COMBAT & CASUALTY CARE

Q2 2024
Tacticaldefensemedia.com

ADAPTING FIELD CARE TO CHANGING MISSION

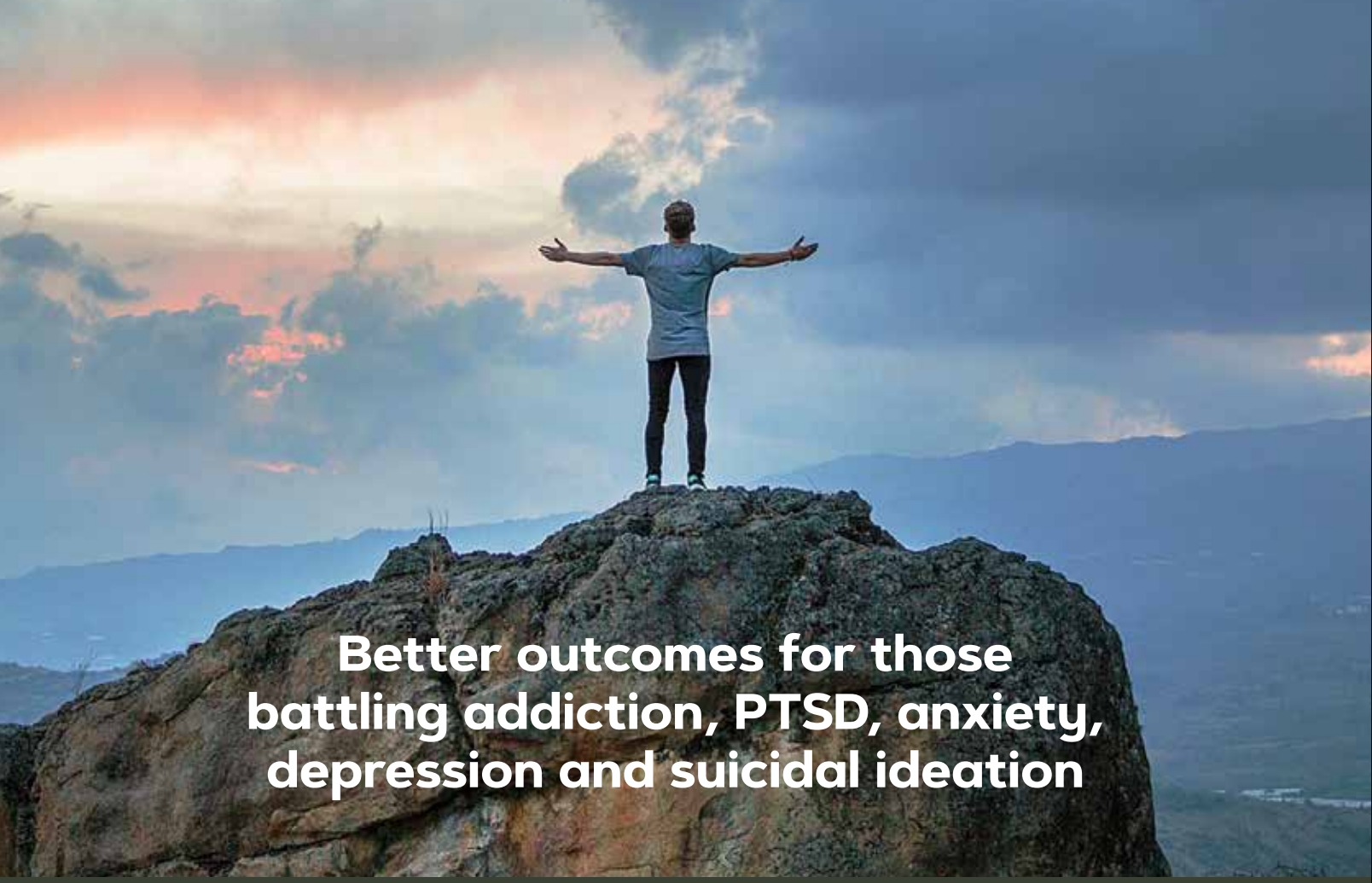
SURGEON'S CORNER

COL Colin T. Frament
Deputy Chief of Staff
Deputy Surgeon
United States Special Operations Command

Mr. Louis Jasper
Project Manager
Warfighter Readiness Performance, and Brain Health
USAMMDA

Andrew J. Patrick
Special Operations Combat Medic
1st Marine Raider Battalion
2017-2021

- SOF Field Surgical Triage
- Freeze-dried Blood Plasma
- Large Scale Combat Operations MEDEVAC
- Special Operations Combat Medic (SOCM)
- AI-enabled Hemorrhage Triage
- Traumatic Brain Injury Blood Test



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DEPLOYING LIFESAVING BLOOD IN FRONT LINE TRAUMA CARE

Former U.S. Special forces corpsman Andrew Patrick details efforts to provide critical care during a remotely-situated hostage rescue mission in 2020. The mission would ultimately save lives.

By T.T. Parish

Featured Interviews

SURGEON'S CORNER

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Deputy Chief of Staff
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LEADERSHIP PERSPECTIVE

Mr. Louis Jasper
Project Manager
Warfighter Readiness, Performance, and Brain Health
U.S. Army Medical Materiel Development Activity (USAMMDA)

Departments

Cover: A Special Operations Surgical Team (SOST) cadre member from the 24th Special Operations Wing observes as SOST pipeline students work to treat and evacuate a simulated casualty during a joint Special Operations Forces (SOF) exercise at Hurlburt Field, FL. SOST are combat-ready battlefield surgeons and medical support personnel who have brought a plethora of advanced combat medicine skills to the U.S. SOF enterprise. (U.S. Air Force photo by Tech. Sgt. Ridge Shan)

COMBAT & CASUALTY CARE

ISSN: 2159-7103 | Online ISSN: 2159-7197

Tactical Defense media

www.TacticalDefenseMedia.com

Published by Tactical Defense Media, Inc.

Tactical Defense Media publications are free to members of the U.S. military, employees of the U.S. government, non-U.S. foreign service based in the U.S. All TDM publications are sent electronically to international readers.

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INSIGHTS

From the moment a combat-related casualty is created, the clock starts ticking and often the only hope for the relative few who become casualties on the field of battle is the combat medic looking right back at them. A shift in focus toward a large scale combat operations (LSCO)-oriented future has the nation's special operations forces (SOF) and conventional military medical personnel preparing for a new reality in field trauma care.

In the Q2 2024 edition of *Combat & Casualty Care*, we focus on combat medicine from a uniquely SOF perspective. Though military field medicine is delivered in much the same manner whether within a conventional or special operations mission set, there are aspects to that delivery that can be defined as more SOF-tailored within the smaller unit, time-sensitive construct that is non-conventional field trauma care. Who better to provide vision into that construct than Deputy Chief of Staff and Deputy Surgeon for U.S. Army Special Operations Command (USASOC), COL Colin T. Frament, whose duty it is to help ensure a combat-ready medical force delivering effective health care, talent management, logistics, and capability development to support and sustain Army Special Operations Forces (ARSOF). As much as ARSOF teams with SOF and conventional Joint and coalition forces worldwide, the need for common standards in medical application for the assurance of quality care delivery across the force, no matter what force that may be, continues to motivate USASOC operational medicine.

Without doubt, the number one driver of combat medical response, SOF or otherwise, is the number one threat to the survival of trauma patients: blood loss by way of massive external or internal hemorrhage. The only solution for blood loss is blood replacement and the availability of whole blood and blood plasma when and where it is critical to the foundation of short- and long-term positive casualty outcomes. Former U.S. Special Forces combat medic Andrew Patrick gives us a first-hand account of one mission in particular which was ultimately deemed a success despite the difference between life and death dependent more on substance than smarts: freeze-dried blood plasma. Only recently Food and Drug Administration-approved, this French freeze-dried plasma (FFDP) product will likely be seen far beyond U.S. SOF units in the future. From blood availability to blood testing, knowing the properties of this lifesaving liquid is also providing a connection to the world of traumatic brain injury (TBI) and how proactive clarity on changes in blood composition after a concussive trauma can provide clues in determining if a TBI has occurred. Mr. Louis Jasper, Project Manager, Warfighter Readiness, Performance, and Brain Health (WRPBH) Project Management Office, U.S. Army Medical Materiel Development Activity (USAMMDA) speaks to this revolutionary discovery.

Of course, without the training of combat medical professionals that answer the call of casualties in need, a lot more in terms of survival would be left to chance. The Special Operations Combat Medic (SOCM) course, directed by MAJ Brett Ambroson and run by the Joint Special Operations Training Center (JSOMTC), JFK Special Warfare and School, Ft. Liberty, NC, is the premier education program for the building of these medic wonders.

As always, feel free to send us your comments and suggestions. Thank you for your continued readership!

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ADAPTING SPECIAL OPERATIONS COMBAT MEDICINE TO MEET FUTURE CHALLENGES TODAY

By John Dominguez, President, Special Operations Medical Association

For the past several decades, the U.S. military medical community has relied on tactical combat casualty care (TCCC) and the benefit of positioning surgical teams closer to the point of injury. These past efforts to refine skills to a level of mastery and develop responses to emerging threats needs to continue to advance the military's ability to be agile and adaptable is critical in medical support to future irregular operations and large scale combat operations (LSCO). Recently, Russia increased its use of drones and its employment of electronic counter drone technology to mitigate Ukraine's use of drones. This new employment of easily acquired and controlled drones is a significant threat to vulnerable assets closest to the fight. To protect the medical community's most critical resource, our surgical teams, may require that their location to be greater distance from the point of injury than in the past. As a result, evacuation times may increase. To compensate for this preservation measure, it is essential to increase the knowledge, education, and proficiency of all medics across the global Special Operations Forces (SOF) enterprise, including general purpose forces. This imperative is directly aligned with the fourth SOF Truth: "Competent Special Operations Forces cannot be created after emergencies occur."

