Colonel Edward Churchill's Transformation of Wound Care in the Mediterranean Theater of the Second World War

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ABSTRACT

Colonel Edward D. Churchill's role as the Chief Surgical Consultant in the Mediterranean Theater of the Second World War brought about major changes to the standards of wound care for all soldiers in the theater. Churchill toured the theater noting the major discrepancies and problems in the medical care of wounded soldiers. Following this tour, Churchill set out to implement higher standards of wound care throughout the theater.

Churchill vehemently worked with whole blood use, implementation of an organized evacuation route, and proper surgical techniques. Civilian doctors who made up the U.S. Army Medical Corps as well as medical misinformation caused many of the problems in these three areas. Churchill's implementation of whole blood use ended the excessive use of plasma, a whole blood substitute, raising the survival rate of the wounded soldiers. Implementation of proper surgical techniques ensured the end of the overuse of sulfonamides, an antibacterial drug, which the military surgeons frequently used in the place of surgery. Lastly, Churchill organized the medical evacuation route from the front lines to the zone of communication which guaranteed that the wounded soldiers received surgical care in a timely and appropriate manner increasing the survival rate of the casualties.

These lessons extended far beyond the Mediterranean Theater to help casualties in the Pacific and European Theaters making Churchill's incites invaluable.

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Chapter I

PROLOGUE

Edward Delos Churchill, Harvard medical professor and head of surgical services at Massachusetts General Hospital, began his wartime service on 6 March 1943 as the Chief Surgical Consultant of the Mediterranean Theater. His arrival in Algiers began a two-year tour of service that took him to Tunisia, Algeria, Sicily, and Italy. The Surgical Consultant position required him to travel long distances to various medical installations in order to assess the quality of surgery and surgical problems. The tours across North Africa revealed much to Churchill about the need for accurate medical knowledge in the fields of surgical wound management and whole blood transfusions. The knowledge gained from these tours shaped the last days of the North African Campaign and defined how physicians cared for the wounded in Sicily and Italy.

Churchill used his first tour across Tunisia as an observational trip to gather information about the British and American medical installations in Tunisia. Churchill's first tour across Tunisia began on 15 March 1943. On 16 March 1943, Churchill visited the British 31st General Hospital at Oved Athmena, Tunisia, which afforded him a closer look at the British installation which so much of the early American medical procedures were based upon. He moved on to Meskiana to the 77th Evacuation Hospital, a 750-bed institution run by a medical group from the University of Kansas. Later on 17-18 March 1943 he moved down to the 9th Evacuation Hospital at Youks le Bains, Tunisia and then on to the 48th Surgical Hospital at Bou Chebka. He also stopped in at the 18th Casualty

Clearing Station and 25th Field Surgical Unit on 20 March before returning to Algiers on 23 March 1943.

Seven days later, Churchill began a second tour of hospitals across Tunisia with Jim Forsee, the commanding officer of the 2nd Auxiliary Surgical Group who was in search of his scattered medical teams across Tunisia. After observing the British 31st General Hospital on 5 April, Churchill and Forsee moved on to the 48th Surgical Hospital. Churchill began to take note of surgical discrepancies, especially problems with the transfusion of blood plasma. For example, Churchill observed a wounded soldier experiencing chills because of the plasma infusions. The medical staff at the 48th Surgical Hospital informed Churchill that when the wounded did not show signs of shock, they were infused with 250 ccs of plasma. Physicians infused patients with more than 500 ccs in an hour when they demonstrated signs of shock. Situations such as this at the 48th demonstrated to Churchill the need for whole blood transfusions. Churchill stated that "The problems calling for expert surgical judgment seen at the 48th Surgical Hospital surpassed in difficulty any that I had encountered previously in surgery."[1] On 6 April, he and Forsee travelled to the 77th Evacuation Hospital near Tebessa where Churchill noted the widespread problems with plasma and whole blood transfusions. Here, the staff performed eight to nine whole blood transfusions per week using their own men as donors. However, getting the men to donate proved difficult as they often refused because they may need the blood if they were later wounded. Here, Churchill encountered problems with sulfonamides and the damage they could cause to patients. He observed a patient treated with sulfonamides immediately after wounding and

[1] Edward D. Churchill, MD, *Surgeon to Soldiers: Diary and Records of the Surgical Consultant, Allied Force Headquarters, World War II* (Philidelphia: J.B. Lippincott Company, 1972), 159.

continued to receive sulfonamide treatments until he reached the 77th Evacuation Hospital, where he arrived with a high fever and infection. However, once physicians cleaned the wound of all fragments, the wound healed negating the need for further sulfonamide treatment. Observing this patient led Churchill to believe that sulfonamides did more harm to the casualties than help.

On 9 April, the pair moved on to the 9th and 38th Evacuation Hospital as well as the 94th British Evacuation Hospital on the outskirts of Algiers. At the 94th Evacuation Hospital, Churchill observed British secondary sutures and the success of the surgical technique. In this procedure, surgeons at forward hospitals opened the wounds and removed all foreign materials. They then bandaged the wound and after a period of rest sent the casualty to the base hospitals such as the 94th Evacuation Hospital. Once here, the surgeons examined the wound once more for signs of infection before closing the wound. Such procedures allowed surgeons to be sure that no foreign materials or dead tissue were left in the wound before closing the wound for good. However, as Churchill later found out, implementing this radical surgical technique would prove difficult.

After returning to Algiers, Churchill again left on a third tour on 20 April, which encompassed the American Base Hospitals. On 20 April, he reached the 12th General Hospital at Oran where he observed wound management techniques. The story of a sulfonamide rash particularly interested Churchill. The young soldier in question had been the victim of a gasoline fire near his base in Rabat and was evacuated immediately following the accident. The soldier passed through several hospitals over the next nine days and each treated him with large amounts of locally applied sulfonamides. On 17 March, the casualty was found to have contracted a severe rash. The soldier reached the

38th Evacuation Hospital on 20 March where the physicians immediately stopped the sulfonamide treatments and the rash cleared. However, when the soldier was evacuated to the 12th General Hospital on 7 April, the sulfonamide treatments began again at which time the severe rash returned. The physicians stopped the sulfa treatments and the rash disappeared. This encounter showed Churchill that the use of sulfonamides not only hindered the proper healing of wounds but could also cause allergic reactions.

Churchill interviewed two of the surgeons while at the 12th General Hospital about their surgical techniques and stated that the surgeons were too set in their ways to experiment with new wound closure techniques such as secondary wound closures. As he traveled on to the 21st General Hospital at Bou Hanifa on 27 April, Churchill again found problems with the unwillingness to accept new wound closure techniques. Here he met Major Wendell S. Dove, the Chief of the Section of Septic Surgery. Dove actively performed secondary sutures that so shocked the traditional surgeons that steps were underway to forbid Dove from this procedure. Churchill further shocked the traditional surgeons at the 21st General Hospital by spending his time observing Dove's performance of secondary sutures instead of with the old-fashioned surgeons. Churchill saw great potential in this procedure and would later install it as the preferred method of wound closure in the Mediterranean Theater.

The situations he encountered during these tours in Tunisia and Algeria formed the medical opinions he had about the care of American casualties and how best to improve medical care. Churchill used these experiences to establish firm rules about whole blood transfusions, proper surgical techniques, as well as medical evacuation of

casualties that drastically changed how the physicians took care of the wounded as the Army moved from North Africa into Sicily and Italy.

Chapter II

INTRODUCTION

Colonel Edward Churchill, acclaimed Harvard Surgical Professor and renowned American surgical pioneer, became one of the most important assets to the Army Medical Department in the Mediterranean Theater of the World War II. His innovative thinking and bold surgical actions helped implement lifesaving practices that transcended the Mediterranean Theater to affect the whole of the Armed Services Medical Departments. His service focused on three areas: use of whole blood on the battlefield, accurate timing of surgery as well as proper surgical techniques, and organization of a medical evacuation route. The case of whole blood particularly shows how the Army Medical Corps was not prepared to enter the war. The Army had not made preparations for whole blood transfusions on the field and instead relied on plasma, a blood substitute. Churchill's investigations showed that there could be no substitute for blood and helped make whole blood transfusions in the battlefield a reality. He also helped establish a proper timeline for surgery whereas before surgery occurred in a hodgepodge manner leaving the wounded unable to fight infections and unable to heal properly. Thus, his reforms to surgical techniques streamlined procedures and provided the wounded a better chance to heal by setting up proper surgical techniques and requiring the removal of all dead tissues from the wounds, allowing casualties a chance to heal. Lastly, Churchill organized medical evacuation that set up the evacuation chain in stages and assigned each of the hospitals in the chain different tasks, allowing the casualties the best surgical care

possible. Edward Churchill's work in these fields especially that of blood transfusion, transformed the medical care in all theaters of the World War II, providing better medical care that saved countless numbers of lives.

Edward Delos Churchill was born in 1895 in Chenoa, Illinois and entered Northwestern University in 1916 where he obtained a Bachelor of Science degree. He later attended the Harvard Medical School and graduated in 1920. Following graduation, Churchill began a two-year internship followed by two a two-year residency at Massachusetts General Hospital. Churchill was awarded the Moseley Traveling Fellowship in 1926 and spent a year traveling abroad in Europe working and training under the best surgeons in Europe. Upon his return to Massachusetts General Hospital, Churchill was given his own laboratory where he explored problems of pulmonary disease and the concept of shock. In the years that followed, he continued to make many meaningful contributions to the field of medicine, including performing the first successful pericardiectomy for chronic constrictive pericarditis, an inflammation of the membrane sac around the heart. In 1928, he headed up the first academic surgical unit at Boston City Hospital. Churchill later returned to Massachusetts General Hospital in 1933 where he was designated by the Harvard Medical School as the John Homans Professor of Surgery as well as the Chief of Surgical Services. It was during the years that followed, as Francis Moore states, that "…Dr. Churchill carried our most of the work that the surgical world later regarded as his major clinical contributions."[1] These works included hyperparathyroidism operations, pneumonectomies, among many other pioneering surgeries.

[1] Francis D. Moore, MD, "Edward Delos Churchill, 1895-1972," *Annals of Surgery* (1973): 508.

Following the Japanese attack on Pearl Harbor on 7 December 1941, the Army Medical Corps drafted surgeons to join the infantry troops in Europe and North Africa. Many hospitals, including Massachusetts General Hospital, and many other medical institutions activated their own units. The director of Massachusetts General deemed Churchill an essential member of the hospital's operation, giving him a reprieve from service in the Army Medical Corp, as he held a position as a surgical professor and served as the head of the surgical unit at Massachusetts General. However, Churchill's guilt for not participating in the World War I resulted in his volunteering for service in the Army Medical Corps. During the World War I, Churchill attended medical school and thus did not join in the war. The social pressure for not volunteering for service in the war left Churchill with a sense of regret that he had not performed his duty as an American. As he saw the hospital's young men prepare for the World War II, he joined the effort. Churchill stated that "Young men who are not on active service are exposed to intense emotional pressure."[2] He felt that after the war, Massachusetts General Hospital would split in two between those who served in the war and those who had not. Thus, his sense of duty compelled him to join the Army Medical Corps. Later that year, in December 1942, the Army made him a colonel in the Army Medical Corps and appointed him the Chief Surgical Consultant of the Mediterranean Theater of War.

The Army Medical Corps that Churchill entered was still recovering from the rapid and detrimental changes following the Great War. Mary C. Gillett, author of *The Army Medical Department, 1917-1941,* states that "…changes in the medical department like those in the army as a whole resulted from the demobilization and the resultant effort

[2] Edward D. Churchill, MD, *Surgeon to Soldiers: Diary and Records of the Surgical Consultant, Allied Force Headquarters, World War II* (Philadelphia: J.B. Lippincott Company, 1972), 27.

to restructure the nation's defenses. They also represented a growing apathy towards all things military."[3] The National Defense Act of 4 June 1920 set these major changes in motion. This act capped the number of regulars in the US Army at 280,000 along with a severe restriction of funds.[4] However, the Medical Corps also went through some positive changes as well, such as the push to standardize all the medical equipment the Army received through its various suppliers. The Medical Corps also began to plan for a future war when many other dismissed the thoughts of war all together.

Throughout the 1920s, Congress continued to cut personnel and the budget for the Army Medical Corps even though the physicians in the Medical Corps could not keep up with the mounting volume of work placed on them because of the lack of help. In some cases, the Army even resorted to a system of circuit specialist who travelled to the various installations seeing patients because there simple were not enough physicians. The Medical Corps also experienced many resignations during this time as physicians left the army in search of better pay in the civilian sector. It seemed that the Army Medical Corps had reached a new low. Surgeon General Merritte W. Ireland stated in 1931 that "The Medical Department is less well prepared for field service than [it] was before the war with Germany."[5]

The situation did not improve during the 1930s as the Depression brought more budget cuts as well as the looming possibility of another war. As a result, "They [the Army Medical Corps] were unable either to train or to equip the number of medical personnel for treating the sick and wounded that would result from a full-scale conflict

[3] Mary C. Gillett, *The Army Medical Department, 1917-1941 (*Washington, D.C.: Center of Military History, 2009): 457.
[4] Allan R. Millett and Peter Maslowski, *For the Common Defense* (New York: The Free Press, 1994), 385.
[5] *The Army Medical Department, 1917-1941*, 476.

fought by a modern army."[6] In preparation for the coming war, Congress did allow for an increase in officers but decreased the number of enlisted men to help these physicians, hindering the productiveness of the new physicians. Such practices stopped the Army Medical Corps's effectiveness as it could not create the base of physicians and enlisted personnel it needed.

However, when Poland fell to Germany in 1939, the United States geared up for war. After the fall of Poland, the Army Medical Corps trained more men and inducted them into the army reserves until they were needed. This process continued as more countries fell to Nazi Germany. The United States was more prepared for this war than any other before, but still not enough for the magnitude of what it faced. As for the Medical Corps, the 1940 Congress did not increase its numbers, but did allow the Medical Corps to keep the reservists for up to one year. Though this helped, in the meantime the Medical Corps would run out of physicians by 1942. However, Congress did approve 13,000 new positions later in 1942. The Army continued to fight its problem by stepping up the training exercises at Carlisle, the home of the Army Medical Field School. Here, the Army trained 500 officers and 100 enlisted men every month as well as created a refresher course, training an additional 500 Medical Corps members each month.[7] The Medical Corps also opened three replacement centers that trained additional numbers of enlisted personnel. Despite the crumbling of the Army Medical Corps following the World War I, the Corps continually worked hard to raise its numbers and train personnel for the war. However, the confusion and magnitude of the war was impossible to prepare for, a fact that Churchill observed first hand.

[6] Ibid, 507.
[7] Ibid, 550.

