

PROTECTING THOSE WHO SERVE

Teleradiology technology
delivers quicker diagnoses
for deployed troops

by Dana Hinesly

Making reliable teleradiology available to forward-deployed medical facilities is a top priority for the military, looking not only for direct benefits, but also for long-term implications.

"Teleradiology is the leader only because we've been doing it longer [than any other form of telemedicine], but if you can do teleradiology, you can do tele-anything," says Col Les Roger Folio, DO, MPH, MSc (Rad), MAS, chief of the US Air Force Telehealth (Falls Church, Va). Earlier this year, Folio accompanied a team into Iraq to further progress on the goal of global connectivity on bases that the Air Force took over from the Army. "Currently, several bases in the deployed setting are being set up with a common expeditionary telehealth solution."

Combat support hospitals (CSHs) aren't the only ones benefiting from this progress. The Department of Defense (DoD) employs teleradiology in domestic, fixed facilities as well as Veterans Affairs hospitals. In addition to improving the level of care, the technology helps compensate for the shortage of qualified specialists that currently exists in every branch of the military.

"The Services do not have enough radiologists to deploy to all locations," says Robert E. de Treville, program manager and designated approving authority at the Army PACS Program Management Office (APPMO) in the US Army Medical Research and Materiel Command (Fort Detrick, Md). "Radiologists deployed to CSHs will receive and interpret exams from smaller facilities where no radiologists are located."

The Navy employs teleradiology to provide backup for radiologists in solo billets. Overnight and on-call coverage is provided from California for physicians in Europe and the Pacific. And the Air Force will soon use a single PACS vendor to connect nine sites in the Pacific Air Forces (PACAF).

"We're trying to reduce the temporary duties required," says Maj Erich P. Murrell, USAF, MSC, FACHE, FHIMSS, CISSP, chief of medical technology sustainment and support in the Office of the Air Force Surgeon General in the Air Force Medical Support Agency Clinical Engineering Branch. "For example, if somebody in Japan goes on leave, right now they have to physically replace him. Our ability to shift workload dynamically across PACAF will reduce the temporary-duty cost for radiologists by 95 percent." The system also will enable sites without radiologists to obtain interpretations much faster.

A similar project is taking place in Europe so that all of US Air Force Europe can work together via one PACS. This dynamic load-leveling approach means that patient care has no boundaries.

"We have digital imaging on board our ships all over the world, specifically on aircraft carriers and large amphibious ships," says CDR Timothy Duncan, MD, a radiologist at Naval Medical Center San Diego. "Those images are sent to the medical centers for interpretation, and reports are then emailed back. Teleradiology means that shipboard physicians are able to provide real-time screening of CR studies."

MEASURING PROGRESS

“The Services have aggressively migrated from analog to digital radiology technology and workflows,” says de Treville, who adds that services are approximately 90% digital in their radiology operations.

In fact, all DoD medical centers have PACS and teleradiology. “The installation of digital imaging at all of the smaller medical facilities (to the level of Battalion Aid Station) means that essentially every medical care component will be connected to a larger center for radiology diagnosis,” says Lt Col Edward Callaway, USAF, MC, officer-in-charge (OIC), PACS, teleradiology, and speech recognition at the Landstuhl Army Medical Center (Landstuhl, Germany).

This technology allows the workload in Europe to be shifted based on personnel availability. Normally, two radiologists serve the 10 teleradiology clinics that feed the regional military hospital at Heidelberg, Callaway explains. “When one deploys or is gone, we shift the workload to Landstuhl. This summer, we will be shifting it to [the United States-supported UN clinic at] Kosovo for the Reserve radiologist to read.”

PAVING THE WAY

Instituting teleradiology through the military did more than improve the field physician's access to interpretations. It made overall improvement in patient care possible through faster access to any specialist, anywhere, in any discipline.

“A big part of establishing digital care is that infrastructure can be used as the foundation for all the other ‘-ologies,’” Murrell explains. “Patient vital statistics, digital dentistry, cardiology, ophthalmology, lab results—anything we can make electronic is being considered for addition to the PACS.”