John Dominguez
President
SOMA

A WAR-TESTED AND LEARNED EVOLUTION

During World War II, few tactical aircraft evacuated casualties from the battlefield. The died of wounds (DOW) rate was 4.5 percent. As aircraft developed, new applications were employed. As a result, during the Korean War, about one out of every seven U.S. casualties were evacuated by helicopter and the DOW rate dropped to 2.5 percent. "During the Vietnam War, the majority of U.S. casualties were evacuated from the front lines by Army dust-off helicopters and the USAF Military Airlift Command (MAC) evacuated the seriously wounded from theater by strategic fixed wing aircraft back to Japan and to the U.S." (Fred M. Clingman. *Analysis of Aeromedical Evacuation Logistics in the Korean War and Vietnam War*. Department of the Air Force, Air University Air Force Institute of Technology, 1989, 92.). "Then, in 2009, during the Global War on Terrorism, Secretary of Defense Gates mandated prehospital helicopter transport of critically injured combat casualties in 60 minutes or less." (Kotwal RS, Howard JT, Orman JA, Tarpey BW, Bailey JA, Champion HR, Mabry RL, Holcomb JB, Gross KR. *The Effect of a Golden Hour Policy on the Morbidity and Mortality of Combat Casualties*. JAMA Surg. 2016 Jan;151(1):15-24.). These efforts, over the years, have greatly lowered the case fatality rate (CFR).

In theaters like the Horn of Africa, East Africa, Caribbean Central America, and Philippines, most SOF did not have the same evacuation capability as in Afghanistan and Iraq. Some teams relied on contracted aircraft that were restricted when and where they could fly, while other locations had to wait hours to days for cross boarder flight approval. Further, even if evacuation was possible, some SOF teams did not have U.S. surgical teams near their operations. Because of their missions and unpredictable or unreliable evacuation capability, defined the requirement for SOF medics to be capable of sustaining care of a patient for up to 72 hours. Further research should be conducted to develop a capability-based assessment (CBA) as more data has been collected since the 2017 CBA was published on medics' critical task lists and skills sustainment.

BLENDING ADVANCED CAPABILITY WITH TRAINING

The next stage of increasing survivability in future conflicts lies with evolving the education, experience, and capability of military medics to bridge the gap that a near-peer or peer-to-peer conflict may present. Currently, U.S. SOF and the U.S. Army Medical Department (AMEDD) are in the process of modifying and modernizing the medic courses to include course material that had previously been taught during pre-deployment training and omitting material that is no longer relevant due to advances in medicine.

Two critical areas that have not changed and still require SOF medic proficiency: their ability to treat disease non-battle injury (DNBI), which directly impacts readiness and their knowledge and relationship with our alliance partners. Medics must be able to fully integrate with our alliance partners as they may be the closest surgical assets or SOF may be using a multinational logistic system. Alliance partners have different, but similar, capabilities. As professionals, military servicemembers need to expand their aperture to truly make the best medical decisions in a tactical environment. This requires mastering the skills that you currently need for the current deployments, while concurrently training to perfect the skills you may need for tomorrows' wars.

DEPLOYING LIFESAVING BLOOD IN FRONT LINE TRAUMA CARE

A U.S. Special forces corpsman details efforts to provide critical care during a remotely-situated hostage rescue mission in 2020. That mission would ultimately save multiple lives.

By T.T. Parish, U.S. Army Medical Materiel Development Activity

Soldiers with the U.S. Army 11th Airborne Division test a Freeze-Dried Plasma kit as part of combat casualty care training during Joint Pacific Multinational Readiness Center (JPMRC), Fort Wainwright, AK, April 2023. FDP is one of several human and canine blood products currently under development by the U.S. Army Medical Materiel Development Activity at Fort Detrick, Maryland. USAMMDA's Warfighter Protection and Acute Care Project Management team partners with both U.S. Department of Defense and non-DoD industry development partners to develop and deliver blood products for possible future use by the military Joint Forces. (U.S. Army Courtesy Photo/Released)

Though far from the front lines, the U.S. Army Medical Materiel Development Activity (USAMMDA), Fort Detrick, Maryland, is a hub of engagement for military medical developers within the Department of Defense (DoD). Here, experts partner with stakeholders, leaders, and collaborators from across the DoD, academia, and industry to identify treatment capability needs—then work to develop, procure, and field modern solutions for frontline medical providers.

One major focus for the USAMMDA team is finding solutions to the problem of blood loss at and near the point of injury. An estimated 25 percent of U.S. fatalities during combat operations in Iraq and Afghanistan may have survived with readily available hemorrhage control measures, according to DoD estimates. To address this issue, USAMMDA is working to develop and field replacement blood products that can be used by medical providers in austere, far-forward environments.

MEDIC TRAINING MEETS REAL LIFE RESPONSE

Andrew J. Patrick, a former special operations combat medic assigned to the 1st Marine Raider Battalion from 2017 to 2021, knows firsthand the value of having medical developers analyze and adapt current efforts based on direct communication with frontline providers. In 2020, Patrick deployed to the Philippines in support of stability operations alongside his fellow Raiders and host nation forces battling Abu-Sayyaf and other terror groups near Jolo, Sulu Province.

During deployment, Patrick provided routine care for roughly 30 special operators and partner nation servicemembers. But due to the nature of "special operations," preparedness for contingencies formed the basis of his approach to medical care, and with good reason: non-conventional warfare operations are conducted by small, independent, highly trained, and lethal groups of special operators, far from logistical hubs and higher echelon care facilities.

Andrew Patrick

As a lone corpsman working to provide care for several small teams, host nation partners, and local nationals, Patrick's tactical skill and professional acumen were in constant demand. During one mission, he and his Raider team relied on an investigational hemorrhage control treatment called French Freeze-Dried Plasma (FFDP), overseen by USAMMDA's Force Health Protection Directorate through a U.S. Food and Drug Administration Emergency Use Authorization (EUA).

According to a clinical vignette to be presented during the 2024 Special Operations Medical Association's annual conference in Raleigh, North Carolina, Patrick and his Raider team rescued a group of hostages who were held for more than a year, some with grievous wounds and illnesses. During treatment, one hostage was unresponsive and displayed signs of hypovolemic shock, caused by a loss of blood and fluid that makes the heart unable to pump sufficient blood to the body.

The local national patient, a 43-year-old male, was suffering from multiple gunshot wounds and shrapnel injuries. Patrick believed the patient's hypotensive state was exacerbated by previous administration of normal saline during treatment. Providing en route care, Patrick administered reconstituted FFDP to mitigate the complications caused by severe hemorrhage. His use of the product stabilized the patient for transport to a higher echelon of care. Later, the patient's family made the difficult decision to remove him from life support.

"This kidnap victim should have been dead [before medevac] by all measures," said Patrick. "He was shot multiple times in the head, chest, abdomen, leg, and genitals. Without FFDP, he would not have survived long enough to be transported."

According to Patrick, freeze-dried blood plasma is crucial for conventional and special forces medical providers due to its immediate availability, ease of storage and transportation, enhanced stability, and universal compatibility. It can be quickly reconstituted and administered, providing an essential treatment for hemorrhagic shock, coagulopathy, and other conditions where traditional blood products may not be available.

THE NEED TO CONTROL THE FRONTLINE BLEED

Although the clinical case detailed by Patrick occurred in 2020, USAMMDA uses examples like his to help shape continuing efforts toward developing, testing, and fielding FDA-approved hemorrhage control blood plasma treatments for frontline medical units and providers. The U.S.-based Freeze-Dried Plasma program is overseen by USAMMDA's Warfighter Protection and Acute Care (WPAC) project management office.

WPAC developers are working with combat medics and medical officers during routine and frequent touchpoints and field assessments to continue the years-long effort to develop a rugged, expeditionary FDP for far-forward use. While the French product is provided in glass containers, which limits its utility for frontline providers, WPAC's FDP development program uses rugged, lightweight plastic IV bags – a critical advancement in blood replacement

capabilities for frontline troops, according to Kendra Lawrence, Ph.D., project manager of WPAC.

"Collecting information from subject matter experts with up-close experience providing combat casualty care is a vital step in the medical development process," said Lawrence, "whether it involves adapting current commercial capabilities for military use or developing novel treatments and devices to meet the needs of medical providers in the joint services and special forces."

For the past several years, the U.S. Army has been focusing on modernizing its forces to meet the challenges of 2030, 2040 and beyond. A main component of this wider strategy is improving lifesaving care for wounded and injured Warfighters at and near the front lines and during en route treatment. The U.S. Department of Defense's focus on dispersed operations, with logistics lines crossing thousands of miles of open ocean and barren tundra, makes building frontline care capacities imperative to joint force readiness.

"During previous conflicts, like in Iraq and Afghanistan, U.S. forces had unparalleled abilities to treat and evacuate the wounded to higher echelons of care, due to wide accessibility of medevac aircraft and relative proximity of secured bases with advanced medical treatment facilities and devices," said Michelle Mason, a logistics specialist with WPAC. "Those advances greatly improved survivability compared to previous U.S. wars. Today's Warfighters are preparing to fight in areas of the world that are much more austere and rugged, where the 'front line' will be geographically isolated, dispersed, and harder to reach by air and seacraft to evacuate the critically wounded.

The FDP program is a significant step forward to equip military medical personnel to provide urgent care at and near the front lines," she added. "When Warfighters are injured, every moment is critical to improving their chances of survival."

