

Capability Enhancement and Amputee Care in Operation Iraqi Freedom: The Role of a Rehabilitation and Prosthetics Assistance Team in Reconstruction Operations

CPT Matthew Scherer, MSC USA

ABSTRACT Defining the role of the U.S. Army Rehabilitation and Prosthetic Assistance Team in reconstruction operations was a key component of this first of its kind Army Medical Department (AMEDD) mission in a combat theater of operations. In the tradition of civil-military operations, a five-man team trained 11 Iraqi rehabilitation and prosthetic providers on best clinical, technical, and business practices to manage the nation's growing amputee population. The team instructed, assisted, and supervised Iraqi clinicians in the delivery of prosthetic and rehabilitation services to 124 patients over 350 patient clinical visits. After a successful transition from Multi-National Force-Iraq oversight to the Iraqi Ministry of Defense (MoD), the premier prosthetics and rehabilitation clinic in Iraq now provides services to patients from current and past conflicts, including civilians and pediatric patients.

INTRODUCTION

As the United States pursues reconstruction operations in Iraq, the necessity for health sector training and program development grows more evident. Morbidity from blast injuries in many areas of the country has taken a significant toll on the security, health, and livelihoods of many Iraqis. The Iraqi census estimates between 80,000 and 100,000 persons with limb loss with etiologies ranging from congenital defects to war-time trauma.¹ Patient access to rehabilitation and prosthetic services continues to be affected by ongoing violence in large urban areas, limitations in health care infrastructure, limited available funding for prosthetic components, and a dearth of trained clinicians who can provide these services.

In 1993 the International Committee of the Red Cross (ICRC) in collaboration with the Iraqi Ministry of Health (MoH) initiated its orthopedic program in Iraq. This program introduced thermoformable prosthetic limb technology into centers in Basra, Mosul, and Najef. In 1996, a similar project started with the Medical Rehabilitation Center of Baghdad. Additional clinics were also opened in Erbil and at the Ibn

Al-kuff Rehabilitation Hospital in Baghdad.² Today, prosthetic services in the country include nine rehabilitation centers and six "limb factories" producing a combination of ICRC thermoformable plastic limbs and other more resource-intensive prosthetic limb designs (personal interview, Iraqi Ministry of Health Director General for rehabilitation medicine, B. G. Sabah, on 15 March 2006).

For members of the Iraqi military and police forces that have lost limbs in support of the current conflict or in operations to reinstate the rule of law in this war-torn country, access to care is even more limited. Incidents of systematic malicious activities against Iraqi Security Forces (ISF) are well documented^{3,4} and present a significant barrier to care for many combat injured.

In January 2006, a five-man team deployed in support of Operation Iraqi Freedom (OIF) to assist local prosthetists and physical therapy providers in the Iraqi Ministry of Defense (MoD) in developing a system to rehabilitate Iraqi amputees. The team was composed of three commissioned officers and two noncommissioned officers from the rehabilitation disciplines of physical therapy, occupational therapy, and prosthetics. While the role of rehabilitation providers caring for American OIF/Operation Enduring Freedom (OEF) patients in the medical center is well documented,⁵⁻⁸ taking the lessons learned in treating wounded U.S. service members and applying them to the care of Iraqi service members and civilians with limb loss in a wartime theater of operations was a new mission for the Army Medical Department (AMEDD).

As U.S. Military and Government agencies working on strategic and reconstruction policy have learned over the last 5 years of operations in Iraq, enhancing the capabilities of Iraqi leaders, soldiers, and clinicians is essential to the long-term viability and success of any new nation-building program. Our mission to train prosthetists and therapists was no different. The mission grew out of an earlier prosthetic initiative developed by personnel from the civil affairs community in 2004 to provide direct prosthetic patient care to Iraqi ampu-

Department of Physical Therapy and Rehabilitation Science, University of Maryland School of Medicine, 100 Penn Street, Allied Health Building, Baltimore, MD 21201-1082.

Previous Presentations: Related material was presented in abbreviated format at two national/ international conferences: "PT and Prosthetic Management of Iraqi Amputees in Support of OIF Reconstruction Operations" presented at the American Physical Therapy Association (APTA) Combined Section Meeting, 17 February 2007; and "Caring for Iraq's Amputees in OIF Reconstruction Operations; A Retrospective Review" Poster presentation accepted and presented at the 12th World Congress of the International Society for Prosthetics and Orthotics (ISPO), Vancouver, Canada July 29-August 3, 2007.

The views expressed in this article are those of the authors and do not reflect the official policy or position of the United States Army, the Department of Defense, or the United States Government.

