical observations of outcomes that the ASG teams would record proved immensely valuable to the entire medical system during, and after, the war. Dr Debakey would come to expand this concept when he returned to civilian

the care provided by the PSH meant finding the correct doctors to advise the Army.

The United States brought together some of the brightest medical minds to focus maximizing survival rates during the war and return very young men to a long, fulfilling life. The Office of the Surgeon General commissioned doctors for the Surgical Consultants Division (SCD) whose job was to recommend and develop surgical treatment policies.

The US military recruited Lt Col Michael E Debakey, MD, to lead the medical consultants. Dr Debakey and the SCD acknowledged that the PSH was a great concept, but they needed to get surgeons even closer to the front line. Noland Carter, MD, a contributing author for the US Army Office of Medical History describes the members of the SCD as “highly qualified and unusually accomplished individuals with special training and experience and eminent reputations in their individual fields of endeavors.”

These physicians recognized that the most physiologically unstable and critically wounded patients would not survive the evacuation to the field hospital or even to the PSH.

Dr Debakey and his colleagues recognized that the soldiers and sailors were a pre-screened patient pool of young, physically fit men. This group of patients, they hypothesized, would be able to survive their wounds and endure partially-completed surgeries so that they could be evacuated to a safer location for more definitive procedures. This led the SDC to propose, develop and implement the Auxiliary Surgical Group (ASG) in 1942.

The ASGs were arranged by surgical specialty (most

practice after the war, and this was his inspiration to overhaul the National Library of Medicine.

The ASGs, though initially controversial among the tactical and medical establishment, quickly proved how effective they were. These compact, portable clinics allowed for life-saving surgery in places and circumstances where a critically wounded soldier might not survive the long, and often dangerous, trek through jungle, mountain or swamp to get to a larger hospital. These doctors, nurses and techs were terrifyingly close to the front lines and operated in primitive conditions that stateside doctors could not have imagined, yet they contributed significantly to the overall survival rate of soldiers and sailors wounded during WWII. The concept was a game-changer, was lauded by military officers at the time and the basic model remains in use today, though dramatically enhanced by the advent of helicopters and rapid air military transport capabilities.

WAR RAGES ON

The second installment in this series will be published in June. That article will elucidate the delivery of medical service around the time of the Invasion of Normandy. As these anniversaries of major events of the WWII occur, we should all remember that so many instruments on our Mayo stands are named after distinguished surgeons who are also veterans of WWII. WWII defined the 20th century and propelled innovation in medicine and surgery. Surgical technology has its roots in WWII, and so does the entire system of surgical specialization. The opportunities to honor those who served our country and those who contributed to this history first-hand are rapidly dwindling, and I am humbled to be able to write about this subject.

ABOUT THE AUTHOR

My Neighborhood MASH

My name is Dolores Goyette, CST, DC. I am a faculty member at Mass Bay Community College in Framingham, Massachusetts. The college is only two miles from the Museum of World War II in Natick, Massachusetts. The museum has the only remaining, fully-equipped WWII-era Mobile Army Surgical Hospital (MASH) in the world. My students and I have had wonderful visits there, and I am grateful for the support of this amazing museum as an instructor and as a fledgling author.

Having a sense of pride that surgical technology as a profession has its roots in the military as specially-trained technicians who assisted the surgeons of WWII, I became very curious about the MASH. I wanted to learn more about the equipment and instruments on display and began researching what took place inside these hospital tents in the 1940s. The passage of 75 years

SNAPSHOT: LT COL MICHAEL DEBAKEY, MD



Dr Michael Debakey, right, receiving the Legion of Merit Award in 1945 from Surgeon General Norman Kirk

Department of Veterans Administration

Michael Ellis Debakey, MD, is one of medicine's most recognized names. During his lifetime, he became one of the most influential members of military medical systems, a surgical

trailblazer, prolific researcher and an international healthcare ambassador.

