COMBAT & CASUALTY CARE

Fall/Winter 2019
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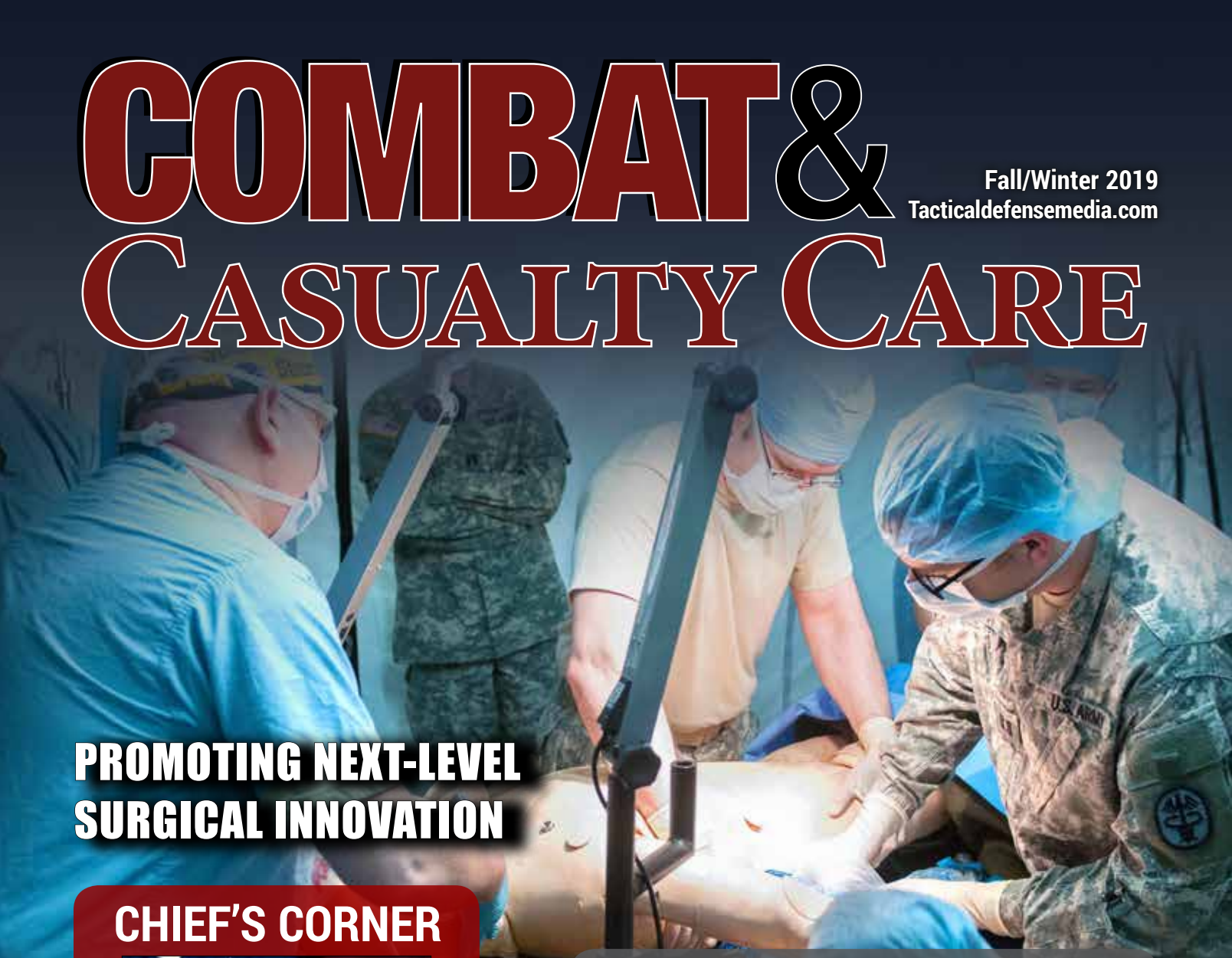

PROMOTING NEXT-LEVEL SURGICAL INNOVATION

CHIEF'S CORNER

LTC George Kallingal, M.D.
Chief
Urologic Oncology
Brooke Army Medical Center

Maj. Julia Nuelle, M.D.
Chief
Orthopaedic Hand, Upper Extremity, Microvascular Surgery
BAMC

Mr. Bill Tinston
Program Executive Officer
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Hands-Free Med Comms ■ MEDEVAC
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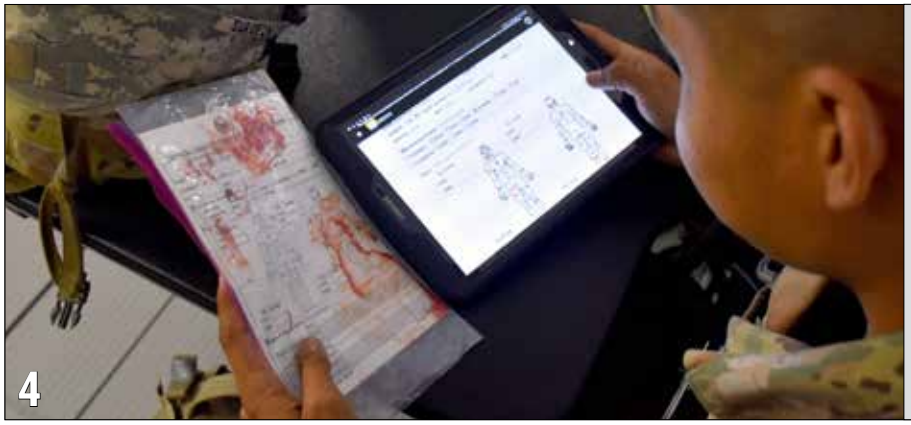

NEXT LEVEL NEXT-GEN MED COMMS

The U.S. Army's latest medical communication system, the Medical Hands-free Unified Broadcast or MEDHUB, has reached a milestone test before fielding.

By Ashley Force

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ADVANCING SURGICAL AUTONOMY

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Brooke Army Medical Center

ADVANCING REGENERATIVE MEDICINE

Maj. Julia Nuelle, M.D.

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PROMOTING CONTINUITY OF CARE

Mr. Bill Tinston

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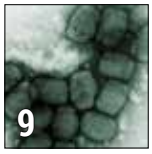
Hands-free for Casualty Focus
A new U.S. Army Medical Hands Free Unified Broadcast (MEDHUB) communication system will provide medics greater freedom of casualty care in medical evacuations.
By Jeff Soares



Enhancing Military Viral Immunity
Under the direction of the Army's Medical Research Institute of Infectious Diseases (USAMRIID), a new smallpox vaccine has recently been approved for fielding.
By Caree Vander Linden

Partnering for Materiel Assurance
The Defense Logistics Agency (DLA) and Department of Veterans Affairs (VA) have recently teamed up to improve veteran care by centralizing the procurement of medical supplies.
By DLA and VA

Care Perspective: Traumatic Brain Injury
The U.S. Department of Defense, the Departmentof Veterans Affairs is working with industry to advance the prevention, diagnosis, and treatment of traumatic brain injury or TBI.
By Ryan M. Leone

Cover: Madigan Army Medical Center personnel team up to with Soldiers of 758th Forward Support Team during a week-long surgical exercise held outside Madigan, on Joint Base Lewis-McChord, Washington. Four live patient surgeries were also performed in the tented environment of the FST. (U.S. Army photo by Sgt. Youtoy Martin, 5th Mobile Detachment)

Departments

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INSIGHTS

The Fall/Winter issue of *Combat & Casualty Care* focuses on advances in surgical and neurological medicine spurred on by need in military application.

With this in mind, *C&CC* spoke recently with LTC George Kallingal, Chief of Urologic Oncology, Brooke Army Medical Center (BAMC), Ft. Sam Houston, TX, regarding the use of a ground-breaking surgical robotics capability called the da Vinci Single Port system that brings multi-jointed wristed instrumentation and 3-D camera technology to a surgeon's fingertips. From robotics to regeneration, we stay at BAMC for a look at the latest efforts to push innovation in neural tissue regrowth. Maj. Julia Nuelle, BAMC's Chief of Orthopaedic Hand, Upper Extremity, and Microvascular Surgery, talks about ways medical science is literally closing the gap in damaged nerve environments to enable natural healing processes where once distances were too great.

Of course, the best way to ensure healthy nerve growth and repair is to avoid traumatic injury in the first place. In this issue's Care Perspective, we highlight traumatic brain injury (TBI) and some of the current trends in both prevention and progression mitigation. The U.S. Army's new Integrated Head Protection System (IHPS), a component of the Soldier Protection System, is the latest improvement to the Enhanced Combat Helmet (ECH) and offers fewer perforations which weakened ECH structural integrity.

From head protection to hands-free communication, the next-generation of Medical Hands-free Unified Broadcast (MEDHUB) will soon enable field combat medics everywhere to put their hands where they're needed most; on their patients. Targeted to the aeromedical community, MEDHUB will bring the advantages of transport telemedicine to medical evacuation, providing medics with greater data flow to and from treatment facility for better post-transport casualty outcomes.

In each issue, we try to provide *C&CC* readers an update on the deployment of DoD's electronic health records system upgrade. Mr. Bill Tinston, Program Executive Officer, Defense Health Management Systems (PEO DHMS), spoke recently with *Combat & Casualty Care* regarding the state of MHS GENESIS roll out and collaboration with the Joint Operational Medicine Information Systems (JOMIS) Program Management Office.