This manuscript was received for review in August 2008. The revised manuscript was accepted for publication in January 2009.

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 2009		2. REPORT TYPE		3. DATES COVERED 00-00-2009 to 00-00-2009	
4. TITLE AND SUBTITLE Capability Enhancement and Amputee Care in Operation Iraqi				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Department of Physical Therapy and Rehabilitation Science,University of Maryland School of Medicine,100 Penn Street. Allied Heaith Btiilding,Baltimore ,MD,21201-1082				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 6	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

tees. The Al-Bedaya Al-Jadidi or "New Beginning" Amputee Rehabilitation and Prosthetics Clinic opened in August 2005 with the mission of providing the most up to date and appropriate prosthetic and rehabilitative services available to Iraqi nationals with limb loss. The clinic was staffed by prosthetists and rehabilitation specialists from the Iraqi MoD. The interdisciplinary team was trained and equipped to deliver appropriate rehabilitation and prosthetic care to upper and lower extremity amputees from complex trauma and vascular limb loss.

The primary purpose of this article is to discuss training issues affecting prosthetics manufacture and amputee rehabilitation, report on the standard of care and outcomes of patients treated in Iraq by U.S. and Iraqi providers, and make recommendations for future program development in health sector capability enhancement missions.

PROSTHETICS MISSION

Iraqi prosthetists are typically locally trained by the ICRC or nongovernmental organizations (NGOs) with support by the Iraqi MoH. Practitioners are often characterized as technicians working in "limb factories" in contradistinction with the Western conception of an allied-health professional performing clinical services.

The prosthetics mission was to educate providers in a "first world" model of prosthetic care with emphases in enhancing provider clinical decision-making skills, improving tradecraft and bench skills, and enhancing the use of available technology. The goal for the prosthetics mission was to shift Iraqi practice patterns from those of a semiskilled worker model (i.e., assembly line worker in a "leg factory") to a more professional paradigm. Clinically, the standards for a successful transition required a shift from fabricating, fitting, and delivering "fair" to "adequate" lower extremity prosthetic limbs to a model that would consistently produce high-quality, reliable, and comfortable prosthetic arms and legs while optimizing the use of available technology (computer-aided design/computer-aided manufacturing, i.e., CAD/CAM systems).

Upon completion of didactic training, Iraqi prosthetic providers returned to full-time direct patient care of local national amputees under the supervision of the U.S. team in a model similar to a clinical residency for medical students. The U.S. prosthetist assisted Iraqi counterparts in refining clinical evaluation skills, clinical documentation techniques, and prosthetic fabrication. Innovations included teaching total contact sockets for transfemoral amputees instead of using quadrilateral sockets per the local standard of care, introducing single-axis feet for unilateral and bilateral transfemoral amputees to soften the transition from initial contact to midstance during gait, and encouraging the prescription of less rigid prosthetic feet to smooth out the gait of lighter Iraqis.

REHABILITATION MISSION

Iraqi physical therapists (PTs) work within a scope of practice with a limited ability to independently evaluate, diagnose, and

prescribe therapeutic interventions for patients. With continuing hostilities throughout the country, the personnel, training, and equipment resources of Iraqi MoD medical providers to meet the demand for care among active-duty service members have been strained. The disparity between services required to meet demands and the capability to deliver services accentuated the need for increased training for MoD rehabilitation providers to assist Iraqi physicians in delivering rehabilitation services and Echelon II musculoskeletal care with minimal oversight. The U.S. team played a vital role in assisting Iraqi MoD providers with implementing current best practices in high-level amputee rehabilitation currently implemented in the U.S. Armed Forces Amputee Patient Care Program. The military composition of the U.S. team further offered the opportunity to mentor the first five providers in the fledgling Iraqi Military Rehabilitation Corps.

The primary rehabilitation mission was to train Iraqi MoD therapists on how to manage patients with polytrauma and limb loss who are typically characterized by extensive comorbidity and in the Iraqi Armed Services, a broad age range. The instruction emphasized clinical evaluation, assessment, treatment program development, and appropriate progression toward higher levels of functional independence. Iraqi counterparts were trained according to rehabilitation models, protocols, and best practice guidelines developed for U.S. service members at Walter Reed Army Medical Center. As of January 9, 2009, 859 active duty service members with limb loss have been treated in Army medical facilities since the initiation of hostilities in the global war on terrorism and the first patient arriving in December 2001.⁹ Upon completion of the initial 9 weeks of didactic training, Iraqi counterparts entered into a clinical phase of training emphasizing patient evaluation and treatment, patient management skills, and implementation of clinical systems such as medical documentation, scheduling patient follow-ups for treatments, prosthetic care, and rehabilitation re-evaluations.

