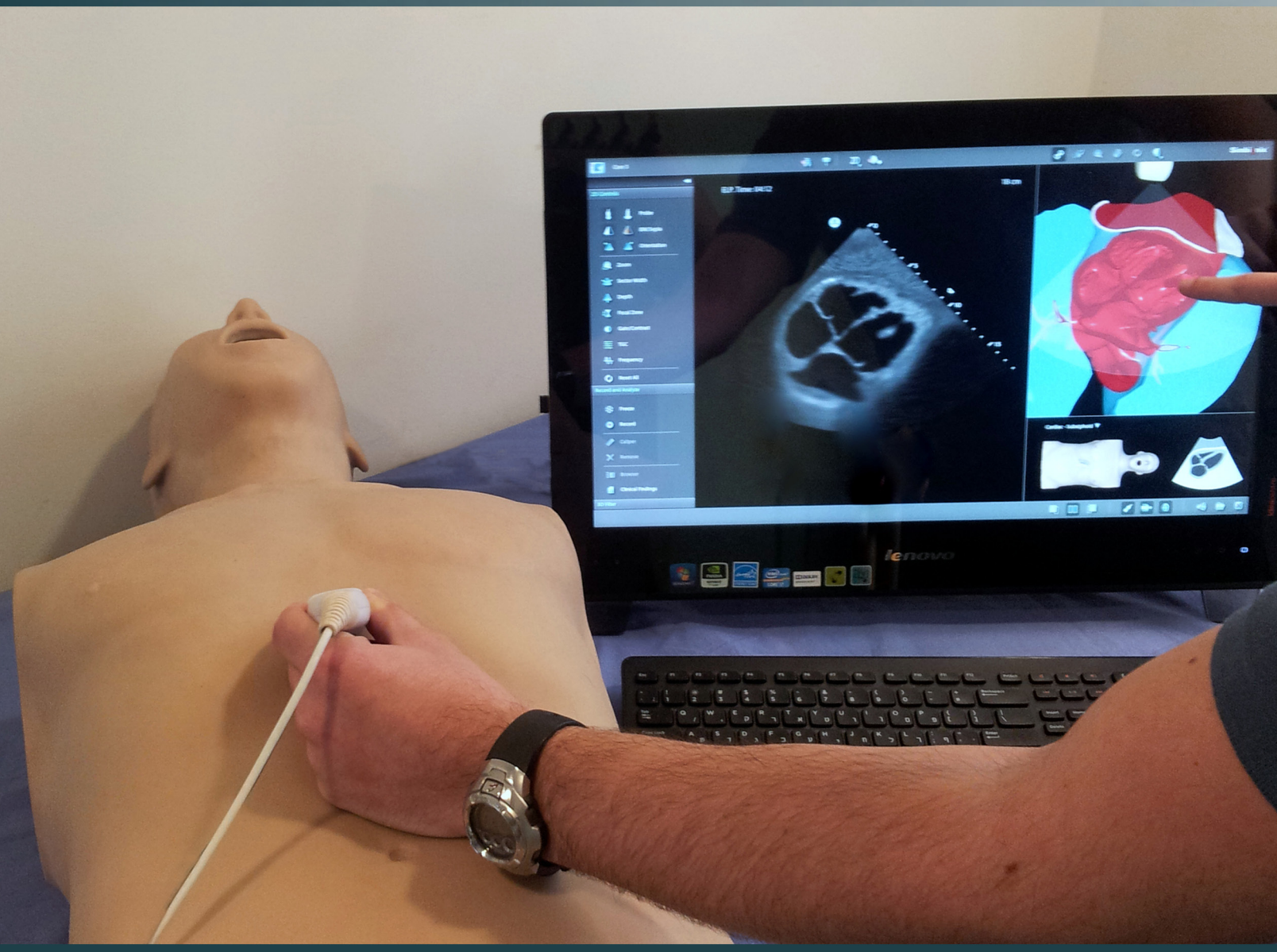

The field of medical simulation training is expanding within the military domain.