Dr Debakey served his country in World War II as chief of the surgical consultants division, remained in the military for a year after the war to establish follow-up care for returning soldiers. When he returned to civilian practice, he continued to work tirelessly for veteran's medical care systems. Dr Debakey created research libraries and systems through which the powers of national governments could influence healthcare policy.

Research that was available from treating the thousands of veterans would propel Dr Debakey's work with the National Research Council and inspire him to push the boundaries of surgical procedural methods. His work as a pioneer of cardiovascular surgery would make him one of the best-known doctors in the world, and he was chosen as the personal physician to some of the world's most powerful leaders and famous faces. Dr Debakey received numerous awards and acclamations, and was featured on the cover of Time magazine in 1965 for his work on the development of the artificial heart. Despite his broad success, he continued to perform surgery, teach and conduct research until the age of 90. He was 99 years old when he died.

An innovator since his youth, the simple, eponymous forceps and clamp are only two of the 50 surgical instruments or methods he invented. The basis for the heart/lung bypass machine, the Dacron arterial graft and the arterial endarectomy are among his accomplishments.



Dolores Goyette, shown in the red shirt, is pictured with her surg tech students and faculty from Mass Bay Community College

Photo courtesy of Dolores Goyette



MASH tent on display in Natick, MA September 2016

Dolores Goyette

was represented by familiar Cushing forceps, Kelly clamps and a Balfour retractor, yet there stood a rudimentary anesthesia machine and terrifyingly inadequate sterilizer. The life-saving work that was done in these conditions left me awestruck.

My initial intention was to write a single technical article about how much surgery had advanced since the war. No matter how hard I tried, I couldn't just write a technical article. My thoughts remain fixed on the people who would have been inside that MASH. I felt compelled to give my best effort at telling some of their amazing stories, and I am grateful for the opportunity to do that.

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The Surgical Legacy of World War II

Part 1: Pearl Harbor, Preparation and Portability

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1. How many Americans were killed during the two-hour attack on Pearl Harbor?
 - a. 1,305
 - b. 1,803
 - c. 2,403
 - d. 2,504
2. Burn injuries accounted for ____ of the victims of Pearl Harbor.
 - a. 50%
 - b. 60%
 - c. 70%
 - d. 80%
3. A large amount of deaths were related to the lack of knowledge of:
 - a. Suturing
 - b. Trauma care
 - c. Trauma recovery
 - d. Anesthesia
4. At the time of the attack, 'anesthetists' had only been trained in a ____ long program.
 - a. Three-month
 - b. Thirteen-day
 - c. Thirty-day
 - d. Two-month
5. The American Surgeon General at the time created what would later be known as:
 - a. Portable Surgical Hospital
 - b. Mobile Army Surgical Hospital
 - c. Evacuation Hospital
 - d. Portable Medical Units
6. PSHs had a strict limit of ____ men would staff the unit to ensure they remained portable.
 - a. 20
 - b. 29
 - c. 39
 - d. 42
7. Lt Col Michael E Debakey, MD, helped create, develop and implement the _____.
 - a. PSH
 - b. MASH
 - c. SCD
 - d. ASG
8. ASGs were arranged by:
 - a. Surgical specialty
 - b. Amount of wounded
 - c. Amount of technicians
 - d. Surgeons available
9. Other significant injuries resulting from the attack included:
 - a. Shrapnel wounds
 - b. Amputations
 - c. Compound fractures
 - d. All of the above
10. _____ was a great challenge to the nature of when the attack occurred and the extent of the burn injuries.
 - a. Treatment
 - b. Recovery
 - c. Identification
 - d. None of the above

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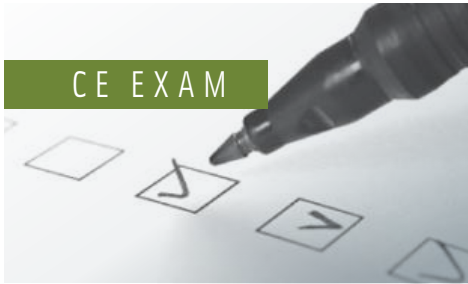
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