The inter-war years also saw great advances in the medical field. Perhaps one of the greatest advances that would have a lasting impact on the war was the invention of an antiseptic that later was hailed as a "miracle drug": the sulfonamides. The sulfonamides began their transformation in 1927 when Gerhard Domagk, a German scientist with the I.G. Farbenindustrie, discovered the curative powers of the Prontosil dye. Historian John E. Lesch recounts the story of how the sulfonamides began the era of the "miracle drugs" in his work, *The First Miracle Drugs: How the Sulfa Drugs Transformed Medicine*.[8] Lesch stated "In retrospect, it is clear that the introduction of Prontosil marked a turning point in the history of medicine. As the first of the compounds called sulfonamides or, more familiarly, sulfa drugs, Prontosil initiated a revolution in the therapeutics and management of bacterial infections."[9]

Until this point, antibacterial drugs remained elusive and no more so than during the Great War. Colonel A.W. Mayo-Robinson, a Consulting Surgeon in the Great War, stated in his article "Some Surgical Developments in Wound Treatment During the War," "…the perfect antiseptic, which, while fatal to germ life, is not injurious to the living cells in the wound has yet to be discovered."[10] However, in the decade after 1927 developments in sulfonamides led to many derivatives and more "miraculous" healings, as the world had never seen such a drug that could fight off infections.

The year following the discovery of sulfonamides, Alexander Fleming, a doctor working in London, discovered penicillin, destined to be a greater discovery than that of sulfonamides. He made his greatest discovery in 1928 while studying the staphylococcus

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[8] John E. Lesch, *The First Miracle Drugs: How the Sulfa Drugs Transformed Medicine* (Oxford: Oxford University Press, 2007).
[9] Ibid, 3.
[10] Colonel A.W. Mayo-Robinson, "Some Surgical Developments in Wound Treatment During the War," *The British Medical Journal* (1918): 2.

bacteria *penicillium notatum*. This accidental discovery happened after he and his laboratory assistants placed several petri dishes with staphylococcus samples on a laboratory bench exposed to the open air. The resulting contamination from various particles led to a mold growth that decimated the staphylococcus bacteria. Further testing showed that penicillin, the name Fleming gave his discovery, even in small doses had a strong effect on a wide variety of bacteria. The mold derivatives had few adverse effects on the host while it destroyed the infections unlike many of the antibacterial substances. Despite the fact that penicillin showed the most promising effect against bacteria, it would not be developed on a mass scale until near the end of the World War II as the process to do so eluded scientist until the mid-1940s.

Advancements in whole blood also progressed in the inter-war years as well. The Great War prompted many great discoveries in whole blood use especially in the problems with hemorrhage. In a 1918 article, "Blood Volume in Wounded Soldiers: Blood Volume and Related Blood Changes after Hemorrhage," Oswald Robertson and Arlie Bock point out the fact that hemorrhaging leads to a reduction in "…the total blood bulk."[11] They also posed that the appropriate method to determine how much blood had been lost in hemorrhage could be determined by a diminishing blood volume, but also state that this method was not always accurate. Most importantly, the authors declare that "…the degree of increased blood production seemed to depend largely on the restoration of the blood volume."[12]

[11] Oswald H. Robertson, MD and Arlie V. Bock, MD, "Blood Volume in Wounded Soldiers: Blood Volume and Related Blood Changes After Hemorrhage," *Journal of Experimental Medicine* 29 (1919), 140.
[12] Ibid, 153.

J. Douglas Robertson corroborated this story in 1935 when he also stated that blood pressure is not an accurate determination of how much blood was lost during hemorrhaging. Robertson also showed that during his experiments with hemorrhaging cats, he found that much of the fluid escaped into the tissues accounting for some of the loss of blood. These findings on whole blood and sulfonamides expanded medical knowledge, but the Medical Corps of the World War II still faced problems with whole blood and sulfonamides.

The historiography and written record of Churchill's World War II experiences are thin, limited to his own writings. While still serving in the Army Medical Corps, Churchill published "The Surgical Management of the Wounded at the Time of the Fall of Rome" in the *Annals of Surgery* in 1944. Brigadier General Fred Rankin of the Army Medical Corps called this article "one of the finest dissertations on management of wounds which has been submitted through the office of the Surgeon General of the U.S. Army."[13] Churchill compares and contrasts the efforts of the Medical Corps upon first entering the theater and how that organization matured within a year, becoming skilled in the practices of military medicine. In particular, he describes the medical improvements that he helped bring about. These include the three phases of wound care, blood transfusion, the excision of devitalized tissues, and the proper use of chemotherapy as well as the various stages of the medical evacuation line. Churchill notes that "It is a satisfaction to note the contrast between the present concept of wound management and the doctrines in vogue scarcely a year ago."[14]

[13] Colonel Edward D. Churchill, "Surgical Management of the Wounded at the Time of the Fall of Rome," *Annals of Surgery* 120 (1944): 268.
[14] Ibid, 283.

Following his return to Boston after the war, Churchill did not write specifically on his experiences in the war until 1972, but he frequently applied the lessons he learned during the war to civilian life. In 1952, Churchill published "The Shock Frog," in which he discusses the British and American understanding of the concept of shock. During the war, Churchill, as later discussed, spent much of his time exploring shock and the various interpretations of the problem. As this article points out, a consensus still had not been reached on shock, but, as he states, the British and Americans no longer needed to look for an overall answer to the problem, only fine tune their ideas.[15]

In a 1953 article, *Panic in Disaster,* Churchill describes how his work with the management of evacuees and wartime surgeries could have been applied to victims of the tornado that struck Worcester, Massachusetts, on 9 June 1953. He describes how in the chaos, responders removed the casualties to the nearest hospital, swamping the facility with victims. Instead, Churchill stated that the responders should have distributed the casualties in this situation similar to the Army's method, taking the seriously wounded to the nearest hospital and moving the less seriously injured to facilities farther away. He also compared the irregular wounds caused by the tornado's debris to the wounds caused by shrapnel in the war and how the surgeons treating these victims could have benefited from wartime surgical knowledge thus giving wartime surgery a dual purpose.[16]

In 1972, Churchill published *Surgeon to Soldiers: Diary and Records of the Surgical Consultant, Allied Force Headquarters, World War II,* the only detailed account of his time in the Mediterranean Theater. This detailed book describes Churchill's work before the war as an integral part of his participation in the Army, such as the

[15] Edward Delos Churchill, "The Shock Frog," *Annals of Surgery* 135 (1952): 573-576.
[16] Edward Churchill, "Panic in Disaster," *Annals of Surgery* 138 (1953): 935-936.

organization and treatment of the wounded at the Coconut Grove Fire in the heart of Boston in 1942 as well as the path he took to becoming the Chief Medical Consultant of the North African Theater in the Army Medical Corps. He sets apart three chapters in his book that describe his most meaningful work in the theater: "Wound Shock and Transfusion," "The New Sulfa Drug Era of Surgery," and "The Army Learns about War," a chapter in which he describes how he helped organize the medical evacuation of the wounded. As the only full description of his time in the war, this account proves a most valuable source for Churchill and the concepts he developed that were applied to other theaters as well.[17]

From the time of his retirement to today, a number of articles and longer works have been written on Edward Churchill's impact on the medical field, although relatively little has been prepared on his work during his service in World War II. In Oliver Cope's November 1963 forward to the *Annals of Surgery* on the occasion of Churchill's retirement from the medical field, his work in the war receives a mere mention.[18] Cope states that "His analysis of the problem of war wounds and his recommendations regarding management stands as a milestone in military surgery."[19] Similarly, Francis D. Moore's lengthy obituary at the time of Churchill's death in 1972, *Edward Churchill, 1895-1972,* refrains from an in depth discussion of Churchill's war service.[20] Moore states that "His [Churchill's] perception of the beacons of clinical reality in a sea of military dogma and surgical mythology, permitted him to make many innovations that

[17]Edward D. Churchill, MD, *Surgeon to Soldiers: Diary and Records of the Surgical Consultant, Allied Force Headquarters, World War II* (Philidelphia: J.B. Lippincott Company, 1972).
[18] Oliver Cope, MD "In Honor of Edward Churchill, Foreword," *Annals of Surgery* 158 (1963): 731-793.
[19] Ibid, 734.
[20] Francis D. Moore, MD, "Edward Delos Churchill, 1895-1972," *Annals of Surgery* 177 (1972),507-508.

improved the care of the American wounded man."[21] Cameron Wright's article from January 2012 recognizes that even forty years after his death the medical community still looks to Edward Churchill for guidance and inspiration in surgical and medicinal matters. However, Wright does not go into depth on Churchill's wartime work, but glances over it in a statement: "Churchill helped to institute the policy of adequate debridement and delayed primary closure of war wounds, early use of whole blood transfusions, establishment of regional blood banks, and the use of air evacuation of wounded soldiers."[22]

Three authors have taken a lengthier and in-depth look at Churchill's contributions to military medicine. Albert E. Cowdrey, former branch chief of the U.S. Army Center of Military History, published *Fighting for Life: American Military Medicine in World War II* in 1994 chronicling the trials and successes of the U.S. Armed Forces Medical Corps during the World War II. Within this work, Cowdrey briefly details Edward Churchill's time in the Mediterranean and the impact that it had on military medicine. Cowdrey describes Churchill's evacuation plan by detailing Richard Tregaskis', famed wartime journalist, removal from an Italian mountainside after an explosion left him with a cranial injury. Tregaskis', like many other soldiers in the Mediterranean, received lifesaving surgery quickly because of this structured system. Cowdrey further details Churchill's hard won implementation of debridement as a standard surgical procedure as well as the replacement of plasma use with whole blood. However, Albert Cowdrey's work focuses on the whole of the U.S. Medical Corps leaving only room for a brief though brilliant description of Churchill's impact on the

[21] Ibid, 508.
[22] Cameron Wright, MD, "Historical Perspectives of the American Association for Thoracic Surgery: Edward D. Churchill, 1895-1972," *The Journal of Thoracic and Cardiovascular Surgery* 143 (2012): 2.

Mediterranean. He cannot capture the detail and full scale of Churchill's impact in his short analysis of the surgical consultant.[23]

Matthew D. Kunhle's 2002 Honor's Thesis, *Learning from Experience: Surgical Management of Wounded Combatants by the United States Army Medical Department and Efforts of Surgical Consultant Edward Churchill in the North African-Mediterranean Theater of Operation during the Second World War,* also seeks to explore the success of the medical department in the Mediterranean Theater and "…the particular role the Colonel Edward D. Churchill played in overseeing and advising surgical management of casualties."[24] Indeed, Kunhle does skim Churchill's contributions in the theater, but without much depth simply identifying the major themes of Churchill's work: organizing the chain of medical evacuation and the elimination of plasma as a blood substitute for whole blood transfusions. This thesis also covers major events in army medicine from the Civil War to the eve of the World War II, a brief description of the Mediterranean Theater and the medical department's work there, as well as how Churchill's contributions helped medical care in the other theaters. With so many broad themes, Kunhle did not cover Churchill's war work in depth.

In 2010, doctors Jeremy W. Cannon and Josef E. Fischer, a former Churchill intern, wrote *Edward D. Churchill as a Combat Consultant: Lessons for the Senior Visiting Surgeons and Today's Military Medical Corps* in which they cover Churchill's

[23] Albert E. Cowdrey, *Fighting for Life: American Military Medicine in World War II* (New York: The Frees Press, 1994).
[24] Matthew Kunhle, *Learning from Experience: Surgical Management of Wounded Combatants by the United States Army Medical Department and Efforts of Surgical Consultant Edward Churchill in the North African-Mediterranean Theater of Operation during the Second World War (*Honors Thesis, The Ohio State University, 2002): 3.

major contributions to the medical field in the Mediterranean.[25] Cannon and Fischer take these lessons further and apply them to today's military and demonstrate how these lessons apply to today's Medical Corps. The authors state that "Churchill's conduct as a consultant holds a number of object lessons which remain relevant for military surgeons today. These lessons can also be used to make a strong case for continued collaboration between civilian surgical leaders and the military medical corps in preserving the lessons of the past and in guiding the military medical corps in the future."[26] Like Churchill, Cannon and Fischer realized that forgetting lessons of the past medical engagements in wars has become a major problem in wars. They state that "Churchill's experience vividly illustrates the difficulty of preserving past lessons learned for future generations of military surgeons."[27] Cannon and Fischer express that it is crucial to ensure that medical knowledge is available to all surgeons. They further assert that Churchill demonstrated that great potential of a mentoring program between the senior civilian surgeons and inexperienced military surgeons. In closing, the authors pose that "…the military medical community must leverage the experience and perspective of senior civilian surgeons to most effectively care for our wounded soldiers and to shape the military medical corps of the future."[28]

These reports and articles show how over his career, Edward Churchill made many changes and improvements to the medical field. However, most fail to record his work during the World War II. While this may not figure as a major milestone in his

[25] Jeremy W. Cannon and Josef E. Fischer, "Edward D. Churchill as a Combat Consultant: Lessons for the Senior Visiting Surgeons and Today's Military Medical Corps," *Annals of Surgery* 251 (2010), 566-572.
[26] Ibid, 566.
[27] Ibid, 567.
[28] Ibid, 571.

career, his service in the Mediterranean Theater drastically improved medical care in all theaters of the World War II and deserves to be considered.

Chapter III

PLASMA AND BLOOD

Edward Churchill arrived at Allied Headquarters in the North African Theater on 6 March 1943 with excitement and anticipation of the forthcoming action. Churchill found the Army Medical Corps in dire straits as they lacked vital equipment and practiced medicine with antiquated knowledge that would be remedied in the war's later years. Churchill found this particularly true when it came to the treatment of shock. His tours across the North African battlefields revealed a complete lack of life saving whole blood, which had been replaced by the ineffective plasma solution. The war in the Mediterranean bore the brunt of the repercussions from the medical community's ignorance of the usefulness of whole blood in the treatment of shock, a problem that Edward Churchill sought to remedy.

One must first have the correct definition of shock and its causes to fully understand the journey that the medical community took when solving the surmounting shock crisis that transpired with the prodigious numbers of casualties. Shock or circulatory shock is synonymous with hemorrhaging. Blood can be lost through the surface wound and also through internal bleeding, which greatly compromises the body's ability to circulate oxygen. This is termed hemodilution. Without proper replacement of these oxygen carrying cells, the body becomes asphyxiated and dies.

Though simply explained today, this definition took years of work in the field and in the laboratory, beginning in earnest in the First World War. The work in this war

consisted of conjecturing the most effective shock treatments as no one knew what shock was much less a proper treatment. Physicians of the Great War recognized "shock" as a problem without ever truly defining what the problem entailed. As Churchill pointed out, the First World War recognized shock as a problem, but did not identify how it pertained to injuries sustained in battle. Physicians held a wide variety of ailments responsible for shock, such as increased carbon dioxide intake by the patient. One doctor from 1908, attributed shock to acapnia and stated that shock was produced from over breathing. Shock virtually became attached to all that involved dying, a dubious definition that continued as a problem during the interwar years.

Though the shock nomenclature crisis continued during the interwar years, vital knowledge began to emerge in the medical community which began to pinpoint shock on circulatory failure. In 1930, scientist Eloise Parsons and Dallas B. Phemister stated that it was more correct to call shock hemorrhage or shock because of hemorrhage. Blalock stated that shock was not a disease but peripheral circulatory failure. In 1938, Virgil Holland Moon continued this look at circulatory failure by stating that shock was caused by circulatory deficiency because of a decrease blood volume.