Be sure not to miss this issue's Preventive Care spotlight which takes a look at recent achievements in smallpox and monkeypox viral vaccines offering disease protection for U.S. military personnel deployed to non-immune, high risks locations around the world. And from a partnering perspective, the Defense Logistics Agency (DLA) and Department of Veterans Affairs (VA) are working to ensure medical materiel is where it needs to be, before it is needed.

Your comments and suggestions are welcome. Thanks for the continued readership!

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NEXT LEVEL NEXT-GEN MED COMMS

The U.S. Army's latest medical communication system, the Medical Hands-free Unified Broadcast or MEDHUB, has reached a milestone test before fielding.

By Ashley Force, USAMMDA

With MEDHUB, medics can use a tablet to complete a Tactical Combat Casualty Care Card electronically. At the receiving hospital, clinicians can see the data for incoming patients and ensure that they have proper staff and equipment on hand for treatment. (Photo by Ashley Force, USAMMDA)

Two years ago, a lifesaving medical communication device was only an idea exchanged off-hours on a napkin. Now, the Medical Hands-free Unified Broadcast, or MEDHUB, system has completed its latest round of user testing to assess functionality in an operational-relevant environment. The Transport Telemedicine Systems program, which was originally initiated in 2013, was focused on bidirectional communications, also known as telementoring. In January 2017, an After Action Review (AAR) was conducted with the Aero-Medical Evacuation user community. The results: due to the noise and vibrations, telementoring would be difficult in an operational environment. In addition, review of the battlefield communication platforms showed there was not sufficient bandwidth for telementoring.

Enhancing Situational Awareness

Following this AAR, Jay Wang, product manager for the U.S. Army Medical Materiel Development Activity (USAMMDA) Warfighter Health, Performance and Evacuation Project Management Office, established the MEDHUB concept. The MEDHUB system provides situational awareness of evacuation patients to improve readiness of deployed hospitals and reduces medic burden, while leveraging the minute Department of Defense tactical bandwidth available. Together with the help of his team of engineers, acquisition professionals and industry partners, the program underwent a new acquisition strategy, which allowed rapid prototyping that accelerated the schedule. Having completed

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independent operational assessment at Fort Bragg, North Carolina, with the 44th Medical Brigade in a Field Training Exercise, MEDHUB has reached Technology Readiness Level 8 within 24 months, and is one step closer to saving lives.

"Studies have shown, there's poor verbal and written communication when handing patients off between medical providers in a life and death situation. Not because they're bad at documenting or communicating, it's because their priority is performing lifesaving interventions," said Wang.

In a standard Army ambulance, one medic may treat up to six patients. MEDHUB uses U.S. Food and Drug Administration-approved medical devices integrated with an Android tablet and the existing DoD tactical satellite network to transmit patient information to the receiving hospital. MEDHUB relays that information as soon as patients are on the medical evacuation vehicle, increasing communication and providing enhanced situational awareness by allowing the deployed hospitals to see near-real-time patient status.

Advancing Data Speed

Without MEDHUB, deployed hospitals typically receive patient information from the MEDEVAC vehicle in the form of a radio call five minutes before the patients arrive. Conversely, when utilizing MEDHUB, medics complete a Tactical Combat Casualty Care card faster and with two times the accuracy compared to pen and paper.

Before deploying MEDHUB in the hands of Soldiers, MEDHUB must be tested for suitability and effectiveness in an operationally relevant environment. During the independent operational assessment, MEDHUB was evaluated during patient transport in ground and air ambulances, from the point-of-injury to the deployed hospital.

The 44th Medical Brigade provided test participants, some playing the role as medic, others as injured Soldiers, and it also provided ground ambulances and two hospitals. The Iowa National Guard provided two Blackhawk air ambulances and flight crews. A total of 10 scenarios were completed with over 40 Soldiers.

The only communication the MEDHUB team had with test participants was during the initial new device training session, which only lasted four hours. This ensured the best possible product would be fielded, because the Soldiers are responsible for operating MEDHUB without assistance from the product manager or trainers.

"The Soldiers either make it or break it on their own. The scenarios are as realistic as possible because our engineers will not be there with the Soldier if MEDHUB breaks out in the field," said Wang. "Through realistic simulations, we can identify the best parts of the system and the worst parts, and fix it before it gets to the field."

Assessing Real-World Application

The U.S. Army Medical Department Test Board from San Antonio independently evaluated the system during independent operational assessment. Its role was to gather data while objectively monitoring everything from how the medics used the tablets, to the performance of the vital sign monitors and the transmission of MEDHUB data to the receiving hospitals.

"During data collection, we were not focused on the patient care or user skill level; instead, we documented their execution of what they were trained on regarding the system under test. Our goal was to collect as much data and get as much Soldier feedback as we possibly could so that we have a strong report," said David Lee, AMEDD's primary test officer from the Test Board.

The Medical Evacuation Proponency Division (MEPD), which is the requirements office, observed the MEDHUB test. As a capability developer, this group ensures MEDHUB meets the Army's need for an automated solution for improved deployed hospital's patient situational awareness and improved patient documentation.

"I think MEDHUB is a technology worth a hard look. It has proven that a medical device can communicate with other medical devices, and it can utilize a military network to transmit information. Those are key pieces," said George Hildebrandt, retired flight medic and MEPD analyst.

On the second test day, key leaders observed MEDHUB in action and were truly impressed with the product's capabilities.

"This collaborative effort is critical to making these tests successful. It's really important to get that real user feedback during user testing because we really just want to make sure the system works for the Warfighter," said COL Ryan Bailey, former USAMMDA commander.

"Data collected from the MEDHUB testing will ultimately determine its future fielding and use on the modern battlefield," said COL Kimberlee Aiello, 44th Medical Brigade commander. "The technology it delivers has proven to be beneficial in its function to provide critical patient information in a timely and accurate manner."

Focus to Date

Over the last two years, the MEDHUB team has reduced the logistical burden and maximized the fielded capabilities. One improvement is the ability to rapidly replace sensors. If a sensor breaks, a new sensor can easily be paired to the tablet — as easily as pairing your cell phone to your home speaker, thus increasing the operational availability of MEDHUB.

In addition, the MEDHUB team has continued to add medical capabilities to the system, such as the MEDHUB's Drug Rack, or DOSE, which stands for Drug Optimal Safety Equipment. DOSE existed as a prototype since 2018 and was tested for the first time during MEDHUB's testing in an operational environment. The medic, through use of the tablet, will select the medication, and DOSE will illuminate the corresponding drug to reduce medication errors. The device controls the access to drugs and tracks the use of narcotics, thus increasing the safety of the patient and provider. This product ensures the right drug, dosage and amount is provided to the right patient, preventing life-threatening medication errors.

Developing the MEDHUB program has required monumental efforts from the U.S. Army Medical Research and Development Command; USAMMDA; the U.S. Army Medical Materiel Agency; U.S. Army Combat Capabilities Development Command - Aviation and Missile Center; PEO Soldier; PEO Aviation; PEO Command, Control, Communications – Tactical; and Sierra Nevada Corporation.

"We are so fortunate to have gotten to where we are over the last two years. I cannot wait to field MEDHUB and help save our Warfighters' lives," said Wang.

The Operational Evaluation Report from this test will be used to influence final product design decisions and system fixes to be implemented. It will also be used to request the Milestone Decision Authority for permission to procure and deploy MEDHUB. Reaching Milestone C would mean the system will be ready for Low Rate Initial Production and an Initial Operational Test & Evaluation, which is the next step for MEDHUB.

HANDS FREE FOR GREATER CASUALTY FOCUS

The U.S. Army's MEDHUB system is expected to provide critical assistance to combat medics in medical evacuation situations.

By Jeffrey Soares, USAMMDA

Sgt. Jordan Rodgers, a combat medic from the U.S. Army Aeromedical Research Laboratory, assesses various capabilities and functions of the MEDHUB handheld electronic tablet prior to a medical evacuation simulation exercise at Fort Detrick, MD. (Photo by Jeffrey Soares, USAMMDA)

During the last week of October 2019, the U.S. Army Medical Materiel Development Activity (USAMMDA) Warfighter Health, Performance, and Evacuation Project Management Office initiated operational exercises to assess the capabilities of its Medical Hands-free Unified Broadcast system, better known as MEDHUB. This innovative device is a medical communication platform that utilizes a handheld electronic tablet to share patient information between medics and hospitals during medical evacuations. The week-long event, which took place at Fort Detrick, Maryland, included staff members from the MEDHUB product team, Army ground medics from the U.S. Army Aeromedical Research Laboratory (USAARL), and Army flight medics and Soldiers from the Maryland Army National Guard. The operational assessment was conducted by personnel from the U.S. Army Medical Department Board, which is the Army's sole independent operational test and evaluation agency for medical-related materiel and medical information management and information technology products.

Sgt. Patrick Fogle (right), a flight paramedic with the Maryland Army National Guard, reviews the MEDHUB handheld electronic tablet with Sgt. Jordan Rodgers, a combat medic from the U.S. Army Aeromedical Research Laboratory, and Austin Langdon, program analyst for the U.S. Army Medical Materiel Development Activity "(USAMMDA) Warfighter Health, Performance, and Evacuation Project Management Office during preparation exercises for an operational assessment held at Fort Detrick, MD. (Photo by Jeffrey Soares, USAMMDA)

No Hand Manipulation Necessary

Through integrating U.S. Food and Drug Administration-approved wearable medical devices, the MEDHUB system seamlessly collects, stores and transmits non-personally identifiable patient information from point-of-injury to the receiving military treatment facility or hospital. Traditionally, ground and flight medics use a handwritten Tactical Combat Casualty Care, or TCCC, card to document the vital signs, injuries, medications, and treatments of patients during MEDEVAC situations. The TCCC card is intended to stay with the individual during transport, and updated along the way by the multiple medics providing care from one point to the next. However, when the scenario is exacerbated by multiple casualties and intense conflict — and in most cases, handled by only one medic with perhaps as many as six patients — completing critical documentation can become a highly stressful process.