By Chris McCoy, M2VA Editor

Medical simulation is the connection between classroom learning and real-life patient experience. Simulation-based assessments provide the opportunity to learn and rehearse clinical techniques and scenarios, either as an individual or as a team, without putting a patient at risk. Simulated clinical scenarios also provide a safe training environment that can be controlled as well as evaluated immediately afterward.

Medical simulation affords instructors the means to provide detailed feedback to the student in areas such as a specific step in a clinical procedure, critical thinking and decision making, and communication skills. Participants can maintain clinical skills necessary to perform critical or complex procedures that are seldom performed, and can gain proficiency with new techniques or equipment.

Currently, medical simulation is used across all levels of the health care continuum. High-fidelity simulation-based instruction offers medical educators a controlled learning environment with the ability to consistently reproduce or tailor clinical scenarios. Participants are granted a forgiving clinical experience, which furthers patient safety. Outcomes are improved by offering educators and participants the opportunity to analyze each step of the procedure or process being trained.

"The return on investment can be valued in many ways, such as higher clinical proficiency and the increased retention of complex medical protocols," said Army Lieutenant Colonel Christopher Todd, the product manager for medical simulation at Program Executive Office for Simulation, Training and Instrumentation. "However, the greatest benefit is in a reduction of errors, which improves patient safety, reduces cost and improves outcomes."

Just as pilots spend hundreds of hours in a simulator rehearsing and preparing for numerous in-flight emergencies, members of health care teams gain confidence and proficiency through simulation by rehearsing procedures and protocols in preparation for a multitude of clinical contingencies.

The military incorporates medical simulation in the clinical training of its health care professionals in much the same manner as any other institutions. However, members of our military health care team must be

prepared to treat severe injuries in austere locations.

"One of our specific products, the Medical Simulation Training Center (MSTC), trains combat medics on how to prioritize and manage critical battlefield injuries, extract patients from difficult terrain and transfer care to the next level," said Todd. "MSTCs enable combat medics to rehearse various clinical scenarios in a simulated-combat environment. In this regard, medical simulation is the catalyst that advances clinical training and improves medical readiness for commanders."

Multidisciplinary Simulators

Founded in 1997, Simbionix is a provider of simulation, training and education solutions for medical professionals and the health care industry. The company offers a wide range of simulators and training solutions. Recently, *Grey's Anatomy* and *Private Practice* featured Simbionix simulators in episodes of their award-winning television programs.

"The nice thing about our products is they are designed to support health care professionals and improve their clinical skills. In fact, we have sold over 2,000 simulators in more than 60 countries across multiple regions around the globe, and that shows we are on the right track," said CEO Gary Zamler. "We see a lot of potential for worldwide demand to continue and we are fully engaged with an aggressive global sales team, a network of distributors and two global call centers operating 24/7/365. We also have a post sales training support team which is larger than several of our competitors, so we have invested heavily in our future and customers support network."

The company's U/S Mentor is a multidisciplinary simulator featuring highly realistic ultrasound simulation within a comprehensive educational environment. The simulator offers a true-to-life training opportunity, including a tangible manikin with realistic anatomy, physiology and pathologies.

"The ultrasound display reliably portrays the anatomy per U/S probe position, incorporating sonographic imaging attributes, artifacts and controls, to best prepare the trainee for systematic scanning and informed diagnosing," said Zamler.

Designed to provide both solo and team training opportunities, the U/S Mentor offers ultrasound skill tasks and procedural tasks alongside patient cases with varying degrees of abnormalities and pathologies.

Simbionix' Arthro Mentor is a virtual reality training simulator for knee and shoulder arthroscopic procedures. The Arthro Mentor virtual reality training simulator provides practice in the key aspects of arthroscopic surgery. This simulator enhances the acquisition of basic skills, reduces learning time and considerably improves the learning curve of complex arthroscopic surgery techniques.

"The system provides a teaching protocol comprised of a series of training modules, providing learners interactive hands-on practice of diagnostic arthroscopy and the chance to train on more complex surgical procedures," said Zamler. "Training modules include basic skills, diagnostic and procedural knee tasks, and diagnostic and procedural shoulder tasks. Our dedicated development team continually adds more content to this line."