In 1941, the Medical Research Council (MRC), a British research institution, produced a thorough though flawed report on traumatic wound shock and blood transfusions. The report stated that shock can come with any injury particularly those with mass hemorrhaging and tissue damage. The report divided shock into two stages, an explanation that Churchill did not embrace, as he proved that shock was a continuous motion, never divided into two stages. The report stated that the first stage consisted of primary shock, a collapse that could follow any injury, but particularly where hemorrhage

was present. This stage resembled fainting and the patient became susceptible to outward stimulants such as the elements. Secondary wound shock followed sometime after the injury heralded by weakness and low blood pressure as its chief symptoms. The Council pointed out that if blood loss exceeded 25 percent or more, the patient slipped into a state of "irreversible shock" and had little chance of recovery, another flawed conclusion. However, the Council did show the importance of whole blood in the recovery of shock patients. The report stated that, "It is now generally accepted that the most important single requirement for arresting the progressive deterioration in general condition which is such a feature of shock is restoration of blood volume..."[1] Though many accepted this theory, it was still not endorsed by the entire medical community.

Churchill harshly critiqued these theories on shock and surmised that all the previous experiments on shock were conducted with a conclusion already in mind and performed solely to support the existing theories. He also found fault with shock nomenclature, which continued as a problem in the Second World War. Churchill stated that the definitions physicians applied to shock were too vague and many times used merely to state that someone was in the process of dying. He stated this was especially true of the concept of irreversible shock. He stated that "Although the diagnosis of 'irreversible shock' appeared with some frequency on the clinical records in World War II, it was merely a pretentious way of indicating that the man had died of a lethal wound."[2] He concluded that all wound shock responded to treatment and irreversible

[1] "The Treatment of Wound Shock, M.R.C. War Memorandum No. 1, 1941," Edward Churchill Papers, Box 26, Folder 2, Francis A. Countway Library of Medicine, Boston, MA.
[2] Edward D. Churchill, MD., *Surgeon to Soldiers: Diary and Records of the Surgical Consultant, Allied Force Headquarters, World War II* (Philidelphia: J.B. Lippincott Company, 1972), 40.

shock was merely a stage of shock difficult to treat, but not unresponsive to treatment. Therefore concepts such as "irreversible shock" could not exist.

Churchill's first wartime experience with shock and proper treatment came after he read the Medical Corps report on the wounded at the Pearl Harbor attack while working at the Army Field Medical School in Carlisle, Pennsylvania. The doctors on duty during the crisis treated the injured with plasma, morphine, and warmth though the patients remained in shock despite their best efforts. The naval hospital brought in large amounts of plasma, the liquid component of blood in which the red blood cells are suspended, from the civilian plasma bank in Honolulu. Doctors then used the plasma on the scene and treated patients with it in order to reverse the effects of shock. Treatment with plasma sprung out of the hypothesis that hemoconcentration was the root cause of shock. Hemoconcentration occurs when large amounts of plasma are lost and the red blood cells are left with no way to travel through the body. The doctors infuse large amounts of plasma in order to restore the pathway through the body. Colonel Perrin H. Long, author of the Pearl Harbor report and a Johns Hopkins physician stated that "The hemoconcentration is already so great that the final withdrawal from the circulation of even small amounts of fluid may lead to catastrophe." [3] Churchill later disputed the theory in the "Report on Shock from the Board of the Study of the Severely Wounded" in August 1943 and stated that mass injections of plasma merely served to further dilute the few remaining red blood cells in the body.[4] Plasma raised the blood pressure for a short

[3] "Some Observations on the Casualties at Pearl Harbor", January 1942, Edward Churchill Papers, Box 29, Folder 5, Francis A. Countway Library of Medicine, Boston, MA.
[4] "Report on Shock from the Board for the Study of the Severely Wounded," August 1943, Edward Churchill Papers, Box 26, Folder 4, Francis A Countway Library of Medicine, Boston, MA.

amount of time but ultimately did nothing to solve the problem of oxygen distribution in the body.

On 26 January 1943, Churchill visited the Walter Reed Hematology Laboratory in Washington, D.C., while he awaited his orders for North Africa and made notes on the transfusion technology he observed. His interviews with the technicians in the laboratory revealed profound knowledge on the importance of blood and its importance to the war effort. However, they felt ignored by those in higher command and entities such as the National Research Committee (ANRC) in favor of an easier, less effective solution. The lab admitted that carrying blood into war theaters would be a cumbersome process, but worth the effort. However, large amounts of plasma were ordered to the forward areas as well as a vast quantity in reserve, which meant between 250 to 500 ccs of plasma per casualty.[5] Norman Kirk, the Surgeon General-elect at the time, later took the blame for not having the technology or the resources ready for the war. He admitted that the medical community spent far too much effort on plasma. Kirk stated that "a huge vested interest had been built up starting from assumptions and erroneous thinking." [6] However, when one turned to battlefield observations, it can easily be seen as the source for the strong push for plasma.

On the battlefield, the terrain and various difficult situations made obtaining whole blood with the methods and technology available in the early 1940s nearly impossible. The Army Medical Corps solved this logistical problem with the overuse of blood plasma. Plasma's sanctioned use came from the highest authorities including the American National Research Council, which instituted and encouraged its use. The

[5] *Surgeon to Soldiers*, 46.
[6] Ibid, 48.

ANRC stated that the front was too far away from the whole blood supplies at the base hospital for such a solution to be possible. The ANRC vowed to encourage the use of plasma until the war came closer to home where whole blood transfusions would be feasible. Such a promise received little criticism as many in the medical community supported the hemoconcentration theory and those that disputed this fact were considered revolutionaries. Secretly, many in the medical community did not want to look for another solution as plasma caused far fewer logistical problems than whole blood. Plasma seemed a miracle, a hype that the medical community encouraged while the problems were ignored. Plasma could be administered without fear of reactions, did not have to be typed as whole blood, and could be dried immediately. Another major factor can be attributed to the underestimation of the loss of blood (later termed as hemodilution) and blood seepage.

In April 1941, the Subcommittee on Blood Substitutes of the National Research Council showed that plasma could be vacuum packed and stored for years without the need for refrigeration. Once in the field, plasma could easily be reconstituted without the bulky equipment that would be required in whole blood transfusions. Large quantities of plasma could be produced systematically and commercially in large quantities. The ease of plasma production and use far overshadowed the problems that occurred on the battlefield from its use.

Preparations for such large quantities of plasma involved the cooperation of many groups, but the American Red Cross became the backbone of the program. The American Red Cross already had the necessary experience while the ANRC and its subcommittees planned out the plasma program. Previously, the Red Cross took on

several volunteer projects at the request of the Surgeon General and the Army that required work with large quantities of blood. The New York chapter of the American Red Cross exemplified this role with the large part it played in the Blood for Britain Program in 1940. In this program, the New York chapter partnered with the British Blood Transfusion program to provide large quantities of plasma for casualties in Britain and France. The American Red Cross was more than ready to produce the plasma that the ANRC and Army Medical Corps deemed would be needed. The American people showed up at donation sites all across America and gave blood donations to be turned into plasma. Though this move was well intentioned, it was also ill-fated.

The Armed Forces had planned for plasma's large scale use before American had even entered the war. Medical leaders suggested that there should be 200,000 units of plasma on hand at all times before the attack on Pearl Harbor.[7] These numbers dramatically increased following the disaster. Many companies and organizations came together to provide all the plasma needed including the ANRC, the American Red Cross, commercial companies for mass production, among many others. The use of whole blood as the cure for shock as physicians suggested before mass production of plasma seemed a distant memory with such a machine in place for the production of what was thought to be the panacea for shock.

Plasma use in the field would ease a major burden on the Armed Forces and was much simpler for all involved as plasma required little complicated equipment and could be administered, if need be, by those with little experience in plasma administration. Plasma had an indefinite shelf-life and could be dried and later reconstituted with ease in

[7] "Development of Equipment for Administration of Dried Plasma in the Armed Forces," *War Medicine* 2 (1942),102 .

the field. Plasma also contained no red blood cells, which eliminated the need for blood typing, thus plasma could be produced commercially without restraint. Understandably, in 1940 plasma seemed the only feasible solution to the resuscitation problem. At the beginning of the war, whole blood could not have been administered even if physicians had deemed the substance the only solution to shock as the technology to mass package and administer whole blood did not yet exist. This included preservation liquid, closed transfusion systems that kept the whole blood from contamination, as well as transportable refrigeration. Even the most ardent whole blood supporters became discouraged.

Churchill saw the full magnitude of the plasma problem when he arrived in North Africa and toured the front lines and base hospitals of the II Corps in Tunisia. Here, he was tasked with answering two questions: 1) Did the theater need whole blood when plasma was readily available? 2) If they needed whole blood, how would it be obtained? Following extensive tours through Algeria and Tunisia, Churchill issued a report to the Surgeon General which stated the bare facts about plasma in North Africa. Churchill pointed out the fact that medical authorities incorrectly labeled plasma as a blood substitute as there could never be a substitute for whole blood. However, he did not deny the importance of plasma. Plasma did play an important role in elevating blood pressure on the battlefield enough to convey the wounded to the proper triage point. However, it did not allow a patient to withstand major surgery though plasma had the ability to superficially bring the blood pressure up to normal levels. Further blood loss following plasma treatments could not be tolerated as the blood had little ability left to carry oxygen. He further conveyed that plasma merely contributed to a mass excitement within

the medical community, which caused many to believe that the substance could truly replace blood. Inexperience in the field caused many unforeseen complications. Inexperienced surgeons took soldiers to the operating room after prepping them with plasma alone. Thus on the operating table the patient lost more blood and what little oxygen carrying capacity was left. The patient then slipped back into shock and often died of asphyxia. Churchill concluded from these observations that whole blood was without a doubt the preferred resuscitation method. Churchill admitted that plasma could not be completely eliminated because of its ease of use at the front, but stated that its use should solely be limited to emergency first aid.[8]

Without a doubt, Churchill became whole blood's biggest advocate in the Mediterranean Theater though many others doubted the feasibility of its use. Unlike blood plasma, technicians would have to cross-match the donor blood with the patient before a transfusion. Whole blood also had to be refrigerated at all times unlike plasma, thus whole blood required transportation in refrigerated trucks across the theater, which many felt would be an unreliable method of transportation as they thought the trucks would break down before their delivery. In addition, the blood had to be held at a temperature about 0° Fahrenheit as it would freeze at anything lower. This problem was further complicated by the fact that the product had a limited shelf life. Physicians, both military and civilian, also experienced problems with coaxing people to donate to the armed forces. Though the American Red Cross ran many successful blood drives throughout the war, many more failed. Blood drives occurring between times of major action overseas saw few donors and hoards when the excitement of action on the

[8] "Memorandum on Whole Blood Transfusion," 24 March 1943 and "Whole Blood Transfusion Report," 14 April 1943, Edward Churchill Papers, Box 26, Folder 10, Frances A. Countway Library of Medicine, Boston, MA.

battlefield spurred them in to donate. On the battlefield, physicians had a hard time getting the lightly wounded to donate blood as most presumed the donation would further weaken them. Churchill stated "The stimulus of 'I may need it when it happens to me is lacking-it has already- it has already happened.'"[9]

Churchill thus instituted the first major push for whole blood in the Mediterranean though he received little support from his superiors. He stated that "I was not popular when I said that wound shock is blood volume loss. We were soon able to say that there was no hemoconcentration. There was hemodilution…We brushed away the cobwebs from 'shock' so that we could get proper means of treatment."[10] When his thoughts on whole blood reached the theater surgeons, Churchill was informed that plasma would be enough, but he would look into the problem. Churchill issued a report back to Washington, D.C., two weeks after his arrival in Algiers. In this report, he reminded the head of the Army Medical Corps that the goal of resuscitation was successful preparation for surgery. He recalled Field Transfusion Unit #9 in this report that showed that 10% of all casualties needed resuscitation and 20% needed whole blood in addition to plasma for survival.[11] He stated that this information proved that the Army must provide whole blood and that there was no excuse for not having whole blood readily available. He stated that plasma use would merely return the blood pressure to normal and stabilize the peripheral circulation but "…further hemorrhage incidents to operation will be considerable."[12] Though many lightly wounded and auxiliary personnel were uneasy

[9] "Whole Blood Transfusion Report," 14 April 1943, Edward Churchill Papers, Box 26, Folder 10, Frances A. Countway Library of Medicine, Boston, MA.
[10] *Surgeon to Soldiers*, 49.
[11] "Memorandum on Whole Blood Transfusion," 24 March 1943, Edward Churchill Papers, Box 26, Folder 10, Frances A. Countway Library of Medicine, Boston, MA.
[12] Ibid.

about donating their own blood, many more readily donated, which enabled many forward hospitals to administer whole blood to the wounded despite a large stock of plasma. He pointed out that blood could not be given without cross-matching as the dog tags had a 3-25% error rate. Lastly, Churchill advocated a central supply depot, stating that "a central supply depot could provide all intravenous solutions, blood, and plasma" and "a distributing service would be required. Certain units would require refrigerators."[13] Administrators in Washington, D.C., virtually ignored this report despite ample evidence to support its findings.

Meanwhile, Churchill took note of the British Blood Transfusion Service, which became the forerunner of all subsequent blood programs. The accomplishments of this program came from its success in the four to six years before the war as well as pre-planning for the distribution of blood on the battlefield. Lionel Whitby, named the head of the British Army Blood Transfusion Service, insisted that the British armed forces have their own self-contained blood program separate from the national blood transfusion program because with the pre-war technology, whole blood could not be transported over vast distances. Whitby and his staff planned extensively for this auxiliary unit and staffed the unit with the best personnel. The British chose to solely use O blood in order to quickly give transfusions to all who needed it. The British Transfusion Service supplemented its supply of blood on the continent with 350,000 French locals willing to donate blood. The British stockpiled blood in the low country in refrigerators, but still experienced a shortage of blood so only the most critical received whole blood. The British system proved that whole blood could be used on the battlefield though blood sometimes was collected in an *ad hoc* manner. Churchill personally recalled that the

[13] Ibid.

British used an improvised system of sterilized beer bottles as vacuum containers and tubes into the donors veins in order to produce a closed transfusion system. Though improvised, this system kept particles in the air from contaminating the blood supply. The British produced a well-established system for blood donations and transfusion before the war began and though the system often proved crude, it was still effective and a far cry from the unpreparedness of the Americans.

The Americans knew about the British success with blood transfusions, but had little way to recreate their success. As Douglas Kendrick, wartime director of the blood transfusion program and author of *The Blood Program in World War II*, pointed out, the Americans were ill-equipped in all aspects in November of 1942 with no provisions for whole blood transfusions. The lack of preparedness irritated many Army physicians, while others obtained whole blood through improvised systems. For example, the 77th Evacuation Hospital located in Tebessa, obtained blood from various hospitals and shock teams, thus their patients received more blood than plasma through a makeshift process. In late June 1943, Churchill sent a task force to the forward hospitals to estimate the feasibility of whole blood distribution. As expected, the forward hospitals lacked all capability for blood transfusions and needed the equipment desperately.

In order to receive the support he needed for whole blood transfusions in the Mediterranean Theater, Churchill sent a serious of three reports to Washington, D.C. Despite the receipt of Churchill's first memorandum in March 1943, officials continued to ignore his call for whole blood transfusions. He sent another notice in April again proclaiming the need for whole blood for the wounded on the battlefield. The April report stated that the Americans, so desperate for blood, borrowed as much transfusion

equipment from the British as they could part with and bought other supplies from the French. Churchill stated that "The need for whole blood transfusions has been personally verified by the Consulting Surgeon from examination of wounded patients in clearing stations and forward hospitals."[14] Another report of a similar nature followed with no reply.

