Advances in Navy Medicine and Combat Casualty Care:
- the future of Navy Combat Casualty Care Research & Translation

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and
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2009 ATACCC Conference, 10 Aug 2009

Concept of Care

Quality Health Care Delivery

- Save lives and take care of people. Lowest battle mortality and disease non-battle injury rates in history.
- Highly skilled people that care for the Navy/Marine Corps Warfighter and their families.
- Education and training programs that attract and train our future force.
- The Joint Commission and other accrediting bodies have rated our quality of care as superior.
- Capability to simultaneously deliver combat casualty care and the benefit mission.
- Research and Development that saves lives.
- Exceptional benefit for retention of Navy and Marine Corps families.

Navy Medicine Strategic Goals – Directed to Support:

- Total Force
- Agile Capabilities
- Deployment Readiness
- Patient and Family Centered Care
- R&D and Clinical Investigation Programs
- Quality of Care
- Performance Based Budget

Total Force

- Maintain the right work force
  - ACCESSION
  - RETENTION
  - EDUCATION
  - TRAINING
  - INCENTIVES

Agile Capabilities

- Ensure healthy forces
- Medically prepared to meet the mission
- Through delivery of consistent, timely and appropriate health care

  - ACROSS THE ENTIRE RANGE OF JOINT MILITARY OPERATIONS

Deployment Readiness

- Warfighters and medical support personnel fully deployable
- Achievement of all training, administrative and medical readiness requirements

Patient & Family Centered Care

- The “Core” concept of care delivery
- Each warfighter and family member as a critical participant in their own health care
- Recognizing the vital importance of the military culture, family, and chain-of-command in “centered care”

R&D and Clinical Investigation Programs

Tier I Goal

Navy Medicine will conduct relevant research, development, testing, evaluation and clinical investigations which protect and improve the health of those in our care

R&D and Clinical Investigation Programs

- Conduct relevant research
- Transition bench-top concepts and discovery to further development
- Efficiently carry out scientifically legitimate and unbiased testing of the developed product concepts
- Evaluate the mature research product in competently managed clinical investigations which translate clinical science to deployable products:
  - To protect and improve the health of all in our care
  - To ensure that products of “poor research” or that are not needed DO NOT GET TRANSLATED
  - To clear the way for directed development of viable assets

Navy Medicine Priority Research Topics

- 1) Traumatic brain injury and psychological health treatment and support for both operational forces and home based families.

- 2) Medical systems support for maritime and expeditionary operations:
  - Limitation of injury, disease and medical risk
    - Body armor, head/neck stability support, hearing protection*
    - Optimal screening protocols and interventions for debilitative and oncologic disorders
      - Cervical, prostate and bowel cancer
    - Viral infection identification and immunization (malaria & H1N1 vaccines)
    - Risk to, and protection of, active duty expectant mother and fetus

Navy Medicine Priority Research Topics (continued)

- 2) Medical systems support for maritime and expeditionary operations (continued):
  - Means for survival of injury
    - Hemorrhage intervention and resuscitation fluids
    - Surgical innovations
    - Wound management*
    - Plastic and regenerative medicine
  - Patient medical support
    - Forward resuscitative support – optimal corpsman training procedures
    - Movement through care levels I, II and beyond with emphasis on USMC CASEVAC and EN ROUTE Care (modeling and simulation), DNBI
      - Astounding record of survival of casualties in transit from OCONUS to CONUS facilities
    - Digitized medical informatics and intervention guidance

Navy Medicine Priority Research Topics (continued)

- 3) Wound management throughout the continuum of care:
  - Chemical, molecular and cellular indicators of optimum time for wound closure
  - Wound-Vac
  - Comprehensive rehabilitation
  - Reset of personnel to operational fitness
- 4) Hearing restoration and protection for maritime, surface and air support personnel
  - Sound energy abatement
  - Pharmacological intervention to protect and restore
- 5) Undersea medicine, diving & submarine
  - physical endurance enhancement
  - catastrophe intervention

Level 2 – Resuscitative Surgery

STP Team

OR Team (FRSS)