LESSONS CONTINUE TO PROVE THE NEED IS REAL

Speaking from experience, Patrick believes expeditionary FDP is an important step toward improving survivability for service members who are wounded or injured in combat and training operations in austere regions of the globe.

"I've treated more American patients from injuries during training missions than on deployment," he said. "There are a lot of risks involved in training, and real-life injuries can and will continue to happen during training."

According to Christopher Weselek, product manager for FFDP, the EUA for the French product allows USAMMDA to continue providing this life-saving measure to U.S. Special Operations Command units until the U.S.-made product is fielded.

"Mr. Patrick's vignette highlights how the real-world experiences of medics, corpsmen, and medical officers in austere locations across the globe can provide critical insights to the development process," he said. "Their experiences help to inform the medical capabilities that USAMMDA and its partners are working to bring to the Joint Force."

MODERNIZING AND ADAPTING WORLD-CLASS MEDICINE IN SUPPORT OF A COMBAT-READY FORCE

Deputy Chief of Staff, United States Special Operations Command - Deputy Surgeon COL Colin Frament assumed the role of Deputy Surgeon United States Special Operations Command (USASOC) July 2022. Colin is an Army Physician Assistant with 32 years of combined enlisted and commissioned service in the Army Reserves, National Guard and Active components. He enlisted in the Army Reserves in 1991 while an undergraduate at the University of Rhode Island. Colin is a 2003 graduate of the Interservice Physician Assistant Program.

Prior to commissioning, COL Frament served as a 12B (Combat Engineer) and 18D (Special Forces Medical Sergeant) reaching the rank of Sergeant First Class. His assignments as a Physician Assistant include Special Operations Command Central (SOCCENT), 4th Battalion, 5th Special Forces Group, Joint Special Operations Command (JSOC) – Joint Medical Unit, JSOC Liaison Officer to the Joint Staff Surgeon (Pentagon), Battalion Commander 44th Medical Brigade, and United States Special Operations Command - HQ. Colin is also an O6-CSL select to command U.S. Army Medical Department Activity (MEDDAC) – Bavaria in 2025.

Combat & Casualty Care had the good fortune to speak recently with COL Colin Frament, Deputy Surgeon, United States Army Special Operations Command (USASOC), U.S. Special Operations Command (USSOCOM) regarding his efforts to help ensure a combat-ready medical force delivering effective health care, talent management, logistics, and capability development to support and sustain Army Special Operations Forces (ARSOF) across the continuum of competition, crisis, and conflict.

C&CC: Please provide the readers with an understanding of the USASOC Surgeon Office's role.

COL Frament: The United States Army Special Operations Command (USASOC) is a three-star Army Service Component Command (ASCC) with the authority to "man, train, equip, educate, organize, sustain, and support forces to conduct worldwide Special Operations across the range of military operations in support of Joint Force commanders and Joint, Interagency, Intergovernmental, Multinational (JIIM) Partners to meet national and theater objectives." The Surgeon Directorate is the proponent for ARSOF medical capability requirements, skill training, force health protection, veterinarian, logistics, medical equipment modernization, and future technologies to develop and sustain competent, flexible, and adaptable operational medical capabilities to support ARSOF. The directorate is composed of a multi-disciplinary medical staff that implements Army, Department of Defense (DoD), and United States Special Operations Command (USSOCOM) medical policy and programs across ARSOF and is the focal point for reviewing and validating all medical requirements for medical capability within the command.

COL Colin T. Frament

Deputy Surgeon
United States Army Special Operations Command
United States Special Operations Command

A significant role of the Surgeon Directorate is developing ARSOF capability and modernizing medical equipment and technology. We are the single-entry point for medical science and technology requirements, material, and medical training development for ARSOF. Though ARSOF medicine may have some unique requirements, we strive for close coordination and collaboration through experimentation and testing with the Army Medicine Capability Development Integration Directorate (CDID) and Fielded Force Integration Directorate (FFID) teams. The USASOC Surgeon provides essential medical input for all human subject research within ARSOF and assists with the implementation of DoD, Army, USSOCOM, and USASOC policies and programs supporting behavioral health, suicide prevention, and promoting brain health.

Aligned with the readiness priorities of the Army's Surgeon General, we focus on protecting the force's health, developing, and sustaining a medically ready force, ensuring appropriate health care and readiness support for the Soldier, and advocating for the health care and wellness of ARSOF Families. In addition, we closely coordinate with the Human Resources Command (HRC) Army Medical Department (AMEDD) to identify and select qualified medical personnel for ARSOF and manage and assign medical personnel to align with Army medicine professional development pathways.

C&CC: What has USASOC done to mitigate traumatic brain injury (TBI) risk and blast overpressure exposure (BOP) for the ARSOF Soldier?

COL Frament: The USASOC TBI and BOP programs are driven by the first SOF Truth: Humans are more important than hardware. For over 20 years USASOC and its subordinate commands have focused on the mitigation of traumatic brain injuries. This focus spans the spectrum from acute, mild, moderate, and severe TBI to the more insidious nature of repetitive BOP exposure.

USASOC is actively addressing TBIs through several initiatives to enhance warfighter brain health and minimize their impact. In 2019, the DoD launched the Warfighter Brain Health Initiative (WBHI), which aimed to unify operational and medical communities in optimizing service member brain health and gain a better understanding of monitoring brain threats and exposures, including BOP. It also sought to create a holistic strategy to minimize effects and risks, improve warfighters' well-being and track service members' brain health from entry into the military to retirement.

The DoD has gathered several lessons learned from the medical, safety, and human performances personnel regarding brain health. The lessons included monitoring and supporting Service Members and other at-risk personnel throughout their careers regarding their exposures to blasts, TBI histories, and cognitive/mental status. USASOC continues to train medical care providers to recognize, evaluate, and treat TBIs of varying severity. Safety personnel are also continuing to recognize BOP weapon systems and placing management controls as necessary. USASOC has past, current, and future research opportunities to advance the science, technology, capabilities, and medical best practices about BOP to inform a change in policy or practice.

USASOC has been able to implement various mitigation measures and tools, hazard assessments, education, and continued research efforts. The intent is to understand current blast exposure levels in dynamic environments and mitigate sources of unnecessary exposure without degrading the quality of combat training. USASOC has worked with Fort Liberty Industrial Hygiene for minor changes such as redesigning firing positions to remove reflective barriers, increasing the distance between shooters, or even ceasing the simultaneous firing of Tier 1 weapons systems on the range.

One example is the ability to map out training areas with blast sensors, which informs where to stand during training to significantly decrease exposure to the trainee, the cadre, and support staff. One USASOC unit evaluated a 3D-printed detonation cord cover, which reduced the blast exposure to the service member by 40-60% during training. Another management control has been designing updates to training facilities (e.g., shoot houses) with walls that better absorb or baffle a blast wave during training, reducing BOP exposure to personnel.

C&CC: What areas of research and studies have USASOC participated in to better understand the impact of blast overpressure?

COL Frament: The USASOC Commanding General (CG) retains the authority for all human subject research approval for USASOC. Starting in 2017, the USASOC Surgeon Directorate formalized a human research policy to investigate areas of interest that subordinate commanders and the CG wanted to understand better to optimize performance, and care for ARSOF soldiers. A significant area of interest was better understanding brain health and the impact of blast overpressure.

The USASOC Surgeon is the office of primary responsibility (OPR) for the ARSOF BOP, and Brain Health initiatives. USASOC uses a multi-discipline team approach to understand, collaborate, and scale solutions. Our efforts coincide with the DoD writ large through collaboration with multiple stakeholders through working groups and committees to inform research priorities to improve Warfighter Brain Health and performance and mitigate the associated risks. USASOC nests its efforts under the USSOCOM's Brain Health working group, the Headquarters Department of the Army Office of the Surgeon General's blast overpressure and brain health working groups, and the Office of the Assistant Secretary of Defense (OASD)-Readiness and OASD-Health Affairs to better utilize available resources and time.

USASOC continues to review and update DoD-established guidelines and thresholds for occupational BOP to prevent negative physical and potential neurocognitive effects. USASOC approaches brain health through six lines of effort (LOEs), which include Protect, Monitor, Treat, Enhance, Advance, and Connect. A multidiscipline team including subject matter experts from medical, safety, human performance, force modernization, and directorate of phycological applications meets regularly to address these LOEs.

C&CC: Describe the challenges of medical support to Irregular Warfare.

COL Frament: The Irregular Warfare (IW) environment will challenge the current tenets of Health Service Support (HSS) to support ARSOF activities below the threshold of armed conflict. The Army Health

System (AHS) has identified three imperatives that are critical to combat effectiveness in a future multi-domain fight: Maximize Return to Duty Rates, Optimize Ground, Air and Sea Evacuation, and Overcome Contested Logistics. The same sustainment imperatives are critical to IW but are difficult to anticipate and sustain in a volatile, uncertain, complex, and ambiguous environment.

The March 2024 Deputy Secretary of Defense memorandum defined IW as the:

"Critical component of how we campaign, disrupting competitor warfighting advantages while reinforcing our own. DoD-led IW activities in denied, less-than-permissive, or otherwise sensitive environments pose the greatest challenges to sustainment operations, including medical support for U.S. and friendly forces. When we cannot provide life-saving treatment and evacuation for friendly forces, more preventable combat deaths occur, which erodes political support, force motivation, and a population's will to resist adversary aggression. DoD's medical community achieved unprecedented survival rates in the last two decades but operating within the so-called "golden hour" as we did during the Iraq and Afghanistan wars will necessarily be harder when forces may be fighting from or around islands spread out across half a hemisphere."