Austin Langdon, a former Army flight medic with the Maryland National Guard, serves as the subject matter expert for evacuation on the MEDHUB team. Langdon is very familiar with the pressure associated with intense MEDEVAC missions. Having been deployed with the Marines to Helmand Province, Afghanistan in 2012, he experienced his first mass casualty event within 45 minutes of landing at the Forward Operating Base. He was the first Army-trained medic to perform a blood transfusion in the back of a military helicopter, as part of the Vampire program. Needless to say, Langdon understands the potential of the MEDHUB system in helping to properly treat patients and save lives.

"MEDHUB doesn't replace the way medics triage a patient, or how they conduct rapid trauma assessments — it changes the way we document medical intervention" he explained. "When the medic is task-saturated, and focused on their critical patient, it may be difficult to write legibly on the patient's TCCC card in a vibrating helicopter. The MEDHUB tablet allows the medic to record administered drugs, or any lifesaving interventions, electronically on a touch screen that can capture all of the necessary documentation, which is transmitted to the hospital and can be scanned into the patient's Electronic Health Record."

"But it also helps with drug dosage calculations, per the Standard Medical Operating Guidelines," he continued. "MEDHUB automatically records the patient's weight and data, and provides the proper dose for that individual, so it's able to help increase the accuracy of drug dosages and reduce the workload for the medic. The real key is its ease of use, and its reliability — it does what it should, when it needs to."

Targeted to Specific Users

In addition to Langdon, who is the third Army-trained flight medic to serve as part of the MEDHUB product team, the group's software expert is a trained paramedic. Staff selection has been very intentional along the way, to ensure a proper mix between scientists, engineers, and experts in medical evacuation. As military ground and flight medics will be the primary user group for MEDHUB, their feedback remains critical to testing and fielding the device, which is why the recent operational assessment was so important in advancing the unit towards ultimate fielding.

"We're very grateful that the active-duty medics from USAARL and the Maryland National Guard came out to support this exercise," said Jay Wang, USAMMDA's product manager for the MEDHUB program. "Having the end-user here to actually demonstrate this capability, this will help us discover new and better ways to train other users and to develop this capability for the final fielded unit, which will allow us to build the best product for our Warfighters."

"This operational assessment allows us to work end-to-end, to see how the users utilize MEDHUB, and how the Army network supports this important capability," he continued. "This is really a follow-up on some things we weren't able to fully demonstrate at our last assessment, due to limitations of the network. However, we've already proven a large part of its capability, and this current assessment is allowing us to validate additional capabilities of the MEDHUB system."

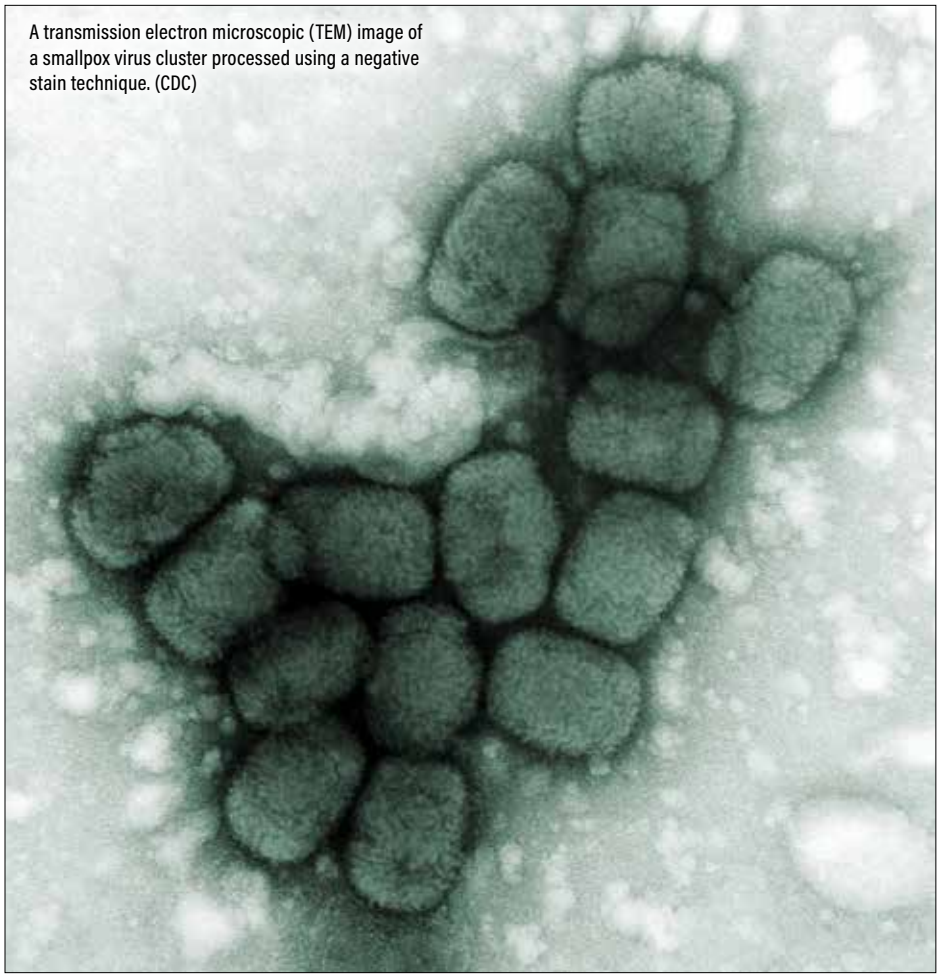
Moving Forward

Wang and his team are very pleased with the success of MEDHUB to date, and they now await the results of the recent assessment, which are expected to be released by the end of December. The group anticipates MEDHUB's use as an approved system for the military within the next few years. Although the initial end-user will be military medical personnel, the device eventually may fall into the hands of civilian medical providers as well. Regardless of who will use MEDHUB, per the observations and comments of the combat medics who participated in this operational assessment, the system should help to alleviate the burden and stress of medical documentation and drug treatment during patient evacuation, both on and off the battlefield. ▪

ENHANCING MILITARY VIRAL IMMUNITY

A recent study, under the direction of the U.S. Army's Medical Research Institute of Infectious Diseases (USAMRIID), has led to the approval of a new smallpox vaccine.

By Caree Vander Linden, USAMRIID



A transmission electron microscopic (TEM) image of a smallpox virus cluster processed using a negative stain technique. (CDC)

A new vaccine, approved Sept. 24, 2019 by the U.S. Food and Drug Administration, prevents both smallpox and a related disease, monkeypox, in adults. Marketed under the brand name JYNNEOS, the vaccine was developed by Bavarian Nordic and tested by the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID). USAMRIID is the only laboratory in the Department of Defense equipped to safely study highly hazardous viruses requiring maximum containment at Biosafety Level 4. Research conducted at USAMRIID leads to medical solutions—vaccines, drugs, diagnostics, and information—that benefit both military personnel and civilians. The Institute plays a key role as the lead military medical research laboratory for the Defense Threat Reduction Agency's Joint Science and Technology Office for Chemical and Biological Defense. USAMRIID is a subordinate laboratory of the U.S. Army Medical Research and Development Command.

"In addition to its public health importance, this vaccine will have a direct impact on improving force health protection for U.S. troops who are required to be immunized against smallpox," said COL E. Darrin Cox, commander of USAMRIID, headquartered at Fort Detrick, MD.

Addressing Population Vulnerability

Following a worldwide smallpox vaccination program, the World Health Assembly declared the deadly disease eradicated in 1980. With a large proportion of the world's population no longer immune to smallpox, however, an intentional release of the virus among military personnel or the general public could have a devastating global impact.

Smallpox is an ancient disease that is highly contagious and often fatal in humans. Symptoms include fever, body aches, and a skin rash that develops into fluid-filled lesions. The smallpox virus is spread through saliva and droplets from the respiratory tract, or by direct or indirect contact with the virus as it is shed from skin lesions. The virus also can be spread through other body fluids and contaminated clothing or bedding.

A smallpox-like condition, monkeypox is a rare disease that does not occur naturally in the U.S. It begins with fever, headache, muscle aches and exhaustion and is typically milder than smallpox, though it can be fatal in some cases. Monkeypox is transmitted to people from wild animals, such as rodents and primates. In 2003, the U.S. experienced an outbreak of monkeypox, which was the first time human monkeypox was reported outside of Africa.

From a Potential Terror Perspective

Current smallpox research focuses on developing vaccines, drugs and diagnostic tests to protect against the virus should it be used as an agent of bioterrorism. JYNNEOS was developed as an alternative to the current U.S. licensed smallpox vaccine, ACAM2000, which cannot be used by people with certain health conditions.

To assess the vaccine's effectiveness, USAMRIID study director Phillip R. Pittman, M.D., led a clinical trial in collaboration with the U.S. Defense Health Agency (DHA). His team enrolled U.S. service members stationed in South Korea for the study, placing 440 participants into one of two groups. Group 1 received two doses of JYNNEOS 28 days apart, while Group 2 received a single dose of ACAM2000. Participants receiving JYNNEOS had a superior immune response and fewer side effects compared to those who received ACAM2000.