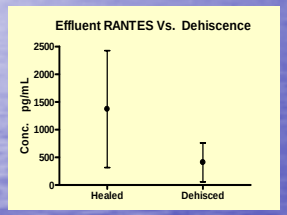
En-Route Care Team

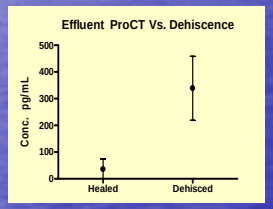
Products from the Bedside

Predictive Biomarkers Of Wound Healing

This wound healed

This wound dehisced





Clinical Translational Research:
Predicting Wound Closure & Healing

ORIGINAL ARTICLES

Inflammatory Biomarkers in Combat Wound Healing

Jason S. Hawksworth, MD,† Alexander Stojadinovic, MD,†‡ Frederick A. Gage, ●●●,* Doug K. Tadaki, PhD,* Philip W. Perdue, MD,§ Jonathon Forsberg, MD,*‡¶ Thomas A. Davis, PhD,* James R. Dunne, MD,§ John W. Denobile, MD,§ Trevor S. Brown, PhD,* and Eric A. Elster, MD*‡§*

A component of a multi-pronged approach to develop wound therapies:

- **Biomarker Panel of Readiness for Wound Closure**
- **Extracorporeal Shockwave Therapy (ESWT) with ONR, NNMC, & WRAMC**

Predictive biomarkers of wounds may reduce the number of required surgical procedures

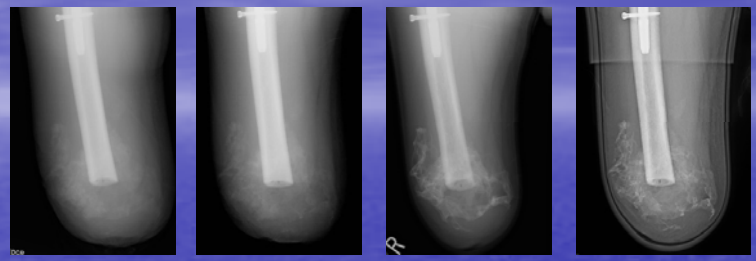
Co-sponsored by Navy Medical Development Program & ONR

"Bench to Bedside" Medical Research: Product Development Stemming from the Surgical Suite

Emergent Issues from OIF/OEF

Heterotopic Ossification

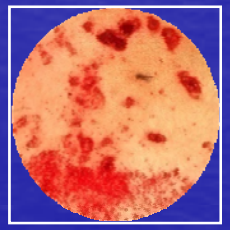
- More prevalent in OIF/OEF casualties than in similar civilian trauma (60% vs. 20%)
- Can present a problem for rehabilitation/prosthetics
- Risk factors:
  - Blast exposure
  - TBI
- Orthopedic surgeons from WRAMC/ NNMC working with researchers at NMRC to identify factors influencing bone growth/preventative treatments



Heterotopic Ossification in High-Energy Wartime Extremity Injuries: Prevalence and Risk Factors

Jonathan Agner Forsberg, Joseph M. Pepek, Scott Wagner, Kevin Wilson, James Flint, Romney C. Andersen, Doug Tadaki, Frederick A. Gage, Alexander Stojadinovic and Eric A. Elster
J Bone Joint Surg Am. 2009;91:1084-1091. doi:10.2106/JBJS.H.00792

Collaborators: NMRC, NNMC and WRAMC



Wound effluent promotes bone growth in culture

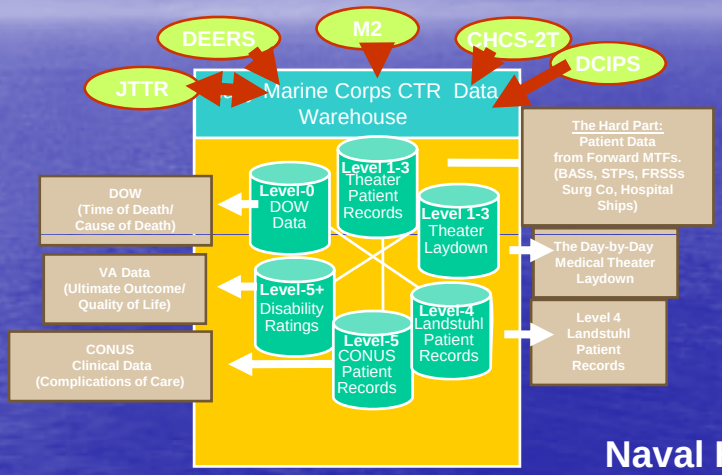
Sponsored by Navy Medical Development Program

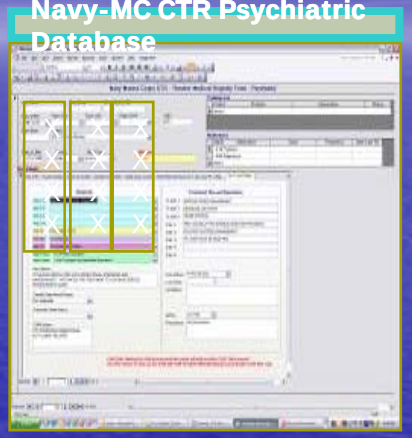
"Bench to Bedside" Medical Research - The close proximity of clinical medicine and basic research yields opportunity

