Guest Article

HEATON LECTURE – Combat Casualty Care

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Following a tradition started in 1981, each year a distinguished medical professional is invited to give the key-note lecture at the 7th Medical Command Medical-Surgical Conference in Germany, to honor the memory and the achievements of the great Army Physician Lieutenant General Leonard D. Heaton.

We, as members of the health care delivery systems of the US Armed Forces have many responsibilities and challenges, but none takes precedence over the care of our servicemen and women injured in combat. While combat casualty care includes a host of medical disciplines, and historically infectious diseases have often predominated over missile injuries as sources of casualties, my paper will be restricted to the latter category. In commemorating General Heaton, I speak as a surgeon. If he could speak today, he would be the first to tell you that the wounds of war are a surgical disease.

To Hippocrates is attributed the admonition, " . . . he who wishes to become a surgeon should go to war." Sir Clifford Albutt, Regius Professor of Physics at Cambridge University, reflecting on the Crimean War, concluded in 1860, " . . . how wide and varied is the experience of the battlefields and how fertile the blood of warriors in raising good surgeons." Twelve years of war in Vietnam (1961-1973) provided more than enough experience to train thousands of US surgeons and tens of thousands of medical personnel of all descriptions in the techniques and philosophies of state-of-the-art combat casualty care. Perhaps never again will we as a nation be quite as proficient in the care of the wounded GI as we were in Vietnam. Certainly no conflict since has seen such expertise. Why were we the best ever at what we did there?

Success in combat casualty care during the Vietnam War can be attributed to six factors. First, US Forces enjoyed complete air superiority throughout the war. Thus all medical operations, from helicopter air ambulance rescue to definitive surgery, to fixed wing medevac out of the theater, could be accomplished without aerial threat. Moreover, the major treatment facilities—the evacuation hospitals—while theoretically "semi-mobile," were in fact fixed installations with concrete floors, air conditioning and macadamized roads and helipads. Second, US Forces enjoyed, for the most part, complete ground security throughout the war. Admittedly, any installation could be and was rocketed, mortared, even over-run. Nonetheless, few medical treatment facilities experienced significant damage or loss of life among their staff or patients. These two factors contributed to an easy flow of patients through the medical treatment chain and minimized the anxieties generated by practicing in a combat zone among those responsible for patient care.

The third and fourth factors contributing to success were the high density of medical treatment facilities and personnel within the combat zone. During the peak of the conflict (1968-1969) there were 24 hospitals "in county;" over one third of these were evacuation hospitals, which functioned as University Hospitals or Level I Trauma Centers, since their staffs included all the surgical sub-specialties. They could perform any operative procedure short of those requiring cardiopulmonary bypass. An abundance of trauma surgeons enabled these hospitals to have four surgical teams each, and it was rarely necessary to reach beyond the first or second teams to render appropriate surgical care, even to the large numbers of casualties (40 to 50) received on a given team's night on-call. The evacuation hospitals had six operating rooms and rarely used more than four at any one time. The helipad, triage/resuscitation area, radiology area, bloodbank, OR and ICU were all connected and on the same level (essentially built on the same concrete slab).

All these factors provided for an incredible, and probably never again to be seen, efficiency in the delivery of lifesaving care to the combat casualty of the Vietnam War while the US was there.

A fifth factor of great significance was the ready availability of whole blood. At the peak of the conflict there were in excess of 35,000 units of whole blood in South Vietnam. This

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blood came from the Unites States and from the Pacific Command and was collected in the combat zone. I personally never ran out of blood nor knew of anyone who did when I was there in 1968, 1969 and 1970. And that's more than I can say of my own Level I Trauma Center at home in peacetime 20 years and more later! Even more important, this blood supply was in the triage area, separated into the major ABO types. A Specialist 4th Class (Spec 4) was responsible for determining a patient's blood type. This test could be performed within seconds. In fact, I timed the process once with a stop watch. From the moment of arrival at the triage area until type-specific whole blood was running intravenously required 82 seconds! That occurred at the 12th Evacuation Hospital in Cu Chi in 1970, and I have never seen it replicated in civilian life.

