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JRRD Guest Editorial

DOD paradigm shift in care of servicemembers with major limb loss

INTRODUCTION

Military operations in Iraq and Afghanistan present a multitude of challenges for the U.S. Armed Forces. Whether operating in an urban environment, such as Baghdad, or the rural mountains of Afghanistan, combat military units need to be flexible to adapt to the constant changes on the battlefield. In support of these military operations, the Military Health Care System (MHCS) needs to be equally flexible. Advances in body armor, expertly trained field medics, forward-area surgical support, and modernized evacuation systems greatly increase combat wound survival rates. Despite these advances, to date more than 4,000 servicemembers have died in the line of duty and countless others have been injured. Military professionals continue to serve their country far from their loved ones in hostile environments and treacherous terrain. Many have served on multiple deployments and have witnessed horrific human tragedy. The MHCS remains committed to these heroes and their families, not only to provide the best healthcare that is available today but to continually explore new technology and science to deliver even better care tomorrow.

The majority of severe injuries that occur in the combat theater result from a blast. Blast injuries may occur from the primary blast wave or the secondary or tertiary effects caused by flying debris or violent displacement of the individual. Given the relative vulnerability of the servicemember's arms and legs, severe limb trauma is frequently encountered. Although modern surgical reconstructive techniques have contributed to a greater preservation rate of limbs than possible in prior wars, many injured limbs still require amputation. As of January 2010, more than 950 servicemembers sustained one or more major limb amputations from injuries sustained in Iraq or Afghanistan. Servicemembers with traumatic limb loss represent a much different patient demographic than their civilian counterparts. More than 85 percent of the servicemembers who undergo amputation because of combat-related injuries are under the age of 35, whereas in the civilian population more than 81 percent are over the age of 44. Additionally, most amputations in the civilian population occur as a result of diseases such as diabetes or peripheral vascular disease as opposed to the traumatic injuries due to military conflict. Further, while traumatic amputations do occur in civilian settings, the types of trauma and associated injuries are often much different than those experienced by our military servicemembers.

EARLY CLINICAL CARE

Extremity wounds, especially those occurring as the result of a blast, are extensively contaminated and typically involve massive soft-tissue disruption. Because of the complex nature of these wounds, military surgeons work collaboratively with various subspecialists to perform innovative soft-tissue, bone, nerve, muscle, and vascular grafts to preserve as much of the limb as possible. For injuries that require amputation, the precise level is often not defined until weeks after the injury to allow for adequate wound debridement and ensure tissue vitality. Every effort is made to preserve as much limb length as possible, including saving precious joints such as the elbow and knee to help maximize long-term functional outcomes. Saving a joint may require the amputation to be performed through the zone of injury, potentially complicating soft tissue coverage and creating significant challenges for achieving adequate prosthetic socket fit and comfort. Considerable debate exists as to the optimal level of amputation, particularly for the transtibial versus Symes amputation, or a knee disarticulation versus a transfemoral amputation. Involving rehabilitative experts, prosthetists, and family members in these surgical decisions often benefits the patient, helping to ensure realistic rehabilitation expectations and fully engaging the patient and his/her family on the road to recovery.

A large percentage of injured servicemembers have associated soft-tissue wounds at sites other than that of the amputation. Nonamputated limbs often sustain fractures, nerve injuries, and infections creating rehabilitation challenges, which need to be integrated with the patient's prosthetic fitting and training. One-third of those with combat-related limb loss also suffer from an associated traumatic brain injury, and one-fourth of those with traumatic limb loss are also diagnosed with posttraumatic stress disorder, which may also contribute to considerable disability. Moreover, a high percentage of servicemembers returning from deployment experience a significant number of psychosocial stressors that may complicate their rehabilitation. Therefore, healthcare providers must be sensitive to these needs and develop strategies to help mitigate their negative effects on recovery and community reintegration.

MISSION AND VISION FOR CENTERS OF EXCELLENCE FOR AMPUTATION CARE

In response to the unique needs of our military population with limb loss, the Department of Defense (DOD) established Centers of Excellence (COEs) for Amputee Care at Walter Reed Army Medical Center in Washington, DC; Brooke Army Medical Center in San Antonio, Texas; and Naval Medical Center in San Diego, California. These Centers were developed under common mission and vision statements:

- **Mission:** Provide the highest quality of care to these men and women who are willing to put their lives in harm's way in support of their country.
- **Vision:** Through the collaboration of a multidisciplinary team, we will provide world-renowned amputee care, assisting our patients as they return to the highest levels of physical, psychological, and emotional function.

Although each of these centers has faced multiple challenges sustaining operations in the face of deployments, staffing shortages, bureaucratic obstacles, and competing priorities, they continue to succeed by remaining focused on their mission and through the continued unyielding public, private, and Federal Government support. The principles that continue to guide these Centers of Excellence are described in the following sections.