While enhancing the medical readiness of U.S. fighting forces, the new smallpox vaccine also has been selected for inclusion in the Strategic National Stockpile, the nation's largest supply of potentially life-saving pharmaceuticals and medical supplies for use in a public health emergency. ▪

ADVANCING SURGICAL AUTONOMY

LTC George Kallingal, M.D., serves as the Chief of Urologic Oncology, Brooke Army Medical Center (BAMC), and the Surgeon Champion for the National Surgical Quality Improvement Program (NSQIP), and Chair of the Robotic Steering Committee. In addition, he helped create and serve in the Enhanced Recovery After Surgery Team, the Urinary Tract Infection Task Force and the Comprehensive Prostate Cancer Clinic. He has demonstrated a passion for process improvement and the advancement of surgery throughout his career. He is a critical asset to BAMC and its mission to provide the best care for its soldiers and patients.

Dr. Kallingal developed extensive experience with robotic cancer surgery and a deep understanding of the role of robotics in surgery. In addition, he helped with pioneering early surgery with the latest version of the multiport surgical robot – the Da Vinci Xi. In 2014, Dr. Kallingal joined the Urology department at Brooke Army Medical Center (BAMC) in San Antonio, Texas. Upon his arrival, he founded and chaired the robotic steering committee. In that time period, he has helped facilitate the acquisition of three Da Vinci Xi robots, facilitated a credentialing and training program for robotic surgeons and technicians, and helped grow BAMC's volume of robotic surgeons and robotic surgery. At present, BAMC is the busiest military hospital in the world for robotic surgery. He was also sent to Landstuhl Regional Medical Center in Germany to help the surgeons and staff train for robotic surgery in international settings.

LTC George Kallingal, M.D.
Chief of Urologic Oncology
Brooke Army Medical Center

C&CC had the opportunity to speak with LTC George Kallingal, M.D., Chief of Urologic Oncology, Brooke Army Medical Center (BAMC), regarding current focus in the arena of surgical robotics and ways the U.S. Army is looking to advance capability.

C&CC: Provide some brief background into the evolution of robotics in surgery, from semi- to fully autonomous capabilities.

LTC Kallingal: A main tenet of surgery is to have adequate exposure and untethered manipulation of critical structures. Often, to gain access to these structures, a generous incision and large retractors are needed, especially in deep cavities in the body, like the abdomen and pelvis. With the advent of laparoscopy, we were able to generate adequate exposure for many surgeries through small incisions, a camera and carbon dioxide gas insufflation to create the space needed. This type of minimally invasive surgery replaced tradition open surgery for select cases because patients healed faster, had smaller incisions, less pain, less hospital stay and often less bleeding. However, the tools for laparoscopic surgery were often limited in function and mobility. So although exposure was often adequate, tissue manipulation (cutting, suturing, etc) was often limited and tethered. Robotic surgery offered a similar exposure as laparoscopy but far more complex instrumentation and control. Robotic instruments are wristed allowing nearly hand-like movements inside the body, instead of stick-like movements. In addition, the robot allowed the surgeon to be removed from the patient's bedside, giving the surgeon access to a 3D view with a sophisticated camera, 20x magnification, and unrivaled control of instruments. Through a combination of software and hardware, the robot offers some automatic functions, but always relies on surgeon control. The surgical robots most commonly used today are not autonomous. The various iterations of the robot have become successively more capable and functional, but still entirely reliant on surgeon control.

In the most recent version of the multiport surgical robot (Da Vinci Xi), there are algorithms which are designed to track instrument location and remember its previous position. There are numerous parameters set on the robotic controls to minimize damage to the body entry sites, minimize instrument collision, and other visual -spatial indicators, which were not available in purely laparoscopic ventures. Newer instruments options for the robot are available including energy devices for vessel sealing, stapling, and providing suction and irrigation. Although these technologies were available

with traditional open or laparoscopic techniques, the ability for the surgeon to precisely control angles and wrist movements are unmatched.

In addition there are sophisticated technologies which can be incorporated into the robotic platform including intracorporeal ultrasound, which allows us to place an ultrasound probe directly on organs to visualize tumors or other anatomic strictures. There is also firefly technology, which allows vasculature or other select structures to light up differently. However, these are still entirely based on surgeon assessment and surgeon control.

Research into autonomous robots is being performed. Most of these research ventures at present are confined to specific tasks and are being performed in 3D printed anatomic models, animals, or cadavers, but not in humans.

C&CC: With lessons learned regarding the state of limitations of manual surgical practice, how is robotic capability helping bridge the gap in providing greater surgical care?

LTC Kallingal: With increasingly sophisticated technology, we are able to perform more and more complex surgeries in a minimally invasive fashion. There are likely no surgeries which can only be performed robotically and not in a traditional open fashion, however there are certainly patients who are far more likely to pursue treatment with a minimally invasive approach than with traditional open surgery. There are also specific areas where robotic surgery can exceed performance of open surgery, such as with firefly technology which can more precisely identify certain vessels and possibly help identify tumors.

For post-operative care and discharge, robotic surgery is helping provide enhanced recovery after surgery. One of the main features of an enhanced recovery protocol is minimally invasive surgery when possible. Certainly, in many surgeries, the robotic approach offers smaller incisions, less pain, less narcotic usage, less hospital stay and patients returning to work sooner.

Lastly, as the pace of technology grows, more sophisticated adjuncts can be incorporated into the robotic platform. This may include better imaging techniques, more precise control of tissue specimens, energy-based technologies to stop bleeding and undeveloped concepts is surgical technology.

C&CC: In terms of limitations in robotic surgical application, what are some primary challenges you see as surmountable and when could we see this?

LTC Kallingal: Two major hindrances for robotic surgery are cost and learning curve. The learning curve with robotics is still being developed for certain surgeries. The more surgeons get experience with robotic techniques, likely the more proficient they will become. This will help with the duration of surgery, which can be lengthy in the initial part of the learning curve for these surgeries. As robotic surgery becomes more prevalent, an entire robotic team needs to be well-trained and available. One challenge is having robotic surgery availability at all times, including evenings and weekends. We are slowly moving toward this paradigm and capability as we are training more technicians and nurses to be proficient with robotic surgery. We hope for full time capability in the next 1-2 years.

In addition, with increased prevalence, utilization and competition for robotics, the costs should come down. As the robotic surgeries we can accomplish become more complex, more training and education will be needed. This means we will have to train more complete robotic teams, including surgical nurses and technicians.

The da Vinci SP (single port) system includes three, multi-jointed, wristed instruments and a fully wristed 3D HD camera triangulated around the target anatomy (C2019 Intuitive Surgical, Inc.)

C&CC: As combat wounds have presented over the recent decades, how do see surgical robotics addressing need where manual limitations exist?

LTC Kallingal: As surgical technology becomes more robust and mobile, we could theoretically see robotic surgery utilized in theatre and possibly part of forward surgical teams. Since the surgeon does not need to be physically at the patient's bedside, robotic surgery is feasible from a distance via a teleconnection and trained assistants. It is feasible to have surgical platforms very close to the battlefield, where lifesaving measures can be more effective, while keeping the surgeon further from harm. This would require a portable setup, specialized assistants, and a reliable teleconnection. However, creating and implementing this type of remote robotic capabilities are still conceptual at this point. Nevertheless, we are seeing robotic capabilities being deployed to medical treatment facilities closer to the theater of combat, so soldiers can get critical care sooner, without having to return all the way home.

ADVANCING REGENERATIVE MEDICINE

Maj. Julia A.V. Nuelle, M.D., graduated from Saint Louis University in St. Louis, Missouri summa cum laude with a Bachelor's Degree in Investigative and Medical Science. She was commissioned as a Second Lieutenant in the United States Air Force upon graduation. She then attended Loyola University Chicago Stritch School of Medicine in Chicago, Illinois, graduating magna cum laude with a doctorate of medicine in 2011. She then trained in orthopaedic surgery at the University of Missouri and returned to Loyola University Chicago for fellowship training in hand, upper extremity, and microvascular surgery. It was in her post-graduate medical education that she developed her interest in treatment of congenital hand deformities and complex upper extremity limb salvage, including both peripheral nerve repair and reconstruction. After reporting to the San Antonio Military Health System, Maj Nuelle, furthered her passion for treating Wounded Warriors, partnering with orthopaedic, plastic, and vascular surgery colleagues to care for patients with complex upper extremity injuries utilizing multi-modal interventions.

Since Jan 2019, Maj Nuelle has served as the Chief of the Hand, Upper Extremity, and Microvascular Surgery Division in the San Antonio Military Health System providing care and conducting clinical research in the Wounded Warrior and civilian trauma population. As the only Level 1 Trauma Center in the Department of Defense, Brooke Army Medical Center's orthopaedic hand surgery division provides expert trauma care to patients with upper extremity injuries, but also provides vital readiness and graduate medical education training to orthopaedic surgery residents. Maj Nuelle's passion for education has led to her involvement in orthopaedic resident education, serving as the Assistant Program Director for Surgical Education and Simulation. In 2019, Maj Nuelle also led of team of 19 personnel on an Army MEDRETE Mission to Honduras where the team provided surgical orthopaedic care to local polytrauma patients while partnering with local Honduran orthopaedic and plastic surgeons and simultaneously advancing the US military's readiness mission. Dr. Nuelle is a vital part of the largest Orthopaedic Surgery Department in the DoD, a Department that continues to have an impact on a global scale and is becoming widely recognized as a leader both nationally and internationally.