Warfighters require HSS functions regardless of the operational environment. For a positive outcome, casualties need a system that can provide treatment from pre-hospital through definitive care. Traditional means of medical support have large footprints, extensive security requirements, overt markings, and expansive pre-positioning of supplies, all of which act as indicators and warnings of planned or ongoing operations.

Many IW activities are conducted below the threshold of armed conflict. Below-threshold operations reduce escalation risks and entail significantly managing the perception of the United States' involvement and presence. In some circumstances, the U.S. government may not authorize the presence of U.S. military forces, necessitating indirect IW operations. This requires allied and partner forces to be self-sustaining to achieve the strategic objectives. In other circumstances, the presence of a limited number of U.S. military troops may be approved. Still, the risk of deploying a complete casualty care system with traditional medical support assets would be too high. In these circumstances, U.S. warfighters must rely on HSS to be provided by allies and partners with possible U.S. augmentation that can operate with low detectability in contested, denied, or degraded environments.

Medical support of IW is a complex problem that requires strong working relationships with allied and partner medical forces. A successful HSS plan below the threshold of armed conflict will require a global health engagement (GHE) plan that can assess standards of care across anticipated conflict areas and establish programs that focus on improving medical interoperability with our allies and partners. This strategy will mitigate the morbidity and mortality of Joint Forces operating in the IW space.

Working groups to formalize a medical support of IW strategy are ongoing, and include contributors from USSOCOM, USASOC, Army medicine, ASD-SO/LIC Med, and several JIIM organizations.

EVOLUTION OF A LIFESAVER

Arterial lacerations, penetrating chest wounds, blast trauma, and other kinetic injuries can quickly become life-threatening. Seconds may mean the difference between life and death. In the early years of Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF), combat medics often carried trauma shears and hook knives for patient exposure, however, switching between them was cumbersome, inefficient, and often impossible in the heat of battle. In 2005, Ripshears, LLC came up with a better idea: combine the two cutting tools into one, hence the first RIPSHEARS prototype was born. We spent the next few years refining our design and materials, and establishing domestic production capability in between rigorous training and deployment cycles before hitting the market with the RS-1 RIPPER and RS-2 RIPSHEARS models in 2010.

RIPSHEARS have been saving lives on and off the battlefield ever since.

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Our Trade Agreement Act (TAA)-compliant 420J surgical stainless-steel shears feature a titanium carbon nitride (TiCN) coating for exceptional durability, corrosion-resistance, lubricity, and edge retention. TiCN is 800% harder than the underlying stainless steel to which it is chemically bonded, is far superior to fluoride or black oxide coatings for personnel operating in maritime, jungle, desert, arctic, or other austere environments, and will ensure reliable service long after other brands have rusted and failed. RIPSHEARS rapidly cut through multiple textile layers to expose underlying wounds without endangering the patient, and easily dispatch denim, leather, wetsuits, drysuits, aramid fibers (Nomex, Kevlar), chemical biological radiological nuclear explosive (CBRNE) uniforms, bunker gear, seat belts, nylon webbing, and bandages. RS-1, RS-2, and RS-3 models feature an integrated oxygen (O2) wrench.

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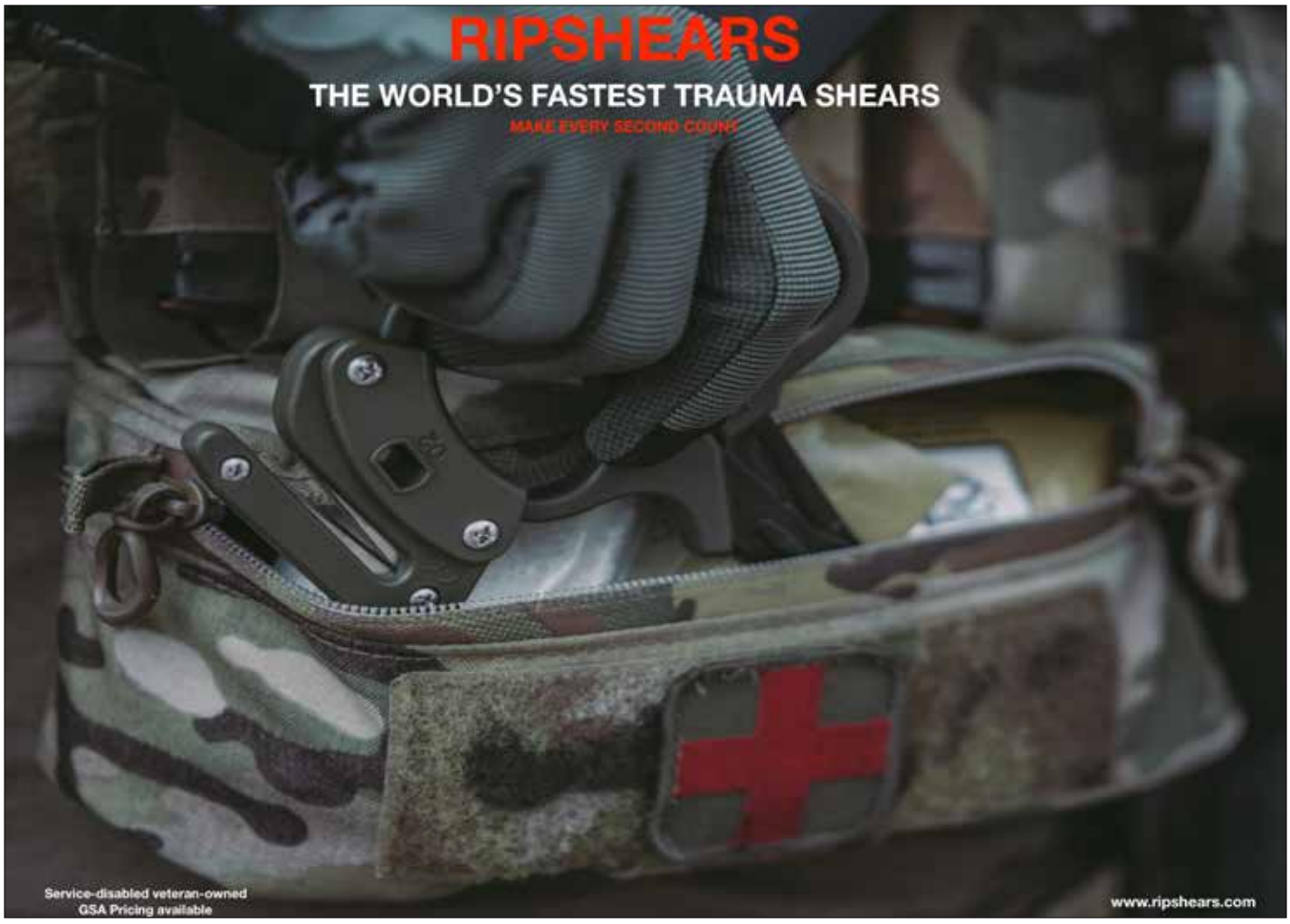

TAPPING DATA AUTOMATION TO ASSESS BLEED RISK CORRELATION

The Food and Drug Administration has approved an artificial intelligence-enabled, data-centered software application to allow combat medics to assess hemorrhage risk at point of injury.

By Paul Lagasse, U.S. Army Medical Research and Development Command

The Automated Processing of the Physiological Registry for Assessment of Injury Severity Hemorrhage Risk Index, or APPRAISE-HRI, is the first triage system ever cleared by the FDA for assessing hemorrhage risk of trauma patients. Developed by the U.S. Army Medical Research and Development Command's Biotechnology High Performance Computing Software Applications Institute, a division of the Telemedicine and Advanced Technology Research Center, APPRAISE-HRI consists of an Android app that collects heart rate and blood pressure data received via Bluetooth from a patient's external vital-sign monitor and analyzes the pattern in these data to estimate the patient's potential risk of uncontrolled bleeding.

The U.S. Food and Drug Administration has cleared a first-of-its-kind artificial intelligence-powered smartphone application developed by the U.S. Army Medical Research and Development Command (USAMRDC) Biotechnology High Performance Computing Software Applications Institute that uses vital-sign data from trauma patients to assess their risk of hemorrhage. The clearance is a major milestone that allows MRDC to license the invention for use in military applications that could save the lives of trauma combat casualties who are at risk of massive blood loss.

The Automated Processing of the Physiological Registry for Assessment of Injury Severity Hemorrhage Risk Index, or APPRAISE-HRI, is the first triage system ever cleared by the FDA for assessing hemorrhage risk of trauma patients. It consists of an Android app that collects heart rate and blood pressure data received via Bluetooth from a patient's external vital-sign monitor and analyzes the pattern in these data to estimate the patient's potential risk of uncontrolled bleeding.

QUANTIFYING RISK FOR INCREASED SURVIVABILITY

Over 90% of combat casualties die at or near the point of injury before they can be evacuated to a medical treatment facility. Furthermore, the primary cause of death among combat casualties is uncontrolled bleeding, which starves the brain and vital organs of the oxygen they need to survive. The APPRAISE-HRI application can stratify the risk of hemorrhage within 10 minutes, greatly assisting medics in triaging casualties in prolonged field care scenarios with limited resources in time to improve their chances of survival.

Dr. Jaques Reifman, senior research scientist and director of BHSAI, a division of Telemedicine and Advanced Technology Research Center, leads the team that developed, tested and obtained regulatory clearance for the APPRAISE-HRI application. He says the clearance represents the culmination of over two decades of hard work performing multiple clinical studies to collect enough high-quality data to train the AI algorithm so that it could produce results of a sufficiently high degree of reliability. The Defense Health Program and MRDC's Combat Casualty Care Research Program and Medical Materiel Development Activity sponsored the multiple phases of the research from inception to FDA clearance. The Henry M. Jackson Foundation for the Advancement of Military Medicine supported BHSAI's research.