Holistic/Comprehensive Care

Instead of following the traditional medical model of "disease-specific care," each Center is challenged to assess each individual and his or her family as a "whole." Therefore, a comprehensive evaluation and treatment plan is individualized to address all existing issues simultaneously in an integrated fashion, rather than waiting for one problem to be resolved before addressing the next.

Emphasis on Early Rehabilitation

The negative effects of deconditioning after sustaining multiple injuries can be severely debilitating, ranging from muscle weakness and atrophy to life-threatening events such as pulmonary embolism. Moreover, impaired mobility and lack of independence negatively affect psychological well-being and recovery. Therefore, rehabilitation principles must be incorporated with acute medical and surgical care.

Interdisciplinary Teamwork

The care of patients with polytrauma often involves medical, surgical, and rehabilitation disciplines. Therefore, it is imperative to bring all subspecialists together to develop an individualized and integrated treatment plan. For an effective Amputee Care Program, primary team members include physical medicine and rehabilitation, physical therapy, occupational therapy, orthopedics, prosthetics, and nursing; in addition, equally important members include pain management and behavioral health experts, vocational rehabilitation specialists, speech-language pathologists, peer-support visitors, rehabilitation engineers, and well-trained and compassionate case managers. All are critical to the success of any program. Interdisciplinary team meetings should occur regularly, and each team member must take personal ownership of each patient's well-being and maximal recovery.

Continual Education

Given the frequency of staff turnover and ever-evolving changes in medical, surgical, and rehabilitation approaches, ongoing educational programs for all medical disciplines need to be emphasized if centers are to maintain excellence in care delivery. This is often difficult, given competing priorities and limited resources, but is critical for success. Leaders must continually assess the needs of those within the program and create opportunities for their continued education and growth.

Sports and Recreational Activities

Historic reports from each military conflict emphasize the need for incorporating sports and recreation into the recovery of servicemembers with severe injuries such as limb loss. We have found this to be as true today as in prior conflicts. Fortunately, today's injured servicemembers can benefit from the pioneering efforts by veterans before them. The opportunities for participation in adaptive sports and recreation that exist today virtually break down all access barriers.

Maintaining a Therapeutic Milieu

At the early stages of the war, significant pressure existed to transfer injured servicemembers to medical facilities closest to their homes. However, historic reports have demonstrated the need to develop COEs to care for this unique group of patients. Care would not be possible at remote hospitals throughout the United States because COEs provide clinical expertise that can only be achieved by caring for a high volume of patients. These patients also require the collaboration of multiple specialists from a variety of disciplines to develop creative solutions to unique problems. In addition, a high volume of patients all facing similar problems creates a healthy therapeutic milieu with immeasurable psychological benefits for patients and their families. In this environment, a newly injured patient is able to recover alongside a fellow patient who may be months out from their injury and working on higher level skills than once thought possible. Witnessing such recoveries firsthand creates a supportive and motivating environment for each patient.

Active Research

Excellence in delivery of cutting-edge care for servicemembers with major traumatic limb loss is both learned from experts and discovered through exploration. An active research program is therefore critical for any COE. As technology improves, opportunities for advancement in care delivery become possible by integrating science and technology with clinical care. Patients and clinicians work directly with researchers to push the limits of technology, resulting in new interventions to improve recovery. To be successful, however, research infrastructure needs to be funded and supported throughout the institution. Additionally, more attention needs to be placed on evaluating short- and long-term outcomes.

COLLABORATION WITH THE DEPARTMENT OF VETERANS AFFAIRS

In achieving these principles, DOD providers involved in the care of severely injured servicemembers have witnessed firsthand the importance of forming collaborative relationships with other institutions. Nowhere has this been more relevant than in the inherent partnership that exists between the DOD and Department of Veterans Affairs (VA). The DOD Amputee Care COEs remain indebted to the VA for its support in helping to build clinical, educational, and research collaborations that continue to provide better opportunities for our injured servicemembers. Today, Active Duty servicemembers with severe injuries frequently receive their care at both VA and DOD treatment facilities. VA employees are often embedded in DOD medical treatment facilities and DOD members in VA hospitals. This partnership remains critical to the continued commitment that both organizations share in providing lifelong care to our nation's heroes, and it should be preserved and cultivated.

Today marks a unique period in history, in which modern science, advanced technology, and improved material design are being brought together to revolutionize the care for individuals with amputation. This collaboration requires significant teamwork and partnership both across and within different disciplines. Modern medical research must reach out to all areas of science, including those not traditionally associated with healthcare. Clinicians must clearly identify and communicate the functional needs of patients to engineers, biologists, computer scientists, and systems engineers to achieve common goals. Furthermore, a mutual sharing of ideas between public and private universities, Federal agencies, and industry partners is necessary to further advance the field.

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DOI:10.1682/JRRD.2009.04.0059