U.S. ARMY MEDICAL RESEARCH AND MATERIEL COMMAND

USAMRMC

Combat Casualty Care Research Program

Mission

The mission of the Combat Casualty Care Research Program (CCCRP) is to reduce the mortality and morbidity resulting from injuries on the battlefield through the development of new lifesaving strategies, new surgical techniques, biological and mechanical products, and the timely use of telemedicine technologies.

Background and Environment

Soldiers are wounded in hostile fire arenas whether conducting large-scale mechanized warfare, low-intensity conflicts, or operations other than war. Initial treatment of combat wounds and subsequent evacuation occur in dangerous surroundings and are complicated by limited diagnostic tools, medical supplies, and life-support equipment. Acute and critical care in these conditions is labor intensive and frequently provided by nonmedical personnel. In addition, difficulty treating battlefield casualties can be exacerbated by long evacuation times, which are often found in military operations. This requires combat medics and physician assistants to stabilize patients for extended periods and makes battlefield trauma care markedly different from civilian trauma care. The primary challenge of the CCCRP is to overcome these limitations.

The CCCRP addresses these issues by developing biologics, pharmaceuticals, and medical devices that improve the first responder's capability to provide effective treatment more rapidly and as close to the place of the injury as possible. The specific goals of the CCCRP are to lower the killed-in-action rate of American troops by 25 percent, reduce the morbidity of combat injuries, and decrease the medical footprint on the battlefield. Research is conducted at the Walter Reed Army Institute of Research and the U.S. Army Institute of Surgical Research as well as various academic institutions and commercial entities. Current program areas include the following:

Advanced Capabilities for Combat Medics Research

This program area focuses on conducting basic and applied research aimed at discovering and developing new knowledge and devices that enhance combat medical personnel capabilities for triage, diagnosis, and decision making relative to combat casualty management.

Blood Research

The focus of this program area is to conduct basic and applied research leading to the discovery and development of safe and effective blood products and blood product substitutes that can be used by Level 1 and Level 2 medical personnel for management of blood loss in combat casualties. These products must mitigate or reduce complications of blood product administration (e.g., mistyping), the deleterious effects of component storage age, infection with bloodborne pathogens, and the current logistical burden of blood products on the battlefield.

Automated Critical Care Support Research

This program area focuses on conducting basic and applied research to support the discovery, adaptation, and development of new devices that can be integrated into a lightweight, semi-autonomous critical care system capable of monitoring and regulating patients pre- and post-surgery at echelons 2 and 3.

Dental Disease and Trauma Research

The focus of this program area is basic and applied research leading to the discovery and development of novel preventives and therapeutics to significantly mitigate or eliminate the impact of dental disease, on the operational readiness of military forces. In addition, this program conducts basic and applied research to mitigate the effects of dental and craniofacial trauma.

Hemostasis Research

This program area focuses on the conceptual development, discovery, and early proof-of-concept studies of novel methods to control severe bleeding resulting from combat injury. The current focus includes novel pharmaceuticals, dressings, biological agents, and directed energy to stop internal bleeding that cannot be controlled easily by external compression methods.

Medical Knowledge Engineering

The focus of this program area is proof-of-concept studies of new tools for data mining and correlating complex, trauma-related physiological data from multiple animal and human trauma databases. The correlation of physiological data with outcome will be used to improve the accuracy of existing diagnosis and treatment algorithms.

Medical Simulation for Training

This program area focuses on improving the quality and the availability of medical simulation training for medical personnel by developing cost-effective, physiologically based patient and procedure simulators that are deployable, wireless, autonomous, rugged enough to survive in the field, and realistically weighted.

Neuroprotection Research

The focus of this program area is basic and applied research leading to the discovery and development of novel pharmaceuticals or other therapeutic measures and doctrine, including improved diagnostics, to significantly mitigate death and residual disability caused by brain injury in combat.

Resuscitation Research

The focus of this program area is conceptual development, discovery, and early studies of new candidate physiological replacement fluids, drugs, and/or biological agents for treatment or prevention of secondary injury resulting from shock occurring due to battlefield injury.

Pain Control Research

This program area focuses on the treatment of acute battlefield pain with the goal of achieving pain control with minimal impact on mental functioning.

National Institutes of Health Collaboration

The focus of this program area is to research, develop, and validate improved methods for resuscitation, including improved resuscitation fluids, blood products, and procedures in pre-hospital and emergency department settings.