A Critical Capability Guiding Intervention & Research

Navy/Marine Corps Combat Trauma Registry

- Informs Navy and Marine Corps combat developers, medical planners, research and development
- Level I & II collection
- Linked to Joint





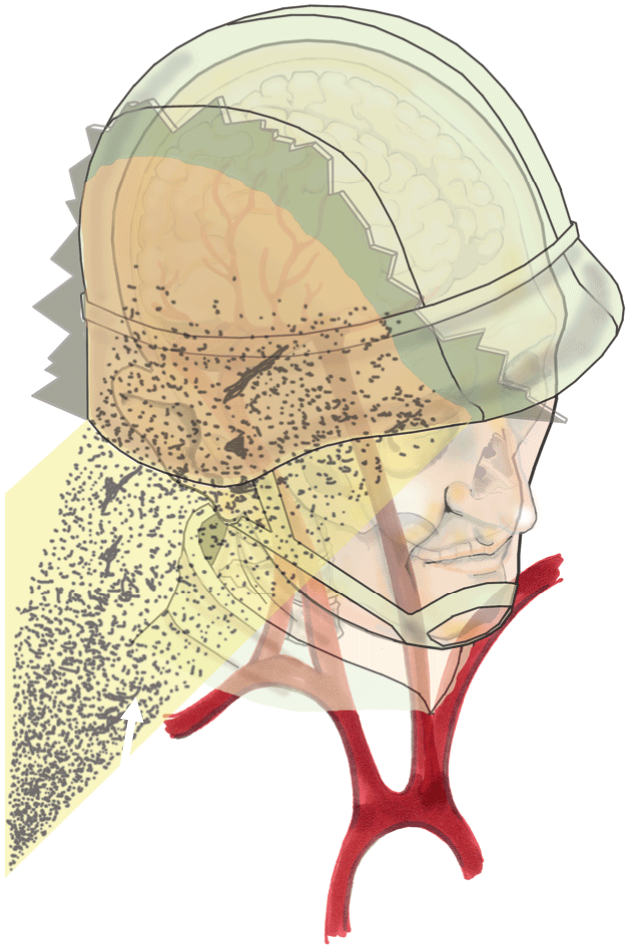
Naval Health Research Center

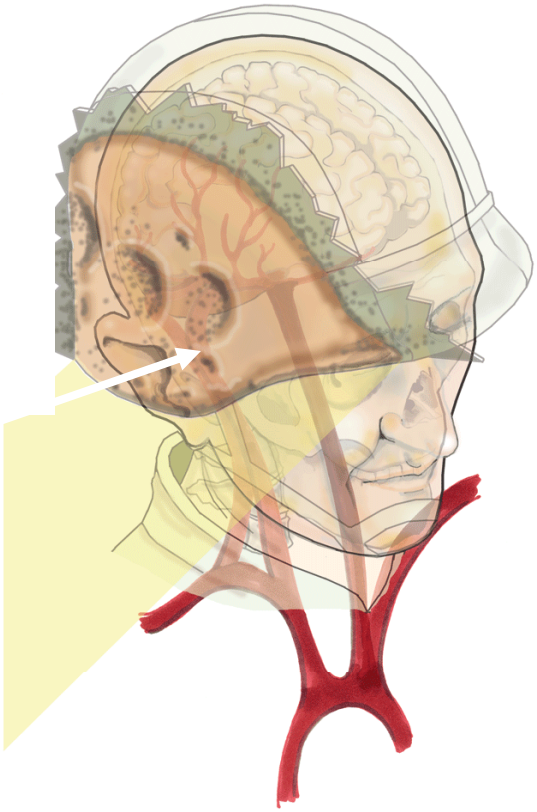
Co-sponsored by Navy Medical Development Program, MARCORSYSCOM (FFMP) , ONR, HQ USMC (HS), Army components, DoD BTA