In Washington, D.C., the Army's Surgeon General, Norman Kirk halted all of Churchill's further requests for whole blood. He stated that the shock question had been answered with plasma and refused to entertain further thoughts on the matter. Government officials did not want to deal with the major logistical issues that came with whole blood despite ample evidence from the field that plasma did not cover the issue. The Army invested thousands of dollars in the plasma program along with massive publicity campaigns as well as the support of major American companies and institutions. With such massive support behind one program, switching tactics in the middle of a major war would be troublesome. However, Churchill did have one advocate in Washington, D.C.: Douglas Kendrick, director of the Army transfusion program. Kendrick became Churchill's mouthpiece in the capital and constantly badgered Kirk over the issue. Historian Douglas Starr illustrated this best with this anecdote: "On one occasion Kendrick…helped draft a resolution urging the use of whole blood as well as albumin and insisted on hand-carrying it to Kirk. 'He turned me down cold,' Kendrick later recalled. 'He said they already had plasma and could not spare planes.'"[15] Kendrick further reminisced on this meeting in his autobiography, *Memoirs of a Twentieth-Century*

[14] "Whole Blood Transfusion Report," 16 April 1943, Edward Churchill Papers, Box 35, Folder 14, Francis A. Countway Library of Medicine, Boston, MA.
[15] Douglas Starr, *Blood: An Epic History of Medicine and Commerce* (New York: Perennial, 2002), 127-128.

Army Surgeon, stating that "This confrontation between me and the Surgeon General led to his statement, 'Goddammit, Kendrick, if you bring this up again, I'll throw you out of my office!'"[16] As Churchill and his supporters received little help from their superiors in Washington, D.C., they turned to other methods to bring attention to their plight.

Churchill turned to a *New York Times* war correspondent since he did not receive the help he needed from his superiors in Washington, D.C. He told the war correspondent that "You must break the story that plasma is not adequate for the treatment of wounded soldiers."[17] On 26 August 1943, the *New York Times* published an article titled "Plasma Alone Not Sufficient" that briefly chronicled Churchill's struggle to bring whole blood to North Africa and urged the support of the American people for the program. Churchill stated that "the initial breakthrough thus came with upsetting the balance of power in Washington, D.C., through *The New York Times* and making people in the States begin to think reasonably about the need to transfuse the wounded and realize that World War II could not be fought on plasma…"[18] Following the report, the Army Medical Corps in North Africa received refrigerators for the mobile hospitals. The Medical Corps also began to draw blood in advance of its need and store it away until it was to be used.

Churchill charged a task force with a survey of the blood needs in the 5th Army the previous December 1942 in anticipation of the move into Italy. This survey looked in particular at incidence of transfusion in the Field and Evacuation Hospitals. Churchill also sent liaisons to the blood bank in San Antonio, Texas, to study advanced methods

[16] Douglas B. Kendrick, *Memoirs of A Twentieth-Century Army Surgeon* (Manhattan: Sunflower University Press, 1992), 89.
[17] *Surgeon to Soldiers*, 51.
[18] Ibid, 52.

and techniques to use in the invasion of Sicily. The San Antonio findings led to plans for blood banks in general hospitals and evacuation hospitals a few miles behind the lines.

However, this pre-planning did not stop problems from occurring as the front advanced through Salerno on 9 September 1943. Though the theater had a sufficient supply of vacuum bottles, the forward hospitals did not have the ability to collect the whole blood they needed. Colonel Joseph I. Martin, 5th Army Surgeon, requested that a transfusion unit be assigned to the 5th Army to counteract that problem. However, his request was put on hold as army officials planned for the invasion of Anzio-Nettuno. Martin instead turned to the British for assistance with whole blood supplies. Kendrick, author of *Blood Programs in World War II,* stated that "In all, the U.S. Hospitals at the Anzio beachhead received about 4,000 pints of blood from this source… The first blood from the Fifth U.S. Army blood bank in Naples was not received on the beachhead until 23 February 1944."[19] The problems with blood collection at the front led to a push to collect blood instead at the base hospitals. Blood collections at the base hospitals would allow the base personnel to donate blood without interruption of the business at the front. The stable environment allowed for more proficient testing for diseases such as malaria. The base hospitals provided an ideal proximity to the front while providing a stable environment for a full-scale blood bank.

These thoughts led to the establishment of the 15th Medical Laboratory Blood Bank on 20 November 1943, which provided the first pints of blood on 23 February 1944. This lab became the parent organization of the Naples blood bank, a vitally important entity throughout the rest of the Italian Campaign. In its infancy, the 15th Medical Lab began as a 20 pint a day blood bank and strictly collected blood to supply

[19] *Blood Programs in World War II*, 398.

the Naples area during emergencies. However, the officers in charge of 5th Army Medical Corps had bigger plans for the 15th Medical Lab. The brass planned for the organization to provide up to 100 pint bottles a day. Leadership also prepared an organizational chart for the smooth distribution of the temperamental substance, production equipment, and designed special shipping boxes to provide the utmost safety for the precious contents. Through these efforts, the 15th Medical Lab was able to provide 0.6 to 0.7 pints of blood per battle casualty at Anzio.[20] However, this was not enough for the 5th Army, which wanted 200 pints of blood a day.

In a letter to Brigadier General Fredrick Blesse, Deputy Director of Medical Services Allied Force Headquarter, on 3 March 1944, Churchill commented on the recently established 15th Medical Lab Blood Bank. He pointed out that the British continued their involvement in the American whole blood venture as they transport the commodity, but the Americans were in the process of creating 14 specially designed cork boxes for that purpose. Churchill stated that according to his sources, the use of whole blood was on the rise across the Mediterranean, which he considered a victory. However, many physicians were not using enough blood per patient to do them any good though the use of whole blood became widespread. In the letter, Churchill proposed a whole blood system for the Italian Campaign that would provide a proficient system for the efficient distribution of blood. This plan divided the task of blood processing and distribution between three different entities. The base hospital was to collect, process and forward blood to an Army distribution unit. Here, the blood waited for distribution to the Army and Corps hospital blood banks. The Hospital then provided the blood to unit

[20] "Blood Usage in the Italian Campaign," Edward Churchill Papers, Box 26, Folder 13, Francis A. Countway Library of Medicine, Boston, MA.

blood banks. He intended that the field hospitals would do little of their own bleeding, and the evacuation hospitals would supplement the supply with their own blood collecting. Churchill stated that the mission of the Blood Transfusion Unit (BTU) was to supply blood to the Army, but not to the base hospital except in times of emergency. Any blood collected other than that collected by the Army Distribution Center became the sole responsibility of the individual hospital and was ordered to follow the same testing instructions as the distribution center. Churchill reiterated the importance of typing and crossmatching blood before a transfusion and recommended that all units of blood have a 24-hour rest period before use in order to facilitate testing. He insisted on the provision of a small vial of blood attached to the pint for testing.

Churchill required the BTU to put out 100 units of O blood seven days a week and label the units with an expiration date (whole blood preservation was still in its infancy and the expiration date became all important, especially during this period). The blood would then be kept at 4° Celsius (at 0° components of the whole blood begin to freeze rendering the unit useless). The vacuum bottles that contained whole blood were disposed of following a transfusion in order to prevent infection and reactions, however the specially designed insulated boxes were returned to the base hospital for further use. Churchill wanted the Army to keep a three day supply of blood on hand at the distribution center, which could be used rapidly without waste.

Churchill did not implement his plan without conflict as many of his colleagues had their own ideas on blood distribution. Fellow 5th Army Surgeon Henry K. Beecher stated that the base collecting needed to increase its daily output of whole blood in order to relieve the evacuation hospitals of this duty during peak activity. Churchill, however,

disagreed with him saying that the unit should have its share of responsibility with whole blood collecting. He justified this logic stating that this would keep each of the units in the whole blood chain independent when they could not acquire a delivery. Additionally, Churchill stated that he wanted whole blood spread out instead of concentrated at the base. Naples could supply most of the blood required in Italy as it had become the largest blood bank in the Mediterranean Theater.

Beecher further disagreed with Churchill when it came to only providing O-type blood to the troops, as he wanted A-type blood supplied as well. In a letter to Churchill, he stated that he had become alarmed by the large number of reactions to O-blood. Many objected to the use of A-blood by the base hospitals on the grounds that the type could easily be mixed among the O-bloods and with the mass sense of urgency on the battlefield, using solely O-blood would be easier on everyone involved. Beecher disagreed and stated that providing A-blood would cause no extra inconvenience and only 3.2 units of blood out of every 12 units produced would be type A. He planned for equal distribution throughout the evacuation hospitals with additional reserves of A-blood. Further needs would have to be provided locally and thus the hospitals would need to keep a list on hand of local A donors for emergencies.

Churchill chronicled this debate in his journal and stated that he felt that the problem was with mass mislabeling of blood units and the blood personnel needed more supervision on the local level to prevent such mistakes. He felt that the turning point had come with the large influx of new personnel, which had led to the labeling mistakes. Furthermore, the O-blood provided for the wounded would need to be low-titered.[21]

[21] Low titered blood would be of reduced concentration, which enabled it to be given to patients of other blood types.

Providing low-titered blood would allow for the slight dilution of O-blood for patients with A or B blood types. Low-titered blood would allow these patients to received O-blood without fear of major reactions. Thus the reaction problem was solved without the burden of providing A and B blood types specifically.

The establishment of the blood bank in Italy further solved the problem with whole blood transportation, the biggest problem in whole blood distribution. When the blood bank first provided blood to Anzio, it shipped the stock via Landing Ship Tanks (LST) as the battlefield was isolated. From 23 February to May 1944, the bank drew over 4,134 pints of blood. This scale drastically increased as the US Army began its drive to Cassino. During the month of May alone, the blood banks drew over 6,000 pints of blood in preparation for this campaign. Aircraft such as the C-47 made for more efficient transportation to Anzio though the Army never completely abandoned transportation by the LSTs. This air transportation drastically reduced the waste of whole blood. Planes shipped whole blood to the front within 24 hours and returned with a cargo of five to six day old blood for immediate use.

Planning for the invasion August 1944 of southern France showed just how precise and efficient the Army Medical Corp became with blood transportation. The Naples blood bank planned to support the 7th Army that would be moving into France. This well experienced blood bank trained a new crew to care for the blood supply moving into France. The new crew instituted a bleeding center where blood would be drawn that would support the Army from an Italian base until the Naples crew could move to France. Planes loaded with whole blood flew from Italy to Corsica where a PT boat delivered the load to the different landing beaches as invasion forces had not yet linked the beaches.

The PT boat deliveries continued through D-Day plus eight when crews readied the airfields for the incoming planes. The forward distributors of the Blood Transportation units landed on the sites with the 7th Army ready to serve. From the beachhead refrigerated trucks distributed blood out to the various platoons and hospitals.

Thus, Churchill saw his visions for the blood program in the Mediterranean Theater realized with the effectiveness of the blood program in the south of France. Plasma use had all but been eliminated except in emergency situations. Whole blood, which most thought an unfeasible solution previously, made its mark on the battlefield and proved once and for all that there was no replacement for its restorative abilities. The whole blood knowledge gained in the Mediterranean spread to the European and Pacific theaters and physicians from both locations sent liaisons to the Mediterranean to learn from Churchill and his associates. Though Churchill continued to work in North Africa and Italy on various surgical concepts, his work with whole blood proved to be his legacy.

Chapter IV

SULFONAMIDES AND SURGERY

Edward Churchill travelled thousands of miles during his tenure as the Mediterranean Theater surgical consultant, examined wounds, and offered advice that improved the quality of medical care in the theater. One of the most challenging problems Churchill faced was in halting the rampant use of sulfonamides. In his early days in the theater, Churchill found that sulfonamides, an anti-bacterial drug that many physicians deemed a "miracle drug," replaced proper surgical techniques in the operating room. Over and over, Churchill saw the abandonment of proper debridement techniques for this easy and simplified solution. Often, this easy solution merely led to infection, allergic reaction, and death. In April 1943, Churchill saw firsthand the adverse effects of sulfonamides in a soldier admitted to the 77th Evacuation Hospital in Tunisia. Medical aides and physicians on the battlefield and in forward hospitals had packed the soldier's wounds with large quantities of sulfonamides instead of removing the dead skin and foreign materials in the wounds. By the time he reached the evacuation hospital, the soldier contracted a severe infection and a high fever. The medical team at the 77th immediately drained the purulent wounds and removed the high explosive fragments and dead tissues that hindered the wound from healing. The clean wound fared much better and the soldier healed accordingly. This was but one of the many cases of sulfonamide misuse the Churchill observed throughout the theater. Thus, Churchill set out to reverse

the trend of misuse of sulfonamide and replace it with proper surgical techniques that promoted effective wound healing that would return the soldier to full health.[1]

By the beginning of World War II, the overuse of sulfonamides had already become a commonplace problem in the medical community. Gerhard Domagk, a German scientist, discovered the basic sulfonamide compound in 1927, which caused a great stir among the scientific community. Many thought this drug could cure many of the bacterial infections that plagued the world population. Subsequently, researchers exhausted exorbitant amounts of resources in researching the chemical make up the sulfonamides. European scientists found great success with their experiments with many variations of the sulfonamides throughout the 1930s. Perrin Long and his associates at Johns Hopkins University introduced America to the sulfonamides with their experiments in 1936, which successfully brought the concept of chemotherapy to America. Long later became the Chief Consultant in Medicine in the Mediterranean Theater and worked closely with Churchill, perhaps compounding the difficulty Churchill faced in eradicating sulfonamide use. The 1940s saw the list of sulfonamides expand drastically. Vast numbers of people hailed the compounds as a miracle sent to save them from dreaded infections that no other drug could cure. Patients asked for the drug by name and the doctors readily consented to the prescription. The October 1939 issue of the *British Medical Journal* stated that sulfonamides provided a "…certainty of benefit such as no previous remedy for the same conditions could approach."[2] Sulfapyridine became among the most acclaimed of the sulfonamides, as scientists stated that "…there seemed to be no

[1] Edward D. Churchill, *Surgeon to Soldiers: Diary and Records of the Surgical Consultant Allied Force Headquarters, World War II* (Philadelphia: J.B. Lippincott Company, 1972), 64.
[2] "Chemotherapy and Infections in War," *The British Medical Journal* 2 (1939): 859.

end to its uses."[3] Article after article in scientific journals and various other sources proclaimed that the sulfonamides could cure all manner of disease. The public clamored for the product as the scientific community backed sulfonamide's powers. Sulfa drugs solidified their place in the American armed forces with their "effective" use at the attack on Pearl Harbor.