PATIENT CARE

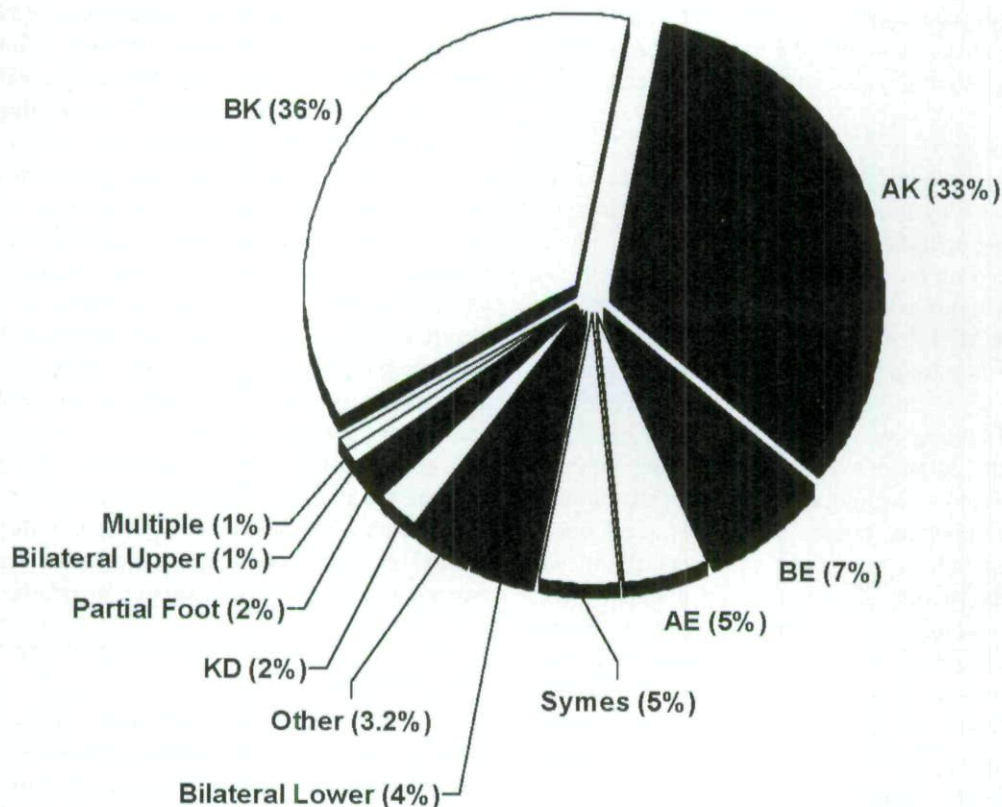
Inpatients with limb loss were evaluated by Iraqi therapists under the supervision of U.S. Amputee Assistance Team members at the 10th Combat Support Hospital (CSH) in Baghdad. U.S. therapists received notification on new patients requiring evaluations from the orthopedic surgery service or the patient administration division. Upon arrival at the CSH, Iraqi therapists would conduct a thorough inpatient evaluation assessing range of motion, motor function, residual limb status, functional mobility, comorbidities, skin integrity, and the patient's cognitive status. Therapists instructed patients in appropriate conditioning, positioning, and mobility techniques and educated patients on the importance of home exercises until they could be seen in the clinic as outpatients.

Outpatients with limb loss were referred to the clinic from both Iraqi and American military sources. Iraqi therapists performed initial evaluations on new patients (as stated above)

but added balance assessments and more detailed functional testing for the outpatients. Upon completion of these evaluations, patients were educated in phase I exercises for lower extremity and pelvic girdle strengthening (for lower extremity amputees), core stability, and scapular stabilization (for upper extremity amputees). All therapeutic exercise prescriptions were based on physical and occupational therapy protocols developed at Walter Reed Army Medical Center for U.S. service members. Initial therapy goals focused on regaining full active range of motion and strengthening key muscle groups to maximize balance, stability, and functional mobility for the residual limb in preparation for the demands of future prosthetic use. Advanced therapy goals focused on educating patients on the independent use of their prosthetic limbs for

ambulation in the lower extremity amputee and for activities of daily living in the upper extremity amputee.