Critical Information Resource DoD-wide for Medical Planners, Combat Developers, Materiel Developers & Researchers

mbination Injuries

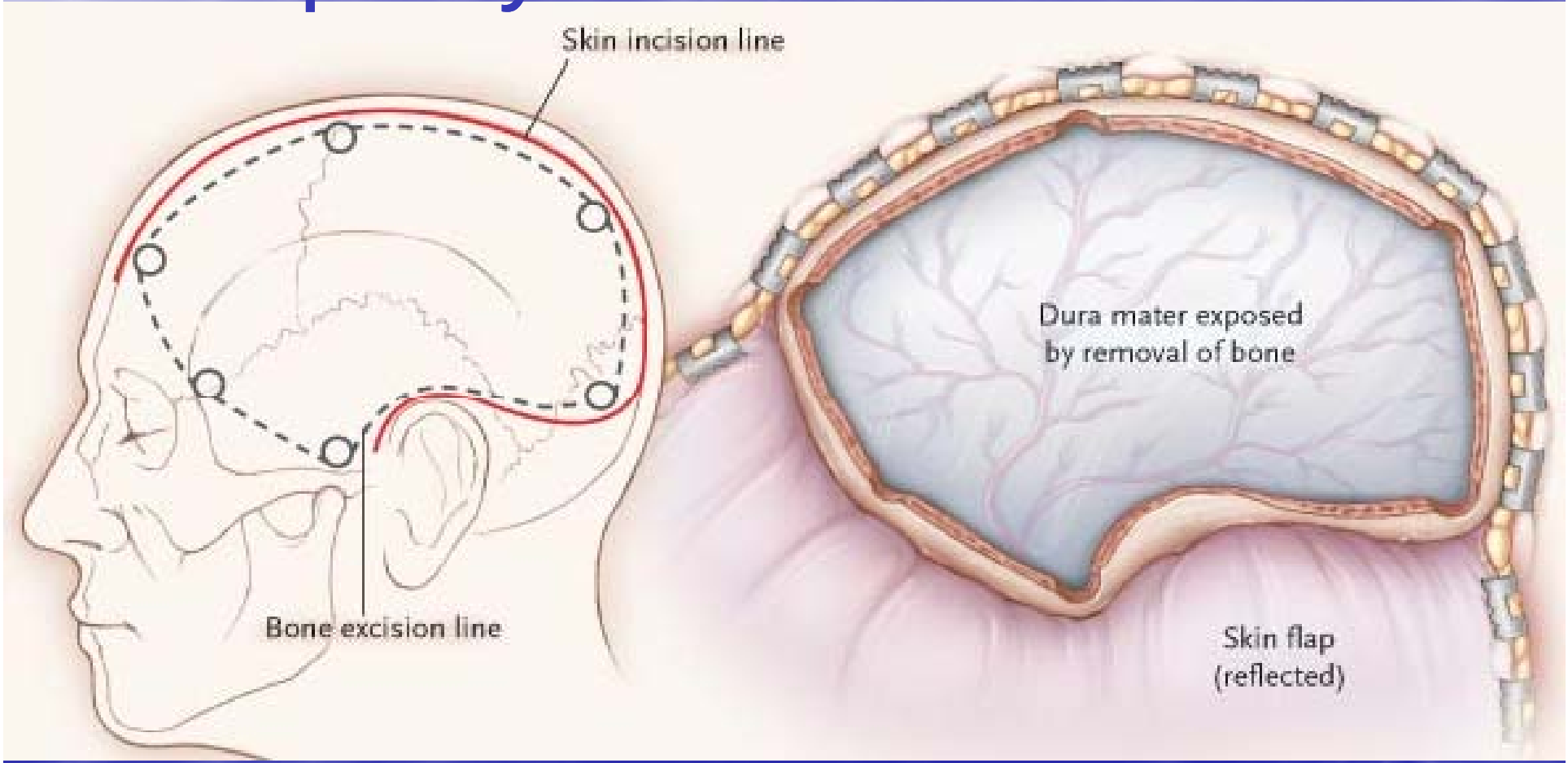
- Under the Body Armor Injury
- Blast Wave Injury exceeding Penetrating Fragments
- Soft-Tissue, Craniofacial-Orbital
- Neurovascular Injury