The attack on Pearl Harbor witnessed the first use of sulfonamides en masse in a military setting. Colonel Edgar King, the surgeon-in-charge of the medical corps in Hawaii, organized the civilian, Army, and Navy medical personnel for faster response time in case of an emergency, which included access to copious amounts of blood plasma and sulfonamides. As the alarms sounded the 7 December 1941 attack, medical personnel brought 14 pounds of sulfanilamide, one of the many sulfonamide derivatives, from Tripler General Hospital at Honolulu and administered it to the incoming patients. At Hickam Field, the station hospital became overwhelmed with casualties forcing the medical staff to turn the hospital into a clearing station, stabilizing the wounded long enough for transportation to Tripler General Hospital. These wounds included high explosive fragments, machine gun wounds, and secondary missile wounds, which the staff packed with sulfonamides. Once at Tripler, physicians debrided the wounds thoroughly, clearing the wound of all foreign objects and dead tissue. Scientists, physicians, and the American community praised the dramatic use of sulfonamides at Hickam Field and Tripler General, though the removal of dead tissue and objects from the wounds played a larger part in preventing innumerable infections. The *Science Newsletter* article on the success of sulfonamides at Pearl Harbor did mention debridement, but also stated physicians used more than 68 grams (2.39 ounces) of

[3] John E. Lesch, *The First Miracle Drug* (Oxford: Oxford University Press, 2007), 181.

sulfanilamide in the wounds as well as multiple doses of sulfathiozole by mouth to ensure the suppression of germs.[4]

Praise for the sulfonamide use at Pearl Harbor continued in the upper echelons of the Armed Services. On 17 December 1941, the US Army flew a committee to Hawaii to observe the continued treatment of the wounded from the attack. This committee included Perrin Long of Johns Hopkins University, the man responsible for introducing sulfonamides to America, and L.S. Ravdin, a professor of surgery at the University of Pennsylvania. They documented their findings in their report, "Some Observations on the Casualties of Pearl Harbor" in which the two stated "We have been impressed again and again with the incalculable value of sulfonamide therapy in the care of many casualties." [5] The pair examined many wounds including compound fractures ,which the doctors did not have time to thoroughly debride, but stated that such wounds were saved from infection by the ample use of sulfonamides. They again praised the drug stating that wounds could be left untreated for up to 72 hours and free from infection if treated with sulfonamides. In the eyes of physicians and scientists alike, sulfonamides had proven themselves battle ready.

The extent to which the American and British professionals relied on sulfonamides alarmed Colonel Churchill when he arrived in Algiers on 6 March 1943. Even Heneage Ogilvie, a prominent British Surgeon and vice president of the Royal College of Surgeons, endorsed sulfonamides stating that these drugs revolutionized medical care and should be the first line of defense against infection in wounds. Ogilvie stated at the meeting of the Committee on Surgery for the National Research Council that

[4] "Pearl Harbor was the Scene of a Sweeping Victory for Drugs," *Science Newsletter* 41 (1942): 53.
[5] "Some Observations on the Casualties at Pearl Harbor," Edward Churchill Papers, Box 29, Folder 5, Francis A. Countway Library of Medicine, Boston, MA.

"…the meticulous excision of the wound as developed in the last war was not necessary" and stressed the "lifesaving qualities of sulfonamides."[6] Such attitudes in even the most prominent of physicians led to lax care for wounds in the name of convenience. Proper debridement became reduced to wound trimming, a superficial removal of the dead tissues as surgeons put their faith in sulfonamides as the best defense against infection.

However, the outcome of sulfonamide proved otherwise. At the clearing station, a soldier's first stop in the line of evacuation, aids and medical personnel packed the wounds full of powdered sulfonamides. The powder then caked in the wound instead of dissolving as the physicians had hoped. When medical personnel undressed the wound for further treatment, they often found festered wounds with large amounts of undissolved sulfa powder inside. Churchill quickly pointed out the fact that such local application of sulfonamides did not produce adequate results. He stated that "It [locally applied sulfonamides] dries and cakes, forming a shell that closes in infection."[7] Churchill further observed physician's dissatisfaction with sulfonamide treated wounds at the 77th Evacuation Hospital at Oran. The 77th received many wounded treated by the French who excised the wounds, packed the wound with sulfa, and dressed the wound before sending the soldier along the evacuation route. Many of these wounds that arrived at the 77th were severely infected as none had been properly excised. The sulfonamides, though effective if used minimally, would never work in such conditions. Churchill pointed out that "Dead tissues and pus contain substances that inhibit the action of sulfonamides. Local application is not a substitute for adequate surgery."[8]

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[6] "Personal Notes on the Suture of Wounds," Edward Churchill Papers, Box 29, Folder 6, Francis A. Countway Library of Medicine, Boston, MA.
[7] *Surgeon to Soldiers*, 67.
[8] Ibid, 65.

Not only did sulfonamides alone do little to treat battle wounds, they also reduced the importance placed on the proper timing of surgery. As seen in the 72 hour limit placed at Pearl Harbor, physicians left wounds that would have normally been surgically repaired as soon as deemed possible, were allowed to wait as surgeons felt that sulfonamides bought them extra time. Even Perrin Long, the physician who praised the sulfonamide use at Pearl Harbor, warned against the drug's over use. In Circular Letter No. 1, in February 1943, Long warned against local use of sulfonamides as well as systemic use. He stated that if a soldier received a dose of sulfonamides orally then the local dose should be reduced and vice versa. Churchill also commented stating the fact that local application of sulfonamides had little use altogether and instead, medical personnel should rely on systemic administration of sulfonamides if use the drugs at all.[9]

Sulfa allergies posed another problem for injured soldiers as well. Churchill observed a patient at the 12th General Hospital in Oran whose pants had caught fire after an accident with gasoline. The aides who attended to him immediately applied sulfa topically, dressed his wound, and repeated this process every three days. The soldier contracted a rash en route to the general hospital, which physicians presumed was because the soldier was dirty. At the 12th General Hospital, doctors diagnosed him with Dermatitis medicomentosa, an allergic reaction to the vast amounts of sulfonamide he had been given. The doctors immediately ceased all sulfonamide treatments and the rash disappeared. Physicians treated the same soldier again with sulfonamides when his wound appeared to be infected. Again, the rash reappeared and then disappeared with the doctor's discontinued treatment. Churchill pointed out that the doctors had no way of

[9] Ibid.

knowing which soldiers would be allergic to the sulfa drugs, which was yet another reason to discontinue their use.

Though doctors themselves often relied too heavily on the sulfonamides, the soldiers themselves complicated the problem as ease of access to the sulfa drugs led to self-treatment. After great success with sulfonamides at Pearl Harbor, surgeons gave sulfonamide tablets to all US soldiers on the battlefield. The ease of access to the drugs calmed the soldiers - if wounded they knew they had a "lifesaving" drug in hand. However, soldiers took advantage of their access to the sulfa drugs and self-medicated for any ailment. A report by Albert Hatcher, the battalion surgeon of the medical detachment of the 434th Anti-Aircraft Artillery Automatic Weapons Battalion in November 1944 called attention to the problem stating that far too many soldiers requested excessive amounts of sulfonamide tablets citing that their supply had been lost, crushed, or had dissolved. Documentation from the field indicated that soldiers used these extra supplies to self-medicate for problems such as diarrhea, minor infections, and prophylaxis for self-diagnosed sexually transmitted diseases. The report stated that the overuse of sulfonamides did not decrease after medical personnel issued a warning stating that overuse of sulfonamides would render them unusable for future infections the soldier may contract. Hatcher recommended that such sulfa packets no longer be issued to the troops and that the authority to provide sulfonamides be restricted to medical officers and qualified aid-men. Churchill received this report during his visit to the 5th Army and heartily consented to its message.[10]

[10] "Issue of Sulfonamide Wound Tablets," 18 November 1944, Edward Churchill Papers, Box 28, Folder 6, Francis A. Countway Library Medicine, Boston, MA.

Stopping surgeons and soldiers alike from using sulfonamide was easier said than done. Sulfonamides provided an easy solution for battlefield wounds instead of the alternative, the reparative surgery. Reparative surgery proved a tedious task that required much specialized training, none of which the civilian doctors who made up the Army Medical Corps had. This situation was further complicated by the fact that the National Research Council, the U.S. government's brain trust on scientific matters, did not issue uniformed guidelines on the proper method to suture wounds. Therefore, patients arrived at the hospitals with all manner of wound closures according to the various interpretations of their doctors.

The task of determining which manner to suture wounds closed plagued their World War I predecessors as well. However, the surgeons of the World War I reached a consensus on antiseptics and wound closures and produced uniform, clean wound sutures. The surgeons of the World War II could have learned much from their predecessors on wounds and wound closures, a fact that Churchill lamented. Other surgeons in the field noticed this same problem as well. Lt. Col. Michael DeBakey and Col. B. Noland Carter of the Austrailian Medical Corps stated that "…there has been some lag in the effort made to utilize, from the last war, the 'wisdom purchased at so tremendous a price.'"[11] Physicians would have known that antiseptics alone could not treat infections, had knowledge of the battlefield medical practices of the World War I been disseminated. Sir Anthony Bowlby, a Consulting Surgeon to the British Forces in France in World War I, stated that "We realized that we had attributed too much power for evil to the microbic invasions; that the infection was too gross to be combated by

[11] Lt. Col. Michael E. DeBakey and Col. B. Noland Carter, "Current Considerations of War Surgery," *Annals of Surgery* 121 (1945): 552.

antiseptics; and that the source of the danger was to be sought for in the damaged of dead tissues contaminated by the mud of the manured fields and in the portions of the muddy clothing and the missiles which were buried in the wounds."[12] This realization led the important process of thorough wound excision. Bowlby stated that without a properly cleaned wound, "… antiseptics are useless and in proportion as technique is good, and excision can be done early and can be really complete, antiseptics applied inside the wound are merely accessory."[13] How much skin comprised a proper excision posed another problem, many surgeons removing too little in order to prevent damage to tissues and muscles, which led to unopened pockets of devitalized tissue and suppurated wounds. Drury Hinton, M.D. of the British Expeditionary Forces stated, "The more carefully the dead tissue is removed and the more thoroughly all recesses are explored, the better are the results." [14]

Once these World War I surgeons excised the wounds, they had to make a decision about how best to close the wound. Surgeons used the primary suture early in the war, which entailed closing the wound as soon as they had finished debridement and repairs. In numerous cases this worked, but in many more the primary suture caused further complications. Many felt that the primary suture closed the wound prematurely, locking in dead tissues and foreign objects. These primary sutured wounds were prone to infect and other complications caused by evacuation across rough terrain. Wounds needed rest in a stable environment under the constant care of a physician familiar with the patient's wound to ensure proper healing. Surgeons instead deferred to the delayed

[12] Sir Anthony Bowlby, "An Address on Primary Suture of Wounds at the Front in France," *The British Medical Journal* 1 (1918): 333.
[13] Ibid.
[14] Drury Hinton, "Suture of War Wounds," *Annals of Surgery* 71 (1920): 193.

primary suture or secondary closure of all wounds. In this procedure, surgeons purged the wounds of all harmful materials at the Casualty Clearing Station or other forward locations. The wounds were left open, carefully bandaged, and moved along the evacuation route following this procedure. Once the wounded had reached a stable location, surgeons proceeded with an examination of the wound to ensure the absence of infection, which included a culture sent to a laboratory for a bacteria count. Physicians promptly proceeded with the wound closure if the results came back negative. William S. Baer, an orthopedic surgeon with the American Expeditionary Force, pointed out that the wounded should be moved six to seven hours following their debridement operation and closed between the second and fourth day to insure the absence of infection. This process afforded the wounded soldiers a shorter recovery period, fewer future complications, as well as returned more soldiers to the front sooner.

The failure of this information from the World War I to carry over to the World War II was further complicated by the fact that the American Army Medical Corps was comprised mostly of civilian physicians. In civilian medical practices, surgeons easily opened a wound, excised it, and sutured the wound closed in one surgery. Civilian surgeries occurred in stable and sterile environments where the patients rested comfortably until their wounds healed. However, neither stable nor sterile environments were available on the battlefield. Churchill described North Africa as a dust filled environment where many of the troops did not have the facilities to properly maintain personal hygiene or change clothes while they served long stints on the front lines of combat early in the war. Such an environment only enhanced the probability of wound contamination. This problem was compounded by the fact that medics kept the wounded

soldiers moving along the evacuation line eliminating any hope for the proper rest they needed to recover. Lt. Col. Michael DeBakey stated that "Judged by the highest standard of civilian practice, the military environment preclude ideal surgical practice and imposes certain modifications upon the treatment of the wounded."[15] As Churchill discovered, these said modifications were easier said than actually instituted.

After the war, Churchill recalled the difficulty involved in getting civilian doctors to understand battlefield surgery from a military aspect. Churchill stated that "…he [civilian doctor] still would have no conception of the destructive force of high-velocity missiles or the timing factor so important in treatment, and the many other elements that make wound surgery a specialty its self."[16] The new civilian surgeons rarely if ever encountered the types of wounds seen on the battlefield, which inhibited their ability to properly care for the injured soldiers. Churchill and his fellow surgical consultants faced the challenge of turning these civilian doctors into military surgeons by teaching them proper debridement methods, suturing techniques, as well as accurately timing these operations to ensure that the wounded healed.

If the civilian doctors intended to treat the wounded properly, the wounds required debridement, which meant all dead tissues and foreign objects must be removed from the interior of the wound carefully or risk damaging healthy tissues. As Churchill stated, often times these foreign objects would not be metallic and therefore would not appear on an x-ray. Therefore the surgeons needed to open the wounds wide in order to extract the foreign objects. Though this was the ideal situation, the early surgeries that Churchill observed soon after his arrival in the field did not meet these high standards.

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[15] "Current Considerations of War Surgery," 550.
[16] *Surgeon to Soldiers*, 180.

Inexperienced surgeons often left pockets of necrotic tissues and pus deep within the wounds, which prolonged the patient's recovery as well as ran the risk of life threatening complications. The treatment of compound fractures early in the war gives a prime example of the dangers caused by inexperienced war surgeons. Early treatment of compound fractures, a fracture in which the broken bone pierced the skin, comprised of poor debridement as well as casing the wound in a plaster cast to stabilize the injury for further evacuation. The casing process took place in the forward hospitals and the surgeons typically left the cast on for four to six weeks with the thought that the wound would have healed to granulation, a process in which tissue temporarily forms inside the wound to replace the tissue lost. This procedure easily worked in the civilian sector, but when surgeons reopened the cast they found the plaster within disintegrated and the skin covered in blisters and pressure sores from the cast. Though some cast looked promising, when removed revealed severe infections brought on by the devitalized tissue that remained in the wound as well as hematomas, a mass of clotted blood, in the undrained dead spaces.

Problems such as the infected compound fractures are but one example of the various surgical mishaps Churchill faced as he toured the North African Theater. He stated that the surgeons focused more on what they were doing, such as the closed plaster techniques as well as sulfa treatments, instead of not doing. The surgeons were quite capable of taking the wound apart but rarely put the wound together again. Churchill stated that for these procedures performed in this manner "All we need is the simple kit of the Civil War surgeon-scalpel-saw-forceps…"[17] Other surgeons excised too much skin as they attempted to debride the wounds. Physicians in the field went from excising

[17] Ibid, 186.

too little skin, which led to an infected wound, to excising far too much tissue and leaving the wound wide open. Surgeons attempting to close a wound in which too much skin had been excised found that the sutures caused too much tension and the wound would break down.

