

Return to Duty Rate of Amputee Soldiers in the Current Conflicts in Afghanistan and Iraq

CPT Daniel J. Stinner, MD, MAJ Travis C. Burns, MD, LTC Kevin L. Kirk, DO, and COL James R. Ficke, MD

Background: The purpose of this study was to determine the percentage of amputee soldiers who sustained their injury during the current conflicts in Afghanistan and Iraq and have returned to duty. In addition, the authors plan to identify the factors that influence the amputee's likelihood to return to duty.

Methods: The computerized records of amputee soldiers who presented to the Physical Evaluation Board between October 1, 2001 and June 1, 2006 were reviewed. This data were crossreferenced with the Military Amputee Database. The following variables were extracted: age, gender, pay grade, amputation level, and final disposition.

Results: During the period reviewed, there were 395 major limb amputees that met inclusion criteria. Of those, 65 returned to active duty (16.5%). The average age of amputees returning to duty was more than 4 years older than those who separated from the service (31.4 vs. 27.2), $p < 0.0001$. Officers and senior enlisted personnel returned to duty at a higher rate (35.3% and 25.5%, respectively) when compared with junior enlisted personnel (7.0%), $p < 0.0001$. Those with multiple extremity amputations have the lowest return to duty rate at 3%, when compared with the overall return to duty rate for single extremity amputees (20%), $p < 0.0001$.

Conclusion: During the 1980s, 11 of 469 amputees returned to active duty (2.3%). The number of amputees returning to duty has increased significantly, from 2.3% to 16.5%, due to advancements in combat casualty care and the establishment of centralized amputee centers.

Key Words: Return to Duty, Amputee Soldier.

(*J Trauma*. 2010;68: 1476–1479)

The wearing of protective body armor coupled with the widespread use of improvised explosive devices in combat operations has resulted in the extremities receiving the

majority of battlefield injuries. In fact, 82% of casualties during the current conflicts in Iraq and Afghanistan sustained extremity injuries.¹ Traumatic amputations comprise 2.3% of all battle injuries and 7.4% of major limb injuries. Although these numbers seem high, they are consistent with previous conflicts.^{2,3} Combat-related amputations are devastating injuries both physically and psychologically. The ultimate goal of a return to an active lifestyle or a return to active duty requires a significant and often lengthy rehabilitation.

In accordance with military regulations, US military personnel are considered unfit for military service if they have a major limb amputation.^{4–6} If an amputee soldier wishes to remain on active duty, he or she must demonstrate a higher level of function with a prosthesis and have the recommendation of two medical officers. The soldiers are evaluated for prosthetic ambulation that exceeds basic ambulation skills, exhibiting high impact, typical of the prosthetic demands of the active adult or athlete, which is consistent with a K4 Medicare Functional Classification Level.⁷

In a previous study, Kisbaugh et al.⁸ reported that 469 Soldiers underwent a Physical Evaluation Board (PEB) for an amputation sustained while on active duty between 1980 and 1988, but only 11 of the 469 (2.3%) remained on active duty. The purpose of this study was to evaluate the return to duty rate of patients with major limb amputations sustained during the current conflicts in Afghanistan and Iraq. In addition, we plan to identify demographic data relating to amputees that have remained on active duty.

MATERIALS AND METHODS

Following protocol approval by our institutional review board, we performed a retrospective analysis of all US military personnel who sustained a combat-related amputation between October 1, 2001, and June 1, 2006. The electronic records of US military personnel who presented to the PEB during that time period were reviewed at a minimum of 2 years after their combat-related amputation. Those individuals with a major limb amputation, defined as proximal to the metacarpals in the upper extremity and proximal to the metatarsals in the lower extremity, were identified within the PEB database. The individuals were then cross-referenced with data collected from the Military Amputee Database. From these databases, the following variables were extracted for analysis: age, gender, rank/pay grade, military occupation specialty or area of concentration, amputation level, and final disposition. Amputation levels were consolidated into the following categories: multiple (involving more than one extremity), above

Submitted for publication February 9, 2009.