C&CC spoke recently with Maj. Julia Nuelle, M.D., Chief of Orthopaedic Hand, Upper Extremity, and Microvascular Surgery, Brooke Army Medical Center (BAMC), regarding current focus efforts DoD is making in the field of tissue regeneration, specifically nerve, to enable more efficient and effective traumatic injury recovery.

Maj. Julia Nuelle, M.D.

Chief, Orthopaedic Hand, Upper Extremity,
and Microvascular Surgery
Brooke Army Medical Center

C&CC: Provide some brief background into the evolution to present of regenerative surgery, particularly from a nerve regeneration perspective.

Maj. Nuelle: The earliest works describing nerve surgery date back to the 7th century, but it wasn't until the 17th century that researchers investigated the possibility that neural tissue can regenerate. A better understanding of what occurs after nerve injury, the process of degeneration and subsequent regeneration, is critical to advancing our knowledge of how to optimize it. We now know that after a peripheral nerve sustains an injury, a complex orchestra of changes occurs throughout the length of the nerve including at the nerve cell body, in the proximal and distal edges of the injury site, and at the distal nerve endings either at the sensory receptors or at the neuromuscular junction. The regenerative process begins almost immediately after nerve injury. The axons disconnected from the cell body degenerate through a process called Wallerian Degeneration and within hours, sprouting from the more proximal axons occur. Schwann cells, a type of cell that supports neurons in the peripheral nervous system, are a

key player in the process as they first aid in digestion of the damaged axon. They then align in tubes called Büngnger bands and elaborate molecules that help guide the generating nerve sprouts. If the sprouts reach the tube formed by the Schwann cells and continue to grow, the regenerating nerve will advance at a rate of about 1 mm per day, if at all. For motor nerves, this becomes a race against the clock for the nerve fibers to reach the destination of the motor end plate at the level of the muscle, before the motor end plates degenerate. Furthermore, if the nerve sprouts cannot reach the tube formed by the Schwann cells, which can be due to scar formation, the gap being too great, or there being interposed tissue, the nerve will not regenerate. Our current techniques of nerve repair, reconstruction, and transfer aim to improve the chances that innervation of the downstream targets actually occurs.

C&CC: As combat trauma-related wounds over the recent decades have presented, what are some aspects targeted for potential regenerative applications?

Maj. Nuelle: For peripheral nerves that are transected and injured over a distance of several centimeters, as is often seen in our service members who sustain blast trauma, the damaged nerve tissue must be resected and there is a resulting gap. Until recent years, the options for bridging this gap included using tubes (called conduits), nerve autograft (taking nerve tissue from second site in the body), or fresh nerve allografts, (which utilize donor nerve tissue). Nerve conduits are advantageous as they restrict the direction of growth of the regenerating axonal sprouts and are available "off-the-shelf" or local veins can be used. However, the gap over which conduits can aid in meaningful nerve regeneration is limited. Thus, nerve grafts are typically utilized for larger gaps. There is morbidity associated with both autograft and fresh allograft options, including loss of function (typically sensation) from where the autograft donor nerve is taken and the requirement for immunosuppression for use of fresh nerve allografts in order to prevent rejection.

The development of decellularized nerve allografts have mitigated these risks as they are also derived from a cadaveric donor, but since they are decellularized, do not provoke an immune response and thus, immunosuppression is not needed. However, these decellularized allografts lack viable Schwann cells, which also limits the distance over which these grafts are useful. This is also known as the critical length, or the length beyond which the graft can support regeneration. Several studies are ongoing investigating ways to augment decellularized allografts and increase their critical length, including the use of bone marrow aspirate concentrate which involves applying the patient's own stem cells to populate the decellularized allograft. Other studies are investigating how to enhance nerve regeneration when either allografts are used or direct nerve repairs are performed such as the use of systemic biomodulators that have the potential to enhance nerve regeneration. Exogenous testosterone has been shown to have a neuroprotective effect after peripheral nerve injury in animal studies. Tacrolimus, an immunosuppressive agent, also possess neuroprotective and neurotrophic properties and is being studied to for its uses in nerve regeneration. These are two of a myriad of substances currently being investigated for their potential to enhance and augment peripheral nerve regeneration after injury.

Another area of exciting research is asking the question, what if we can prevent Wallerian degeneration in the first place? If that is successful, and immediate signal transmission and nerve function is attained, the variable recovery that is seen with the other repair and reconstruction techniques current employed could be mitigated. At BAMC, I am part of a team, led by COL Joseph Alderete, Director of the Center for the Intrepid and orthopaedic oncologist, where we focus on limb salvage and advanced amputation techniques for patients with severe extremity injuries. In a collaborative effort to answer this question, we have joined forces with Dr. George Bittner at the University of Texas at Austin, Dr. Jaimie Shores at Johns Hopkins, and Dr. Vijay Gorantla at the Wake Forest Institute for Regenerative Medicine and their respective labs. In animal studies, applying a process developed by Dr. Bittner called PEG-fusion to both nerve repair and reconstruction with allografts, has demonstrated permanent restoration of axonal continuity and restoration of the motor functions of the treated nerve within 2-4 weeks. The continued translation of this work to human applications is the focus of our joint efforts.

Capt. Tayt Ellison, left, and Maj. Julia Nuelle perform a left index finger nerve reconstruction with nerve allograft on a patient at Brooke Army Medical Center. (U.S. Army)

C&CC: With advances in prosthetics in recent years, how do you see regenerative surgical capability supporting this avenue of rehabilitation?

Maj. Nuelle: As prosthetics continue to advance, so do our surgical approaches to amputation care. Skillful amputation surgery spans surgical disciplines including orthopaedic surgery, plastic surgery, vascular surgery, and neurosurgery with an eye towards pain-free function and prosthetic fitting and wear. The management of nerves in amputee care falls into two major categories: prevention and treatment of painful neuromas; and harnessing the power of detectable nerve signals to power neuroprosthetic devices. Three recent advances in surgical techniques currently being employed for these purposes are: targeted nerve implantation (TNI), targeted muscle reinnervation (TMR), and regenerative peripheral nerve interfaces (RPNI). Although each uses a different surgical technique, all three give the transected nerve ends and sprouts "something to do" by providing a different distal muscle target for the regenerating axons thereby preventing neuroma formation. The muscle fibers that become innervated by the transected nerve endings using these different techniques, then can act as an amplifier of nerve signal that can be detected by neuroprosthetics allowing voluntary patient control of the device. With these techniques, more independent signals can be detected by the neuroprosthetic, giving patients autonomous control of more planes of motion. As researchers continue to advance prosthetics to include sensory feedback, surgical techniques such as targeted sensory reinnervation will become more critical to provide physiologically-relevant sensory feedback with more high fidelity prosthetics.

C&CC: Feel free to speak to challenges/goals in regenerative surgery moving forward.

Maj. Nuelle: It has become clear that despite the surgical advances in treatment of peripheral nerve injuries, a multimodal, multidisciplinary approach is required to optimize nerve regeneration. This includes not only advanced surgical repair techniques, but also tissue engineering, cellular therapies, and application of both local and systemic modulators of neuroregeneration. Further research is needed to advance these therapies from the bench to clinical practice and to further understand how these treatments and techniques can act in concert, instead of individually, to optimize nerve regeneration.

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Cancer-Killing Cold Plasma

While using cold plasma to kill cancer cells isn't an entirely novel concept, a team of researchers and students at South Dakota School of Mines & Technology (SDSMT) are exploring new ways to regulate cold plasma technology to target and kill cancer cells while leaving healthy cells alive. If successful, the technique would prove to be a drug-free, minimally invasive cancer treatment that would affect the lives of millions of patients around the world.

What is Plasma?

Plasma is ionized gas – an energetic state of matter where some of the electrons in the outer atomic orbitals have become separated from the atom. In other words, it's a collection of ions and electrons no longer bound to each other. Cold plasma is a partially ionized gas where particles possess much higher energy. SD Mines assistant professors Prasoon Diwakar, Ph.D., of the mechanical engineering department, and Timothy Brenza, Ph.D., of the chemical and biological engineering department, are overseeing the research with undergraduate mechanical engineering students Kristen Haller and Nicole Miller. Chemical and biological engineering PhD student Jordan Hoops and applied biological sciences undergraduate student Taylor Bright are also contributing to the work. Bright will be continuing the research in this area as an accelerated master's student in biomedical engineering.

Cold plasma laser light targeting cancer cells (SDSMT)

Diwakar began researching cold plasma cancer treatments as a postdoctoral research associate at Purdue University in West Lafayette, Indiana. While at Purdue, Diwakar worked with Ahmed Hassanein, a professor of nuclear engineering, to develop PLASMAT, or Plasma Technologies, for a Healthier Tomorrow. The PLASMAT technique combines cold atmospheric plasma (CAP) with electroporation and/or photoporation in order to kill cancer cells without destroying healthy cells.

Targeting Only Cancer Cells

When he arrived at SD Mines in 2018, Diwakar began collaborating with Brenza, whose lab works with cancer cells in drug delivery research, including lung cancer. Together, the researchers turned their eye toward using cold plasma to treat lung cancers, but with a specific goal of vastly improving the plasma's capability of targeting potential of cancer cells only. Diwakar explains that cold, atmospheric plasma is not cold, but room temperature. Diwakar demonstrated by holding his finger in a delicate, blue stream of laser light. It causes no damage to his finger. However, a specific level applied to cancer cells will destroy them.