Finally, and perhaps most significantly, combat casualty care reached new heights because of the helicopter air ambulance. While helicopters were not new to the combat zone, we had never seen them employed so extensively with a primary, almost exclusive, mission of removing wounded from the battlefield. The UH1D (Huey) and its medical evacuation call sign, "Dustoff," became synonymous with a new level of expertise in medical care for the wounded soldier. At the height of the conflict there were over 100 air ambulances operational in Vietnam. They averaged 2.5 missions and five patients per day with an average pick-up to delivery time of only 35 minutes. At a cost of $250,000 each, they probably represented the best dollar investment in that war!

These six factors combined to render an unprecedented record of combat casualty care in Vietnam. Hospital mortality was 2.6%, which was a slight increase over that same parameter in the Korean War (2.5%), but is readily explained by the air ambulance, which enabled more critically wounded GIs to reach major treatment facilities more rapidly than in any preceding, or in fact subsequent, war. The ratio of US killed in action (KIA) in Vietnam, (58,021) to wounded in action (WIA) (303,678) — 1/5.2 — is the highest ever recorded. To paraphrase the words of Sir Winston Churchill following the Battle of Britain in 1940, "Never in the field of human conflict have so many owed so much to so few (the RAF pilots)." It has been said of US medical care in Vietnam, "Never in the field of human conflict have so many been treated so effectively." Were mistakes made in Vietnam, medically? Of course.

First and foremost, incoming personnel were not briefed appropriately. Of course I speak as a surgeon, who literally had to make the transition from elective surgery at home to emergency surgery in the combat zone. Five weeks of basic training was wasted on such subjects as the Federal Stock Registry and map reading. What I hungered for, and needed most, were protocols for the care of the war wounded.

We must not forget the fact that as recent as the late 1980s, the American College of Surgeons concluded that " ... less than 25% of board eligible general surgeons evidenced significant trauma training in the US." Most of us arriving in Vietnam had little or no trauma experience, and certainly no experience with the management of high-velocity missile injuries. I recall spending what seemed like a long time at the 90th Replacement Battalion in Long Binh while awaiting eventual assignment to the 71st Evacuation Hospital in Pleiku. This time would have been better spent had I had the opportunity to be coached by a surgeon about to complete his tour of duty in Vietnam. A school whose faculty was composed literally of those about to rotate home could have lectured us newcomers didactically for a few days—better yet a week—in the principles of combat casualty care, which they had learned in the preceding 11 months. There were plenty of surgeons in country to make this logistically simple. Instead, most of us had to learn the hard way at our final destination.

Secondly, we never used external fixation of fractures in Vietnam. We did use internal fixation, but it was quickly abandoned as an inappropriate approach to open long bone fractures resulting from high-velocity missiles, because osteomyelitis occured too frequently. External fixation of fractures did not reach our trauma centers until after the Vietnam War. The principle was not discovered then — rather it was rediscovered then — and was not applied to wounded on US battlefields until Desert Storm in 1991. Raull Hoffmann, a Swiss Surgeon, introduced the technique of external fixation of fractures of the mandible which bears his name in the 1930s. He later described the application of the principle to fractures of all the long bones, including the pelvis, in the 1940s.

A third deficiency, albeit a relatively trivial one, was perhaps overuse of the double barrelled colostomy for colon wounds. This was mandated in principle in 1970 by the US Army Surgeon General, largely because of the large number of colon wounds complicated by pelvic abscess. Nonetheless, it seemed excessive for cecal and right colonic wounds as a routine treatment procedure. Colonel Heaton cautioned against primary repair of all colon wounds then, but offered a choice of solutions to colon injuries seen at Pearl Harbor in 1942.

Finally, we were late in realizing what was in fact learned and applied to the Vietnam casualty, namely resuscitation with crystalloid solution (Ringer's lactate). Acute respiratory distress syndrome (ARDS) was first described among US wounded in the Vietnam War and, not surprisingly, there resulted hesitation in what would appear, by the standards of that time, excessive fluid administration. How then did our most recent conflict, Desert Storm, compare with regard to Vietnam and the care rendered there?

Theoretically, combat casualty care should have been significantly better

in the Persian Gulf War. After all, we had all the advantages we had during the Vietnam War, and even some more. Specifically, we had complete air superiority in the Gulf, and in fact, complete ground security as well. We had an equally high, or even higher, density of medical treatment facilities and trained medical professionals to staff them. We also had plenty of blood, I am told. Our helicopter air ambulance capability was augmented by the addition of the UH-60 Blackhawk, whose twin engines gave it not only greater lift and range but also greater resistance to enemy ground fire. Added to this list of resources are two more which dramatically distinguish the combat casualty care providers sent to the Persian Gulf from their predecessors in Vietnam: The 12 years of experience gained in Vietnam—which have been studied and restudied since—and the benefit of the two decades of trauma research, in the US and elsewhere, which was accomplished between the two wars.