While the surgeons may have begun to excise the wounds properly, the methods they used to suture them caused problems just as they had done in the World War I, the most problematic being the primary suture. Primary sutures consisted of closing the wound immediately following the debridement surgery, which often caused the wound to suppurate just as had been proven in the World War I. Further evacuation only enhanced the dangers inherent in this type of suture. As Debakey pointed out in *Current Considerations of War Surgery*, some of the primary sutures may heal properly, but surgeons could never know which ones would do so. Churchill and Debakey both summarized that this was a risk that should not be taken when there were other options. Debakey stated "Primary closure enhances the development of life-endangering infection and interruption in the continuity of professional supervision imposed by evacuation precludes its early detection."[18] Instead, Churchill intimated that such wounds should be carefully bandaged following debridement. The wound need not be packed with gauze, which would further damage the wound, but instead the surgeon should insert a thin mesh cloth in the wound followed by a bandage, readying the wound for evacuation. These carefully bandaged wounds frequently became infected as the wounded were evacuated by medical personnel who removed them in order to check the wound. Churchill pointed out in his 1943 Annual Report to the North African Theater of Operations Headquarters that "Lifting up the corner of the dressing with fingers to inspect the wounds was

[18] "Current Considerations of War Surgery," 550.

oftentimes repeated in several stations before the casualty arrived at a hospital for emergency surgery. Even then, the wound might be exposed with the patient on a litter on the floor of the receiving tent…"[19] Instead the medical staff needed to pass the wounded to the rear with the original bandage undisturbed in order to avoid unsafe levels of contamination.

The debridement and bandaging process comprised the first phase of a two-phase system that Churchill later devised similar to the system used in the World War I. The first phase promoted the already described debridement process as well as chemotherapy if needed. The second phase commenced after the patient arrived at a general hospital where the casualty could recover from the reparative surgery in peace. This concluding surgery began with an examination of the wound followed by secondary sutures if the gross appearance was deemed satisfactory. Churchill laid out the four steps of this second phase in his article, "The Surgical Management of the Wounded in the Mediterranean Theater at the time of the Fall of Rome." First, the surgeons would decide by the appearance of the would whether it could be closed or not doing away with the time consuming method of bacteria cultures from the World War I. Churchill nixed this step calling it unnecessary as an infection severe enough to prevent closure of the wound would be visible to the human eye. Secondly, if the wound appeared purulent, the medical staff would clean the wound. He pointed out that if the debridement process had been done properly, then this step would be minimal. Next, the surgeons would perform a secondary wound closure a few days later. He stated that the medical staff could give the patient a dose of penicillin if the staff deemed the medicine necessary, but that if the

[19] "Wound Infection and Wound Healing Report," Edward Churchill Papers, Box 35, Folder 15, Francis A. Countway Library of Medicine, Boston, MA.

surgeons performed the process correctly, the medication could be freely omitted. Lastly, Churchill pointed out the extreme importance of the "time-lag" between each step of the surgical process. He stated that "The time-lag between wounding and initial surgery referred to as 'the golden period' has been greatly reduced by the organization of medical service in the forward area to this end. The time-lag between initial surgery and reparative surgery has now assumed an equal degree of importance."[20] He called the four to ten days following debridement the "golden period" for wound closure, fixing fractures, removal of foreign material, and infection prevention. Churchill pointed out that eventually, failure to take advantage of early reparative surgery would be as unthinkable as not removing foreign materials from the wounds.

Though Churchill saw the advantage of secondary sutures, many of his fellow surgeons did not embrace this change to their techniques well as Churchill found out during his tour across North Africa. Upon his arrival at the 21st General Hospital in Bou Hanifia , Churchill asked about how the surgeons pursued secondary sutures. He stated that "…I was met by incredulous looks. As I learned afterwards, steps were underway to *forbid* this procedure from being undertaken."[21] However, he met Major Wendell Dove, the head of Septic Surgery at the 21st General Hospital, who pursued secondary sutures despite doubt from his fellow surgeons. Dove's unorthodox methods so scared the other surgeons though, that they had in motion a special order to stop him from such sutures and took offense when Churchill asked to see Dove perform a secondary suture. Dove's patient that Churchill observed was a young soldier with a leg wound in which an incision had been made directly through a tattoo of a peacock. The wound compromised

[20] Edward D. Churchill, "The Surgical Management of the Wounded in the Mediterranean Theater at the Time of the Fall of Rome," *Annals of Surgery* 120 (1944):283."
[21] *Surgeons to Soldiers*, 183.

a traditional secondary wound closure in which the wound had begun to granulate as it healed. The edges had become stiff and undercuts, a loosening of the skin around the edges of the wound in order for the wound to be closed, would be required to bring the wound together.[22] Dove closed the wound without incident with the added accomplishment of keeping the peacock tattoo intact, which proved that too much skin had not been debrided, a common criticism of forward surgery by those in the rear. Across the theater, surgeons were taking on such unorthodox procedures despite the doubts of their contemporaries.

While some surgeons did attempt the secondary sutures, many attempted them far too early, which caused complications. Any such suture attempted before the fourth day after the excision surgery became known as a delayed primary suture. The wound did not have enough time to rest nor did the patient between surgeries with the added complication that these early closures often led to severe infections. Churchill saw this firsthand as he visited the 59th Evacuation Hospital in Casablanca where the surgeons encouraged discontinuing delayed primary sutures after several failed closures arrived at the hospital. The 59th received over 200 prisoners of war, twenty of whom had their wounds closed within 48 to 72 hours prior. The 59th found that 16 of these 20 patients showed signs of purulent, septic wounds. These surgeons opposed secondary sutures as well for the same reasons. Churchill researched these statements and said, "…it was found that these were instances of delayed primary suture evacuated within a few days of closure. Of course, they (the closure) broke down."[23] In order to prevent further discontent with the secondary closure procedure, Churchill implemented proper closure

[22] Undercutting a wound would relieve enough tension along the wound edges to close the wound.
[23] *Surgeon to Soldiers*, 187.

techniques by educating his fellow surgeons about the proper timing of wound closures. Though delayed primary sutures and secondary sutures seemed similar, closure timing meant the difference between a wound that broke down and one that healed and returned a soldier to duty.

Though the system Churchill and his fellow consultants implemented took much work, by the end of the war they saw the pleasant effects of this method. One consulting surgeon stated in his August 1944 letter that the surgeons of the Mediterranean Theater had done away with the trimming operations of the early war years in exchange for a thorough excision of the wound, terminated the closed plaster method, as well as divided wound surgery into two distinct methods. These practices, the surgeon claimed, had helped close thousands of wounds with great success. Reports flowed into Churchill from all over the Mediterranean about the success of secondary sutures. Captain Samuel Flowers of the 64th Station Hospital reported on the success that he and his staff had with all wounds closed in the ten to fourteen days following debridement. The surgeons frosted the wound with sulfa, applied a moderate pressure dressing, and immobilized the wound. Flowers reported that this procedure produced a wound that healed rapidly and cleanly. These are but two examples of the success brought about by Churchill's advocacy of secondary sutures. The use of primary sutures and the overuse of sulfonamides halted by the end of war as well were a testimony to Churchill's persistence.

At the beginning of the war, Churchill would have never expected such success from the surgical principles he advocated. Surgeons disregarded proper surgical techniques in favor of the convenience offered by the new sulfonamide drugs. The

popularity of these drugs came after physicians attending the wounded at Pearl Harbor praised them for saving so many lives. However, these drugs only masked the problem for a short period of time on the battlefield. The aid men at the front packed the wounds with sulfa powders. When the doctors at the evacuation and general hospitals opened these wounds again, they found an inflamed, purulent wound. Churchill stated instead the surgeons needed to rely on the proven surgical methods of the World War I instead of the sulfonamides. The physicians in the World War I stated that the only sure way to ensure that a wound would heal would be through proper debridement followed by a period of rest to guarantee the absence of infection. The surgeons pursued secondary sutures a few days later, after which the patients fully recovered. However, the civilian surgeons in the World War II strongly resisted these methods calling them unorthodox as well as unnecessary. Churchill proved over and over by example that though considered unorthodox, the secondary sutures yielded a better healing wound than the one-step surgery that the civilian doctors performed. These education efforts, though tedious, proved successful by the end of the war. Churchill overthrew the doubts that his fellow surgeons had about surgical techniques such as the secondary suture. These efforts provided each of the battlefield surgeons with surgically sound methods that ensured that each of the wounded soldiers returned to full health.

Chapter V

MEDICAL EVACUATION

The medical evacuation process, the procedure used to move casualties from the battlefield through a network of medical stations, implemented in the Mediterranean Theater, though relatively simple, proved a difficult concept to execute. However, the stable medical evacuation plan proved an invaluable asset once established. Army medical historian Albert E. Cowdrey demonstrated the smoothness of the evacuation scheme as it existed in late 1943 in his book *Fighting for Life*. Cowdrey recalled the harrowing medical evacuation of Richard Tregaskis, an American wartime journalist hit by a shell as he scaled a hilltop in Cassino, Italy. Tregaskis stated in *Invasion Diary,* his account of his time in Sicily and Italy, that "I realized I had been badly hit. I was still stretched on the rocks. A couple of feet from me lay my helmet which had been gashed in at least two places, one hole at the front and another ripping through the sides."[1] Following his injury, Tregaskis received aid from a medic and then made his way to an aid station with the help of a fellow soldier. From the aid station, the first step in the evacuation line, Tregaskis and all other evacuees were taken to a collecting station. Here, physicians checked the wounded once more and the most severely injured received immediate blood transfusions. Next, evacuees were taken by litter to the clearing station where physicians separated out those needing immediate treatment and took these casualties to the field hospital adjacent to the clearing station. These casualties received

[1] Richard Tregaskis, *Invasion Diary* (New York: Random House, 1944), 208-209.

lifesaving surgery at the field station such as stabilization of injuries and surgical repair of any immediately life threatening injuries. Surgeons kept these casualties at the field hospital until their injuries stabilized enough to allow them to be evacuated. Ambulances or air evacs next took the casualties to the evacuation hospital where surgeons performed definitive surgery. All previous surgeries performed were in anticipation of the causalities' arrival at the evacuation hospital. Here, bones were mended and surgeries involving the brain, such as Tregaskis's, were performed. When casualties recovered enough to withstand travel, they were removed by ambulance or airplane to the communication zone where they were admitted to the base hospitals, a permanent part of the communication zone. Here, the casualties could recover safely in the hands of well-trained surgeons who had the best equipment available to them. The base hospitals were a relatively safe distance from the front, which relieved any worries the wounded had of being caught in the line of fire. This smooth working evacuation system removed casualties such as Tregaskis to safety quickly and efficiently, saving many lives. However, this smooth operating evacuation system did not exist when Colonel Churchill encountered it late 1942.[2]

The joint American-British invasion of North Africa, otherwise known as Operation Torch, began on 8 November 1942, beginning America's long three year involvement in the Mediterranean Theater of World War II. Colonel Churchill arrived in the theater three months later in February 1943 to find the Army Medical Corps in disarray, some of which has been previously discussed. The problems of plasma infusion and improper suture techniques were further complicated by the fact that the Medical

[2] Albert E. Cowdrey, *Fighting for Life: American Military Medicine in World War II* (New York: The Free Press, 1994), 153-158.

Corps had arrived in the theater without plans for a working medical evacuation route. The wounded were moved to the rear in an ad hoc manner that complicated their recovery and slowed evacuation. Casualties arrived at the aid stations and hospitals without records documenting the medical attention they had received causing further chaos. Perrin Long, the American developer of sulfonamides as well as a surgical consultant, commented on the American Army Medical Corps's utter lack of an evacuation plan. Long stated that "…there had been no attempt to examine, much less to formulate, policies for the management of the wounded. Surgical policies were all at loose ends."[3] As was seen in the surgical policies on sutures and anti-bacterials, the American Army failed to carry over into the World War II the lessons learned in the Great War.

The evacuation plan developed in the World War I planned for the removal of the wounded from the battle lines to the general hospitals in the rear. Lt. Col. Jay W. Grissinger, the Chief Surgeon for the 42nd Division, First Corps, 3rd Army of the American Expeditionary Force, described this process in his 1927 article, "The Development of Military Medicine." Grissinger stated that

> Professional care of a soldier who becomes a casualty on the battlefield begins as soon as he falls into the hands of the medical department representatives who search the field for wounded. Naturally, however, treatment in the field and during evacuation must be confined to first aid until the patient arrives at an evacuation hospital. Here many operations are performed but prolonged treatment can be furnished only by organizations in the Zone of the Interior, far removed from the noise and stress of combat, namely, in the general hospitals.[4]

[3] Quoted in Edward E. Churchill, *Surgeon to Soldiers: Diary and Records of the Surgical Consultant, Allied Force Headquarters, World War II* (Philadelphia: Lippincott, 1972), 82.
[4] Jay W. Grissinger, "The Development of Military Medicine," *Bulletin of the New York Academy of Medicine* 3 (1927): 353.

Grissinger describes that when soldiers fell on the battlefield, stretcher bearers carried the non-walking casualties to the battalion aid stations located 500 yards from the front lines. Casualties were then taken from the battalion aid station to the collection station, the furthest point forward that ambulances could traverse. Ambulances carried the casualties to the hospital stations where the physicians examined the wounded and those needing urgent surgery were taken to the adjacent surgical hospital where surgeons mended all wounds needing immediate repair. Medical aides took the less severely injured to the Evacuation Hospitals or even the general hospitals in the Communication Zone. Once casualties reached the general hospitals, they would be out of the reach of the artillery fire from the front. Here, the wounded received the corrective surgeries whereas earlier in the evacuation line, surgeons administered only the most basic lifesaving surgeries.

Such an evacuation line offered the wounded soldiers the best chance at a full recovery whereas the individualistic approach pursued early in Mediterranean Theater promoted dangerous surgical techniques. In this approach, a surgeon took responsibility for all casualty operating procedures, including preventive and definitive surgical care. Unlike in an evacuation line, where such responsibilities are spread out among the stations, the casualty's life became the responsibility of that particular surgeon, a liability that the surgeon was not equipped to handle. Churchill blamed this individualistic approach on the age old idea that surgeons should strive to be "heroes." Churchill observed this concept in the armored division of the II Corps where the physicians employed half-tracks with a shelf bolted to the back. Surgeons intended this vehicle to be a mobile operating room for surgery under any conditions. Churchill condemned this

concept for not taking into account the welfare of the patients after the operation. Who and how were these patients to be taken care of after their operations as they would not be fit to travel long distances? Churchill attributed such philosophies to the concept that surgeons are trained heroes, an idea that stated that a surgeon should strive by heroic acts to care for the wounded and do whatever necessary to heal the casualty, an idea that often had disastrous consequences. Medical philosophy promoted the idea of surgical heroics throughout the early 20th century. Physician Charles Dana laid out the heroic standards to which young surgeons were to strive in his 1927 article, "How Young Doctors Should Behave." Dana stated that "Heroism is certainly a commendable thing…Heroism invalues courage, skill, daring, and initiative. It seems that all these qualities are needed, or maybe employed in the career you have chosen."[5] Through such indoctrinations, the young surgeons serving in the World War II felt it their duty to be heroic surgeons. However, surgical heroics did not fit into the Army's medical plan though the Army itself had little idea of how to approach medical care.