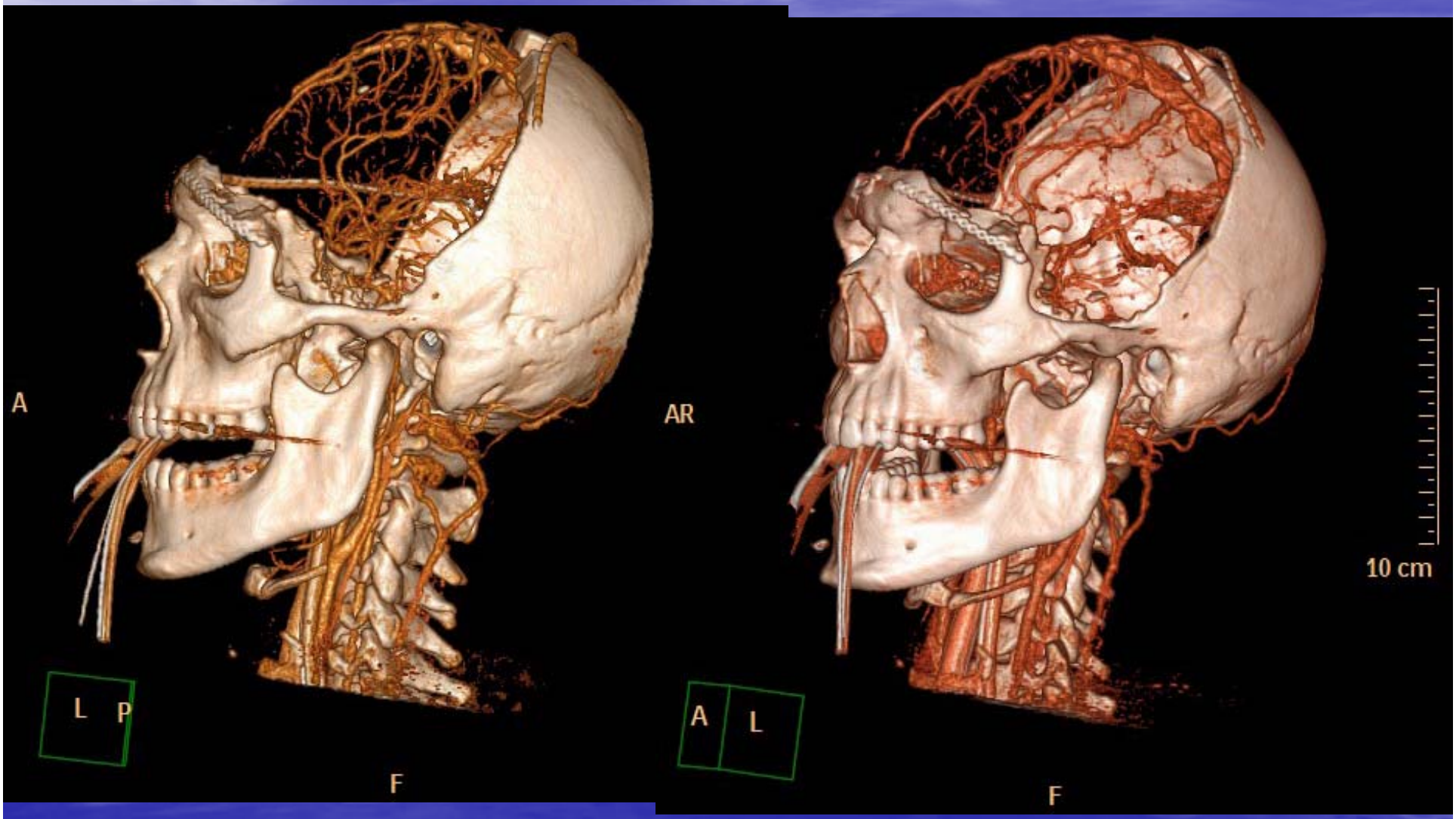


Transtemporal Trajectory of the Blast Wave and Low Velocity Fragments

Hemicraniectomy with Duraplasty

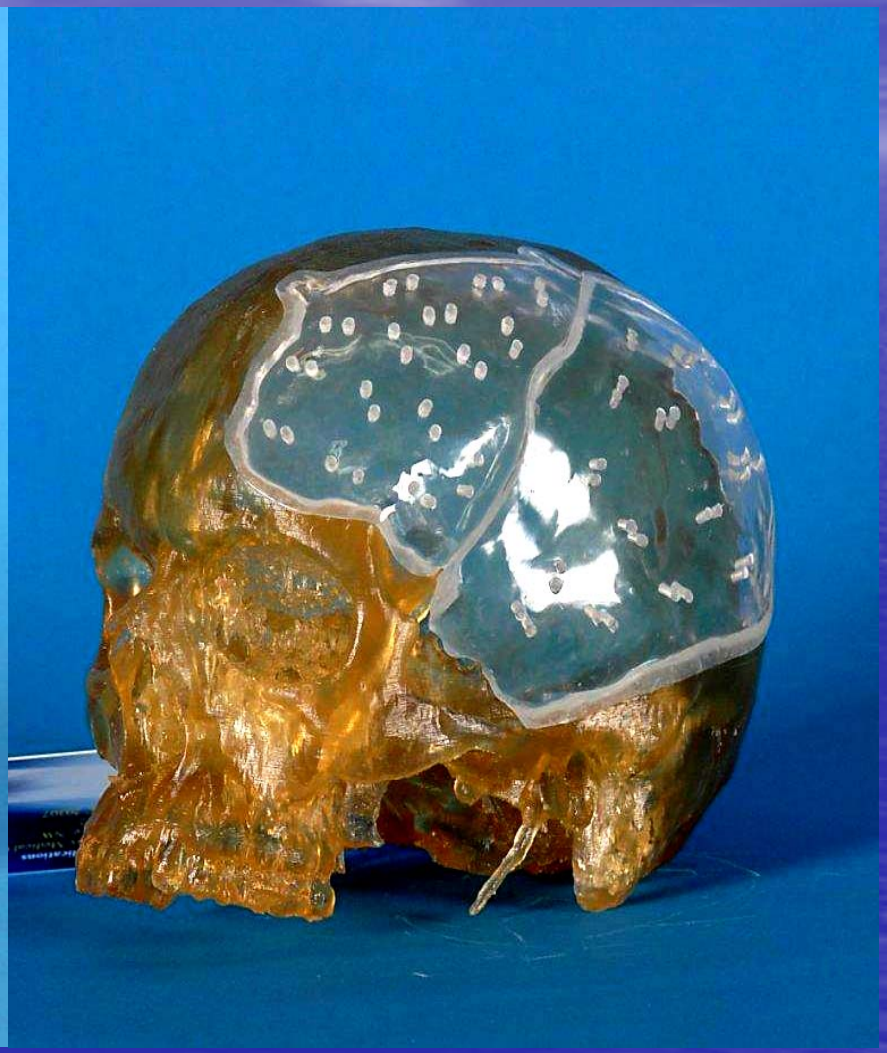


3-D Reconstruction of the Skull



Acrylic Implants

Before



After

Joint Service Cooperation

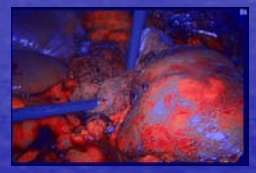
- Products of DoD Enterprise-Wide Benefit
  - Results of cooperative effort
  - Transferable between Service platforms
  - Synergistic operational support
- Evidenced by joint research and development cooperation between Army, Navy, Air Force, USUHS, VA
  - Applied research development/outcomes support:
    - Astounding record of survival from trauma for soldiers, marines and air personnel within theater
    - Profound record of successful evacuation from Southwest Asia to Level 4 in Central Europe and from Central Europe to CONUS
    - Unprecedented return to duty of wounded operational personnel

Translational Research

Clinical Practice in the Field, Clinic & MTF ⟷ **Medical R&D Laboratories**