Prior to the outbreak of the ground war in the Persian Gulf, US assessment of the potential medical need was grim. We were told by the news media that " ... the potential for carnage is immense. For the US military, dealing with it could prove the toughest part of the Gulf mission." Former Assistant Secretary of Defense for Health Affairs, John Beary, said of the impending ground offensive, "It's potentially the biggest medical challenge we've faced since World War II." Others, including trauma surgeons interviewed by the press, cautioned us about the wounds, "which would be much more severe than ever seen before because of the sophisticated and devastating weapons of modern warfare." These would prove to be words of charlatans. There is a common medical denominator to all wars, one which will transcend the wounding potential of "modern technology" and simplify the surgeon's task. Simply stated, if a weapon has heretofore unseen but nonetheless devastating wounding power, wounds will be sufficiently severe as to be beyond treatment. Dead soldiers are not a medical challenge, nor are those triaged to expectancy. More to the point were the words of George Santayana, from his *Life of Reason*, "Those who cannot remember the past are condemned to repeat it." If only we could remember what we had spent so many years learning in Vietnam.

As in Vietnam, we deployed a large number of hospitals and health care workers to the Persian Gulf. It was rumored that the ground war could not begin until the medical assets were in place in sufficient numbers. These numbers included some 93 hospitals, depending upon the description of hospital, and 19,000+ hospital beds. Of these, there were 43 US Army hospitals, including 21 evacuation hospitals, accounting for over 13,000 beds. Over 2,500 physicians from all services were deployed. Coalition forces supplied an additional 2,500 beds within ten hospitals. The requisite number of 20,000 beds was met, and the war was allowed to proceed.

My own deployment was with the 251st Evacuation Hospital, a South Carolina, US Army National Guard unit from Columbus under the command of Col A. Mason Ahearn, an orthopaedic surgeon and veteran of the Vietnam War. We were located at King Khalid Military City (KKMC) in northern Saudi Arabia and occupied the city hospital there in a host nation agreement. It is a modern 400-bed facility. We were co-located with the 85th, the 114th and the 350th Evacuation Hospitals in an Echelons Above Corps (EAC) configuration. The host nation agreement provided for dual authority over all hospital units, but the gentlemen's agreement in force stated that, had the hospital been caring for mostly American casualties, the Americans would have primary responsibility for decision making. The converse would hold true should a majority of the casualties be Saudis. As it turned out, we cared for more Iraqi soldiers and civilians than those of any other nationality.

While in theory the host nation hospital concept offered potential benefits, those benefits were counterbalanced by significant drawbacks. Our hospital was "up and running" essentially immediately but it was clearly not programmed for combat casualty care. There was no identifiable area for triage, the operating room functioned slowly and inefficiently for a variety of reasons, and the ICUs and burn unit were closed for lack of adequate staff. Islamic culture pervaded the atmosphere and culture gaps were prevalent. A "Body Chiller Center" in the basement was reserved for the dead and familial convocation, which would have proven a nightmare to the logistics of triage. The Islamic physician would insist that the dead be brought inside the hospital and that the expectant be admitted to the surgical wards. Many languages permeated the hospital. Polish nurses and nurse anesthetists spoke only Polish, Philippino nurses spoke Tagalog, Egyptian nurses and many physicians spoke only Arabic and so on. Often three separate nationalities with three mutually exclusive languages performed a single assignment. Rivalries were inevitable and often counterproductive. Despite the relative luxury of our fixed installation, we often envied the relative efficiency of our counterparts in tents.

Two unique hospitals in our area belonged to the Saudi Ministry of Aviation and Defense (MODA), as did the hospital occupied by the 251st. One of these was north of us and consisted of 13 Mercedes-Benz 18-wheelers capable of travel anywhere over relatively smooth terrain (such as the desert), with each unit subserving a special function. One was an operating room, another an ICU, another a kitchen, etc. All were connected side by side in a simple column with walkways above ground. Each cost a reported $1 million. A large tent was utilized as the triage area. This hospital had maximal mobility and minimal set-up time, but these

features were never stressed by proximity to the forward edge. A similar hospital was composed of C-130s and was even more mobile, but again was not to my knowledge really combat tested.