As the American Army moved into North Africa in November 1942, the American system of surgical organization fell apart. The Army Medical Corps compensated by superimposing the British evacuation and medical care system over its own. As Churchill pointed out, the British physicians were experienced in wartime medical care, but lacked the manpower and equipment of the Americans. Heneage Ogilive, Chief Surgical Consultant for the Royal Army Medical Corps, wrote a guideline for the British and American Medical Corps in order to synchronize both forces. However, the Royal Army Medical Corps was not always as well adjusted to battlefield

[5] Charles L. Dana, "How Young Doctors Should Behave," *Bulletin of the New York Academy of Medicine* 3(1927): 650.

medicine as they appeared to the Americans moving into North Africa. The British began with a spotty evacuation system. The Royal Medical Corps did not have a set system of which patients to keep for further surgery and so chose the patients inconsistently. At the casualty clearing station, the second stop in the evacuation line, the British operated on the casualties as soon as possible no matter when the patient had to be moved as they wanted to evacuate all patients except those in the worst condition 24 hours after surgery. They also employed mobile surgical units with vehicles built as mobile operating rooms. Churchill criticized the British system of "surgery on wheels" as well as the early evacuation of all casualties from the casualty clearing station. He stated that such a system focused on quantity and not quality. Instead, the surgeons at the front should give their patients the same care as they would under normal conditions as the treatment in the forward area determined how the patients would recover. Churchill stated that "By the time the patient reaches the base, the subsequent course of the injury is largely determined."[6] He further intimated that all surgeries at the front should be limited to the severely injured and those on whom surgery had been performed were to be held at their current hospital until they were fit for travel. Ogilvie also criticized the Royal Army for how surgeons were placed in the field. He stated that "…they are looked on as flags on the map…often far from real surgical work. Recognition of their value lends to their being sent where they are not much more than supporters of morale or divisional mascots."[7] Churchill evaluated the Royal Army Medical Corps's initial performance in the Mediterranean by stating that "The same elements repeat themselves:

[6] *Surgeon to Soldiers*, 95.
[7] "Abstract of tour report of the Consultant Surgeon on visits to 1st Army, 8th Army, and Lines of Communication, Brigadier General W.H. Ogilvie,"1 May 1943, Box 34, Folder 1, Francis A. Countway Library of Medicine, Boston, MA.

the lack of planning at the outset, the need to bring surgery forward and the necessity for mobility weighed against the cold surgical fact proper resuscitation and post-operative care are of importance equal to the operation itself in determining whether a wounded man will survive."[8] These were the examples that the Americans had to follow when they entered the theater no matter how critical Churchill was of them.

Friction between the Army commanders and medical corps led to further problems with proper execution of medical care. Churchill pointed out that the commanders felt the Medical Corps more of a hindrance and an inconvenience than helpful.[9] Medical Corps members not only had to keep up functioning medical practices, but also work to appease the commanders over them. Churchill felt the relationship between the two important as the Medical Corps physicians were to give the Army commanders advice on the medical risk they took when planning maneuvers on the battlefield. However, much of this advice fell on deaf ears as Army commanders gave their own recommendations for the best care of the wounded. General George S. Patton stated in his 6 January 1943 speech that "If you have two wounded soldiers, one with a gunshot wound of the lung, and other with an arm or a leg blown off, you save the sonofabitch with the lung wound and let the goddamn sonofabitch with an amputated arm or leg to hell. He is no goddamn use to us anymore."[10] Without support from the higher ranking members of the American Army and no plan for the proper evacuation and care for the wounded, the Army Medical Corps faced major challenges in the Mediterranean Theater.

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[8] *Surgeon to Soldiers*, 98.
[9] Ibid, 89.
[10] Quoted in Albert E. Cowdrey, *Fighting for Life: American Military Medicine in World War II* (New York: The Free Press, 1994), 118.

While on tour of the hospitals in Tunisia, Churchill became intimately acquainted with the II Corps medical services, which demonstrated the bad shape that the American Medical Corps found themselves in. Previously, the II Corps took on the Germans in the Battle of Kasserine Pass without an adequately staffed medical unit. Fortunately, additional medical troops did arrive, but during the heat of battle. The addition of physicians only contributed to the confusion in the hospital wards as the individual physicians treated each casualty according to their own interpretation of the wounds. Clearing stations closer to the front faced further mayhem as they were understaffed and stocked with faulty equipment. These surgeons received little guidance from the Army Medical Corps as to how to perform their duties. Churchill stated that "They [clearing station physicians] were relying on the advice they could get from the evacuation hospitals behind."[11] Two months after the Battle of Kasserine Pass, Churchill found the conditions of the II Corps medical service unchanged. He reported in his 16 April 1943 *Memorandum on Surgery in the II Corps* that the aid stations at the front frequently attempted to perform definitive surgery with disastrous results. Additionally, the aid station physicians failed to record what treatment they gave to each patient. Churchill found similar results at the clearing stations. Here, the doctors were prepared to perform definitive surgeries, but lacked x-ray machines as well as post-operation treatment centers. Because they lacked the post-operation treatment centers, the surgeons were responsible for the stream of wounded men flowing into the station as well as the post operation care of those already operated on, a stress the physicians were not equipped to handle.

[11] Ibid, 86.

The lack of small evacuation hospitals meant that some mobile surgical units would be used for purposes for which they were never intended. Surgical Hospital #48, intended as a mobile surgical unit, became used as an evacuation hospital because the II Corps lacked small 400 bed evacuation hospitals. The unit performed 455 debridement surgeries in March 1943 as well as 741 other surgical procedures, a feat that the personnel and equipment were not designed to handle.[12] Surgery at Surgical Hospital #48 became an assembly line without distinction between the initial primary surgery and definitive surgery, a treatment normally performed in the evacuation or base hospitals. The assembly line strategy passed the wounded through many extra hands, which resulted in infection and wounds that were difficult to heal as well as slowed down the evacuation process. Also, physicians often failed to record the medical treatment and medication given to each of the casualties under these stressful circumstances. Thus, when the patient reached the next station or hospital in the evacuation line, the doctors did not know what treatments the patient had previously received. Churchill found that few emergency tags, labels attached to each soldier's clothing recording their medical history in the evacuation line, were missing. The doctors simply did not fill them out or dirt or blood made them illegible further complicating the already strained evacuation line. Brigadier General W.H. Ogilvie, British surgical consultant and vice president of the Royal College of Surgeons, stated of the American evacuation line: "Your problem seems as difficult as it could be. For all the skill you have available, your lines of evacuation are so complex and your hospitals so scattered along them that to segregate

[12] "Memorandum on Surgery in the II Corps," 16 April 1943, Edward Churchill Papers, Box 35, Folder 14, Francis A. Countway Library of Medicine, Boston, MA.

special cases with any degree of completeness seems an impossible achievement."[13] Churchill knew that a more organized system must replace the ad hoc scheme used in North Africa up to this point.[14]

Instead, Churchill implemented a system of medical evacuation utilized in the Spanish Civil War from 1936 to 1939 by Douglas W. Jolly. Jolly, a British citizen, volunteered for service in the Republican Army and was given command of a mobile surgical unit from November 1936 to December 1938. Jolly and the other members of the Republican Army Medical Corps were forced to structure their units from scratch as most of the Republican doctors defected to the Nationalist cause. To make the most of their small medical corps, the Republican Army developed a highly organized medical evacuation system. Jolly stated that "To ensure a service of field surgery to its large and growing army in all varying phases in the total war in which it was engaged, Republican Spain evolved the Three-Point Forward System, based on the self-sufficient mobile surgical unit."[15] This system spread out the responsibility for the wounded among the stations and hospitals, ultimately providing better surgical care and a better managed evacuation chain. Jolly explained that the Republican Army needed a medical evacuation system that would eliminate the gathering of wounded in any one place as this would invite aerial bombardment from the enemy. To accomplish this, the medical corps needed to split up into its functional elements. Casualty Clearing Stations would be divided into a casualty classification post, Number 1 Hospital for the most urgent

[13] "Quoted in Edward D. Churchill's Annual Report of Consulting Surgeon to Surgeon, NATOUSA," 2 July 1943, Edward Churchill Papers, Box 35, Folder 15, Francis A. Countway Library of Medicine, Boston, MA.
[14] "Memorandum on Surgery in the II Corps," 16 April 1943, Edward Churchill Papers, Box 35, Folder 14, Francis A. Countway Library of Medicine, Boston, MA.
[15] Douglas W. Jolly, *Field Surgery in Total War* (New York: Paul B. Hoeber, Inc., 1941), xii.

wounded, and the Number 2 Hospital for the less urgent casualties with other functional elements in between. This system reduced the number of stations and hands through which the wounded passed, especially on the front line. Jolly stressed that multiple posts meant that the wounded passed through a multitude of hands and received many unnecessary dressing changes. Jolly stated that "Innumerable sufferers in every war have been bandaged to their grave at the hand of over enthusiastic dressers."[16] Such a system provided a stable environment for evacuation of the wounded.

However, not all agreed with Jolly's principle of evacuation. Tudor Hart, Jolly's contemporary, stated that the wounded must be removed from the front as rapidly as could be allowed and that "…absolutely nothing must be allowed to interrupt the flow of casualties to the rear, even if this means some loss of lives that might have been saved under peace time working conditions."[17] Jolly stated that the evacuation system did not have to mean the death of numerous wounded for the sake of speed. Instead, division of the responsibilities among the functional elements would provide a speedy evacuation system that would give the wounded a fair chance at survival.

In Jolly's evacuation plan, medical aides took the wounded soldiers to the battalion aid post immediately behind the front lines. At the battalion aid post, the patients received treatment for any immediately life threatening conditions such as hemorrhage after which the physicians readied the casualty for transport. Physicians also attached a field casualty card to the patient's clothing. This card would be used to record the treatments the patient received throughout the evacuation line. Litter bearers took the wounded to the classification post one to four miles behind the front once the patient was

[16] Ibid.
[17] Ibid, 21.

readied for transport. Here, Jolly stressed the importance of keeping the wounded from accumulating at the classification post as such an occurrence would invite enemy air bombardment. At the classification post, physicians determined the types of wounds the casualties had received and whether or not these wounds were life threatening. Jolly stated that "It cannot be too often stated that the working of the Three Point Forward System depends on an early and exact classification of the wounded."[18] Elimination of this classification step could result in the severely wounded not receiving the lifesaving surgery they required. The classification post gave blood transfusions to the men in shock, a proposition ahead of its time, splinted or re-splinted legs, and removed tourniquets. Next, ambulances took the most seriously wounded to the Number 1 Hospital or the Forward Hospital for further treatment while the less seriously wounded were moved to the Evacuation Hospitals.

Physicians at the Number 1 Hospital or Forward Hospital were responsible for arresting severe hemorrhage as well as mending severe abdominal, chest, and head wounds as well as all cases of severe skin or tissue destruction. The Number 2 Hospital dealt with all other casualties except for the most trivial, which physicians sent on to the Evacuation Hospital. Jolly stated that the Number 1 hospital should be as near the front as possible without compromising the safety of the patients. He insisted that this position must be within five hours travel from the classification station. When Jolly reduced the time lag between the classification post and the forward hospital for abdominal patients from 10 to 5 hours, he saw recovery rates improve from 30 to 57 percent. He also insisted that the forward hospital must be in a location where the patients could be kept for eight or more days after their procedure. Patients recently operated on needed these

[18] Ibid, 23.

days of rest as post operation patients could not withstand further transport immediately following surgery. The reduction in time lag as well as a rest period for the post operation patients meant a better overall recovery.

Churchill planned to use Jolly's evacuation system with some modification to bring order and unity to the chaotic medical evacuation line seen in North Africa. He introduced the first modification to Jolly's system at the clearing station. When the litter bearers arrived with the wounded at the clearing station, doctors immediately sorted them according to the severity of their wounds. Physicians sent the severely wounded on to the field hospital and all others to the evacuation hospital. Instead of re-splinting the wounded and preparing the wounds for further transportation, Churchill stationed field hospital platoons at the clearing station, which allowed the severely wounded to be transported the field hospital immediately by stretcher. Churchill stated that "No pause is required for resuscitation of interference with splinting or dressings. Expert surgical management that embraces resuscitation, operation, and prolonged post-operative care, becomes immediately available."[19] He further stated that the surgeons and physicians at the field hospital must be the most thorough of all the Army surgeons in order to save life and limb. He stated that "Initial surgery cannot be carried on as a hasty, slap-dash and bloody spectacle, with rapid evacuation of the patient to the rear if satisfactory results are to be achieved."[20] Surgical expertise at the forward hospital also acted as a morale booster as well as improved the medical procedures performed in other sectors. Splinting at aid stations was improved and the clearing and collection companies were less likely to take on comprehensive "heroic" surgeries with a hospital of experts so near the front.

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[19] Ibid.
[20] Edward D. Churchill, "Surgical Management of the Wounded at the Time of the Fall of Rome," *Annals of Surgery* 120 (1944):271.

Still, Churchill pointed out, these forward hospitals only care for a fraction of the wounded with the evacuation hospital in the rear bearing most of the burden. Churchill stated that "These institutions [evacuation hospitals], with trained experienced professional staffs have attained a high degree of proficiency in the procedures of initial wound management and remain the backbone of the Army Medical Service."[21] From the initial wound care at the aid station to the evacuation hospital, Churchill's use of Jolly's Spanish Civil War plan brought the much needed organization to the Mediterranean medical evacuation plan. Churchill stated that "This principle of triage based on the urgency of the wound with separate hospitalization for the two categories of cases subsequently became the basic principle followed by the US Medical Corps in World War II."[22] Such a system would allow the army to continue its fight and the medical corps to continue its lifesaving mission.

When the Germans and Italians retreated to Sicily, the American ground troops planned their invasion of the island called Operation Husky, while the Medical Corps prepared for the invasion. In the month before the invasion, Churchill reiterated the importance of the lessons learned in North Africa about the importance of an organized medical evacuation system. The 9 June 1943 Circular Letter Number 16 reminded surgeons if they did not have the proper aftercare facilities the casualties should be evacuated instead. The letter also reminded physicians to limit the heroics of their surgical techniques and that initial surgery was intended for infection prevention and transportability only.[23]

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[21] Ibid, 272.
[22] *Surgeon to Soldiers*, 92.
[23] Ibid, 211.

The medical corps prepped for the invasion of Sicily by examining the types of wounds seen in North Africa and estimating the number of wounded in the Sicilian Campaign based on these figures. The medical corps also spread hospitals out along the coast of North Africa ready to receive the wounded from Sicily. Churchill stated that "I tried to get a system established to sort the wounded as they came back from Sicily and distribute them among these hospitals."[24] He also helped set up specialty centers. These centers housed expert surgeons prepared to handle the most difficult cases in their particular field, the most important being neurosurgery, a weakness in the North African Campaign. As the day of invasion approached, Churchill continually toured the North African coast, inspecting the hospitals prepared for the invasion. During this time he used the beaches on Bizerte and Tunis to set up a mass triage station where the wounded from Sicily would be immediately evacuated from the island and be sorted for distribution to the various hospitals on the North African Coast. These preparations along with their experience in North Africa, the medical corps felt ready for the invasion of Sicily.