High-fidelity Simulation

CAE Healthcare offers a broad portfolio of patient, ultrasound and surgical simulation training solutions as well as validated scenario packages that range from tactical medical care to perioperative management.

"Our simulators are high-fidelity, meaning they are engineered to be as realistic as possible and to respond automatically to medical interventions," said Paul Bernal, director of government and military sales at CAE Healthcare. "We were the first company to develop and produce a high-fidelity wireless patient simulator in cooperation with the U.S. Army in 2007. Our iStan and METIman wireless simulators can be operated remotely by an instructor and remain very popular in the field and for training interdisciplinary teams."

CAE Healthcare's trauma simulator, Caesar, was built to withstand extreme temperatures, rain, dirt and dust, and body impact. Caesar was developed for the military but is also generating enthusiasm among disaster response centers that simulate man-made or natural disasters on a large scale, such as the Department for Homeland Security's Center for Domestic Preparedness in Anniston, Ala.

"You can place Caesar in training locations that would be safety risks to live actors, such as a high-angle rescue, a confined space or under a collapsed building," said Bernal. "He's also being used for decontamination exercises."

CAE Healthcare's fastest-growing product is a simulation center management system called LearningSpace, which allows centers to capture simulation on video for debriefing. LearningSpace is deployed in one or multiple simulation centers for audiovisual recording, learner debrief, and assessment and reporting. The U.S. Air Force and U.S. Veterans Health Administration are currently using versions of LearningSpace in their simulation centers.

CAE Healthcare's Vimedix ultrasound simulator uses both a manikin and virtual reality technology to help practitioners gain proficiency in bedside ultrasound, such as the Focused Assessment with Sonography for Trauma exam. The company also has a wide range of other simulators.

"Our EndoVR and LapVR surgical simulators are training medical residents to get a feel for bronchial and gastrointestinal assessment and laparoscopic surgery," said Bernal.

Innovative Health Care Training

For over 50 years, Laerdal Medical has continuously strived to develop and improve needs-based products and solutions to meet educational and clinical needs. Since 1940, the company has been a pioneer in medical simulation development.

"We always start with the customer's objectives. In other words, what problems or initiatives are they trying to solve? How are they approaching it, and what is working and not working? Then we try and build a solution that addresses all aspects of a successful program—that includes initial training, implementation and measuring outcomes. Our focus is not on the simulator as much as achieving the outcome the customer is looking to achieve," said Joe Pahlow, vice president of sales, Laerdal Americas.

Laerdal solutions are used extensively in Army, Air Force, Navy and Marine Corps training centers. Today there are hundreds of Laerdal patient simulators throughout the armed forces community in a variety of environments, including OCONUS and hospital ships. In addition, Laerdal technologies have been beta tested at military installations in the most demanding environments, including lane training and litter obstacle courses in various climate elements.

"Laerdal Medical has been at the cutting edge of innovative health care training for over 50 years. Simulation has gathered increasing acceptance over the years as a core element of health care training. It serves as a fundamental approach to improving patient safety practice. The challenge now is to make simulation more accessible to the wider health care community, including the military and Veterans Health Administration," said Mark Owens, government service account manager at Laerdal Medical.

Laerdal Medical's SimMan is the world's most widely used advanced patient simulator. SimMan 3G is a realistic, full body adult, wireless patient simulator with advanced clinical functionality to teach critical skills. With "simplicity of use" being a fundamental principle of its design, both novice and experienced instructors can now take full advantage of the benefits of simulation. Built with the military standards in mind to be rugged, reliable, networkable and mobile, SimMan 3G Mystic makes simulation easier and more realistic than previous manikins.

The initial fielding of SimMan 3G Mystic is to the U.S. Army's medical simulation training centers. These sites represent over 28 facilities around the world. The high-fidelity manikins will also be fielded at the NATO Special Forces Headquarters in Belgium.

Hollywood Magic

Strategic Operations Inc. provides training services and products for military, law enforcement and other organizations responsible for homeland security. The company focuses on creating medical simulators that are very realistic, appropriate for the task at hand, useful for training, user-friendly, cost-effective, easily maintained and easily user-repairable.