The 251st Evac Hospital began patient care on Feb 17, 1991 and closed for patient care on April 26, 1991. During that time it admitted 2,250 patients and performed 428 major operative procedures. Its outpatient services recorded 36,374 visits. We were told, unofficially, that we were "the busiest hospital in theater." I personally had up to 36 patients of my own in the hospital at one time, and when I departed at the end of April, I turned over 12 patients to my Saudi/Egyptian counterparts.

We triaged on only one occasion. I was the triage officer and I admit to mistakes and lessons learned. It would have been a good dress rehearsal for days that, although anticipated, never came. On the night of Feb 26, shortly after the ground war started, we received 64 Egyptian soldiers beginning at 10PM. Of these, 21 were declared priority and were operated on and 43 were classified walking wounded and were admitted after local care of their wounds. There were no expectant patients nor were there any patients who died after reception and treatment. The most difficult problem we faced was the congestion and confusion caused by those accompanying the wounded soldiers. Those tagging along usually exceeded those wounded by a two to one ratio! Many carried weapons. Strict enforcement of separation of casualty from friends and weapons at the door of the triage area is essential. A combination of military police as well as senior NCO medics is mandatory for this purpose, particularly when language barriers prevent explanation of possible exceptions to the rules.

Equally fundamental in assessment of mistakes made and lessons learned was frequent failure to completely disrobe our casualties. This can lead to oversight with tragic consequences. A combination of cold weather, Islamic custom and haste contributed to this deviation from protocol. By 10AM the following day the last patient was moved out of the operating room; the triage area had been cleared by 1AM and the last patient admitted to the surgical wards by 5:30AM. In retrospect, we were one of the few hospitals to ever resort to a true triage mode of operation. This may prove to have been an unfortunate paradox. No single principle in successful combat casualty care exceeds in importance a sound understanding of triage. However, to learn triage requires repeated exposure to large numbers of casualties treated over a relatively short period of time. Had this been our experience we would have considered ourselves experienced veterans of mass casualty care, but simultaneously we would also have witnessed a rise in our morbidity and mortality figures. Appalled at the statistics, we would have rightfully opted for inexperience in this principle. Now, however, we must recognize that those who claim experience with, let alone develop doctrine regarding triage, based on the Persian Gulf experience, are merely speculating. What then did we learn medically from that brief encounter with war?

In an article titled "United States Military's Wheat and Chaff" the syndicated columnist Evans listed nine "winners" and nine "losers" during the Persian Gulf War. The winners included such obvious factors as US air power and the Patriot missile. No mention was made of US medicine. The losers included chemical protective equipment and the B-1 bomber. Again, no mention was made of US medicine. Did we go unnoticed? We did introduce some "new" technology to the battlefield.

The computerized tomographic (CT) scan was first seen in war during Desert Storm, and neurosurgeons there were grateful. External fixation of fractures was used extensively and had wisely been placed in Deployable Medical Systems (DEPMEDS). Interlocking intramedullary rods were used successfully (we think) for the first time in a combat zone. Wound closure with constant tension traction was applied to debrided wounds that, for one reason or another, had not been closed primarily with delayed primary closure (DPC) techniques. These are a few of the lessons learned from my vantage point. What were the lessons not learned? What were the mistakes made? Five stand out.

First, wound debridement was in my estimation inadequate. One of the lessons of combat casualty care that cannot be learned anywhere else but on the battlefield is thorough, one time only, adequate debridement of high velocity missile injuries. And we were not there long enough to learn this fundamental skill. In Vietnam we first debrided insufficiently — we then over-debrided multiple fragment wounds (MFW). By the fourth month of combat casualty care in Vietnam we were experts — we debrided "just enough." Along the way we were coached by those who had been there, and that made the difference. Equally critical to successful debridement is timely closure of debrided wounds. Delayed primary closure should be performed five days later. This was usually not done to our soldiers in the evacuation chain. One surgeon at Walter Reed, on promise of anonymity, informed me that he did not encounter a single GI whose debrided wounds had been subsequently closed in a timely manner (DPC)! Some surgeons told me that their hospital commander, also a surgeon, forbade them to close debrided wounds as described. This is a serious error for many reasons, hopefully obvious, including good medicine, cosmesis, reduced morbidity, unnecessary evacuation and return to duty.