"We conducted three clinical studies to collect real-world data on a total of about 2,000 trauma patients, which we used to train the AI algorithm," explains Reifman. "Some of the data were collected in austere environments – a moving ground or air ambulance and at the Emergency Department of the Massachusetts General Hospital in Boston. One of our biggest challenges was ensuring all that data were reliable and consistent."

A HIGHER STANDARD TO BETTER TARGET RISK TYPE

MRDC's Office of Regulated Activities served as the regulatory liaison between Reifman's team and the FDA throughout the clearance process. To meet the FDA's strict requirements for clearance, the APPRAISE-HRI application was also independently and blindly validated in a clinical utility study that used vital-sign data collected from an additional 6,000 trauma patients at nine different sites. The study found that APPRAISE-HRI was highly effective in classifying patients into one of three risk categories based on their likelihood of experiencing a hemorrhage.

With the granting of the FDA clearance, MRDC's Medical Technology Transfer Office is now actively seeking commercial partners interested in licensing APPRAISE-HRI for use in products that can be employed by military health care providers in the field. The DoD holds three U.S. patents related to APPRAISE-HRI. MTT uses its award-winning Assistive Technology Transfer process to help DoD inventors ensure that their new products are mature and military ready.

INTRA-THEATER EVACUATION DURING LARGE SCALE COMBAT OPERATIONS

U.S. Army Futures Command, Austin, TX, working in conjunction with U.S. Army Medical Center of Excellence (MEDCoE), Joint Base San Antonio, TX, is in the process of incorporating force-wide standards addressing future challenges to medical evacuation across vast, contested battlefields that will be the purview of Army global Joint and coalition multi-domain operations.

By Master Sergeant Eric W. Pelkey, Nationally Registered Paramedic

U.S. Army medic paratroopers assigned to the 173rd Airborne Brigade carry a notional casualty to a UH-60 Black Hawk during medical evacuation training in Grafenwoehr Training Area, Germany, in preparation for Exercise Saber Junction 20, taking place later this month. The 173rd Airborne Brigade is the U.S. Army's Contingency Response Force in Europe, providing rapidly deployable forces to the United States Europe, Africa and Central Command areas of responsibility. Forward deployed across Italy and Germany, the brigade routinely trains alongside NATO allies and partners to build partnerships and strengthen the alliance. (U.S. Army photo by Spc. Ryan Lucas)

In 2022, United States Army Futures Command (AFC), working with U.S. Army Medical Center of Excellence (MEDCoE), released AFC Pamphlet 71-20-12, Army Futures Command Concept for Medical 2028. The foundational document provides the Army Health System (AHS) a path to modernization. It sets expectations as to how medical formations should support warfighters across the spectrum of competition, crisis, and conflict within future operational environments (FOE). The threat of contested and austere environments drove AFC to outline the importance and challenges associated with AHS's mission. Their support to joint warfighters dispersed across the multi-domain environment is paramount to success within large scale combat operations (LSCO) (AFC, 2022). To address operational challenges, AFC developed four broad solutions, consisting of 17 core capabilities, to tackle the problem of providing medical support to joint forces taking part in future operations (AFC, 2022). Unfortunately, since 2016, AFC and MEDCoE consistently identified gaps preventing successful application of required core capabilities during formal assessments and/or experiments such as the 2022-2023 Indonesian-Pacific Command (INDOPACOM) Theater Based Assessment (TBA). Gaps associated with tactical evacuation and casualty treatment during LSCOs raised concern among both AFC and AHS leaders. For instance, the former MEDCoE commander concluded, "Army formations are at risk of mission failure because they lack capability and capacity to evacuate large casualty numbers while conducting joint activities across the range of military operations" (Talley, 2023). The threat of LSCOs with a national pacing threat enhances the importance of AHS's preparedness to execute medical evacuation in support of the joint warfighter. The Army's lack of internal capability to independently execute intra-theater medical evacuation in FOEs places the joint force at risk of mission failure; thus, the U.S. Department of Defense (DoD) should designate evacuation responsibilities across the joint force to achieve objectives aligned with national interests.

THREAT-INDUCED SHIFT IN MISSION FOCUS

The onset of counter-insurgency operations (COIN), during the Global War on Terrorism (GWOT), coincide with a new standard of evacuation within contested operational environments (Mandril, 2017). The Secretary of Defense (SECDEF), via DoD Directive 5100.01, grants sole responsibility of intra-theater aeromedical evacuation (AE) to the U.S. Army (2020). Senior leaders commanding land-based COIN operations within U.S. Central Command's (USCENTCOM) area of responsibility (AOR) provided the conditions necessary for the Army to display an unmatched standard of rapid evacuation and enroute care. In fact, Army AE dominated the overall tactical evacuation space due to the U.S.' ability to project superior combat power (Mandril, 2017).

Unlike earlier conflicts, the military's stable posture, coupled with technological advances, afforded commanders an ability to evacuate battlefield casualties ultimately preventing high death rates compared to previous conflicts (Mandril, 2017). For example, LSCOs during World War II resulted in 291,557 battlefield deaths. During the Vietnam Conflict, 47,434 battlefield deaths occurred. These numbers do not include non-mortal wounds or death by other means (DoD, 2024c). Of importance, Army leaders began employing rotary wing AE assets during

the Korean War. However, the Vietnam Conflict saw the first widespread employment of dedicated intra-theater AE assets. In fact, 116 Army helicopters, assigned to two companies and a dozen detachments, held responsibility for AE within Vietnam by 1969. Their use contributed to a reduced mortality rate not seen in previous conflicts. Vietnam served as the initial doctrinal example of how the Army utilizes AE assets. Luckily, the U.S.' capability and capacity to provide these assets only increased over the decades (Howard, 1991). GWOT casualty numbers reflect the success of AE assets in the modern era. Total hostile deaths during Operation Enduring Freedom (OEF) only reached 1,845 which is less than Operations Iraqi Freedom's 3,841 hostile deaths (DoD, 2024a; DoD, 2024b).

Increased operational stability within USCENTCOM's AOR contributed to increased aversion to risk among senior government officials regarding prompt evacuation of injured or ill casualties. For instance, in 2009, SECDEF Robert Gates set a 60-minute Army AE mandate for all critically injured (CAT-A) coalition members within the USCENTCOM AOR. Meaning, all approved urgent evacuation requests required completion by an Army AE team within 60 minutes of issuance to ensure casualties received medical care within a timely manner. Additionally, the USCENTCOM Commander established a 15-minute AE aircraft launch requirement upon receipt of an approved CAT-A urgent request. The Army subsequently increased the amount of deployed aeromedical evacuation and surgical units within USCENTCOM's AOR to ensure compliance with the issued directives (Garrett, 2013). Current U.S. Army doctrine continues reflecting the 60-minute AE standard set by the SECDEF (Department of the Army [DA], 2019).

In 2011, the Defense Health Board (DHB) recommend the Secretary of Defense pursue development of an advanced evacuation care capability. The recommendation called for changing the minimum standard of care aboard aeromedical evacuation platforms to critically care trained paramedics (DHB, 2011). By 2012, the MEDCoE began a proof of concept, or pilot program, critical care paramedic course to test feasibility of setting up a permanent program (Garrett, 2013). The House of Representatives (H.R.) Armed Service Committee, in 2012, mandated a critical care paramedic standard of care aboard aeromedical evacuation platforms across the Army. The 2013 National Defense Authorization Act (NDAA) codified the requirement, further establishing Army aeromedical evacuation as the intra-theater standard of evacuation (H.R., 2012). However, the current model of care and transport used in aeromedical evacuation does not translate well to multi-domain environments such as the INDOPACOM AOR.

THE CHALLENGE AT HAND

In 2023, after years of analysis and experimentation, former MEDCoE commanding Major General Michael Talley determined the Army is ill prepared to complete mass casualty medical evacuation and treatment in multi-domain operational areas. This places the U.S. at risk of mission failure against near-pear pacing threats such as the People's Republic of China (PRC) should conflict arise. AHS's ability to provide any aspect of medical services directly affects return to duty (RTD) rates, died of wounds (DOW) rates, and commanders' freedom of action across the joint operational area (JOA). Each service branch organizes, trains, and equips its assets in a manner best suited to their assigned mission. Thus, the movement and enroute care provided to casualties within a JOA lacks standardization among service branches (Mandril, 2017). Currently, the U.S. Army and Airforce are the only two branches, designated by the DoD, providing evacuation assets (SECDEF, 2020). Current capabilities provided by these two services prove insufficient, during LSCO experimentation, to move large casualty numbers. Translated, casualty estimates during conflict against a national pacing threat, such as the PRC, make the likelihood of prompt intra-theater evacuation implausible without implementation of significant capability solutions (Blakeney & Boenker, 2023). In short, the DoD's assigned intra-theater tactical evacuation assets are not solely capable of moving casualties within a LSCO theater.