Operation Husky commenced on 11 July 1943. This invasion and the subsequent march across Sicily proved confusing and complicated for the members of the medical corps. The evacuation plan Churchill devised in North Africa was still in effect, but different terrain and tactical situations called for major modifications. In his Tour Report of the Sicilian Campaign on 19 August 1943, Churchill stated that an evacuation plan based on days had become impossible to keep in the forward hospitals. He stated that "The rapidly changing tactical situation as well as the need to constantly move hospitals forward in support of the combat divisions requires evacuation from the corps to be

[24] Ibid, 214.

defined in terms of transportability rather than days of expected disability." [25] He further stated that the evacuation line should not be stalled because of the stated number of days for the casualties to recover. The mountainous terrain added to the difficulties. Evacuation across the flat terrain of the North African deserts had not prepared the medical corps for evacuating patients across the Sicilian mountains. Churchill gave an example of such difficulties stating that "One patient was moved by a nine hour litter carry that required 50 different litter bearers."[26] Litter bearers evacuated most casualties in no less than 5 to 6 hours. As shown in North Africa, long and arduous evacuations served to irritate the casualties' wounds. Thus, physicians kept casualties facing difficult journeys at the aid station for 24 hours, giving their wounds time to rest. The medical corps further improvised by using pack mules to evacuate the slightly wounded as well as jeeps with two litters attached to them. The mountainous terrain not only complicated the evacuation process but also placed level land at a premium, thus the forward hospitals and stations fought with other army installations for this land, such as ammunition dumps, ordinance installations, and air strips.

The mountainous terrain was not the only problematic entity. The members of the medical corps themselves proved difficult to manage. Though the medical corps discovered that the Sicilian terrain was intrinsically more difficult to traverse than in North Africa, as Churchill stated, the evacuation system he had set up in North Africa would still work in Sicily albeit with modifications. Medical corps members from the litter bearers all the way to the surgeons had been informed of the evacuation plan, but many dispensed with the casualties as they saw fit causing great chaos in the line of

[25] "Tour Report of Sicilian Campaign," 19 August 1943, Edward Churchill Papers, Box 35, Folder 17, Francis A. Countway Library of Medicine, Boston, MA.
[26] Ibid.

evacuation. Churchill's fellow surgical consultant, Frank Berry, observed that his hospital repeatedly received large numbers of unsorted casualties. Berry stated that the ambulances dropped off the wounded wherever they saw fit and did not attempt to move them to the correct hospital. Churchill observed that "No one seems to be really interested in the prompt and proper evacuation of the patient nor to have the adequate authority and cooperation to accomplish it smoothly." [27] Instead, he moved to have a unit put in place to oversee the evacuation process. This group would divide the evacuation line into sectors with a supervisor over each sector. He stated that this unit's intimate knowledge of the evacuation system would make sure that the operation ran smoothly.

Following several tours of the Sicilian hospitals, Churchill returned to Algiers to reflect on the problems encountered in the campaign. Unlike the North African Campaign, in Sicily the elements of the Army Medical Corps frequently moved and operated under fire. Churchill stated that "…the military intensity of this campaign in part accounts for some of the weakness in the evacuation procedures…"[28] He recommended that in fighting such as the medical corps saw in Sicily, the medical corps should be under the command of the Corps instead of the Army. Under the command of the Corps, the various hospitals would react quicker to the constantly changing tactical situations. Each consultant in the field also needed to become an expert in the line of evacuation in order to advise units in the field. Churchill stressed the need for cooperation between the elements of the evacuation line because without the medical corps working as a team, the evacuation line would become a hodgepodge scheme as has been seen in the early days in North African.

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[27] *Surgeon to Soldiers*, 216.
[28] Ibid.

Churchill did not write much about the troubles with the evacuation line after his involvement in Sicily. However, one can see from Tregaskis' example in *Fighting for Life*, that Churchill's evacuation plan worked despite the difficulties experienced in Sicily. Churchill's implementation of Jolly's medical evacuation plan from the Spanish Civil War brought much needed order to the medical evacuation line in North Africa. The Army Medical Corps failed to enact a working evacuation plan before the start of the campaign, causing chaos. Physicians and surgeons acted as individuals instead of as a team, which left the burden of the patient's care in the hands of one surgeon, an encumbrance the surgeon was not equipped to handle. Furthermore, the stages of surgery were not yet divided out among the stations and hospitals meaning that initial and definitive surgery could take place simultaneously. This approach led to infections and left the patient un-transportable for a long period of time. Churchill's implementation of Jolly's evacuation plan solved both of these problems by dividing up the responsibility of care for the casualties among the stations and hospitals in the evacuation line. He divided the hospitals into their most basic elements, spreading the care for the casualties among several stations and hospitals, relieving physicians of the burden of complete care for the patients. This stable evacuation plan afforded the casualties a reduced evacuation time as well as better quality medical care. However, the evacuation plan failed to reach its full potential during the Sicilian Campaign. Despite these shortcomings, mostly because of improper use of the evacuation line and difficulties with the Sicilian terrain, Churchill's evacuation plan provided a stable strategy to remove the wounded to safety through a system stations and hospitals that proved successful overall.

Chapter VI

EPILOGUE

Colonel Edward Delos Churchill's medical work and oversight in the Mediterranean Theater of World War II transformed the medical care in the theater from unorganized and inexperienced to stream lined and state of the art care. When Churchill entered the theater in 1942, the Army Medical Corps, mostly made up of civilian draftees, had little to no experience with military medicine. This problem resulted in the use of faulty medical information that led to life threatening problems such as plasma use and improper debridement. Churchill realized the depth of these problems and worked to correct these follies, which resulted in a Medical Corps well versed in military medicine. These lessons learned in the Mediterranean Theater echoed throughout the whole of the Medical Corps in the European and Pacific Theaters. The hard lessons learned in North Africa, Sicily, and Italy resulted in safer medical practices that saved more lives throughout the United States' involvement in World War II.

Perhaps Churchill's most far reaching contribution was clarifying the definition of "shock" and instituting the use of whole blood instead of plasma to reverse shock during hemorrhage. Defining shock had continued from World War I as a major problem. Physicians in the early 20th century attributed shock to absurd causes such as over-breathing. Through the World War I and into the early stages of the World War II, the concept of shock was divided into three distinct albeit erroneous phases. The first phase consisted of primary shock, which initiated from the initial blood loss after wounding. Next, the casualty entered secondary shock. Physicians stated that casualties entered this stage sometime after injury and could be characterized by weakness and low blood

pressure. If not arrested, shock could lead into "irreversible shock," which was a condition from which no one could recover. Additionally, the the general consensus among army physicians was that shock was caused by hemoconcentration, a condition in which the red blood cells concentrated in the blood stream after plasma, the liquid in which blood was suspended, had escaped the body. Therefore, under this definition, physicians treated shock with plasma, which instead of helping served to suffocate the patients as the red blood cells lost were not replaced. Churchill condemned these teachings as flawed and stated that shock was caused by hemodilution, a condition that occurs when both red blood cells and plasma are lost during hemorrhage and the only cure is an infusion of whole blood. However, the cure was easier said than done as the army had yet to create a way to transport whole blood into the field. Churchill solved this problem by creating a system of local blood collection and implementing preserving methods. This ensured that casualties had a greater chance at survival.

Simultaneously Churchill also battled the problem of the overuse of the antibacterial drug sulfonamides instead of proper debridement and surgical techniques. This "miracle drug" caused a great stir in the states and was hailed as the only cure for bacterial infection. After army physicians saw what they determined as good results from the drug following the attack on Pearl Harbor, sulfonamides were added to the arsenal of medical cures. In the Mediterranean Theater, physicians filled wounds with the sulfonamides, which only served to cause further major infections. Churchill instead proved that surgeons needed to debride wounds if they were to heal properly. By debriding the wounds, physicians removed dead tissues and foreign objects from the wounds, thus removing the breeding ground for bacteria that could cause major

infections. Physicians also needed to wait to close the wound in order to ensure that all foreign materials had indeed been removed. Churchill suggested 4 to 10 days, a time he labeled as "the golden period." Each of these steps ensured a better healing wound and fewer complication for the doctors throughout the evacuation chain.

Churchill's third major accomplishment as the chief surgical consultant of the Mediterranean Theater was the implementation of an organized medical evacuation line, which guaranteed the safe removal and care of casualties from the battlefield to general hospitals in the rear. Initially, the Medical Corps lacked an evacuation line and the medical aides and physicians on hand removed the casualties from the front however was seen fit. Haphazard removal from the battlefields led to major complications for the casualties such as infection as well as the undoing of all previous surgery because of rough travels and no rest period between periods of travel. Churchill, in order to fix this problem, implemented a plan devised by Douglas Jolly in the Spanish Civil War in which the removal of patients from the front was enhanced by an organized system that gave each station along the evacuation route set standards that each were to implement. This system staggered surgical care and eliminated the problem of heroic surgery. Casualties were no longer subjected to haphazard surgery and instead encountered a smooth running evacuation line that ensured them quality medical care.

The principles that Churchill established in the Mediterranean Theater not only helped heal those in North Africa, Sicily, and Italy, but also spread to the European and Pacific Theaters. While confusion may have reigned early on in both theaters, the established medical findings of the Mediterranean Theater shortened the period of confusion greatly. This can be best seen in the use of whole blood in the European

Theater. The European Theater proved more bureaucratically complicated and problematic than the Mediterranean. Here, blood had to be flown over the Channel and bad weather often complicated its delivery. The fact that the European Theater was made up of five different armies caused problems because the surgical heads of each army all had different interpretations of how to use whole blood. Despite these problems, the Chief Surgeon of the European Theater had been kept informed by the National Research Council about the developments in other theaters on whole blood, blood substitutes, and shock. He also received all of the reports from the Mediterranean Theater about blood use. So impressed by these findings, the Chief Surgeon sent several of his staff to the Mediterranean Theater to learn more about blood use first hand. Likewise, several members of the unit responsible for the Mediterranean Theater blood bank visited Europe before the invasion. As Douglas Kendrick, head of the blood transfusion program in World War II stated, "They had much to contribute for the Mediterranean Theater had been an active theater of operations for 2 ½ years before operations in Europe."[1]

However, the inexperienced surgeons in the European Theater were bound to make mistakes. For example, following the 6 June 1944 invasion, the 1st and 3rd Armies only had access to a limited supply of whole blood and conserved what they could for the most severely injured patients. It was not until 13 August 1944 that the Surgeon General agreed to send whole blood to the U.S. troops in Europe.[2] Later, when these armies had access to adequate blood supplies, they continued to conserve blood. Thus the biggest lesson for the European Theater was the fact that the casualties had to be given blood in

[1] Brigadier General Douglas B. Kendrick, *Blood Program in World War II* (Washington, D.C.: Office of the Surgeon General, 1964), 460.
[2] Douglas B. Kendrick, *Memoirs of a Twentieth-Century Army Surgeon* (Manhattan: Sunflower University Press,
1992), 89.

large quantities. Kendrick states that "…these lessons were well learned is evident in the fact…that in the last months of the war in the European Theater, as in the Mediterranean Theater, the ratio of units of blood to wounded men was close to 1:1."[3]

The European Theater also learned about the great success that the Mediterranean Theater had with proper surgical techniques such as debridement, but the lessons came too late for use in the 6 June invasion. Mather Cleveland, author of *Orthopedic Surgery in the European Theater* states that "It was not until late spring 1944, only a few weeks before D-Day in the European Theater that delayed primary wound closure [that] was also adopted in the Mediterranean Theater… and lack of time as well as lack of liaison, prevented the general dissemination of the information in the European Theater."[4] The European Theater did experience the same problems as the Mediterranean Theater but on a much smaller scale. The surgeons here had the advantage of the "Manual of Therapy," which laid out the steps for proper surgery as well as the experience of the surgeons in the Mediterranean Theater to build on. Following the 6 June invasion, confusion caused major problems with surgery in the forward areas as the surgeons here were inexperienced and new. However, in a few weeks when calm was restored, physicians again relied on proven surgical methods of the Mediterranean Theater.

Churchill's methods also extended to the Pacific Theater. The Pacific Theater's blood program proved an organizational miracle as the whole blood supply had to travel from the mainland to the islands. In the beginning, the blood supply came from Australia and later on from the mainland. The adequate supply of blood mainly came from the organizational skills of the blood distribution center on Guam. As Douglas Kendrick

[3] *Blood Program in World War II*, 460.
[4] John Boyd Coates and Mather Cleveland, *Orthopedic Surgery in the European Theater* (Washington D.C.: Office of the Surgeon General, 1956), 82.

pointed out "In one operation out of four, said the May 1945 report of the distribution center at Guam in reference to the early stages of the Okinawa Operation, 'we had too much [blood] too early but in none, including the other phases of the Okinawa Operation, to date did we ever have too little, too late.'"[5] Douglas Kendrick, the head of the Army Blood Transfusion Program and blood transfusion officer for the 10th Army in the Pacific, stated that the principles that Churchill advocated in the Mediterranean Theater transposed themselves onto the Pacific. Furthermore, the Pacific proved that blood could be collected from the Zone of the Interior and moved for use in even the most remote Pacific island. Again, this movement is a tribute to Churchill's innovations as he helped pioneer preservation methods to move whole blood over long distances.

Douglas Kendrick further imparted the lessons he learned from his work with Churchill by presenting the surgical techniques of the Mediterranean Theater to the 10th Army consultants. Together, the consultants and Kendrick planned a speaking tour across the medical establishments of the 10th Army. Kendrick stated "The consultants of the 10th Army conceded that this most recent information from combat trained physicians and surgeons played a tremendous part in the respectable results obtained by the medical services in Okinawa."[6] Another author, Emile Holman, former Chief Surgeon of the Mare Island Naval Hospital, promoted Churchill's proven principles. While Holman did advocate the use of sulfonamides in the Pacific, he declared that proper excision was an equally important step. In his article "Experience with Chest Wounds from the Pacific Combat Area," Holman compared two identical chest wounds, one that received proper debridement and one that did not. Holman stated that "Although these two injuries were

[5] *Blood Program in World War II*, 638.
[6] Douglas B. Kendrick, MD, *Memoirs of a Twentieth-Century Army Surgeon* (Manhattan: Sunflower University Press, 1992), 102.

almost identically located, and presented exactly similar effects, the one in whom immediate excision was performed recovered, while the other, in whom immediate excision was not performed, died…"[7] The work by these two men proves the fact that Churchill's surgical principles enable the Pacific to better care for its casualties and less time figuring out the best way to do so.

Edward Churchill's achievements during his tenure as the Chief Surgical Consultant of the Mediterranean Theater brought about major changes in the Mediterranean Theater and beyond. His medical knowledge and skills enabled him to deduce solutions to problems in the theater such as plasma use and misguided surgical techniques. Equally as important was his position as the surgical consultant through which he synchronized medical practices in the theater. Standardization allowed for consistent medical care for all casualties as well as eased the physician's burden as he knew what to expect in the casualties coming into his ward from the front. Further, regulation of the medical practices allowed for the implementation of whole blood use in the Mediterranean Theater to happen sooner than it would have otherwise. Widespread whole blood use may have eventually happened in the Mediterranean Theater, but Churchill ensured that it happened quickly and effectively. However, other principles such as an organized evacuation route and proper surgical techniques may not have materialized without Churchill. These technical procedures spread to both the European and Pacific theaters, creating an informed medical corps better equipped to care for casualties. Thus Edward Churchill's work as the surgical consultant in the Mediterranean

[7] Emile Holman, "Experiences with Chest Wounds from the Pacific Combat Area," *Annals of Surgery* 119 (1944), 3.

Theater had far reaching consequences that changed the course of medical care in the war and deserves to be remembered.

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