Second, triage was virtually unknown in my experience in the Persian Gulf. This should not come as a surprise because there is little opportunity to learn triage outside the combat zone. Our last major military medical experience was in Vietnam, sev-

eral decades earlier. Few veterans of Vietnam were deployed in the Gulf War, and civilian experience is scant. Triage practice is unimaginative at best and generally deceptive. Those who write about it, like those who write first aid handbooks, generally regurgitate what has been written before embellished with speculation derived from disaster drills! Small wonder that triage in the Gulf War was to be conducted in the dark, outside the hospital, on the ground and with only a penlight flashlight for interpretation of a cryptic message on a field medical card (FM 102) written by a stranger many miles and minutes distant. Small wonder too that a look at the Army's Evacuation Hospital reveals no tent large enough for triage. Necessary is a "Fest Tent" large enough to hold 50 litters, waist-high, adequately illuminated and heated so that resuscitation can be begun immediately with attention given to the ABC's. A single triage officer, who in my opinion should be the most experienced trauma surgeon, surveys the surgical teams' assessments and makes decisions. He or she never treats; he schedules surgery and radiology, communicates with the OR, the medical regulator (MRO), the blood bank, etc, and makes those decisions which provide for the expeditious, orderly and appropriate flow of casualties to the OR (the priority), expectant area (the expectant) or minor treatment area (the walking wounded). The triage officer advises the commanding officer but "captains the ship," medically, and stays until relieved by another equally experienced triage officer.

My experience with medical regulating was disappointingly frustrating, and I have found no other physician who disagrees with me. This was the third major medical deficiency in Desert Storm. The MRO sent us patients from other evacuation hospitals, advised us of patients soon to arrive who never showed and of the future arrival of patients we had already treated! We received patients with no warning. Our consensus was that MRO did more harm than good. Then again, how do you train for medical regulating? Like triage and debridement, certain principles can be learned only on the battlefield and with time. The learning curve is steep under such circumstances. Were there no regulators from the Vietnam era? I don't know the answer to this question.

Medical records were abysmal in my medical experience and patient care suffered as a result. But then, every hospital that I know derides record keeping by physicians. Nonetheless, a more efficient, cryptic system would seem appropriate, and even attainable. Had the system of documentation been more accurate, however, we might have been even more alarmed at the treatment rendered! Certainly, one way of avoiding criticism for a choice of therapy is to not record what you did. We were frequently at a total loss as to what had been done to a patient and why, throughout a chain of evacuation, which circulated a patient among as many as five hospitals before evacuation out of theater. A British hospital I visited had a very concise, one-page summary of treatment rendered to a patient, one which we might profitably emulate for future use. This was a fourth major medical deficiency in the Gulf War.

Professionalism in the theater was also problematic in my opinion. The physicians I encountered were excellent, with few exceptions. However, with few exceptions, obstetricians/gynecologists failed to assume the responsibilities of combat surgeons as had been the case in Vietnam. There were notable exceptions to this generalization as well. In this age of increasing specialization this should not, and did not, come as a surprise, despite the C-4B course designed to address the potential problem. Anesthesiologists and nurse anesthetists were superb in my experience, and this also should not have come as a surprise. These individuals perform their specialty with regularity in peacetime and readily adapted to the combat zone as they had in Vietnam. Nursing was only fair, in my opinion, but that opinion was shared by my colleagues within the many, mostly Army Guard Reserves (AGR), hospitals I visited. Why the low rating, which I know offends the Army Nurse Corps? Because many ANC personnel in the Reserve Component (RC) don't practice their specialty in their civilian occupation—they may be in Quality Assurance, they may be records analysts, research coordinators, administrators, teachers or any one of a number of occupations that have long since distanced them from bedside nursing, the ICU, the OR or the ER. Their reserve training fails to compensate for their rapidly diminishing hands-on skills, which was most notable in the operating room.

