

The Silver Lining Of War

SIGNIFICANT ADVANCES HAVE BEEN MADE IN COMBAT CASUALTY CARE AS A RESULT OF MORE THAN A DECADE OF CONFLICT IN AFGHANISTAN. BUT AS TROOPS WITHDRAW, WHERE TO FROM HERE FOR COMBAT MEDICINE, AND CAN THE ADVANCES MADE IN RECENT YEARS BE SUSTAINED?

For the world of combat medicine, war is a double-edged sword. Without the realities of conflict and injured personnel, there would be few, if any, advances in combat casualty care. In Afghanistan, IED and non-IED (blast, ballistic) injuries led to advances in haemorrhage control and the replacement of blood volume. “Without the tremendous burden of injury from war we would never have realised these advances,” observes Colonel Todd Rasmussen, deputy director of the Combat Casualty Care Research Programme at the US Army Medical Research Materiel Command, Fort Detrick, Maryland. “Some of the advances we have made in combat casualty care transfer rapidly into civilian trauma care, and [these advances are] the silver lining of what is an otherwise dark cloud of war.” Col. Rasmussen is an Air Force officer who trained as a vascular and trauma surgeon. He has enjoyed a 20-year career in the military and is part of a larger team that is

responsible for planning, programming, budgeting and executing the nation’s investment in military trauma research.

The last decade or so of conflict in Afghanistan constitutes perhaps one of the richest periods for advances in combat medicine. The Combat Casualty Care Research Programme that Col. Rasmussen oversees has an annual budget of approximately \$100 million. Most of its research is directed towards gaps identified from the battlefield. “It’s not research for research sake but research based on experiences in Afghanistan and Iraq that is aimed at providing specific knowledge and material solutions to observations made in those combat scenarios,” Rasmussen explains. Information taken from the US military’s Joint Trauma System Registry, which collates information regarding all combat injuries, guides the research programme’s areas of focus. As well as reliance on surgical research institutes and labs within the US military, a significant portion of the US Combat Casualty Care



US AIRMEN WITH THE 76TH EXPEDITIONARY RESCUE SQUADRON OFFLOAD A PATIENT FROM A TRANSPORT AIRCRAFT AT CAMP BASTION AFGHANISTAN (US AIR FORCE PHOTO BY SENIOR AIRMAN TYLER PLACIE)

“SOME GAPS IN COMBAT MEDICINE ARE NOT SOLVABLE. WE HAVE TO BE PRUDENT OR REALISTIC WITH THE INVESTMENT AND NOT BE DISTRACTED BY TOPICS THAT ARE UNDULY EXPENSIVE.”

(US AIR FORCE PHOTO/TECH. SGT. CECILIO RICARDO JR)

Research Programme is performed by non-governmental academic and industry partner institutions.

One of the major medical advances from recent operations are gains made in the understanding of blood transfusion and replacement of blood volume. “Before the wars [in Afghanistan and Iraq],” says Rasmussen, “we just gave crystalloid solutions or packed red blood cells back to individuals. Now we understand that giving blood components, including plasma and platelets, back in certain ratios is more effective.” In order to achieve these advances, Rasmussen says a step-by-step process was followed. The first step entailed refining the ratios at which blood products were given back to injured personnel. “The next step was then getting these products on helicopters and further forward so the patient didn’t have to languish for a period of time.”

These advances had several spin-offs including a major effort to develop and test a dried form of plasma that can be stored for a longer period of time in a stable form in a bottle or plastic container. This dried blood product, or others like it, could then be reconstituted when needed and given to severely injured patients such as those treated in field hospitals at Bagram and Camp Bastion in Afghanistan. “The next step,” says Rasmussen, “will be how do we get these blood products to the combat medic in a different formulation? We need to give medics better ways of stopping bleeding and replenishing blood lost.”

HAEMORRHAGE CONTROL

Other significant advancements that came out of Iraq and Afghanistan were in the area of haemorrhage control. According to the US Army Institute of Surgical Research, haemorrhage was the leading cause of death in 90% of the potentially survivable battlefield cases and 80% of those who died in a military treatment facility during Operation Iraq

Freedom (OIF) and Operation Enduring Freedom (OEF) in Afghanistan.

“We have used tourniquets for hundreds of years, but reappraisal of their use has probably saved thousands of lives during these recent wars,” says Rasmussen. One particular study of battle injury data from OIF and OEF showed that most medical interventions were for haemorrhage control with 89 tourniquets applied to 66 casualties. The report showed that of casualties with tourniquets, almost all reached the next level of care alive (95%) and ultimately survived (94%).

Tourniquets were used to control haemorrhage from extremities, but Rasmussen says its research continues to focus on what can be done to control haemorrhage inside the torso where a tourniquet cannot be applied. Studies conducted at a Level III Air Force Theatre Hospital at Balad Air Base, Iraq, demonstrated the benefits of using catheter-based techniques (also referred to as endovascular techniques) to help control bleeding from blood vessels inside the torso, kidney and artery. Although these techniques are widely used to treat age-related disease and injuries in the civilian setting, until the report from the theatre hospital in Balad, Iraq, little was known of their use in wartime.