The San Diego-based company also has a history in the motion picture industry, which they leverage in their military training solutions.

"After decades of experience in the TV/movie business, 12 years ago we introduced 'Hollywood magic' to military training," said Executive Vice President Kit Lavell. "We have supported the training of more than 700,000 military personnel with a mission to apply the techniques of the entertainment industry to make live military training 'hyper-realistic.' Our mission is to make the first combat mission hopefully no worse than the last hyper-realistic simulation."

According to Lavell, Strategic Operations' medical simulation services and products grew out of that mission mindset.

"We designed the Human Worn Partial Task Surgical Simulator 'Cut Suit' to be hyper-realistic, a term meaning so realistic as to suspend disbelief that it is not the real thing," said Lavell. "In this context, it is a simulator that is worn by a person on whom surgical procedures can be performed."

The company's tactical combat casualty care version of the Cut Suit allows medics, corpsmen and other first responders to perform on a live human—under combat conditions—procedures to realistically treat the three most preventable causes of death on the battlefield: uncontrolled hemorrhage, airway compromise and tension pneumothorax.

"The Surgical Cut Suit has been used in medical schools to train students in surgical and team skills," said Lavell. "Peer-reviewed scientific journals like the *Journal of Special Operations Medicine* and *American College of Surgeons Bulletin* have also featured articles about the Cut Suit."

Critical Trauma Skills

Operative Experience Inc. (OEI) has developed simulation-based systems to rapidly train both combat medics and surgeons in critical trauma skills. These include all procedures of tactical combat casualty care and a variety of major operations such as the surgical exposure of blood vessels, cricothyroidotomy, craniotomy, fracture fixation, fasciotomy, wound debridement, emergency thoracotomy and leg amputation.

"Our company does not just make simulators. For each combat trauma skill, we produce a multimedia training module based on the technical curriculum," said Robert F. Buckman III, vice president of sales and marketing. "The training modules detail the anatomy, tactics, tools and techniques for each of the critical trauma procedures and demonstrate the correct performance on the simulator. These modules are formatted so that they could be reviewed in a handheld device, such as a smartphone or iPad."

The first system OEI developed was in response to a need to teach proper two-incision four-compartment fasciotomy of the lower leg. There was a concern the incision and exposure during this procedure in theater was often of sub-optimal length, possibly failing depressurization in all compartments. This could result in loss of limb or even death.

The OEI training solution includes an operable lower leg simulator, and a training video detailing the anatomical planes and the correct procedure. The operable leg has embedded landmarks to ensure the incision is of appropriate length and that all four compartments have been decompressed. The early implementation results indicate a reduction in fasciotomy errors. Fasciotomy training cannot be performed effectively on live tissue animals.

Buckman explained that OEI training solutions are unique because their combat casualty care manikins have accurate anatomy at all levels and form the basis for rapid trauma skills training systems.

"Our simulators are designed by trauma surgeons, not engineers, and are the first in the world in which major, 'hands-in-the-body' operations can be performed. OEI systems are, accordingly, designed to support the training of surgeons as well as medics," said Buckman. "We have also begun to embed integrated sensors and programmed logic controllers directly into the simulators that will permit the automatic and objective grading of trainee performance."

All branches of the military utilize OEI simulators. "We have a set of manikins with wound patterns that simulate an IED explosion followed by an ambush, and all or parts of these are used by the Army, USUHS and USASOC," said Buckman. "Our two-incision four-compartment fasciotomy training system is used at all pre-deployment medical centers, the Army Trauma training center, Navy Trauma training center and C-STARs—the USAF's trauma training center. We are also working with C-STARs and the Navy on an advanced surgical leg, which will facilitate training in seven surgical procedures."

Ultimately, as medical simulation technologies continue to advance and a range of new companies enter the medical simulation industry, the military community will be flooded with a number of new options for training its medical personnel. These new options will, in the words of Todd, improve patient safety, reduce cost and improve outcomes. ✯

For more information, contact *M2VA* Editor Chris McCoy at chrism@kmimediagroup.com or search our online archives for related stories at www.m2va-kmi.com.