Accepted for publication April 15, 2009.

Copyright © 2010 by Lippincott Williams & Wilkins

From the Department of Regenerative Medicine (D.J.S.), United States Army Institute of Surgical Research; and Department of Orthopaedics and Rehabilitation (T.C.B., K.L.K., J.R.F.), Brooke Army Medical Center, San Antonio, Texas.

Podium presentation at Society of Military Orthopaedic Surgeons (SOMOS) Annual Meeting, Las Vegas, NV, December 9, 2008.

Podium presentation at Texas Orthopaedic Association (TOA) Annual Meeting, Austin, TX, April 23–24, 2009.

Podium presentation at the 31st Annual Gary P. Wratten Symposium, Tacoma, WA, May 20–22, 2009.

Podium presentation at American Orthopaedic Foot and Ankle Society Annual Meeting, Vancouver, BC, Canada, July 15–18, 2009.

The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

Address for reprints: Daniel J. Stinner, MD, Department of Regenerative Medicine, United States Army Institute of Surgical Research, 3400 Rawley E. Chambers Avenue, San Antonio, TX 78234; email: daniel.stinner@amedd.army.mil.

DOI: 10.1097/TA.0b013e3181bb9a6c

elbow (includes shoulder disarticulation and elbow disarticulation), below elbow, wrist disarticulation (includes hand proximal to the metacarpals), above knee (includes hip disarticulation and knee disarticulation), transtibial, and Syme (includes foot proximal to the metatarsals). Rank/pay grades were grouped into three categories: junior enlisted (E1–E4), senior enlisted (E5–E9), and officers (W1–O8). To remain on active duty, US military personnel must achieve a PEB final disposition of fit for duty, return to duty, or continue on active duty (COAD). An amputee found fit for duty can reasonably perform the duties of their military occupation. If a soldier injured during combat is found unfit for duty and desires to continue to serve, they may petition the military to COAD with support from their commanding officer.

RESULTS

During the period reviewed, there were 448 amputations. Fifty-three patients were excluded from the study, 9 amputees were deceased at the time of data collection, an additional 14 had either a partial foot (n = 9) or a partial hand (n = 5) amputation, and 30 amputees had not completed a PEB. The remaining 395 major limb amputations were included in this study. Of those, 65 (16.5%) amputees remained on active duty, with 54 receiving a PEB final disposition of COAD and 11 fit for duty. Demographic data can be found in Table 1. The return to duty rate based on gender, rank, and job characteristics is found in parentheses.

There are several key results shown in Table 1. First, officers and senior enlisted personnel return to duty at a significantly higher rate (35.3% and 25.5%, respectively) when compared with junior enlisted personnel (7.0%), *p* < 0.0001. Second, the average age of amputees returning to duty was more than 4 years older than the average age of those who separated from the service (31.4 vs. 27.2), *p* < 0.0001. Third, amputees in the combat arms (i.e., infantry and armor) comprise the majority of the army amputees and, although not statistically significant, trended toward having a higher return to duty rate than both combat support (i.e., military intelligence and military police) and combat service