In order to kill cancer cells, however, the pores of the cells must be opened to allow the cold plasma to be "shot" into the interior of the cell. Electroporation opens the cell pores. Haller demonstrates this by placing the cells, which have been suspended in a conductive solution, into an electroporation system. An electrical pulse lasting just milliseconds is discharged through the cells, disturbing the outer membrane and creating temporary pores. Once the pores are opened, Haller shoots cold plasma into the interior of the cell where the cancer cells are located. The cold plasma introduces reactive oxygen and nitrogen into the cancerous cells, which leads to apoptosis or death of the cancer cells.

Diwakar says researchers have used cold plasma to "push cancer cells over the limit so they die." But this new research is focusing on finding the "right limit" – the level of cold plasma dosage needed to only kill the strain of cancer cells without damaging any healthy cells nearby. By identifying the limit, doctors will be able to apply proper dosage of cold plasma based on the type of cancer, the strain of cancer cells and other specifics - all while leaving healthy cells thriving, he says. Eventually, this cold plasma process could be introduced into cancerous tissues and/or tumors in a person's body to kill the cancer cells. And, unlike chemotherapy or even radiation, it would so precisely target the cancer cells that patients would not suffer the side effects that they do now with traditional treatments, including loss of hair, burned skin, nausea, etc.

Electroporation and cold plasma treatment would be most feasible for cancers that are easily reached in the body, such as skin cancer or cancers that cause localized tumors that can be accessed. But once this research is successful, the next step will be application of the treatment to less accessible cancers, Diwakar says. Obviously, cancer inside the body would have to be exposed for electroporation to occur followed by cold plasma application. "If it's proven it can work, we'll have to change how it's applied. The cancer affected area must be exposed. But we have some ideas," Diwakar says, including accessing the cancer with laparoscopy.

Looking Ahead

The team has shown preliminary results that the combination of cold plasma and electroporation is effective in killing lung cancer cells. Results were presented at the SCIX 2019 The Great Scientific Exchange Conference in Palm Springs, FL in October 2019. The next step is to study the exact mechanism which leads to cell death.

More info: sdsmt.edu

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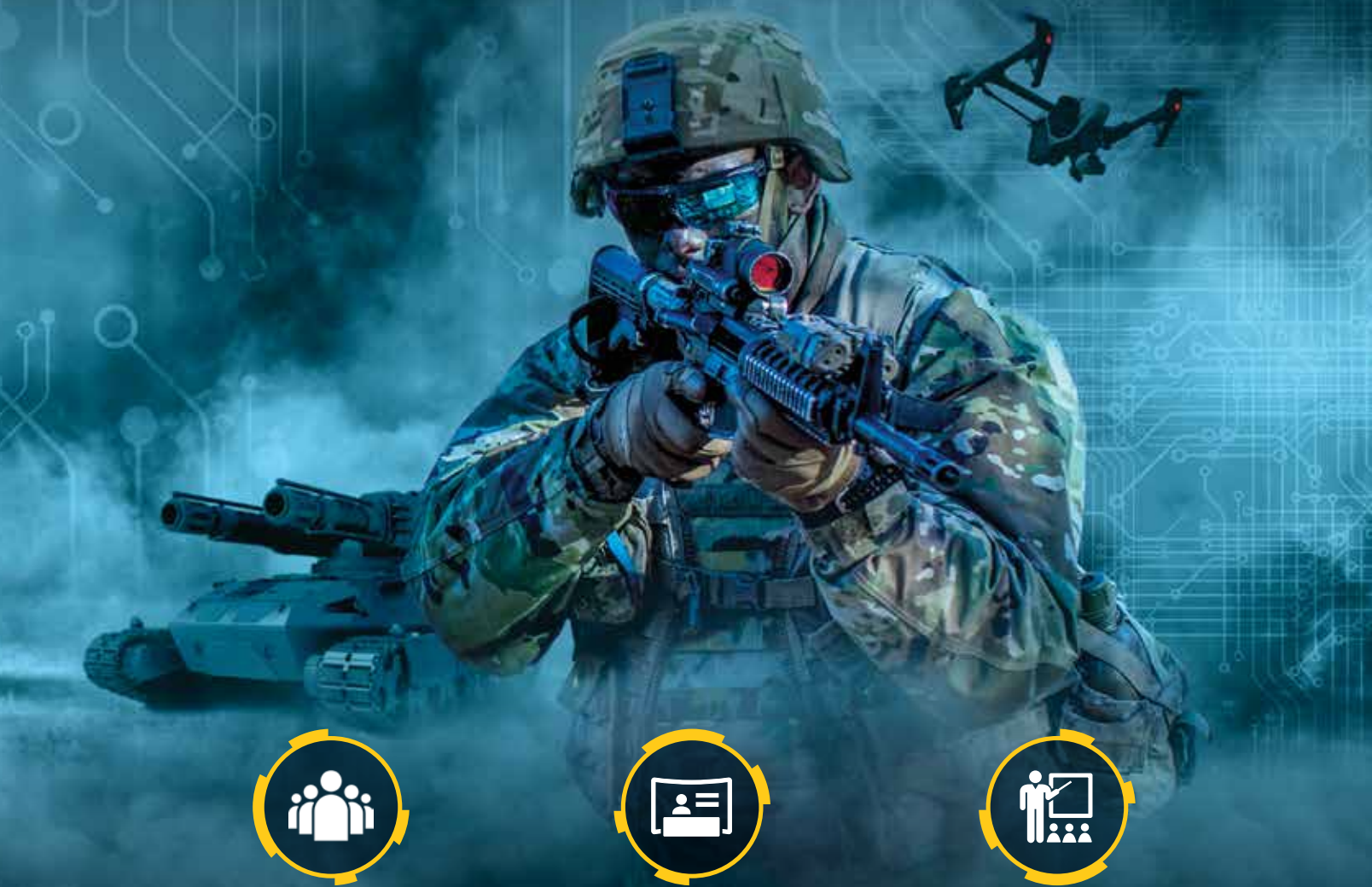

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SETTING STANDARDS FOR HEALTHCARE RECORDS

Mr. William J. Tinston serves as the Program Executive Officer for the Program Executive Office, Defense Healthcare Management Systems (PEO DHMS). The mission of PEO DHMS is to transform the delivery of healthcare and advance data sharing through a modernized electronic health record (EHR) for service members, veterans, and their families. Mr. Tinston provides direction to the following program offices: the Department of Defense (DoD)/Department of Veterans Affairs (VA) Interagency Program Office, the DoD Healthcare Management System Modernization Program Management Office (PMO), and the Joint Operational Medicine Information Systems PMO.

As Program Executive Officer, Mr. Tinston oversees the deployment via wave model of the DoD's modernized MHS GENESIS. Additionally, he works with the VA and United States Coast Guard to assist their transition to the same EHR as the DoD, ensuring a single, common record for beneficiaries.

Mr. Tinston previously held senior executive positions at the Defense Logistics Agency (DLA), most recently serving as the Program Executive Officer. In this role, Mr. Tinston was responsible for the management and oversight of DLA's Major Automated Information Systems programs and special interest programs, and was the milestone decision authority for DLA's less-than-major programs. He was the corporate provider of acquisition management services and provided overall direction and guidance for the development, acquisition, testing, systems integration, product improvement, and fielding for assigned DLA programs.

Before becoming the DLA Program Executive Officer, Mr. Tinston served as the Chief Technical Officer (CTO). He was responsible for providing a comprehensive IT technical strategy to enable the DLA to achieve current and emerging business objectives using secure state-of-the-practice tools and technologies. Prior to his tenure as the CTO, Mr. Tinston held a variety of increasingly responsible positions at DLA, including Technical Director and Deputy Program Manager of DLA's Business Systems Modernization program, where he played a vital role in delivering the department's first successful large scale Enterprise Resource Planning system.

C&CC spoke recently with Mr. Bill Tinston, Program Executive Officer, Defense Healthcare Management Systems (PEO DHMS), regarding the state of application and readiness of the DoD's MHS GENESIS electronic health records system and lessons being learned as the system continues implementation across the Joint Services.

Mr. Bill Tinston

Program Executive Officer
Defense Healthcare Management Systems

C&CC: What is MHS GENESIS and what will it do for the medical provider and the patient?

Mr. Tinston: MHS GENESIS is the Department of Defense's (DoD) modern, secure, and connected electronic health record (EHR) that supports the availability of health information for 9.5 million beneficiaries, while transforming the delivery of healthcare and advancing data sharing. Ultimately, it will replace all DoD legacy EHRs. MHS GENESIS currently operates in four initial fielding sites in the Pacific Northwest, and as of September 7, four sites in California and Idaho that comprise the first of 23 Wave deployments. Full deployment of MHS GENESIS to sites across the country and around the world is set to conclude in 2023.

MHS GENESIS enables the application of standardized workflows, integrated healthcare delivery, and data standards for the improved and secure electronic exchange of medical, dental, and patient data. It provides a multitude of benefits to the medical provider, including:

- Monitoring a beneficiary's health status through greater population health data as well as tracking and alerting capabilities;
- Improving the ability to monitor patient safety, outcomes, and operational and medical readiness;
- Expanding data access and sharing health information across the spectrum of military operations as well as with VA, United States Coast Guard, and other participating healthcare organizations; and
- Increasing the accessibility of integrated, evidence-based healthcare delivery and decision-making.