All the advances mentioned above undoubtedly contributed to a reduction in the case fatality rate (CFR)—the percentage of those injured in combat who died. In Afghanistan, the CFR for US personnel went from a high of approximately 18% in 2005 to less than 10% in 2013. Yet, given its limited research budget, Rasmussen says the Combat Casualty Care Research Programme cannot solve every medical gap identified from battlefield experience. “Some gaps in combat medicine are not solvable. We have to be prudent or realistic with the investment and not be distracted by topics that are unduly expensive or those that are not likely to result

in meaningful near or mid-term solutions for the war fighter. We must also be aware of science that is being funded by other federal entities such as the National Institutes of Health or the Centres for Disease Control and Prevention. In this context we want to leverage and not replicate research that is supported by other federal entities, which have significantly larger budgets than the Combat Casualty Care Research Programme.”

When it comes to getting workable medical solutions into the hands of field surgeons and combat medics, Rasmussen says one of the strengths of the US Army’s Medical Research & Materiel Command is that it works hand in hand with industry. Its advanced development and regulatory experts also help the command and its research programmes interface effectively with regulatory authorities such as the Food and Drug Administration, which must approve products before they can be used on the battlefield. But with the war in Afghanistan coming to an end, can the command sustain the same level of investment to ensure that medical advances

from the last decade or so are not lost? “We strive to continue to show the benefit of this research, not only to the volunteer military force but also to civilian medicine and trauma care so that there can be a sustained effort,” says Rasmussen.

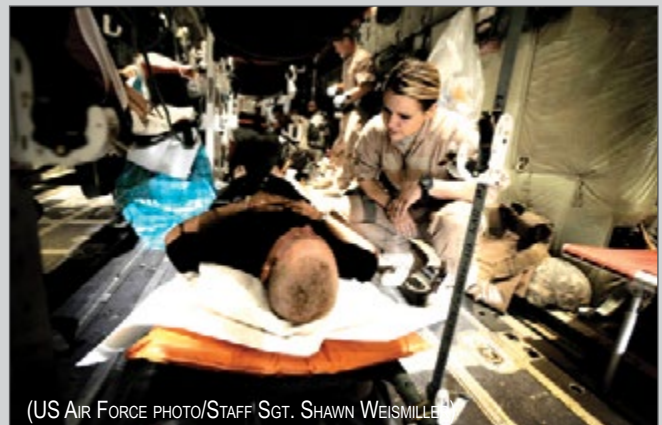
In addition to focusing on research in neurotrauma, haemorrhage control and resuscitation, Rasmussen says the programme is also considering the future of field hospitals. “We are contemplating what it would mean to have enhanced forward surgical and resuscitative capabilities in the back of a fixed or rotary winged aircraft. Are there capabilities (knowledge products or material solutions) that would allow us to reduce our medical logistics footprint and obviate the need for traditional echelon II facilities and instead perform that level of combat casualty care in the air? Are there ways that we can advance and make use of technologies like automated, closed-loop devices and telemedicine capabilities to bring intensive care and resuscitation forward to the injured troop and maintain high-level intensive care throughout his or her movement through the evacuation chain?” ■

The Legacy Of War – Key Advances In US Combat Casualty Care

World War 1 (1914-1917) US military surgeons’ involvement and experience during the war was brief (21 months). The Mayo brothers (Drs. William and Charles Mayo) served with the Surgeon General for medical military preparedness during the war. The Mayo Clinic fielded medical units on the western front in France. Mayo physician, Colonel Dr. Louis Wilson contributed greatly to the war effort and the future of laboratory medicine by establishing more than 300 medical laboratories for the American Expeditionary Forces. In 1919, the Mayo brothers proposed a Uniformed Services University to provide a dedicated corps of medical officers training in the special medical needs of military conflict.

World War II (1939-1945) US surgical experience was confined to a period of 45 months (1941-1945) but a tremendous amount of surgical knowledge was obtained. The Mayo Clinic fielded medical units in the Pacific theatre. Dr. James Priestley, one of the early collaborators of Charles and William Mayo, stood out for his contribution to the surgical effort in World War II and led the unit stationed at Finschhafen near New Guinea. US Army Colonel Michael DeBaakey, the father of modern cardiovascular surgery, deployed to the European theatre of war in support of combat operations. He helped modernise battlefield surgery by urging that doctors be moved from hospitals to the front lines. This was an early version of what later became known as the Mobile Army Surgical Hospital, or M.A.S.H.

The Korean War (1950-1953) US surgical experience was abbreviated at 40 months. Dr Frank Spencer, a surgeon serving with the Marine Corps pioneered many of the vascular reconstruction techniques used today. He assembled surgical teams in two medical units behind the combat zone to treat arterial injuries, which saw him awarded the Legion of Merit. During the Korean War, the life



(US AIR FORCE PHOTO/STAFF SGT. SHAWN WEISMILLER)

saving advance of rapid rotary wing medical evacuation of wounded US personnel was realised.

The Vietnam War (1954-1975) US surgical experience was expanded to 100 months. A tremendous amount of medical knowledge and advancement came from the war particularly in the area of burn care and surgical intensive care.

Operation Enduring Freedom, Afghanistan (2001-present day) A significant burden of injury resulting from more than 50,000 injured US service personnel and more than 6,000 soldiers who lost their lives led to advances in the smart use of resuscitative fluids for severely injured patients. The US Army’s Institute of Surgical Research led innovations in the use of tourniquets—Emergency & Military Tourniquet and the Combat Application Tourniquet—to stop haemorrhage from extremities. The US Air Force has flown more than 35,000 medical evacuation missions with its CCAT (Critical Care Air Transport Team), which is known as “the flying ICU”.

Advances were also made in the use of catheter-based or endovascular techniques—balloon catheters, sheaths and shunts—to stop bleeding and extend the window of limb salvage.