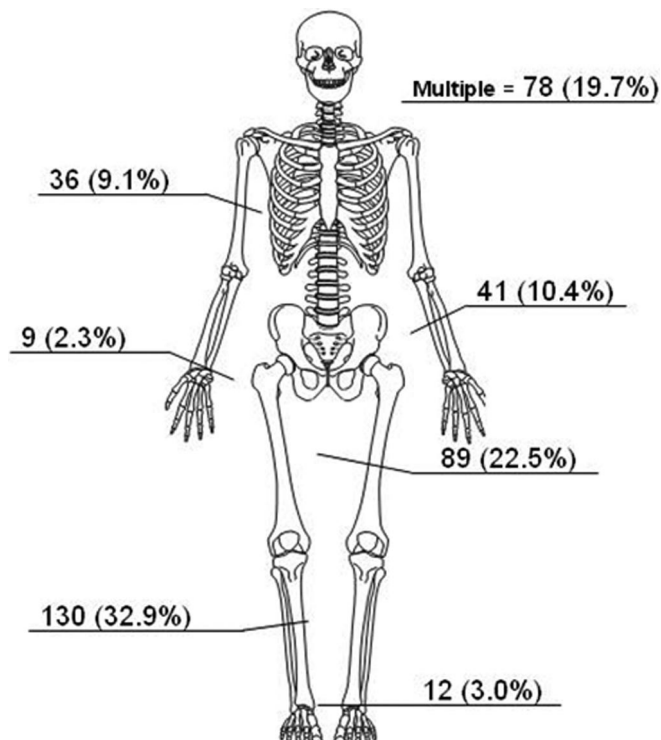


Figure 1. Distribution of amputees (total = 395).

support (i.e., medical and transportation) personnel. Finally, this is the first conflict when a female amputee in the US military has returned to duty after a combat-related traumatic amputation. Despite the small sample size, female amputees demonstrated a similar return to duty rate as male amputees.

As seen in Figures 1 and 2, US military personnel with transtibial amputations make up the largest group of amputees and have one of the highest return to duty rates at 22%. In addition, of the 11 amputees declared fit for duty, nine had transtibial amputations. Those with multiple extremity amputations, making up approximately 20% of amputees, have the lowest return to duty rate at 3%, which was statistically significant when compared with the overall return to duty rate for single extremity amputees (20%), *p* < 0.0001.

DISCUSSION

The use of ceramic plates and Kevlar body armor has reduced the number of soldiers killed in action, but the extremities remain susceptible to injury.⁹ Eighty-two percent of soldiers injured during the current conflicts in Afghanistan and Iraq sustained extremity injuries. Of the 1281 soldiers with extremity injuries reviewed by Owens et al.,¹ there were 915 fractures, 82% of which were open fractures, signifying the severity of these battlefield injuries.

Care for the soldier with a major limb injury begins immediately on the battlefield with the placement of a tourniquet and administration of oral antibiotics; both are standard issue for US military personnel.¹⁰ Damage control orthopedics at the frontlines has also continued to evolve, comprising debridement and irrigation of open wounds,

TABLE 1. Amputee Demographics

	Return to Duty	Separated From Service	Total Amputees
Average age (range), yr*	31.4 (22–44)	327.2 (19–47)	
Gender, n (%) [†]			
Male	63 (16.4)	321 (83.6)	384
Female	2 (18.2)	9 (81.8)	11
Rank: pay grade, n (%)*			
Junior enlisted: E1–E4	15 (7.0)	197 (93)	212
Senior enlisted: E5–E9	38 (25.5)	111 (74.5)	149
Officer: W1–O8	12 (35.3)	22 (64.7)	34
Job characteristics (army) [†]			
Combat arms	33 (13.9)	171 (86.1)	204
Combat support	3 (11.1)	21 (88.9)	24
Combat service support	7 (12.0)	64 (88.0)	51