And such upgrades don't necessarily translate to significant cost increases. Using a methodical approach means that the system keeps building, without tearing down what's already done, he says.

De Treville concurs. The DoD already has demonstrated—either in active use or undergoing operational testing—the feasibility of telepathology, teleophthalmology, and telepsychiatry, among many others, he says.

It is almost impossible to overstate the growing importance of telemedicine and

the role it plays in the military's approach to providing care.

“Over the next ten years, it will become the cornerstone of our government's approach to resolving health issues before they become critical disease,” de Treville predicts. To reach goals of this level, the Army, Air Force, and Navy are working in concert, with support from such departments as the Telemedicine and Advanced Technology Research Center (TATRC of Frederick, Md).

“In April 2004, the Army initiated the teleradiology system for [all of the military's current areas of operation], which includes Iraq, Kuwait, and Afghanistan, as well as other deployed sites like Bosnia and Kosovo,” says COL Ron Poropatich, liaison officer to the Department of Homeland Security, senior clinical advisor to the TATRC, and telemedicine consultant for the Army Medical Department. Poropatich gives credit to the TATRC for helping to make the implementation happen. “The system has since expanded to seven disciplines: burn, trauma, nephrology, pediatric intensive care, infectious disease,

dermatology, and ocular health, [the latter of] which includes both optometry and ophthalmology.”

To obtain a consult, the deployed healthcare provider simply emails the patient's clinical history and exam findings—minus identifying patient information—along with any necessary digital images, Poropatich explains. Response times range from as few as 6 hours for urgent requests to 24 hours for routine queries. “The beauty of the system is its simplicity; all they need to do is remember an email address,” he adds. “Here in the United States, we figure out who is going to answer it.”

Though established by the Army, the telehealth system is benefiting everyone. More than 190 deployed providers have used it, with about 15% of the consults coming from Air Force and Navy providers, Poropatich says.



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—Col Les Roger Folio, DO, MPH, MSc (Rad), MAS

BRING ON THE BANDWIDTH (PLEASE)

You don't have to be tech savvy to understand the importance of bandwidth. Anyone who has waited 20 minutes for a favorite song to download knows that more bandwidth makes life easier. It also can save lives.

For the medical professionals serving their country by treating wounded service members, waiting for images to transmit is frustrating.

“Bandwidth limitations prevent smaller units from transferring studies digitally,” says MAJ Gerald York, MC, OIC Radiology for the 228th Combat Support Hospital, a reserve unit out of San Antonio currently serving in Mosul, Iraq, that treats referrals from the outlying forward-operating bases as well as nearby prisons. “I have a system capable of sending images anywhere in the world, but we lack the satellite send/receive infrastructure to accomplish this goal.” Instead of transmitting images via satellite, lower-quality digital images are emailed or printed and transferred.

Troops fighting in the desert aren't the only ones in need of increased transmission capabilities. The Navy employs teleradiology shipboard, specifically on aircraft carriers and large amphibious ships.

“The images are sent electronically to the medical centers for interpretation,” explains CDR Timothy Duncan, MD, a radiologist at Naval Medical Center San Diego. “The equipment is reliable and works very well; the lack of available bandwidth is really the rate-limiting factor for our teleradiology efforts.”

A Familiar Endeavor

The struggle to obtain dedicated bandwidth for medical use has been taking place for more than 10 years. The lack of improvement is not a result of malice as much as inattentiveness.

“It is probably as much educational as it is

With forces spread around the globe, being digital is important, as telehealth saves lives by preventing unnecessary evacuations. Teledermatology referrals alone resulted in 30 avoided aero-medical evacuations, with a combined potential cost savings of \$640,000.

“There's a lot of expense in evacuating patients with skin problems from the field for an evaluation,” says Callaway, who serves as the US Army European regional medical command clinical consultant for teleradiology. “A lot of the issues are not really critical, but they require somebody with a little more expertise than a physician in the field.”

the fact that deployable environments are very linear,” says Robert E. de Treville, program manager and designated approving authority at the Army PACS Program Management Office (APPMO) in the US Army Medical Research and Materiel Command. “It's difficult to get new ideas and capabilities inserted into today's portfolio of operations.”