Operating Room Technicians (ORT, 91D) were generally poor in my experience, but again this echoes the general impressions of my colleagues in RC hospitals. For example: the reservist is a brick layer in civilian life; he went to 91 Delta School five years ago and, although he trains religiously with his unit, he has not been inside an OR for years. Not surprisingly, he is a fish out of water in the combat zone. Given time, he would learn. His counterpart in Vietnam was outstanding. The current OR technician would have learned more quickly had the circulating nurse (91C) been able to help him. Here again the system failed. The circulator, a night watchman in a nursing home in civilian life, was also a loyal reservist but again had not been in an OR for years—he didn't know one instrument from another and kept a very low profile during surgery. His education would have been possible had the head nurse (ANC) been proficient. She, unfortunately, was not familiar with the OR either. She was both a loyal reservist and a head nurse in the urology clinic at a VA hospital in civilian life. It was a case of the blind leading the blind. Surgeons can and did function under such circumstances, but it was a severe deficiency that cries out for

address. Time would have corrected all these deficiencies. Perhaps we will have to be content with the knowledge that the first few months will in essence be on-the-job training for certain skills in any future conflict. How long did it take in Vietnam—a year, six months? It is an undefined period, but you know it when you reach it, and we didn't reach it in the Persian Gulf. But, you say, we were there for four months. True, but the ground war lasted only a few days and we had few US casualties. In my experience, morale is proportional to the volume of US WIA and inversely proportional to the number of enemy or civilian WIA treated at a combat support hospital. When morale is low, meaningful training is nonexistent. Such was the case in the Persian Gulf, for most of the medical units for all but a brief period. Those who came well trained stayed that way, and those who came untrained did also.

A major deficiency, and again one which would have been rectified with time, was missing equipment. To be missing state-of-the-art equipment was, for those of us who work in trauma centers in civilian life, disappointing. Such items as the pneumatic tourniquet for control of extremity hemorrhage (used extensively in Vietnam) never made it to my hospital and could not be found in a nearby MEDSOM. The same could be said for the MAST, even amputation knives! The pleurovac autotransfuser, which we have been using in the civilian community in the emergency room for the past five years, never made it to the Gulf. It's such a simple devise/technique, it's unusually battlefield oriented. Its absence exemplified poor planning, as did the absence of pulsed jet lavage. This technique of wound debridement was introduced by USAIDR dental officers in the early 1970s at WRAIR as a spin-off of the dental "water pick." It is a must in trauma care, and in my opinion is the single-most important refinement in wound debridement in this century. It also never made it to Desert Storm. These are a few examples, but suggest that the planners didn't know, were poorly advised or, worse yet, were afraid to ask. It may be difficult for some to admit that we didn't perform as brilliantly medically as we would like to have thought we did in the Persian Gulf War, but our future depends on acceptance of that fact. We must not repeat the same mistakes all over again. The next time we may not get by with such incredibly small numbers of casualties.

I would request your indulgence in what I have just said and ask that you not shoot the messenger! There is no criticism of Operation (medical) Desert Storm that I have made that lacks a constructive counterpart for correction. There are solutions to each deficiency. What then is the future of US combat casualty care?

In both the active (AC) and reserve components (RC) we will see a reduction in numbers, both authorized and on hand, as both components undergo force reductions and as recruitment and retention have become problematic as a result of Operation Desert Storm. Since 75% of the medical assets for war in the US Army are located in the RC, this becomes a critical issue, as the reserves in general face reductions of up to one quarter of a million in the next few years. These cuts, fortunately for the AMEDD, are mostly in combat units. Medical units must remain numerically strong as well as sufficiently specialty strong in order to be combat ready. Innovative recruitment and retention programs, such as STRAP, must be retained, protected and amplified. My own area of New Jersey has seen a recruitment slump since the Persian Gulf War, even though none of our special program MCs were deployed overseas. Equally important will be what we do with these RC AMEDD personnel to make them better prepared for the next war. Of course we need to emphasize training and equipment.

We hear a lot about training; we pay lip service to it and we produce training schedules to verify we actually did it. As a reservist, I can say candidly I've never done anything to improve my combat casualty care capabilities during Monthly Unit Training Activities (MUTA), or during annual training (AT)! Whose fault is that—mine, the Army's, the system's? The answer is "all three," but then again, I am a trauma surgeon and I don't need much more than what I experience on a day-to-day basis as a civilian. How about my counterparts? They do need to know what I know as a result of the Vietnam War and the time I spent there. Those special assets, cognitive as well as technical skills, are rarely learned away from the combat zone. They are triage, wound debridement and limb salvage.