Examples of ongoing programs where Army and Navy surgeons have developed innovative clinical approaches (*there are, and should be, more*)

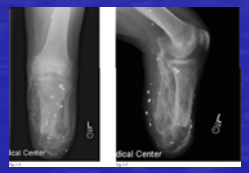
- Wound management/healing
- Heterotopic Ossification
- Diagnostic Imaging of wound/organ perfusion



Enhanced spectral imaging of perfusion in organs/wounds

Navy and Army Surgeons working collaboratively to bridge clinical medicine with cutting edge research from the Medical R&D Laboratories

Wound biomarkers



Heterotopic Ossification

A critical ingredient to success: from "Bench to Bedside" (and back again)

Products Delivered

Hemostatic Agents for Hemorrhage

Then

Navy: QuikClot

Army: Hemcon

ATACCC circa 2000

Now

Combat Gauze

ATACCC Circa 2008

- **Studies performed at The Naval Medical Research Center & The Institute of Surgical Research separately assessed multiple (10+) hemostatic preparations in pre-clinical swine hemorrhage models.**
- **In 2008 the Committee for TCCC brokered a review of the data and recommended Combat Gauze.**

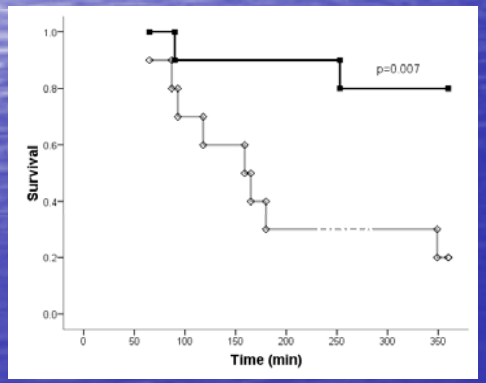
Sponsored by MARCORSYSCOM(FFME)