Fortunately, the ongoing need continues to be championed from within the military community. One proponent is LTC (P) Robert Rhodes, signal officer for the Army's Medical Command in San Antonio, who markets the benefits of dedicated medical bandwidth to the signal and combat commanders in the field.

Rhodes isn't the only one aware of the problem. “It's still an issue, but it's better than it was a year ago,” says Ronald R. Richardson, Jr, deputy program manager in the APPMO. “I think Central Command is recognizing that bandwidth is a force multiplier; it helps preclude evacuations and provides better care to the soldiers in the field.”

Active coordination assistance has translated to increased satellite and terrestrial connectivity of medical units in support of Operation Iraqi Freedom, including combat-support hospitals in Iraq, Kuwait, and Afghanistan, de Treville says.

But as deployments disperse, American troops around the globe and their medical teams will continually strive to provide a higher standard of care—resulting in an even greater demand for available connectivity. For a nation eager to support its troops, perhaps the best method isn't magnetic ribbons but action.

Stresses de Treville, “Bandwidth for health-care is probably the most important enabling factor in projecting the best possible care to our service members deployed in harm's way.”

—DH

Telemedicine also has the potential to save lives by *triggering* evacuations. “We actually have caused early evacuations because of our early assessment and diagnosis. Ultimately, it means getting the patients to the right specialist in a timely fashion,” says LTC Hon Pak, a US Army teledermatology consultant. In fact, since its inception, teledermatology consultations have caused seven evacuations. “It's about providing the right care at the right time for the right patient.”

A CONTINUITY OF CARE

Teledermatology isn't the only telemedicine increasing in use. As of May 2005, about 600 dermatology, 40 ophthalmology, 50 infectious disease, 760 dentistry, and 14 pathology teleconsults were completed, according to Poropatich.

“Telemedicine is really about providing a continuity of care,” he says. And that care is not limited just to US soldiers.

“Last summer, about half of the Baghdad hospital was filled with Iraqi nationals, either military guard, police, or detainees,” Poropatich says. “In Balad, that number is about 20 percent, and in Mosul, Iraqis constitute about 20 percent of the patients.” Further deployment of Web-based teleradiology in the Abu Ghraib and the Buca prison medical facilities is slated for installation in the fall.

“We provide all the care for detainees at both prisons,” Poropatich explains. “What was lost in [the negative press about Abu Ghraib] is all the work that's been going on for several years now.”

ON THE HORIZON

While working diligently to provide care for all active duty and retired service members and their families, the military's medical professionals are keeping their eyes on the future. For the Army, a key aspect of their evolving telemedicine program will be developing standards and guidelines for how images are gathered.

“It's not enough to give someone a camera and just have them take pictures,” says Pak, who sits on the board of directors for the American Telemedicine Association (Washington). “You need protocols that dictate the images required for each type of injury.”

At the top of the agenda for both the Army and Air Force is establishing digital mammography programs. Much of this

progress, however, is dependent on the performance of existing equipment.

"The Army is waiting to see just how good digital mammography technology turns out to be," de Treville says. By monitoring ongoing studies of both computed and digital mammography, the Army hopes to determine which will be the best alternative to the film it currently uses. The Air Force is taking a similar tack.

Other improvements will make work safer for those treating patients on the front lines. To care for their fellow soldiers, field medics often must put themselves in the line of fire. But that could be changing.

The concept is similar to a self-sufficient ambulance. Virtually eliminating in-field medics and battlefield hospitals, these autonomous units—dubbed "trauma pods"—would be able to stabilize wounded soldiers as they are transported to full-service facilities.

Wireless technology will allow human surgeons to perform telesurgery during the trip.

In March, the Defense Sciences Office of the Defense Advanced Research Projects Agency awarded a contract to a group of universities and high-tech firms, tasking them with making the concept a reality.

Regardless of what future technology offers, it undoubtedly will benefit those who serve. "I think the bottom line is the current generation of technology combined with the different program offices working together puts us very close to being able to deliver the capability of a Walter Reed Army Medical Center to a soldier in the Humvee on the front line," says Ronald R. Richardson, Jr, deputy program manager in the APPMO. "And that's really what it's all about." ■

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TELERADIOLOGY VIA FAX?