TRANSFORMING WITH THE NEEDS OF THE FIGHTING FORCE

As the Joint Force transitions to LSCOs, the Army's ability to continue being the primary provider of intra-theater medical evacuation requires significant focus. The joint force considers tactical evacuation a part of overall patient movement. The joint force states:

> *The PM mission consists of unregulated and regulated movement, via CASEVAC, MEDEVAC, or strategic evacuation (STRATEVAC) from the point of injury, illness, or wounding, through successive roles of care within the theater, to include evacuation to definitive care when warranted. (Joint Chief's of Staff [JCS], 2023, p. III-13)*

Current DoD directives do not mandate service branches to provide ground or sea intra-theater medical evacuation assets. Yet, the complexity of MDO within a LSCO environment demands a joint force approach. Currently, AFC's medical modernization efforts serve as a preparatory measure for contested multi-domain operations (MDO) between U.S. pacing threats and the Army of 2028 (AFC, 2022). The lead pacing threat being the PRC (DoD, 2022). Understanding the complexity of global operations, the 2023 U.S. Army Posture Statement emphasizes the Army's need to cooperate jointly within Indonesian-Pacific Theater (Wormuth & McConville, 2023). Yet, the Army remains the only service explicitly tasked to provide intra-theater medical evacuation.

The Army assessed its ability to provide intra-theater evacuation in four separate assessments between 2016 and 2023. The Russia New Generation Warfare (RuNGW) Capabilities Based Assessment (CBA), 2017-2018 Capabilities Needs Analysis (CNA), INDOPACOM TBA for Competition, and INDOPACOM TBA for Armed Conflict revealed 37 capability gaps preventing AHS from carrying out its mission during LSCO (McGowan, 2024). These gaps drove the Medical Capability Development and Integration Division (MED CDID), a subordinate of AFC, to host multiple limited objective experiments (LOE) focused on AHS's ability to execute it mission during LSCOs. Two of these events focused heavily on intra-theater medical evacuation (Blakeney & Boenker, 2023).

In June 2022, MED CDID hosted a patient movement (PM) medical LOE at Fort Gregg-Adams, Virgina. In collaboration with the U.S. Army Sustainment Center of Excellence, the MED CDID gathered subject matter experts (SME) from across DoD military service branches to examine the complexity of patient movement within the multi-domain environment of LSCOs. Although focused heavily on Army capabilities, the LOE highlighted multiple gaps in the joint force's ability to successfully clear LSCO battlefields within INDOPACOM (Huggins et al., 2022). In February 2023, MED CDID conducted a follow-on LOE focusing explicitly on Army medical evacuation (MEDEVAC). Conducted at Joint Base San Antonio (JBSA), Texas, the MEDEVAC LOE again highlighted gaps in the Army's ability to successfully carry out intra-theater medical evacuation during LSCOs. Both LOEs used operationally based vignettes to simulate anticipated LSCO conditions faced by the Army of 2030 (Blakeney &

Boenker, 2023). The result of the experiments showed a need to address several capability gaps. One of the key findings in both LOEs was the lack in delineation of roles and responsibilities between the joint services and combatant commands regarding intra-theater multi-modal patient movement. This includes both patient evacuation and regulation (Blakeney & Boenker, 2023).

TARGETING WEAKNESSES TO SHORE UP CAPABILITY

The DoD utilizes the joint integrated capability development system (JCIDS) to identify and address doctrine, organization, training, material, leadership and education, personnel, facilities, and policy (DOTMLPF-P) capability gaps (Joint Requirements Oversight Counsil [JROC], 2021). AFC used the JCIDS three phased capability-based assessment (C-BA) to determine solutions for multiple DOTMLPF-P gaps identified across previously mentioned assessments and experiments. Given battlefield casualty clearance is paramount to joint commanders' continued maneuverability, the Joint Force should share responsibility for evacuation services and closing related capability gaps (Blakeney & Boenker, 2023). Collaboration provides a way to address AHS DOTMLPF-P gaps and is ever-important given the intricacies of the multi-domain environment and increasing reliance on joint functions.

PROMOTING STANDARDIZATION THROUGH DOCTRINE AND POLICY

The current JP 4-02, Health Service Support, uses the term tactical evacuation to describe multi-modal medical and casualty evacuation within a combat setting. Senior leaders delineate the two subtypes of evacuation by the terms dedicated and designated. Responsible agents, across the joint force, differ depending on the designation given to an asset. Furthermore, DoD policy grants geographic combatant commanders (GCC) command and control (C2) responsibilities over theater evacuation systems (SECDEF, 2018). Given, the Army lacks the independent ability to synchronize multi-modal evacuation efforts and the DoDs position on C2, evacuation requires a joint approach (Blakeney & Boenker, 2023). One potential solution is the modification of Army and joint publications to clearly delineate and redefine evacuation roles and responsibilities. This includes authorities for planning, coordinating, synchronizing, intelligently tasking, and executing multimodal-patient movement across JOAs. Inclusion of the joint services and combatant commands should enhance the forces' overall ability to provide intra-theater evacuation during LSCO (Blakeney & Boenker, 2023). A supporting option is the updating of DoD Directive 5100.01 with guidance from the Joint Chiefs of Staff (CJCS). The direct assigning of new roles, missions, and authorities for intra-theater multi-modal patient movement will force joint partners to develop new doctrinal concepts and capabilities. Furthermore, updating DoDI 6000.11 ensures intra-corps, intra-theater, inter-theater medical regulating roles, missions, processes, and authorities receive proper attention across the joint formation. Again, a joint force problem requires joint force solutions codified in writing (Blakeney & Boenker, 2023).

PUTTING FOCUS ON ORGANIZATIONAL AND MATERIAL INVENTORY

Currently, the Army lacks sufficient multi-modal transport capability to account for extreme distances between aerial and/or seaports like those present within INDOPACOM. Luckily, the Army identified a material solution by means of The Future Long Range Assault Aircraft (FLRAA) Program, initiated in 2019. The goal of identifying a new aircraft capable of closing gaps associated with long distance travel came to fruition in 2022 when the DoD awarded a development contract to aircraft manufacturer Bell Textron. The company's replacement for the UH-60 Blackhawk is set to support the Army of 2030 and beyond (Lacdan, 2022). In the interim, using joint force assets should make the travel distances manageable. For example, using naval vessels as ambulance exchange points for rotary wing aircraft or Airforce assets for intra-theater patient movement. Material solutions aid in the physical act of evacuation, however transportation without care can lead to poor survivability results.

Currently, the Army is the only service nationally mandated to provide an advanced level of care aboard intra-theater evacuation platforms. Unfortunately, this requirement only applies to aeromedical evacuation units. The standard of care directed by the 2013 NDAA was a result of a disparity in care between paramedic and non-paramedic trained medical providers. Congress effectively set a precedence of care aboard military evacuation platforms (DHB, 2011; H.R., 2012). To support this level of care aboard all possible transport platforms, joint forces must determine the appropriate amount of personnel required at echelon. This includes identifying appropriate knowledge, skills, and attributes (KSAs), necessary to plan, coordinate, synchronize, and intelligently task assets to enable the medical evacuation (Blakeney & Boenker, 2023).

BREAKTHROUGH: ASSESSING TRAUMATIC BRAIN INJURY

Mr. Jasper assumed duties as the Project Manager, Warfighter Readiness, Performance, and Brain Health (WRPBH) Project Management Office, U.S. Army Medical Materiel Development Activity (USAMMDA) in March 2019. As Project Manager, Mr. Jasper is responsible for overseeing and directing all aspects of cost, schedule, and performance to accomplish program objectives for the development, production, and sustainment of medical products in the Defense Health Agency's WRPBH advanced development portfolio.

Mr. Jasper has over 18 years of experience in government service supporting Army and Joint Service programs. Prior to his current position, Mr. Jasper served as the Acting Civilian Deputy to the Principal Assistant for Acquisition, directly reporting to one of two Senior Executive Service members within the U.S. Army Medical Research and Development Command (USAMRDC).

Mr. Jasper served as the Deputy Project Manager for the Pharmaceutical Systems Program Management Office (PSPMO) at USAMMDA from October 2016-November 2018. From 2009-2016, he served as a Product Manager within the PSPMO, leading integrated product teams in the advanced development of infectious disease and combat casualty care medical products for U.S. Service Members.

Prior to 2009, Mr. Jasper served as the Chief, Product Technical Operations, Division of Regulatory Affairs and Compliance within the U.S. Army Medical Research and Materiel Command and served the government as a contractor with Science Applications International Corporation. Additionally, Mr. Jasper spent several years as a Research Engineer and Laboratory Supervisor conducting orthopaedic-biomechanics research at the University of Maryland and the Johns Hopkins University International Center for Orthopaedic Advancement. Mr. Jasper has also worked as a Research Engineer for the Army Research Laboratory's Non-Lethal Technology Program and worked briefly on the Airborne Warning and Control System program at Northrup Grumman.

The U.S. Army announced in April 2024 that a new TBI test developed with industry partner Abbott was cleared by the U.S. Food and Drug Administration. It allows for assessing a patient for TBI using a few drops of whole blood at the patient's bedside, yielding lab-quality results within 15 minutes. Combat & Casualty Care spoke with Mr. Louis Jasper, Project Manager for Warfighter Readiness, Performance, and Brain Health (WRPBH), U.S. Army Medical Materiel Development Activity (USAMMDA), Fort Detrick, Maryland, to learn more about the implications of this test in assessing TBI in Joint Service personnel.

C&CC: Why is this new test such an important milestone in terms of managing TBI in Warfighters?

Mr. Louis Jasper

Project Manager
Warfighter Readiness, Performance, and Brain Health (WRPBH)
U.S. Army Medical Materiel Development Activity (USAMMDA)

Mr. Jasper: Traumatic brain injuries have a significant impact on our Nation's Warfighters. Since 2020, U.S. service members have experienced almost 500,000 TBIs. Until now, the only objective means we have had to assess service members for TBI were Computerized Tomography (CT) and Magnetic Resonance Imaging (MRI) scans—methods that are not available in the forward operational environment. Now, we have a rapid and objective way to assess our Warfighters for TBI using only a few drops of blood. Moreover, this technology can be used at role 2 and role 3 in the operational environment, enabling DoD medical personnel to make more informed and more timely evacuation and treatment decisions.