Patients benefit from the MHS GENESIS Patient Portal, a secure website allowing them to access their health information and exchange messages with their care team anytime and anywhere. With the Patient Portal, patients can easily request prescription renewals, view notes from clinical visits and certain lab/test results, and access information related to health concerns and medications, among other things. Patients also benefit from MHS GENESIS' strict cybersecurity requirements, which increases the safety of their health data.

C&CC: How will DoD and VA use their electronic health records to work in sync?

Mr. Tinston: In the past, patients treated at DoD and VA facilities received records in each department's EHR. Ensuring these records were interoperable was an important task because different data could reside in different records across both departments.

Today, the departments are deploying the same system, so whether the systems will "work in sync" is no longer an issue—both departments will share a single, common record. A new joint DoD-VA office, the Federal Electronic Health Record Modernization (FEHRM) Office, is currently under development. Among other things, the FEHRM will ensure millions of individuals treated at DoD and VA facilities will one day see their healthcare history as a single record available to all their DoD and VA healthcare providers.

Another benefit of the VA's implementation of the EHR includes extended system capabilities which the DoD will adopt, maximizing the use of shared services—the collaboration will ultimately increase MHS GENESIS capabilities by 30 percent, bringing added value, and ultimately transforming healthcare delivery for the federal government. The single EHR will also greatly expand both departments' connections with private-sector health information exchanges (HIE).

C&CC: What can you say about MHS GENESIS and other new developments for our deployed personnel?

Mr. Tinston: While we're a few years away from deploying MHS GENESIS to theater locations, our Joint Operational Medicine Information Systems (JOMIS) Program Management Office continues to plan and test for the future deployment of MHS GENESIS to deployed personnel. JOMIS provides continual input for the development of the MHS GENESIS theater build to ensure compatibility and interoperability with JOMIS' currently deployed and future systems. We recently conducted a site assessment aboard the hospital ship USNS Mercy to assess hardware, software, and workflows and compile data in preparation for full risk reduction testing aboard the ship next year. These risk reduction activities will allow us to validate functionality and assumptions to further guide development of the MHS GENESIS theater build and successfully deploy it.

JOMIS systems provide first responders the ability to document care on mobile devices. (PEO DHMS)

As we continue to develop the MHS GENESIS theater build, JOMIS shifted its near-term priority to warfighter support delivery across all five operational medicine functions. We were already focusing on healthcare delivery, of which MHS GENESIS is the largest piece, but we're also now working on enhancing and modernizing capabilities that support patient movement, medical command and control, medical situational awareness, and medical logistics.

JOMIS is transitioning to an Agile capability delivery model, allowing the program to take advantage of some innovative acquisition options to prototype and deliver new capabilities to the warfighter. We're already reviewing proposals for a prototype theater blood disconnected/mobile application. We support U.S. Transportation Command (TRANSCOM) to enhance the TRANSCOM Regulating and Command and Control Evacuation System (TRAC2ES) and improve global patient movement. We facilitate working groups with the medical command and control and medical situational awareness communities of interest to define requirements and initiate planning for modernized capabilities to meet those operational medicine functions.

JOMIS also continues to strengthen an important partnership with the Operational Medicine Functional Champion (OMFC). The OMFC will receive and prioritize service needs for JOMIS, which will ensure we push the right products in the right order to our deployed personnel.

C&CC: What are some of the lessons learned and successes from the initial fielding and first wave of deployment?

Mr. Tinston: From the start we've seen the superior advantages of MHS GENESIS over legacy EHRs, and we only continue to improve. Thanks to lessons learned from the initial fielding, Wave TRAVIS successfully deployed MHS GENESIS to all four sites simultaneously. One of the site commanders said the deployment went "better than I could have imagined." In turn, this recent Go-Live is preparing us for the next year and beyond as we ramp up the number and frequency of the Wave deployments.

The initial fielding gave us a great amount of feedback for future deployments. The experience led us to tweak our Go-Live strategy, including updates to our training strategy. For example, we reduced redundant training content for users with multiple roles, transitioned from "buttonology" based training to scenario- and workflow-based approach, ensured the training technical environment syncs with production environment, and modified our computer-based training and instructor-led training content.

Shortly after the initial fielding, the industry standard for measuring EHR adoption, Healthcare Information and Management Systems Society (HIMSS) Analytics, reported an increase in usability and adoption at MHS GENESIS initial fielding sites as compared to legacy systems. One site received a usability score accomplished by only 20 percent of providers nationally, indicating it met several technology functionalities of safety and efficiency.

MHS GENESIS is already generating good news stories. A clinician at one of the initial fielding sites shared their appreciation for MHS GENESIS shortly after their Go-Live. This radiology team member noted that under the legacy system, it could take days to transfer images from one location and system to another. With MHS GENESIS, all information resides within the same system, so the images are available in a matter of hours, significantly improving the patient's experience.

Early results from the recent Wave indicate we'll see a lot of successes coming out of those sites as well. During Go-Live, stakeholders noted a significantly improved deployment—as one example, Wave TRAVIS sites saw 50 percent fewer trouble tickets than reported at the initial fielding sites.

One final story from the Wave TRAVIS Go-Live: a few hours before Travis Air Force Base deployed MHS GENESIS, clinical staff at David Grant U.S. Air Force Medical Center were presented with a patient in sudden cardiac arrest. Because of their training for the new EHR, they felt confident in making the quick decision to use MHS GENESIS' cardiovascular imaging capabilities to treat the patient. Thanks to their fast action, they saved the patient's life. These successes mean the most because they focus on the patient, and illustrate how we're improving healthcare delivery for them. After all, it's not about IT, it's about people.

PARTNERING FOR MATERIEL ASSURANCE

Improving veteran care by centralizing the procurement of medical supplies is the goal of an interagency agreement between the Defense Logistics Agency (DLA) and Department of Veterans Affairs (VA) signed at the VA Headquarters in Washington, DC, this past August.

By Defense Logistics Agency and Department of Veterans Affairs

Department of Veterans Affairs Secretary Robert Wilkie (center left) and Defense Logistics Agency Director LTG Darrell Williams (center right) display the newly signed interagency agreement between DLA and VA with the team who helped make it possible behind them at VA Headquarters in Washington, D.C. (Photo by Christopher Goulait, Defense Logistics Agency)

DLA Director LTG Darrell Williams and VA Secretary Robert Wilkie recently formalized a partnership expected to help reduce costs of pharmaceutical national contracts, radiology and imaging contracts, and electronic cataloging.

"In the 21st century, an ad hoc supply chain is not sufficient," Wilkie said. "It does not do justice to those we are sworn to serve. This is part of not only comprehensive reform of this institution, but it also cements our relationship with the Department of Defense."

The partnership gives the VA access to DLA Troop Support's worldwide procurement system for medical and surgical items, cleaning supplies and equipment, construction materials and equipment, and other supplies, according to a VA release. A centralized ordering system will also reduce risk, fraud, waste and abuse when ordering these materials. "On behalf of the Department of Defense, we are proud to be a value-add to VA on behalf of America's veterans," Williams said. "Leveraging economies of scale, like the ones outlined in this agreement, help us reduce costs for the military services and other government partners like VA."

The agreement is part of DLA's Whole of Government portfolio, which provides supplies and services to non-DoD agencies, added Dan Strausbaugh, deputy division chief of DLA's Whole of Government Support Division. "We're always reaching out for more business to better streamline certain processes and make the taxpayer's burden on the federal government less," he added.

Addressing Need for More Centralized Acquisition

The VA will now have increased ability to provide materiel support to Veterans through the strategic partnership. The agreement between VA and DLA allows better acquisition over medical and surgical items, cleaning supplies and equipment, construction materials and equipment, and other items.

This first step gives VA networks across the country increased access to DLA's broader supply catalog; improving productivity and efficiency. "The adoption of a single health care logistics system by VA and DoD highlights the commitment of both organizations to improve military and Veteran health care by increasing the access and quality of care they receive," Wilke said. "This is a huge step forward in our efforts to transform VA into a modern, high-performing organization by simplifying operations and leveraging DoD's supply chain system to support our Veterans."

The agreement combines resources from VA and DoD to create a centralized ordering system for VA, reducing risk, waste, fraud and abuse in purchasing medical equipment and supplies. The secretary said VA needs to be a part of the "national security continuum," which extends from when a Soldier, Sailor, Airman, Marine or Coast Guardsman leaves for basic training to when they leave service. He added VA needs to be a partner to the military services to provide the best support to military members, who then become Veterans.

"VA must be a part of that integral equation," Wilkie said. "With this, we are joined at the hip." Wilkie said the agreement will help reform ordering process to provide better care to "those who we are sworn to serve."

"This is all about our Veterans," said Williams. "We are committed to your vision of greater materiel support to Veterans Affairs."

In March, VA's Captain James A. Lovell Federal Health Care Center became the pilot site for DLA's Defense Medical Logistics Standard Support commodity ordering system. ■

CARE PERSPECTIVE: TRAUMATIC BRAIN INJURY

Research and development projects funded by the U.S. Department of Defense, the Department of Veterans Affairs, and private companies have led to significant advances for the prevention, diagnosis, and treatment of traumatic brain injury or TBI.

By Ryan M. Leone, C&CC Correspondent and Research Assistant, University of London

Often considered the signature injury of the conflicts in Iraq and Afghanistan, traumatic brain injury (TBI) has been diagnosed in over 380,000 servicemembers between 2002 and 2018, according to the Defense and Veterans Brain Injury Center (DVBIC). These men and women may have been exposed to blast waves from improvised explosive devices, direct impacts in vehicular collisions, or collateral damage from shrapnel contacting the head.