**p* < 0.0001; [†]*p* > 0.05.

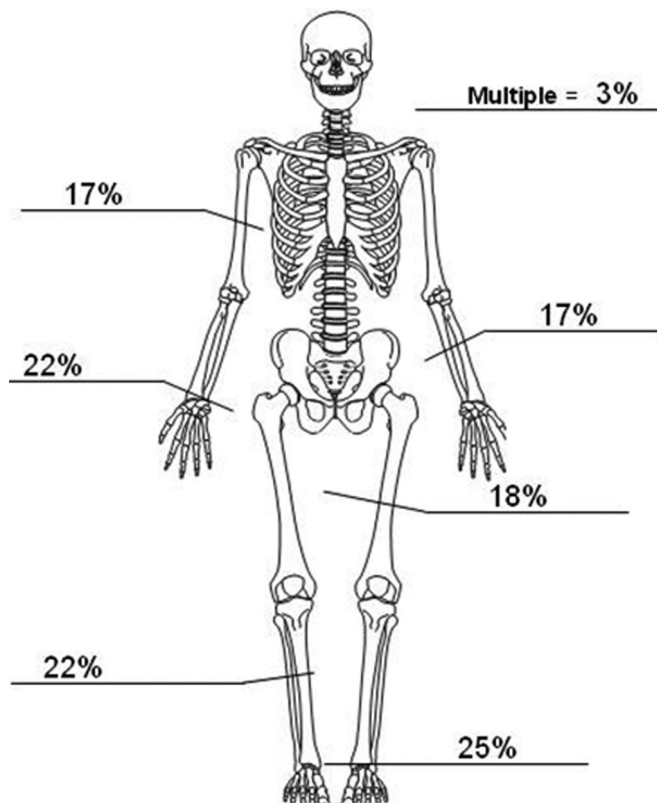


Figure 2. Return to duty rate for each amputation level.

external-fixation of unstable fractures, fasciotomies for developing compartment syndromes, and revascularization of dysvascular limbs.⁹ Injured patients receive, on average, two procedures before arrival at a military hospital in the United States, which for the injured amputee usually occurs within 96 hours of injury.^{9,11}

To care for these injured soldiers, the US Armed Forces Amputee Patient Care Program was established, creating centralized centers for amputee care at Walter Reed Medical Center, Brooke Army Medical Center, and Naval Medical Center San Diego. At these centers, centralized teams of surgeons, physiatrists, physical therapists, prosthetists, nurses, and psychiatrists work to progress the amputee soldier from wound closure to reintegration within civilian life or return to active duty, dependent on the soldier's goals.

The development of centralized centers for amputee care is not a new concept. Amputee centers have been established during many of our previous conflicts, the last of which was during the Vietnam era, when the Valley Forge Army General Hospital, among others, provided a designated amputee service. In a recent review of transtibial amputees during the Vietnam War, Dougherty¹² stated that on contacting these veterans 28 years after their injuries, the majority praised the informal group therapy, which is commonplace in such an environment. With designated amputee centers, the amputee soldier benefits not only from state of the art custom rehabilitation but also the effects of peer therapy as they work together during the rehabilitation process. During the 1980s

and 1990s, no such designated military amputee centers were in operation. This may be one reason for the lower return to duty rate of 2.3% identified by Kisbaugh et al.⁸

Rank seems to significantly influence US military personnel retention. Compared with junior enlisted, senior enlisted personnel who sustained a combat-related traumatic amputation are three times more likely to return to duty, whereas officers are more than five times more likely. Islinger et al.¹³ reported that only 9% of junior enlisted returned to duty after spine fractures, whereas 43% of senior enlisted and 100% of officers returned to duty. Similarly, Kuklo et al.¹⁴ reported that 20% of junior enlisted and junior officers returned to duty, whereas 94% of senior enlisted and senior officers returned to duty after total hip replacement.

Senior enlisted personnel usually have more time in service and are closer to retirement. In addition, senior enlisted personnel, and officers, have more opportunity to control their work environment. Because officers and enlisted personnel are promoted, their job profiles change to one encompassing more leadership and managerial roles with less physically demanding duties. This, likely, makes the return to duty an easier transition. In addition, the average age of amputees returning to duty was more than 4 years older than those who were separated from service, supporting the idea that length of service and seniority have a positive effect on retention.

Because less normal anatomy is retained as a result of a combat related amputation, the likelihood of returning to duty diminishes, as shown by the very low return to duty rate for the multiple extremity amputee (3%) when compared with the single extremity amputee (20%). In addition, because the amputation site moves more distal, an increasing amount of normal anatomy is retained. A traumatic Syme amputee had a 25% likelihood of returning to active duty, whereas a transtibial amputee and an above-the-knee amputee had a 22% and 18% likelihood, respectively. This is likely due to the observation that the amputee maintains more normal gait mechanics and expends less energy during ambulation because the amputation level moves more distal.¹⁵

Personnel in combat arms units comprised the majority of army amputees, and although not statistically significant, trended toward a higher return to duty rate. This is somewhat counterintuitive as those in combat arms units, on average, have more physically demanding job requirements than those in combat support and combat service support roles. The authors can only speculate that this may be a result of the job satisfaction and dedication to service these soldiers share.