C&CC: Why are technologies like ATBI important for enabling lifesaving care during combat operations in austere environments?

Mr. Jasper: In the forward operational environment, our medical staff often lack access to CT scanners to enable an objective assessment

for TBI. Technologies like the ATBI provide medical personnel with a capability that they do not currently have: the ability to rapidly assess for injuries that historically required the robust medical assets of role 3 and role 4 medical units. In Large Scale Combat Operations (LSCO), medical assets will likely be overwhelmed. Tools like the ATBI will increase the capabilities and bandwidth of our forward medical personnel, enabling them to save more lives and (in the case of TBI) retain combat power.

C&CC: Why is it necessary to provide rugged assessment and treatment options for providers far forward in the battlefield?

Mr. Jasper: Field medical personnel function in austere conditions. More importantly, they function during battle. It is our responsibility to ensure that military units receive reliable, deployable systems that work under these conditions, whenever the equipment is needed. Accordingly, the medical equipment we develop is designed and rigorously tested to ensure it is field suitable.

C&CC: Please tell us a bit more about TBI assessment and treatment options and their importance to the Department of Defense.

Mr. Jasper: The current standard of care for TBI is clinical diagnosis relying on self-reporting of the incident, symptoms, and clinical examination by a health care provider. Service members are also frequently sent/evacuated for a CT scan to assess for brain bleeding, as individuals with significant injury may initially have few symptoms and a normal-appearing clinical examination. However, frequent evacuations will be problematic in near peer/peer Large Scale Combat Operations (LSCO). Implementation of the ATBI will enable more efficient evacuation for the TBI casualties that require further evaluation while retaining those with uncomplicated mild TBI (mTBI). Additionally, the ability to assess TBI more rapidly and objectively on the battlefield will help to mitigate injury progression and expedite return to duty.

C&CC: How will the use of this test help to improve care for Warfighters with possible TBIs at and near the front lines?

Mr. Jasper: Currently, there are few treatment options for TBI on the battlefield. This test, however, will help providers to avoid unnecessary evacuations of casualties with uncomplicated mild TBI (mTBI). The current test is FDA-approved to aid in the evaluation of casualties suspected of having a mild TBI within 24 hours of injury to assist in determination of the need to obtain CT imaging of the head. Specifically, a "not elevated" test interpretation is associated with an absence of brain lesions, such as bleeding, on CT. In the absence of other concerning neurological findings or other non-central nervous system injuries, a provider at or near the front lines could safely determine that the casualty does not need to be evacuated, while casualties with elevated biomarkers could be better prioritized for evacuation. During OIF/OEF/OND, frontline providers tended to "over-triage" isolated mTBI casualties, with 68 percent of isolated mTBI casualties being evacuated by rotary wing. The ATBI will enable more of these casualties to be managed farther forward following the Progressive Return to Activity guidelines. This, in turn, will enable more rapid return to duty.

C&CC: Please describe the development process. Who were the partners and when did you start working on this technology?

Mr. Jasper: The ATBI program is an example of how the U.S. Army Medical Research and Development Command can take a capability need and translate it into a fielded solution. In this case, the genesis of the ATBI program was through a Congressionally Directed Medical Research Program-funded grant to the Walter Reed Army Institute of Research (WRAIR). Through the early work conducted by WRAIR and its partners, they completed experimental animal model and pilot clinical work demonstrating proof-of-concept in detecting specific protein biomarkers that are present in the blood after a TBI, namely GFAP and UCHL1 (markers for neuroinflammation and neuronal cell death, respectively). From there, an Integrated Product Team was initiated to develop a capability for the acute management and triage of TBI on the battlefield.

In 2014, USAMMDA contracted Banyan Biomarkers to perform a pivotal, 2000-patient trial to support a pre-market approval submission to the FDA and established a partnership with Abbott Point of Care to transfer the biomarker assay technology to the highly portable i-STAT device. In February 2018, the FDA granted the de novo request to Banyan Biomarkers for the commercialization of a benchtop, in vitro diagnostic blood test to aid in the evaluation of concussion as part of its Breakthrough Devices Program. This first version, prototype assay established the regulatory pathway for the TBI biomarkers and set the foundation for development of a field-portable capability.

The subsequent partnership with Abbott Point of Care focused on developing a field-portable ATBI capability, enabling field laboratory personnel to quickly detect a brain injury using only a few drops of blood. The development included a plethora of testing to include bench development, clinical trials, user evaluations, environmental testing, a formal Limited User Test, and a Clinical Implementation Operational Assessment conducted at Womack Army Medical Center and in CENTCOM. In 2021, we were able to achieve FDA approval for a plasma assay and in March 2024, we achieved FDA approval for the whole blood assay, paving the way for fielding of a rapid and objective method to assess for TBIs on the battlefield.

C&CC: What are some current focus areas and programs within the Warfighter Readiness, Performance, and Brain Health Project Management Office that may have an impact on future combat trauma care capabilities?

Mr. Jasper: Many of our efforts are now focused on future capabilities to meet the Army's Medical Modernization Strategy as well as the challenges of LSCO. Our programs will address capability gaps associated with behavioral health on the battlefield, including post-traumatic stress disorder treatments, lifesaving pharmaceutical treatments for TBI on the battlefield, next-generation TBI assessment devices that can be used far-forward in role 1, and blast overpressure monitoring systems.

C&CC: What is USAMMDA's mission and how does it support Warfighter health and readiness?

Mr. Jasper: USAMMDA's mission is to develop and deliver medical capabilities to the Army and Joint Force. The WRPBH Project Management Office is also committed to this mission. Specifically, our focus is on medical products that ensure the readiness, optimal performance, and brain health of U.S. service members. We do this through executing acquisition rigor throughout the development process, culminating in the fielding of novel medical solutions that meet mission, improve health, build readiness, and help our Joint Services to win the fight.

MOLDING THE NEXT-GENERATION LARGE SCALE COMBAT OPERATIONS-READY COMBAT MEDIC

The Joint Special Operations Medical Training Center (JSOMTC) Special Operations Combat Medic (SOCM) training course at the John F. Kennedy Special Warfare Center and School (JFKSWCS), Ft. Liberty, NC, combines skills in tactical combat casualty care (TCCC) with core fundamentals to prepare field medics for global standards in future large scale combat operative trauma response environments.

By MAJ Brett Ambroson, Director, Special Operations Combat Medic Course, JFKSWCS, SWMG (A)

Soldiers participating in the Special Forces qualification course, try to revive a simulated casualty, during the Robin Sage exercise at Ft. Liberty, NC. Robin sage is the culmination exercise for all Special Forces qualification course students. (U.S. Army courtesy photo/Released)

The Special Operations Combat Medic (SOCM) course at the Joint Special Operations Medical Training Center (JSOMTC), an educational facility under the Special Warfare Medical Group (Airborne), or SWMG (A), is a provision of the U.S. Army John F. Kennedy Special Warfare Center and School (USAJFKSWCS), Ft. Liberty (formerly Ft. Bragg), North Carolina. The SOCM course produces Special Operations Advanced Tactical Practitioners (SO-ATP), a certification required for all enlisted medical providers under U.S. Special Operations Command (USSOCOM), and a prerequisite for Special Forces Medical Sergeants and Special Operations Independent Duty Corpsman within the U.S. Marine Forces Special Operations Command (MARSOC). The SOCM course is a 36-week, rigorous period of instruction focused on producing tactically advanced, certified paramedics and advanced medical providers for SOF units under USSOCOM. Students learn multi-patient, multi-system trauma care and prolonged casualty care alone, and in resource limited environments. The curriculum is validated and certified within USAJFKSWCS, Army Training and Doctrine Command (TRADOC), and successful completion results in an associate's degree via the Uniformed Services University.

REALIGNING TO BROADEN MEDIC FOUNDATIONAL READINESS

Historically, the SOCM course curriculum has been taught based on a mix of advanced trauma life support and tactical combat casualty care (TCCC). Some of the processes and verbiage were changed to accommodate for more advanced skills, procedures, and thought processes students use to care for multisystem trauma patients, but the overarching algorithms and treatment protocols for trauma were the same or very similar. Over the last couple years, the SOCM course has been re-aligning its educational objectives to start teaching formal TCCC from the beginning of the course, to include many students with no medical training background. The DoD language for trauma is TCCC. By shifting education back to TCCC and having students build from that, they can now communicate effectively with other DoD medical assets in the care, stabilization, transport, and evacuation of combat wounded. Students are trained with follow-on assignments to 1st Special Forces Command, 75th Ranger Regiment, 160th Special Operations Aviation Regiment, U.S. Army Special Operations Command, MARSOC, and partner nation SOF units worldwide. The curriculum is up to date with specific directives from USSOCOM, updated Joint Trauma Service Clinical Practice Guidelines, TCCC, feedback from operational units, and general medicine best practices. The SOCM course produces a baseline interoperable U.S. SOF medic capable of interacting and integrating with U.S., allied, and international medical assets. Some instructional pieces are the same as those used in conventional force medic training, however, are taken beyond the conventional force teaching, expanding on base

Students from the U.S. Army John F. Kennedy Special Warfare Center and School who are in the Special Operations Combat Medic Course work alongside trauma specialists from Cooper Trauma Center in Camden, New Jersey. The Soldiers attending the course underwent intensive training at the trauma level-1 hospital that will allow them to specialize in trauma management, infectious diseases, cardiac life support and surgical procedures in order to provide medical care while deployed to remote and austire locations throughout the world. (U.S. Army photo illustration by K. Kassens)

algorithms and testing students on critical thinking, reasoning, multi-tasking, and other SOF-specific skills. The student population is a mix of prior trained conventional medics, prior military occupational specialty (MOS) soldiers, and recruits without a medical professional background. A good deal of commonality in course training exists with conventional and international unit training as a common base language can only be beneficial. International students from partner nations are integrated within the course which helps expand the understanding of tactical medicine within the operational lens of U.S. allied countries. Shared language and experience through the SOCM course enhance international partnerships between providers. The course also exports cadre instructors to allied nation schools to help with curriculum development and medic education.