TBI is classified into categories, ranging from mild TBI to moderate, severe, and penetrating. These symptoms range from short-term confusion in mild TBI, also known as a concussion, to loss of consciousness for over 24 hours in severe TBI and penetration of the skull and brain in penetrating TBI.

The unfortunate prevalence of TBI has led VA, DoD, and industry leaders to work both independently and cooperatively towards providing solutions for service members. These intensive efforts to fund research and development (R&D) in this space have led to a variety of innovative diagnostic, treatment, and preventative solutions.

Rapid Diagnosis

The NIH shares that imaging equipment like Computed Tomography (CT) can be used alongside cognitive tests to check for TBI. However, military physicians cannot utilize this expensive equipment in combat, leaving them with just tests of memory, cognition, consciousness, and language to diagnose TBI. The screening tool developed for military purposes is called the Military Acute Concussion Evaluation (MACE) and can be administered in 10 minutes. However, according to Dr. Mary Ann Spott, the Deputy Director of the DoD's Joint Trauma System, this test alone is insufficient for the diagnosis of mild TBIs: "While criteria have been put in place to require an exam after the blast and tests like MACE and ANAM have been developed, we are still searching for better methods of identifying and treating these difficult injuries."

Dr. Mary Ann Spott

Dr. Spott also shared that the challenge of diagnosing TBI is further complicated by a resistance to reporting amongst troops: "Often times the effects of a TBI are not well diagnosed because the warfighter wants to stay with his/her team and he/she may not immediately report the injury."

To aid objective diagnosis, researchers have been working to uncover biomarkers that are present in the system within 24 hours of a suspected TBI. One company that has partnered with DoD to develop such a test is Banyan Biomarkers. Their product, the Banyan Brain Trauma Indicator (BTI), includes measurements of two blood proteins: UCH-L1 and GFAP. The levels of these two proteins have been found to rise in the blood shortly after injury and those concentrations are consequently being used to rule out whether patients need a CT scan. The company has even recently offered a non-exclusive license to Abbott Laboratories to further the development of diagnostic equipment that utilizes these biomarkers.

CIRCULOGENE, a molecular diagnostics laboratory located in Alabama, has taken a different approach to finding TBI biomarkers in the blood. With the support of a $1.5 million DoD grant, CirculoGene intends to utilize an in-situ, cell-free DNA (cfDNA) quantification process to reliably establish cfDNA and other potential biomarkers as valid. An exciting further area of research funded by the grant is to develop cfDNA signatures for injuries that go beyond the scope of TBI, potentially adding to the value of this biomarker approach during multi-trauma cases.

Beyond these liquid biomarkers, technologies like the BrainScope One device have been developed to diagnose TBI by measuring EEG signals. According to BrainScope, their system is "an easy-to-use, non-invasive, hand-held platform that empowers physicians to quickly make accurate head injury assessments at the point-of-care." Such a portable piece of equipment may further enable far-forward medics and providers to understand when TBIs occur. The device is currently "cleared" by the FDA, meaning that it was deemed substantially equivalent to an already-approved technology. This qualifies it for military use, where it is currently being tested in Marine Corps and Battalion Aid Stations before potential widespread usage.

Innovative Treatments

Once TBI is diagnosed, the NIH suggests that treatment course may vary depending on the severity of the injury. For mild TBI, patients are traditionally told to rest, avoid activities that require concentration or screens, and abstain from using alcohol or other drugs. For moderate, severe, and penetrating TBI, surgical approaches to remove clotting, repair skull fractures, and relieve skull pressure may be necessary in the acute stages. After emergency treatment is provided and other concomitant injuries are addressed, treatment with medications can aid in recovery, but rehabilitative therapy to cope with any lost physical or cognitive capabilities is commonplace.

Recently, hyperbaric oxygen therapy (HBOT) has gained popularity as an experimental treatment for TBI. According to the Mayo Clinic, the underlying principle of HBOT is that increasing the surrounding pressure enables your lungs to take in more oxygen, which will be distributed throughout cells to aid in their recovery. Because some studies have shown positive results, but others have attributed the improvement to the placebo effect, the effectiveness of this treatment for TBI patients is considered controversial. HBOT is traditionally used for a variety of cases, including treating decompression sickness, accelerating wound healing, and addressing carbon monoxide poisoning. However, TBI is among the many other conditions, such as cancer and depression, that have an inconsistent evidence base for success with HBOT.

Despite this uncertainty, the VA shares that several states have provided funding which allows VA physicians to prescribe HBOT to veterans with TBI, PTSD, or a combination of the two. Furthermore,

according to Stripes, an act introduced this summer by Rep. Andy Biggs (R-AZ.) and Sen. Kevin Cramer (R-ND) would, if passed, expand the use of HBOT to all VA facilities. While some patients have experienced welcomed improvements from this approach, further studies must be conducted to establish a stronger association between the treatment and patient recovery.

Resilience Training

Beyond physical treatments, there is also the potential for mental approaches to treatment to help patients recover. Therapies like cognitive-behavioral therapy have been used to treat anxiety symptoms arising after moderate to severe TBI, but a new focus on resilience training could further bolster the psychological therapy toolkit.

One 2018 study coming from the DVBIC showed that resilience, as measured with the Connor-Davidson Resilience Scale, was strongly associated with lower symptom severity after mild TBI. Although this study demonstrated correlation between resilience and reduced symptom severity, another 2018 study out of Virginia Commonwealth University showed that a program called the Resilience and Adjustment Intervention (RAI) improved the psychological health of patients suffering from TBI when compared to severity-controlled patients who did not receive the RAI. Given that RAI requires just 7 total hours of treatment spread across 1-hour sessions, this intervention could also serve as a time-saving, cost-effective treatment. Further studies must be conducted to assess how this type of treatment will do in the long term, but this early success is promising.

Dr. David Cifu

Equipment and Prevention

Although diagnostic innovations and new treatments will effectively help those who suffer from TBI, the best way to care for soldiers is to prevent a TBI from occurring in the first place. Improving helmet technology can reduce the forces that are transferred to the brain upon impact, limiting the potential severity of a TBI. The U.S. Army's new Integrated Head Protection System (IHPS), a component of its latest Soldier Protection System, will be rolled out as a more protective alternative to the current Enhanced Combat Helmet (ECH). The IHPS is produced by Ceradyne Inc. and offers an advantage over the ECH because it has fewer holes in it. The holes in the ECH are used to connect the chinstrap, but those holes weakened the helmet's material, thereby reducing its protective quality. The boltless chin strap feature of the IHPS eliminates the need for four of the holes found in the ECH. According to Business Insider, the new helmet is a step forward operationally since it heightens the optionality soldiers have for mounting other equipment on, such as visors or goggles.

Another piece of equipment that has been explored for use in TBI prevention and treatment is the blast sensor. Although the DoD discontinued its wearable blast sensor program in 2016, a renewed interest came about in May of 2019 when the Henry M. Jackson Foundation for the Advancement of Military Medicine purchased 10,000 Blast Gauge® Systems from Critical Solutions International and BlackBox Biometrics. These new wearable gauges are meant to measure overpressure from shoulder-fired weapons as a part of the Combat and Training Queryable Exposure/Event Repository (CONQUER) program, with a particular focus on Special Operations Forces. Data from this system could one day be used to prevent soldiers who have been exposed to a threshold intensity of blasts from going back out into combat.

The Integrated Head Protection System, or IHPS, as displayed at Fort Belvoir, VA. The helmet is a component of the U.S. Army's new Soldier Protection System. (US Army/Devon L. Suits)

The Way Ahead

Ultimately, tremendous progress has been made across the public and private sectors to diagnose, treat, and prevent TBI. Going forward, the pace of discovery must continue in order to ensure that our military members are taken care of during and after their service. One resource that will help facilitate this progress, according to Dr. David Cifu - a Senior TBI Specialist at the VA - is the Federal Interagency Traumatic Brain Injury Research (FITBIR) informatics system. This database contains information on trials, data, and methodologies that is openly shared and consolidated by DoD, the NIH, the CDC, and other governmental agencies.

While Dr. Cifu expresses concerns that the private sector is not delivering as much as the government due to their focus on profit, he believes that the governmental approach to research is headed the right way: "They [the government] are taking a "center" (consortium) focus to force researchers to work together, which has been highly effective. Keeping the funding in this direction is key." With such sustained cooperation across industry, academia, and government facilities, the prognosis for civilians and servicemembers will likely continue to improve. ▪

CALENDAR OF EVENTS

NOV 21 – 22
Modern Warfare Symposium
Ft. Bragg, NC
Globalsofsymposium.org/mws

DEC 2 – 6
AMSUS Annual Meeting
National Harbor, MD
Amsus.org/events/annual-meeting-2/

DEC 3 – 5
Future Ground Combat Vehicles
Detroit, MI
Idga.org/events-groundcombatvehicles

DEC 4 - 5
West Coast Small Business
Defense Contracting Summit
San Diego, CA
Defenseleadershipforum.org

DEC 10 – 11
Special Operations & Irregular Warfare
Tampa, FL
Sof.dsigroup.org

DEC 10 – 11
Digital Forensics for National Security
Alexandria, VA
Digitalforensics.dsigroup.org

DEC 10 – 12
Sensors Summit 2019
San Diego, CA
Sensorsglobalsummit.com

JAN 14 – 16, 2020
Surface Navy Symposium
Arlington, VA
Navysna.org

JAN 21 – 24, 2020
SHOT Show
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Operational Energy Summit
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