Military medics make the most of what's on hand

Think of it as teleradiology in its most primitive form. In 1994, a physician assistant (PA) stationed at Kunsan Air Base (South Korea) treated a boy complaining of shoulder pain. Because the new Medical Diagnostic Imaging Support teleradiology equipment was not yet in place, the PA attempted to describe the injury to a specialist over the telephone, which proved fruitless.

So he did the next best thing. "He put the film on a viewbox, traced the clavicle fracture onto paper, and faxed it to Seoul," recalls Col Les Roger Folio, DO, MPH, MSc (Rad), MAS, chief of the US Air Force Telehealth.



And it worked. The drawing (above) gave the orthopedic specialist everything he needed to recommend treatment.

"This event truly helped me understand the clinical need for diagnostic teleradiology support at remote locations," says Robert E. de Treville, program manager and designated approving authority at the Army PACS Program Management Office in the US Army Medical Research and Materiel Command, who was at Kunsan Air Base at the time. He notes that image interpretation in Korea took 21 days in 1994, as compared to 4 hours today.



Another story of medical ingenuity comes from Folio's personal experience. Needing to verify the severity of a local resident's painful thumb injury before recommending evacuation—but without a traditional X-ray—he improvised.

"I used the dental X-ray [left], developed the film in urinalysis cups, and taped it together," he explains. Albeit poor, the quality was enough for definitive diagnosis. "Acceptable levels of compression depend on the pathology and situation."

Both examples illustrate the use of interim solutions, he says. "I learned from an orthopedic surgeon in Alaska that if you do not have the right tool, then use the wrong tool the right way until you get the right tool to treat your patient the right way."

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TAKING CARE TO SOLDIERS

Logic dictates that the best medical care should be available where it is needed the most. For the military, that need is on the front lines, and the goal of delivering it is almost complete.

"The primary sites in Afghanistan and Iraq all have teleradiology equipment now," says Ronald R. Richardson, Jr, deputy program manager in the Army PACS Program Management Office (APPMO). "These sites provide echeloned support for radiology, so a site without a radiologist can push workload to a radiologist at a supporting site in-country."

In terms of radiology, three systems have been deployed in Iraq (in Baghdad, Mosul, and Balad) as well as three systems in Kuwait and one in Afghanistan. Put in place by the Army, the technology is shared by all service branches.

"It is a huge confidence builder for our deployed service members to know that the medical expertise of our modern military medical centers can be projected to very remote environments," says Robert E. de Treville, program manager and designated approving authority at the APPMO in the US Army Medical Research and Materiel Command.

Not Quite Perfect

Despite notable progress, some hardships specific to Iraq, Kuwait, and Afghanistan present challenges for medical professionals serving there.

"The major threat to the equipment we use is the heat," says MAJ Gerald York, MC, OIC Radiology for the 228th CSH, currently serving in Mosul, Iraq,

and covering medical assets in Tikrit and Northern Iraq. "We protect it with environmental control units and tarps to shield equipment from the sun." To protect against the ongoing threat of mortar and rocket fire, the equipment is "hardened" by surrounding it with cement protective barriers and sandbags. "The equipment also is cleaned on a weekly basis to remove the significant amount of dust that accumulates," he adds.

Working in a war zone also means working without the basic equipment sometimes taken for granted in a domestic setting.

"MRI is not deployed forward, mainly because of the logistics of keeping the magnets cold enough to operate," York explains. Interventional equipment also is limited in the forward hospitals. "I have been making do with arterial line catheters to do limited angiography, but I am unable to do any significant intervention to help the surgeons stop bleeding, which is very frustrating."

However, efforts are being made to provide the latest technology to the front lines, and when possible, new equipment does make it to deployed locations.

"Newer multi-slice CT scanners are filtering into theater, which allows for thinner slices, faster scan times, and better heat tolerance during scanning," York says. "These are all issues that become important in mass-casualty events. The faster that scans can be performed, the faster that appropriate treatment can be rendered."

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