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# War zone trauma cases yield medical insights

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BAGRAM AIRFIELD, AFGHANISTAN - On most days of his six-month deployment, surgeon David H. Zonies was lucky just to get outside and see the sun. Often, his only break from work was 30 minutes on the treadmill in the physical therapy department.

Every day, a half-dozen casualties arrived at the Joint Theater Hospital here, nearly all needing surgery in the next 24 hours, many missing limbs, a few barely clinging to life. The 36-year-old Air Force major was the "trauma czar." His job was to coordinate the patients' care and operate on about a third of them.

At the end of October, however, Zonies took two days away from the job. He exchanged blue scrubs for a brown flight suit, flew to Kandahar Airfield 350 miles to the southwest and presented two papers at a medical conference.

One described bringing dialysis to the war theater, and the other was about a new lab test for measuring the strength of blood clots. Thirty people from four hospitals in Afghanistan watched his PowerPoint presentations and asked him questions. Then he flew back to work.

Zonies' big outing - and the willingness of the Air Force to let him take it - says a lot about how important medical research is to the American military, even during one of the most intense periods of a nine-year war.

The armed services are dedicated to saving every life, limb and eye of battle-wounded service members in Afghanistan and Iraq. The task requires not only skill and energy, but also the capacity to learn from failure and broadcast success.

Military medicine has made consistency and self-scrutiny part of the mission. It takes to heart the quality-assurance mantra "If you can't measure it, you can't change it." It values publication in peer-reviewed journals as much as does the faculty of Harvard Medical School.

"Among the big challenges in medicine is taking up new stuff that works and letting go of the things that don't. My sense is that the military kind of has a handle on both," said Carolyn Clancy, director of the Agency for Healthcare Research and Quality, the federal agency assigned to finding ways to better apply existing medical knowledge.

Historically, civilian medicine has had a poor handle on those challenges.

In a famous study published in the 1990s, a group of Harvard researchers measured how long it took for knowledge to turn into action in medicine. They performed a "cumulative meta-analy-sis" - essentially a running score card - of the results of clinical trials testing new heart attack treatments. They compared when there was enough information to say something worked, and when doctors started putting the treatments into practice.

They found that clot-dissolving thrombolytic drugs weren't widely recommended until 13 years after it was clear they saved lives. For the use of aspirin in acute heart attacks, the lag was 10 years.

In the armed services, new approaches are viewed with more urgency.

"There is a push for people to get feedback quickly. It can't just be when somebody gets around to looking at the data," said Cmdr. Lisa Osborne, a 42-year-old Navy nurse anesthetist who is coordinating in-theater research in

Afghanistan. "There's an expectation to ensure that 'lessons learned' are actually changing practice."

The upshot is that military medicine in many ways is a model for civilian medicine. It's also a testing ground, although not in the way many people might think.

**War zone discoveries**

Randomized controlled trials are the gold standard for trying out new treatments. But with few exceptions, such studies are never done with soldiers. The existence of rank and the chaos of the battlefield make getting "informed consent" for clinical experiments essentially impossible.

Nevertheless, war has been an incubator for medical progress as far back as the time of the Roman legions. From a flood of mayhem and disease, new insights emerge. Andrew N. Pollak, a surgeon at the University of Maryland's R Adams Cowley Shock Trauma Center in Baltimore and president-elect of the Orthopaedic Trauma Association, sees that happening now.

The Shock Trauma Center gets about 30 limb-threatening leg injuries a year. Doctors at the Walter Reed Army Medical Center get about 30 a month. Insights at the military hospital are causing orthopedists everywhere to question how they treat violent leg fractures. Pollak is helping design a randomized trial that will test two different strategies this year.

"What the war has done is focus our questions better," he said.

The insights available from combat in Iraq and Afghanistan have been especially obvious because of the length of those conflicts, said John B. Holcomb, a surgeon who retired in 2008 after 23 years in the Army and is now a professor at the University of Texas Health Science Center in Houston.

"At the beginning of a war, the flow of knowledge is from the civilian world into the military," he said. "After a couple of years, it is from the military to the civilian."

**Trauma database**

A trauma registry is the data backbone of state and regional trauma systems in the United States. But at the time of the Sept. 11, 2001 attacks, the Department of Defense didn't have one.

It does now.

The Joint Theater Trauma Registry is the record of injuries sustained, treatment given, surgery performed, transfusions and antibiotics prescribed, complications sustained and, most important, health outcomes in 40,000 casualties from the Iraq and Afghanistan wars. The data are so important that troops are deployed just to capture it.

At Bagram this past fall, Maj. Camille Walker and Maj. Harriett Johnson, Air Force nurses, spent their days in a windowless room at the hospital transcribing data from paper patient records into computer files. Each morning, one of them would go on ward rounds and take notes.

"We need to get every CT scan, diagnostic test and procedure code, and we try to do it in real time," Walker said during a break from the arduous work.

The registry is a data mine that, excavated properly, can yield nuggets of insight.

Consider "abdominal compartment syndrome," a rare condition most often seen in burn patients, in which internal organs swell and essentially choke each other.

The registry allowed doctors to correlate the syndrome with the amount of IV fluid given. Guidelines for fluid

resuscitation of burn victims were rewritten and the problem "went to zero overnight," said Col. Brian J. Eastridge, an Army surgeon who helps run the registry.

In another particularly useful insight, military surgeons studying registry records determined that the mortality of patients needing "massive transfusions" (10 or more pints of blood in a day) could be reduced from 33 percent to less than 20 percent if they received whole blood, not just red blood cells and an occasional unit of plasma.

"We modified our transfusion guidelines over a year ago as a result of this," said Lynette Scherer, the 43-year-old chief of trauma at the University of California in Davis, who visited Bagram in October as part of an American College of Surgeons delegation. "It has made a difference for patients I take care of in Sacramento."

**A broad variety of studies**

There are 96 military "research activities" underway or being planned in Iraq and Afghanistan.

Before any begin, an eight-person Joint Combat Casualty Research Team addresses two key questions: Does this study have to be done here? Is it feasible? If the answers are yes, the team helps researchers fine-tune their study design and sometimes helps collect data. A "human protections administrator" audits the activities, which are first approved by ethics panels in the United States.

The topics are wide-ranging. A big one now is pre-hospital care.

Medics are trained to do many things for wounded soldiers, both on the ground and en route to the hospital. But how many of the life-saving interventions get done, whether they were done right, and whether they made a difference are questions that largely go unanswered.

"The question we have to be constantly reevaluating is: Are we teaching them the right skills?," said Army Lt. Col. Robert Eckart, a 39-year-old cardiologist who heads the joint research team. An equally relevant question is who should be doing what.

Most medevac helicopters carry only a medic or corpsman to attend to the wounded. The Army, however, is starting to rotate critical-care nurses onto helicopters, too. The British armed forces send physicians into the field to assist medics. These varied practices are creating a natural experiment that may shed light on which strategy works best.

"I think a lot of people would like to know that," said Osborne, the Navy anesthetist on the joint research team.

There are studies on the frontline treatment of traumatic brain injury and on whether heart problems can be adequately addressed without evacuating patients to Germany. There's a study to determine whether muscle-building powders, which troops take like vitamins, affect their livers. One project seeks to learn whether playing with dogs eases combat stress.

As of this week, 586 articles arising from the experiences of the Iraq and Afghanistan wars have appeared in peer-reviewed scientific journals.

There will be more.

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