From January 2006 through May 2006 Iraqi and American clinicians saw 124 Iraqi patients with limb loss for rehabilitation and prosthetics needs (Fig. 1). There were a total of 364 patient visits of which 156 were for rehabilitation and 208 were for prosthetic services. While the specific mechanisms of injury in this patient population cannot be disclosed in light of information clearance and operational security issues, injuries ran the spectrum of acute to chronic, with and without comorbidity. The author acknowledges this limitation in disclosure and refers interested readers to MEDCOM policy 05-018. During this time, 33 prosthetic devices were delivered (27% of patients seen) with the remainder of patients either



Key

BK (below the knee)- Trans-tibial limb loss

AK (above the knee)- Trans-femoral limb loss

KD- knee disarticulation

Symes- ankle disarticulation

Partial Foot- Carpal-metacarpal amputation

Bilateral lower extremity limb loss (e.g. transtibial, transfemoral or symes amputations)

BE (below the elbow) or Trans-radial limb loss

AE (above the elbow) or Trans-humeral limb loss

Bilateral upper extremity limb loss (e.g. trans-radial or trans-humeral amputations)

Multiple limb loss- Loss of three or more limbs

Other- Significant deformation of limb not necessitating prosthetic prescription

FIGURE 1. Level of limb loss among patients seen in clinic (N = 124).

evaluated and waiting for delivery or wait listed pending completion of earlier cases. This relatively low delivery rate during the specified time frame was because of a combination of in-country customs and shipping delays as well as an eroding security situation in the region that affected shippers, providers, and patients alike. Delays in the delivery of prosthetic devices did have a positive consequence of increasing the conditioning and preparation time for patients who might not otherwise have continued to come into the clinic had they received their limb in a more expedient manner.

Unlike earlier civil-military operations working with local national Iraqi amputees, the primary focus of this mission was capabilities enhancement for Iraqi prosthetists and therapists. To that end, the delivery of patient care services was both an end unto itself and a training process for our Iraqi counterparts. Consequently, the quality of medical documentation and as assessed by periodic chart reviews provided an informal measure of clinical proficiency among the Iraqi providers as they progressed through their didactic and clinical training.

DISCUSSION

Capability enhancement missions will continue to play a vital role in ensuring the long-term viability of health services during nation-building operations. While much strategic emphasis has been placed on training Iraqi Security Forces to take over security operations in the country over the last few years, the mission of the MNF-I Amputee Assistance Team was the first of its kind to train Iraqi prosthetics and rehabilitation providers to care for active duty Iraqi soldiers and police officers with limb loss. Defining the role and scope of a rehabilitation and prosthetics assistance team in reconstruction operations will be vital to the planning and successful execution of future AMEDD-supported reconstruction operations during nation-building operations. In this section we identify relevant issues affecting the success of such missions, including challenges to effective amputee care during low-intensity conflict states, recommendations for long-term program viability with rehabilitation programs, factors influencing training mission success in a theater of operations and the role of high-tech fabrication technology in rebuilding nations, and cultural considerations for adopting new practice patterns for rehabilitation and societal reintegration.

Challenges to effective amputee care during low-intensity conflict are numerous. The country's developing infrastructure affects the availability of power to run clinic computers and equipment. Poor communications and antiquated banking systems affect the timely and reliable delivery of medical supplies and prosthetic components. Actual or perceived threats from insurgents and sectarian groups can affect the ability of providers to get to their clinics. Amputee patients dealing with mobility impairments have the additional challenge of negotiating security checkpoints en route to the clinics and run the risk of possible identification from insurgent forces that might target them as beneficiaries of "Western" prosthetic limbs provided by coalition sympathizers.

Anecdotally, many nascent prosthetic operations in the developing world face great challenges in maintaining short-term efficacy and long-term sustainability upon the redeployment of the Western clinic sponsor or training team. Cognizant of these challenges, our team began preparing our counterparts from the first days of the operation for their imminent roles as independent practitioners and clinic administrators. Training focused on providing counterparts with skill sets and evaluating their ability to independently evaluate, treat, and provide services for their patients. Counterparts all assumed a strong sense of ownership in the program as their presence in the clinic predated the arrival of the team and their livelihood was contingent upon the success of the clinic.

Role of High-Tech Fabrication Technology in Rebuilding Nations

The role of technology in reconstruction operations continues to be controversial. Advocates for high-technology solutions point to increased efficiency and productivity of prosthetic limb production with the use of digital imaging equipment and CAD/CAM. This technology has the potential to streamline production times by as much as 25–50% and allows a single skilled technician to manufacture numerous molds for use in the fabrication process. Critics cite extensive difficulties in finding trained repair technicians to service and repair such equipment in the event of a malfunction or electronic difficulties, which still occur intermittently given the antiquated power grid in the Baghdad area. The final analysis depends largely upon the skill and care of the technician using the equipment and the precautions taken to ensure long-term reliability of the equipment. Continued efforts to improve the quality of prosthetic devices and timeliness of supporting services should focus on concurrently improving clinical and production skills and incorporating the highest level of technology that can be consistently maintained in a region.