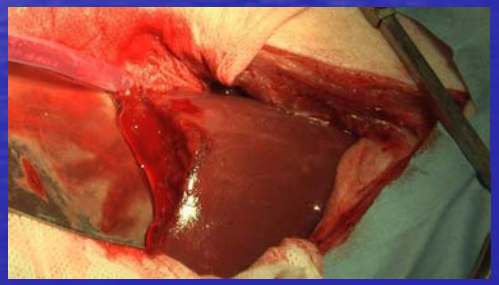
Sometimes medical product development provides a consensus solution, sometimes not. Competition is healthy, coordination essential.

Products in the Pipeline

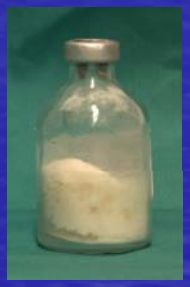
Infusible Hemostatic for Internal Hemorrhage

- **Studies at the Naval Medical Research Center to compare two platelet-derived formulations in a laproscopically-induced (closed) liver injury hemorrhage model.**





Platelet-derived Hemostatic Agent (PDHA)



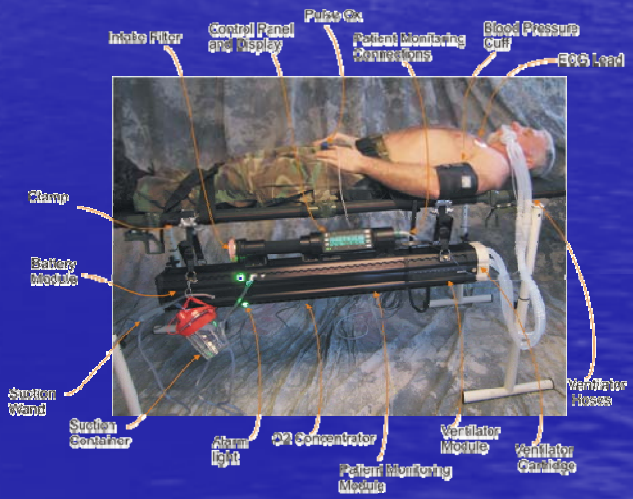
Co-sponsored by Navy Medical Development Program & US Army Combat Casualty Care

Coordination of Navy and Army Advanced Development Programs, the Army Combat Casualty Care Program, DARPA, USU & Industry

Products in the Pipeline

MOVES (Monitoring, Oxygen, Ventilation, & External Suction)

- **Lightweight, portable device targeted to provide capability for "transport of opportunity"**
- **USMC Procurement CY09**
- **Adding anesthesia connection in FY10**
- **MOVES Anesthesia module scheduled for FY13/14 as P3I. Functions in Stand-alone as well**

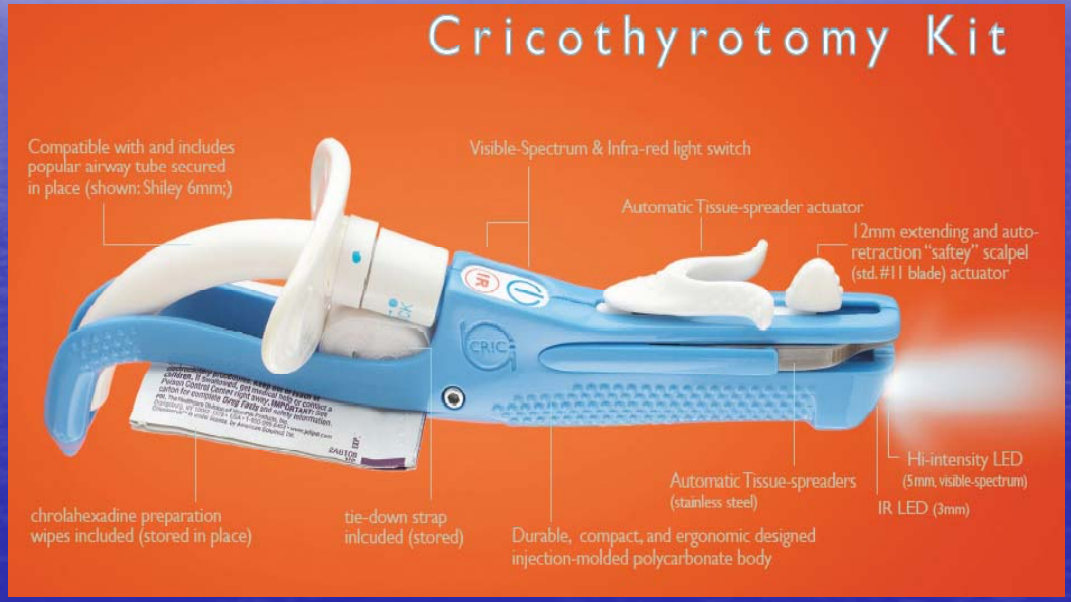


Joint Program – MARCORSYSCOM (FFME) & Navy Medical Development
MOVES II to include Army & USAF Requirements

