

Innovation Workshop Working Groups

CIMIT Innovation Workshop Leader:

George C. Velmahos, MD, PhD, MSED, CIMIT Program Leader, Trauma and Casualty Care; John F. Burke Professor of Surgery, Harvard Medical School; Chief, Division of Trauma, Emergency Surgery, and Surgical Critical Care, Massachusetts General Hospital

Pre-Hospital Resuscitation

Session Leader:

Hasan Alam, Massachusetts General Hospital

Participants:

- Greg Beilman, University of Minnesota
- Eileen Bulger, University of Washington
- Raul Coimbra, University of California San Diego School of Medicine
- Brian Dunnigan, Imaging Associates
- John Kheir, Children's Hospital Boston
- Duncan (Gus) McGrouther, University of Manchester
- Herb Phelan, UT Southwestern Medical Center at Dallas
- Jonathan Sackner-Bernstein, DHHS/FDA/CDRH/OCD

Priorities:

1. Introducing Preserved Blood Products into the Pre-Hospital Setting
2. Bridge Therapies and Tools for Ideal Patient Identification

Discussion:

The goal of pre-hospital resuscitation is to keep a patient alive until he or she can be brought to the appropriate treatment facility. Numerous bridge therapies, such as hypothermia and drugs designed to slow the metabolism, are being investigated, and some of these are promising. Other possibilities include developing new oxygen carriers and providing preserved blood components in the pre-hospital setting. A problem in pre-hospital resuscitation is detecting when a patient is about to slide into shock. A monitoring system designed to detect shock would be useful in the field. The discussion focused on how to introduce preserved blood products into the pre-hospital setting and on how to translate research related to bridge therapy into practice.

Non-compressible External Bleeding Control

Session Leader:

Martin Schreiber, Oregon Health & Science University

Participants:

- Suresh Agarwal, Boston Medical Center and Boston University School of Medicine
- Jeffrey Borenstein, Draper Laboratory
- J. Christopher Daniel, US Army Medical Research and Materiel Command
- Daniel Darlington, US Army Institute of Surgical Research
- Kenji Inaba, University of Southern California
- Robert Mazzoli, DOD-VA Vision Center of Excellence
- Dwight Meglan, SimQuest
- Anita Shukla, MIT

Priorities:

1. Immediately Effective Adherent Haemostatic Agent - Intracavitary Absorbable Timed Release
2. Conformable Compressible Device

Discussion:

The group discussed controlling external bleeding using external and intravascular agents as well as innovatively designed clamps for providing pressure. Puramatrix is a self-assembling peptide that could be injected at a bleeding site, and RAD 16 is another self-assembling peptide that is currently used to make scaffolds for tissue engineering. The participants decide to focus their energy on the need for an immediately effective, adherent hemostatic agent. They envision an agent that would be absorbable and would contain molecules that could be released in a sequential manner. For example, the agent could be a nano-particle capable of the timed release of coagulation factors followed by antibiotics and anti-inflammatory drugs. A second area of interest of the group is the creation of conformable and compressible devices for delivering wound pressure.

Internal Bleeding Control

Session Leader:

Charles Wade, UT Health Houston and Center for Translational Injury Research

Participants:

- James Benn, Plumored
- Dallas Hack, US Army Medical Research and Materiel Command
- Jeff Karp, Brigham and Women's Hospital, Harvard Stem Cell Institute, Harvard-MIT Division of Health Science and Technology
- David O'Dowd, Draper Laboratory
- Christine Paulson, Lawrence Livermore National Laboratory
- Jack Sava, Washington Hospital Center
- Kyle Sims, US Army Special Operations Command

Priority:

1. Detecting Internal Bleeding

Discussion:

Internal bleeding is often difficult to detect and treat. Some trauma victims, including young men in the military, do not show signs of decompensation until they have lost almost half of their total blood volume. Military medics are interested in finding new ways of detecting internal bleeding because this technology would help them make logistical decisions about how quickly to evacuate wounded soldiers from the battlefield. Any new device must be built with the needs of the end user in mind. In the military, for example, field medics have limited training and can only carry a limited amount of equipment. Treating internal bleeding is a separate challenge, and the members of the group decided to focus on the detection of bleeding. Ideas proposed included using a shape-based approach to detect blood in unusual shapes and a motion-based approach to detect changes in rotational inertia due to blood in the lung. Many people in the group were willing to collaborate, but no definite plans were made.

Innovative Monitoring

Session Leader:

David King, Harvard Medical School, Massachusetts General Hospital

Participants:

- Antonis Armoundas, Massachusetts General Hospital
- Ryan Bardsley, CIMIT
- Michael Callahan, Defense Advanced Research Projects Agency
- Lee Cancio, US Army Institute of Surgical Research
- John Chang, Lawrence Livermore National Laboratory
- Jackie Oldham, MIMIT
- John Morris, Vanderbilt University
- Peter Rhee, University of Arizona, Tucson
- Michael Rosenblatt, Lahey Clinic
- Shankar Sundaram, Draper Bioengineering Center
- William Wiesmann, BioStar, Inc.
- Andrew Reisner, Massachusetts General Hospital

Priorities:

1. Wireless Non-invasive Real-Time Detection of Imminent Cardiac Arrest - see below
2. Wireless Non-invasive Real Time Detection of Cardiac Output and Blood Pressure

Discussion:

The medical community needs a non-invasive, accurate, real-time measure to detect when a patient is in imminent danger of going into cardiac arrest. Possible approaches to this problem would be to accurately measure blood pressure or cardiac output. Both variables would preferably be measured wirelessly. Blood pressure measurements are currently unavailable on the battlefield. Non-invasive cardiac output measurements would be connected more directly to prognosis than blood pressure, but it is unclear whether doctors and other care providers would embrace this new measurement. Either measurement would require an algorithm to simplify the presentation of information in order to prevent the user from becoming overloaded with information. Questions related to wireless security would have to be addressed before the technology could be used on the battlefield. Many members of the group expressed an interest in collaborating.