There are several limitations to this study. This is a retrospective study and retains the inherent shortcomings of such studies. Second, our calculations of the return to duty rates are based on data obtained during a particular period of an ongoing conflict in which final dispositions are still pending. Finally, despite collecting outcome data more than 2 years after the last patient was included in this study, 30 (7.0%) of the final dispositions were pending, resulting in their exclusion from the study.

In summary, during the current conflicts in Iraq and Afghanistan, soldiers with major limb loss are returning to

duty at a significantly higher rate than seen previously. After the amputation has been performed, the rehabilitation process begins. With the advent of amputee centers providing specialized care and modern prosthetics, soldiers with limb loss are afforded the opportunity to rehabilitate in an environment that is specifically tailored to meet their individual needs. As a result, more are remaining on active duty. Although we are returning more amputees to active duty, further studies are needed to look at factors leading to and outcomes associated with combat-related amputations to allow us to better serve our wounded.

ACKNOWLEDGMENTS

We thank COL (Ret.) Charles R. Scoville, PT, for his assistance throughout this project.

REFERENCES

- Owens BD, Kragh JF Jr, Macaitis J, Svoboda SJ, Wenke JC. Characterization of extremity wounds in operation iraqi freedom and operation enduring freedom. *J Orthop Trauma*. 2007;21:254–257.
- Potter BK, Scoville CR. Amputation is not isolated: an overview of the us army amputee patient care program and associated amputee injuries. *J Am Acad Orthop Surg*. 2006;14:S188–S190.
- Stansbury LG, Branstetter JG, Lalliss SJ. Amputation in military trauma surgery. *J Trauma*. 2007;63:940–944.
- Standards of Medical Fitness*. Washington, DC: Headquarters, Department of the Army; 2008; AR40-501.
- 4E Department of Navy Disability Evaluation Manual. 2002; SecNav 1850.
- Medical Examinations and Standards*. Vol 2. 2006; AFI 48-123.
- Gailey RS, Roach KE, Applegate EB, et al. The amputee mobility predictor: an instrument to assess determinants of the lower-limb amputee's ability to ambulate. *Arch Phys Med Rehabil*. 2002;83:613–627.
- Kisbaugh D, Dillinham TR, Howard RS, Sinnott MW, Belandres PV. Amputee soldiers and their return to active duty. *Mil Med*. 1995;160:82–84.
- Gajewski D, Granville R. The United States armed forces amputee patient care program. *J Am Acad Orthop Surg*. 2006;14:S183–S187.
- Kragh JF Jr, Walters TJ, Baer DG, et al. Survival with emergency tourniquet use to stop bleeding in major limb trauma. *Ann Surg*. 2009;249:1–7.
- Lin DL, Kirk KL, Murphy KP, McHale KA, Doukas WC. Evaluation of orthopaedic injuries in operation enduring freedom. *J Orthop Trauma*. 2004;18:S48–S53.
- Dougherty PJ. Transtibial amputees from the vietnam war: twenty-eight-year follow-up. *J Bone Joint Surg Am*. 2001;83:383–389.
- Islinger RB, Kuklo TR, Polly DW. Spine fractures in active duty soldiers and their return to duty rate. *Mil Med*. 1998;163:536–539.
- Kuklo TR, Heekin RD, Temple HT, Islinger RB, Horan PJ. A review of total joint replacement in active duty soldiers. *Mil Med*. 1997;162:201–204.
- Waters RL, Perry J, Antonelli D, Hislop H. Energy cost of walking of amputees: the influence of level of amputation. *J Bone Joint Surg Am*. 1976;58:42–46.