Products in the Pipeline

Cybertech Cricothyrotomy Kit

- **Everything needed in one small, integrated package**
- **One-handed operation device**
- **Retractable scalpel that provides automatic, full retraction when the integrated tissue spreader is advanced into the incision.**
- **Incorporates IR & Visible LEDs for illumination**



Co-sponsored by Navy Medical Development Program

Joint USMC - Navy - Army Investment Partnering with Industry
Dual-use with Civilian EMS

The Navy Clinical Investigation Program

(preparing the clinicians and researchers of the future)

TOTAL # OF RESEARCH PROJECTS

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	YTD 09	Cum Var
TARGET		**651**	**651**	**651**	**651**	**1953**	
THRESHOLD		**506**	**506**	**506**	**506**	**1518**	
ACTUAL		**670**	**792**	**784**		**2246**	
VARIANCE		**19**	**141**	**133**		**+293**	**+293**

The Navy Clinical Investigation Program
(preparing the clinicians and researchers of the future)

TOTAL RESEARCH PUBLICATIONS

		Qtr 1	Qtr 2	Qtr 3	Qtr 4	YTD 09	Cum Var
TARGET		121	181	181	120	483	
THRESHOLD		82	123	123	83	328	
ACTUAL		247	265	209		721	
VARIANCE		126	84	28		+238	+238

The Navy Clinical Investigation Program
(preparing the clinicians and researchers of the future)

 # OF RESEARCH FUNDING PARTNERS

	Qtr 1	Qtr 2	Qtr 3	Qtr 4	YTD 09	Cum Var
TARGET	17	25	30	33	30	
THRESHOLD	12	17	21	23	21	
ACTUAL	15	121	199		199	
VARIANCE	-2	96	169		+169	+169

Quality of Care

- Quality:
  - Outcomes carefully and systematically measured
  - Meet or exceed patient and third-party quality expectations
  - Evaluated/ investigated via maintenance of support platforms such as tissue and trauma registries
  - Development of real-time results - available in the field
  - Monitoring of evacuation care
  - Follow-up of results by “medical partners” (IOM, AFIP, “Joint Commission”)
  - Morbidity and Mortality reviews as “teaching moments”

Quality of Care

- Ready and convenient access to health care resources on the battlefield and at home
  - Assisted by upgraded IT systems, available in the field/in theater/at home
- Consistent provision of lasting results:
  - Comprehensive preventive medicine
    - Entomology, malaria abatement, monitoring of endemic diseases, fresh water/food
  - New and advanced methods to mitigate health and physical risk
- Assisting providers in delivery of the best and most current practice

Quality of Care - The Outcome

Achievement and Maintenance of:

- Operational effectiveness
- Reputation as a high-quality, high performance military medical enterprise
- Provision of innovative, outcomes based, highly effective medical care to our Wounded Warriors as well as military families and health care beneficiaries
- Reflecting great credit upon Military Medicine and our Nation’s image and capabilities

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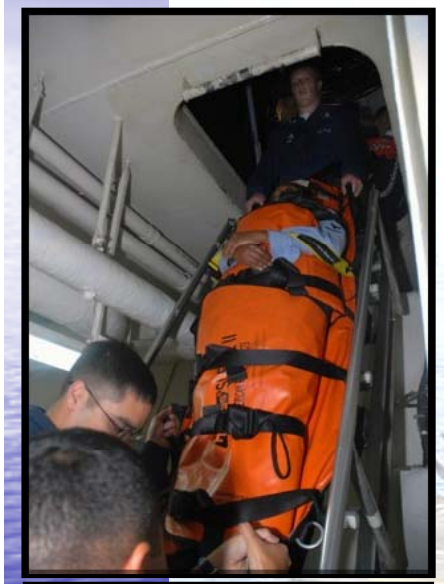
The Surgeon General, US Navy










Serving Navy and Marine Corps Needs in Joint Operations