Cultural and Environmental Considerations for Rehabilitation

As with any civil-military operation, cross-cultural communication was an essential component to successful capabilities enhancement. Clinical practice patterns implemented in the nascent Iraqi amputee patient care program included an emphasis on patient education. Providers focused on stressing the importance of regular conditioning, stretching, strengthening, balance, and functional skill development to their patients with limb loss. Discussing concepts such as training frequency, intensity, time, and type in the clinic ensured a systematic approach to therapeutic exercise prescription in an environment where such concepts were likely novel to patient-clients. The importance of prescribing a home exercise program was even more pressing for patients given the unstable security environment to minimize frequent and unnecessary trips back to the clinic. The receipt of the patient's prosthetic limb typically marked the transition in rehabilitation goals to functional outcomes such as using an upper extremity prosthesis to per-

form activities of daily living (ADLs) or improving gait with a lower extremity prosthesis.

As in many parts of the world, "disability" carries a strong social stigma in Iraq. Our role as mentors, instructors, and change agents carried with it the important responsibility of changing perspectives on capabilities among our foreign national counterparts who would be charged with training other providers in their respective disciplines. Use of the World Health Organization's International Classification on Functioning, Disability, and Health (ICF)^{10,11} allowed us to reframe cultural perspectives on the rehabilitation process in a country that has been largely closed to such influences over the last 30 years. The cross-cultural dialogue between U.S. and Iraqi providers and patients helped to initiate a shift in thinking about amputee patient care from one that focused strictly on obtaining a device to one that emphasized focused rehabilitation to best use the device to improve function.

If combined U.S. provider-Iraqi counterpart efforts to focus on skill development through rehabilitation in patients with limb loss continue to be successful, they may have important implications for regional and national practice patterns.

CONCLUSION

The role of the Military rehabilitation and prosthetics team in reconstruction operations is not yet clearly defined in doctrine. As U.S. service members from the medical community deploy in support of reconstruction operations, the Army Medical Department should continue to emphasize a capabilities enhancement focus utilizing the highest level of sustainable technology to ensure program efficacy and longevity. Capability enhancement missions in the medical sector have great potential to improve the quality of health care services in countries rebuilding after conflict, demonstrating U.S. Government commitment to individuals and their communities.

ACKNOWLEDGMENTS

The author specially thanks CPT Joseph Miller, SGT John "Brad" Owensby, and CPT David Lares for their contributions to this work and COL Theresa Schneider and COL Charles Scoville (Ret.) for overall mission support. No outside funding was provided for preparation of this work.

REFERENCES

1. Rehabilitation and Caring for the Disabled in Iraq, Iraq Ministry of Health (MoH) Medical Operations and Specialized Services Rehabilitation and Prevention Against Disability Department, p. 7.
2. International Committee of the Red Cross (ICRC) Orthopaedic Programme in Iraq 1994-2002. ICRC internal publication/information paper.
3. Fam M.: Suicide bomber kills 40 at recruiting center. *Stars & Stripes*, March 28, 2006, p. 3.
4. Anderson JW: Iraqi soldiers report doctor's admission of killing policemen. *Stars & Stripes*, March 28, 2006, p. 5.
5. Doukas W, Javernick M: Process of care for battle casualties at Walter Reed Army Medical Center: Part I. Orthopedic surgery service. *Milit Med* 2006; 171(3): 200-2.
6. Springer B, Doukas W: Process of care for battle casualties at Walter Reed Army Medical Center: Part II. Physical therapy service. *Milit Med* 2006; 171(3): 203-5.
7. Pasquina P, Gambel J, Foster L, Kim A, Doukas W: Process of care for battle casualties at Walter Reed Army Medical Center: Part III. Physical medicine and rehabilitation service. *Milit Med* 2006; 171(3): 206-8.
8. Howard W, Doukas W: Process of care for battle casualties at Walter Reed Army Medical Center: Part IV. Occupational therapy service. *Milit Med* 2006; 171(3): 209-10.
9. Statistics from Amputee Monthly Report for (date), Amputee Patient Care Services, Integrated Department of Orthopaedics and Rehabilitation, National Naval Medical Center, Walter Reed Army Medical Center. Contact Walter Reed Public Affairs, 202-782-7177.
10. World Health Organization: International Classification of Functioning, Disability and Health (ICF), 2002. Available at www3.who.int/icf/icftemplate.cfm
11. World Health Organization: Towards a common language for functioning disability and health. WHO, Geneva, 2002. Available at www.int/classification/icf

Copyright of *Military Medicine* is the property of Association of Military Surgeons of the United States and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.