ADDRESSING AN OPERATIONAL SHIFT TO LARGE SCALE COMBAT OPERATIONS

One of the biggest challenges currently faced is U.S. military posture change from counterinsurgency operations and the Global War on Terror (GWOT) to Large Scale Combat Operations (LSCO). U.S. Department of Defense operational planning and doctrine has been moving back to large area, denied space, and cyber threat focus missions. The last twenty-plus years have seen our medics shaped through wars in Afghanistan and Iraq, among other low-scale conflict zones. Training to promote the ability to rapidly evacuate patients to nearby Role 2 or Role 3 medical assets and the ability to transfuse blood close to point of injury enables U.S. field combat medical care to exact a high survivability rate. With the current conflict in Ukraine, a shift back toward large scale continental war zones and typically-associated injuries/casualties is posing challenges that this shift in potential conflict needs to produce in terms of changes in combat medical training. A large focus on Prolonged Casualty Care (PCC) is giving medics the skills and training to care for critically-injured patients for up to 72 hours where LSCO-defined warfare does not allow for immediate medical evacuation. Adjustments are being made in how triage and mass-casualty scenarios are trained for based on large unit conflict, area-effect high-explosive weaponry, low medic-to patient ratios, and more. Movement of patient care away is happening from fixed structure treatment facilities to smaller, mobile casualty evacuation (CASEVAC) platforms and alternative treatment sites, along with re-integration of low tech along with high tech treatment and monitoring capabilities.

AN INTERNATIONAL PARTNER-SHARED, SKILLS-DRIVEN FUTURE

Conventional medics are today being familiarized with many of the advanced procedures SOCM medics perform, and now, SOCM medics are being formally trained on the algorithms and procedures their conventional counterparts are learning. All this is paramount in furthering the interoperability of conventional and SOF forces. Lastly, the mission of many SOF medics is to train their teammates and partner nation forces on combat casualty care. TCCC is a very digestible, easy to understand language for both medical and non-medical personnel when taught appropriately. Having a strong background in TCCC helps U.S. medics train their teams and partners, therefore becoming even better force multipliers for patient care on the battlefield. The SOCM medic continues to evolve and improve based on the current and past performance of combat trauma practitioners. Goals of SOCM moving forward are integrating newer, more reliable telemedicine capabilities, training on advanced diagnostic tools such as pocket-ultrasound, and integration of conventional assets.

AN EVOLUTION IN AIRWAY MANAGEMENT

By Dr. Richard Ma, Chief Medical Advisor

Air management via tracheostomy has been documented in Hindu literature from 2000 BC. In 1878, the first elective endotracheal tube placement was documented with anesthesia. During the First World War, the intubation and tracheostomy were widely performed. It was during this period that the superiority of intubation over tracheostomy was established. The specialty of anesthesiology was developed.

Oxygen is essential to life, and our brains are hardwired to panic when we develop shortness of breath. Having been in healthcare for more than 20 years, I have seen my share of respiratory failure and the difficulty of establishing an airway. Other than an anesthesiologist, most health care providers have as much fear as the patient when confronted with establishing an airway in patients in distress. Studies have shown that the success of intubation is around 74% on the first attempt. The overall success rate is about 97%, but with each successive attempt the patient has longer periods of hypoxemia. It is widely established that intubation is operator dependent. Complications of intubation include teeth extraction, vocal cord damage, tracheal stenosis, and vocal cord paralysis.

BUILDING ON KNOW HOW

In 1981, Dr. Archie Brain developed the laryngeal mask airway (LMA) to make the process of establishing an airway easier. He was inspired to do this after having difficulty with intubating a patient. The LMA is easier to place because it is done without having to visualize the vocal folds. Once inserted, it is inflated to block off the esophagus so that patients can be adequately oxygenated. Using the LMA avoids many of the complications of endotracheal intubation.

Complications of LMA include laryngeal spasm, sore throat, nerve injury, and pharyngeal rupture. Studies have shown that the success rates of intubation on the first try with LMA is around 81 percent.

The aerFree AMS (airway management system) device was recently invented as a non-invasive method to maintain a patient airway, in spontaneously breathing adults undergoing medical procedures less than 2 hours in duration where the patient is intended to have mild-to-moderate sedation. The aerFree device is a simple device applied to the anterior aspect of a patient's neck. Once the device is placed on the neck, constant negative pressure is applied to keep the airway patent. This device is very simple to use and the only complication is mild irritation of the skin of some patients from the pressure.

EASING VOLUME-DRIVEN STRAIN

Our healthcare system is currently overburdened and the wait time for appointments and procedures are excessively long. I see the aerFree device as one of the solutions to the long wait times. Using this device, you can have a nurse place it on a patient for short surgical procedures. This will make surgical centers more efficient because it will free up the anesthesiologist to take care of more complex patients. If intubation or LMA is used in the same cases, then the start time is delayed by waiting for the anesthesiologist to be free.

Further, when a procedure is done, the patient must wait for the anesthesiologist to remove the airway. If each case can be shortened more patients can get procedures on the same day. Also, the longer a patient is sedated, the more complications they will have with anesthesia. Shortening the duration of cases will lead to better care, less complications, and improving the wait times for procedures. Even though most cases are elective, many are done to screen for cancer. Minimizing any delay in treatment can greatly increase a patient's chance of survival.

EFFICACY OF NEGATIVE PRESSURE THERAPY

Respiratory complications during moderate sedation are reported to be infrequent. However, the true incidence of respiratory impairment may be underestimated by relying on pulse oximetry as the sole measure of respiratory function in patients receiving supplemental oxygen. An open label pilot study was conducted to, 1) determine the frequency of apneas and oxygen desaturation during routine colonoscopy as assessed by a Nox T3 monitoring system (Nox Medical), and 2) investigate the effects of negative pressure therapy applied to the upper airway using aerFree AMS. Twenty-four control subjects were enrolled to assess the frequency of apneas and hypopneas ≥ 30 sec. Thirty subjects were studied with the application of aerFree AMS. The two groups were similar with respect to age, sex, BMI, STOPBang scores and sedation dosage. The results are summarized below:

	Control (n=24)	aerFree (n=30)
Mean Apnea Hypopnea Index (range)	12.9 (0-42.4)	4.1 (0-18)
% of subjects with Obstructive Apnea (OA)	87.5	10
Mean episodes of OA/subject	2.9	0.1
% of subjects with O_2 desaturation ≥ 5 mm for ≥ 30 sec	54	12.5
% of subjects with O_2 saturation < 90%	30	13.3
% of subjects requiring increase in O_2	41.6	10

These observations suggest that obstructive and central apneas are common during moderate sedation. The application of aerFree AMS is a safe and effective means of diminishing obstructive apneas and improving oxygenation.

NEW INNOVATION

aerfree® AMS

Airway Management System

First Non-Invasive External Airway Aid

FDA Cleared

Avoid Airway Issues Before They Start

Clinical Benefits

Non-Invasive Airway Patency Support: May eliminate invasive interventions during sedation
Easy to Use: Applies to patient in seconds
Simple: Minimal training required. May be used by personnel of all experience levels
Effective: Used prophylactically, reduces the occurrence of upper airway collapse
Improves patient safety and comfort
Hands-Free Chin Lift: Decreases interventions which can disrupt workflow

Clinical Evidence

Clinical Study: Conducted at Scripps Clinic, La Jolla, California, utilizing aerFree AMS during screening colonoscopy procedures.

Conclusion: During screening colonoscopy, sedation-related respiratory impairment is significantly reduced by aerFree AMS.[1]

Study published in Endoscopy, June 2016

45% reduction in respiratory impairment
92% reduction in obstructive apneas >20 sec.
82% fewer patients with obstructive apneas
76% fewer patients required supplemental 0_2

For more information, visit our website at www.aerfree.com.

[1]Kais, S.S., Klein, K.B., Rose, R.M., Endemann, S., Coyle, W.J. (2016). Continuous negative external pressure (cNEP) reduces respiratory impairment during screening colonoscopy: a pilot study. Endoscopy 48(6), 584-587.

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Website: www.aerFree.com

CALENDAR OF EVENTS

JUN 4 – 6
Future Soldier Technology USA
Arlington, VA
Smgconferences.com

JUN 24 – 25
AIM Health R&D Summit
San Antonio, TX
Velocitytx.org

AUG 13 – 15
Indo Pacific Irregular Warfare Symposium
Honolulu, HI
Gsofindopacific.org

AUG 13 – 15
GVSETS
Novi, MI
Ndia-mich.org

AUG 20 – 22
Defense Health Information Technology
Dallas, TX
Dhits.com

SEP 3 – 5
Commercial UAV Expo
Las Vegas, NV
Expouav.com

SEP 9 – 13
EMS World Expo
Las Vegas, NV
Emsworldexpo.com

SEP 16 – 18
AFA Air Space Cyber Conference
National Harbor, MD
Ntpevents.com

OCT 1 – 3
Global SOF Europe
Bratislava, Slovak Republic
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OCT 14 – 16
AUSA Annual Meeting
Washington, DC
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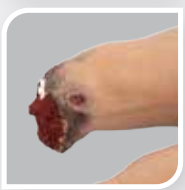

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