So far we have never simulated successfully a mass casualty in an exercise, although we repeatedly pat ourselves on the back and say we did. It is just not possible to simulate active bleeding and declaration of expectancy or pericardial tamponade in the minor debridement area. Maybe we shouldn't try; after all these exercises were the probable sources of the foolish concepts of triage found in Desert Storm and what appears in our literature. What is needed is a document that describes triage and which emanates from a pooled consensus of those who have triaged. It should reflect their recommendations for physical assets necessary for its accomplishment. Perhaps the hospital TOE needs a designated triage officer for added emphasis. It certainly needs a large triage tent!

Wound debridement remains a mystery for many despite the Persian Gulf war. Inadequate debridement of high velocity missile injuries and failure to close wounds secondarily, or delayed primary closure (DPC), were so common to US surgeons as to reflect a major deficiency in training of combat casualty care. No civilian experience has come forward to simulate the wounds of the battlefield, with the exception of the occasional blast injury or shotgun wound. The mod-

ern trauma surgeon treats such patients with debridement and daily redebridement in the OR. This is not only poor trauma care; it is prohibitive in combat, where a single operative procedure done correctly is time honored and efficient. Delayed primary closure, five days later, of such wounds is an elusive concept and apparently anathema to those who should have known better in the Persian Gulf. Evacuating a casualty out of theater "because he has an open wound" is a mistake that could have tragic tactical consequences. We must remember that "the medical evacuation system is the number one source of replacements during combat" (TRADOC).

Limb salvage versus primary amputation remains an apparently simple concept to address but hard to accept at home during peacetime. All too often we attempt to save a limb —which requires the skills of many specialists and many hours of operative time—only to lose not only the limb, but also the patient. As Napoleon's surgeon, Dominique Jean Larrey, said almost 200 years ago, "Better to lose the limb and save the life." Even more important in the combat zone is the decision to quickly amputate those limbs which are not likely to be usefully salvaged. This principle saves lives, time and resources. Criteria for limb salvageability do exist and should be found in our combat casualty care courses. They should be revised periodically by our best thinkers on this subject.

A final word about morale is appropriate. Few in the AMEDD appreciate how valuable they are to their country, especially in time of war. A survey of those in Desert Storm will arrive at the conclusion that many there felt "they didn't do much." That may be true; it is also irrelevant. Milton's sonnet *On His Blindness* concludes with the phrase, "They also serve who only stand and wait." No statement better describes the vital role of the AMEDD in time of war. So critical to combat readiness is medical support that the ground war in the Persian Gulf didn't start until the medical assets were in place in sufficient numbers. Why? Because we are critical to morale, and the absence of morale causes failure among combat units.

The US soldier fights well if the three "Cs" are met. These are conviction, collaboration and care. A believable cause is a positive factor in maintaining morale among the troops. Likewise, morale is higher for the soldier or the unit who knows he or it is not alone but is well supported by others. Just as important as these two factors is care. The modern soldier believes that if his head is blown off, the medics will literally put it back on again! We don't teach this philosophy but neither do we discourage it, because it is good for morale. No country takes better care of its casualties than ours, and our servicemen and women know that. The average soldier sees only a caduceus without distinguishing its configuration, color or associated rank. He sees a caduceus, and he knows he'll be OK. That's why we have so many on the battlefield. Their very presence is critical to successful engagement with the enemy. You, who wear a caduceus, or its naval equivalent, must remember that you are more important to your country than your counterpart in any other country, regardless of your job, rank or service branch.

I have reviewed combat casualty care in the last two wars in which we have been involved from my perspective as a combat surgeon. We reached our zenith in Vietnam. We didn't have time to do it again in Desert Storm. We can do it in the next war in which we become involved if we address the lessons learned or not learned in the most recent war. We can either "hit the ground running" medically, or we can again learn the hard way, as we seem to want to do, based on performance in past wars. "Lack of prior planning does not constitute an emergency" as we all know, and we should not have to make an emergency call home from the battlefield asking for equipment, personnel or know-how. They should be in place because we were able to deploy what we knew in advance that we would need. Remember the US casualty has always received the very best care available—better than that rendered by any other country. This is so because he needs it, expects it and deserves it. If we are to continue this tradition of excellence, we must examine and reexamine ourselves and our programs to maintain state of the art combat casualty care.

In closing, I would like to emphasize, that on behalf of all those with whom I had the pleasure of serving in Vietnam and Desert Storm, I thank you. ●