Recent strategic planning sessions have identified the need to expand the current Department of Defense (DoD)-funded injury research program and to initiate research programs in the following areas:

Combat Eye Trauma – Combat eye trauma and "low vision," a common consequence of traumatic brain injury, are unique to the military and need to be studied.

Burns – The U.S. Army Institute of Surgical Research and Brooke Army Medical Center will continue their many years of cutting-edge burn care research via a series of data-driven experimental protocols in clinical interventions.

Key Themes and Messages

Trauma is the number one killer of the nation's fighting Soldiers, having caused more than 20,000 injuries and approximately 4,000 hostile deaths in the Global War on Terror. Approximately 86% of all battlefield deaths occur within the first 30 minutes after wounding.

Civilian trauma is the leading cause of death from ages 1 to 44. It is responsible for more than 160,000 deaths annually, accounting for 37 million emergency department visits and 2.6 million hospital admissions.

The frequency, type, and extent of military trauma casualties far exceed those experienced in the civilian community. While the mechanisms of injury are different, military and civilian trauma casualties are treated similarly. Thus, improvements gained by focused, relevant trauma research in each group will benefit both.

The CCCRP's goals are to significantly reduce the killed-in-action rate of American troops, the morbidity of combat injuries, and the medical footprint on the battlefield.

Restoring function to more wounded Warfighters will enable an increase in eligibility to return to active duty, saving the cost of training replacements and reducing recruitment quotas. More important, it will increase morale and raise feelings of self-worth in individuals.

Questions and Answers

Q1. What is trauma research?

A1. Trauma research investigates the physiological impact of injury on the body and methods for limiting the severity of injury through early intervention. The present portfolio is focusing on issues identified through analysis of data gathered during the current conflict. These evidence-based investigations capitalize on collaborations among trauma surgeons, numerous medical specialties, engineers, and epidemiologists to find ways to enhance healing and reduce long-term effects from trauma.

Q2. Why does the DoD invest in trauma research?

A2. Trauma is the number one killer of the nation's fighting Soldiers, having caused more than 20,000 injuries and approximately 4,000 hostile deaths in the Global War on Terror. The type and extent of military wounds are unmatched in civilian trauma.

Q3. How much does the DoD invest in trauma research?

A3. The current Presidential Budget appropriation for the CCCRP is approximately $60 million, 15% of the total DoD medical research budget.

Q4. Is trauma research funded elsewhere in the government?

A4. Trauma is not studied systematically and is underfunded when compared to other conditions of similar magnitude. Work that is done is mostly basic research, which traditionally does not translate into solutions for the combat wounded.

Q5. What are the most significant areas being studied by the CCCRP?

A5. Urgent subject areas of trauma research include:

- Controlling internal bleeding
- Improving recovery from loss of blood
- Using novel fluids to replace lost blood
- Defining predictors of adverse outcomes from vital signs
- Diagnosing and treating traumatic brain injury
- Developing materials and processes that facilitate the regeneration of tissues after traumatic injury

Q6. What are some additional research areas being pursued by the CCCRP?

A6. In addition to the more urgent subject areas listed in the previous answer, the CCCRP is addressing the following research efforts:

- Strategies and diagnostics for resuscitation to improve survival when evacuation is delayed and resources are limited
- Advanced, noninvasive physiologic sensors for detecting penetrating or blunt trauma wounds and remote triage
- Prevention/treatment of dental diseases and battlefield oral and maxillofacial injuries
- Surgical techniques, equipment, and implants to address extremity/musculoskeletal injuries
- Neuroprotective treatment strategies for brain and spinal cord injuries
- Intravenous clotting agents such as recombinant activated factor VII (NovoSeven®) to greatly reduce internal bleeding, thereby keeping Soldiers alive long enough to get damage control surgery

Q7. What is damage control resuscitation?

A7. Damage control resuscitation is a systematic approach to mitigating the consequences of and controlling severe bleeding resulting from combat injury. The focus is on reversal of clotting deficiencies while restoring the flow of oxygen throughout the body. This is accomplished through the parallel administration of red blood cells, plasma, platelets, and other

clotting enhancers. Delivery of clear fluids is restricted to minimize inflammation beyond the normal response to the injury.

Q8. What is combat critical care engineering?

A8. Combat critical care engineering is a systematic approach to developing automated critical care technologies. The process integrates data acquisition (vital signs monitoring) and data qualification, mining, and analysis to drive development of algorithms and hardware to deliver life support (i.e., oxygen, ventilation, and fluids) via closed-loop, computer-controlled systems. The payoffs are better care through real-time adjustments in delivery, conservation of resources, and better utilization of critical care nursing personnel.