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Overseas organ donation during wartime operations: Benchmarking military performance against civilian practice

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ABSTRACT

Background: Over the past 15 years of war, eligible U.S. military members donated organs overseas in Germany. Our hypothesis was that outcomes at a military treatment facility were comparable to a civilian cohort.

Methods: Military donors were matched 1:3 with a donor cohort from the U.S. United Network for Organ Sharing. Data were compared using univariate and multivariate analysis. Significance set at $p < 0.05$.

Results: Forty military organ donors were compared with 116 civilian matched donors. The military cohort conversion rate was 75.5% and recovered more organs per donor (4.6 vs. 4.0, $p = 0.02$) with more transplants (4.2 vs 3.5, $p = 0.01$). Multivariate analysis controlling for sex, age, and type of organ donation showed no difference in odds of total organs donated in the military versus civilian cohort (odds ratio 2.1, 95% CI 0.87–5.24, $p = 0.10$).

Conclusions: Organ donation at a military treatment facility overseas can be accomplished successfully.

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1. Introduction

Since September 11, 2001, nearly all service members injured in combat operations in Afghanistan and Iraq have been transported to the Landstuhl Regional Military Medical Center (LRMC) prior to evacuation back to the United States. Tragically, there have been soldiers, sailors, airman and marines over the past twelve years of war who suffered catastrophic brain damage as a consequence of their injuries. In 2002, LRMC established a standing collaboration with the German Organ Transplantation Foundation (Deutsche Stiftung Organtransplantation, or DSO). Whenever possible, family members of injured service men and women are flown to LRMC to be at the bedside as soon as the patient arrives. If death according to neurologic criteria is established, the service member's family is notified, and authorization for organ donation is requested. In collaboration with the DSO, hundreds of organs were donated by military service members who lost their lives in combat during Operations Iraqi Freedom, Enduring Freedom and New Dawn.

The unique situation of having a US military medical facility in Germany required the development of a policy for donating organs overseas in adherence with Department of Defense (DOD) standards for organ donation.[1] In 2007, LRMC became an American College of Surgeons verified level 2 trauma center, and in 2010, became verified as a level 1 center. Previous studies have shown that lack of a standardized approach to organ donation results in missed opportunities for transplantation.[2–5]

In order to improve the process and outcomes for organ donation, the trauma program at LRMC developed an organ donation protocol that adhered to the standards of both the Department of Defense and the DSO's regulations. This resulted in the formation of clinical practice guidelines for care providers at LRMC. These guidelines included standardization for neurologic determination of death, suitability for organ donation, and policies and procedures to ensure optimal outcomes while complying with the highest clinical standards and ethical guidelines. Organ donation after circulatory determination of death (DCDD) is not permitted in Germany by the German Medical Association and the German Transplant Society. As such, guidelines for DCDD were not

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developed at LRMC.

The purpose of this study was to identify and benchmark organ donation outcomes from U.S. combat casualties at an overseas U.S. military treatment facility against a matched civilian cohort in the U.S. Our hypothesis was that outcomes at a military treatment facility were comparable to a civilian cohort.

2. Methods

This was a retrospective study approved by the U.S. Army Medical Research and Materials Command institutional review board. Following approval, we identified all patients that died at LRMC between 1 January 2006 and 31 July 2013. Patient demographic data were abstracted from the institution's local trauma registry and inpatient medical records. Data on organs recovered and transplanted were obtained from the DSO database.

3. Identification of potential organ donors

Potential military organ donors were defined as patients that met clinical criteria for neurologic determination of death and did not have contraindications to organ donation (HIV, active hepatitis B virus, Jakob-Creutzfeldt's disease, malaria, or disseminated tuberculosis), active visceral or hematologic neoplasm, uncontrolled sepsis, or clinical signs that indicate the organ is unlikely to function. Military donors were matched 1:3 with a civilian organ donor cohort from the U.S. United Network for Organ Sharing (UNOS) Donor Management Goals Registry, which includes organ donors from UNOS Regions 4, 5, and 6. Patients under the age of 18 were excluded, and matching was performed based on the year of donation (40 military and 116 civilian donors). Civilian donors included those that donated after circulatory determination of death, as well as those that donated under expanded criteria. Expanded criteria for donation include any donor over the age of 60, or a donor over the age of 50 with two of the following: a history of high blood pressure, a creatinine greater than or equal to 1.5, or death resulting from a stroke.

4. Statistical analysis

Normally distributed continuous variables are described as means with standard deviations (SD), and skewed continuous variables are described as medians with Inter-quartile ranges (IQR). Binary variables are described as proportions. The organ donation conversion rate was calculated as the number of organ donors over the total number of potential donors. The organs recovered were calculated as the number of viable solid organs (heart, lung, liver, kidney, pancreas) recovered per donor. The number of organs transplanted per donor was also calculated as the number of solid organs successfully transplanted per donor. If a single liver donor was split between multiple recipients, each split was counted as a transplanted organ. Demographic variables were compared between the military and civilian cohorts. Outcome variables included organs recovered and organs transplanted per donor. A univariate analysis of organs recovered and organs transplanted per donor was performed between the military and civilian cohorts. A logistic regression analysis controlling for differences between two groups was also performed. Significance was set at $p < 0.05$.

5. Results

Of all the U.S. military patients declared dead by neurologic criteria at LRMC between January 1, 2006 and 31 July 2013, there were a total of 53 potential organ donors identified (Table 1). Thirteen of 53 potential donors did not donate organs (24.5%).

Table 1
Potential military organ donors and reasons for non-procurement.

	Total	Percent total
Potential Organ Donors	53	100
Total Organ Donors	40	75.5
Reasons for Non-Procurement		
advanced directive	6	11.3
family not approached	1	1.9
family refusal	6	11.3

Reasons for not donating organs were prior medical documentation declining organ donation (6/53, 11.3%), family refusal for organ donation (6/53, 11.3%), and one case where the family was not approached for organ donation (1/53, 1.9%). A total of 40 military patients were authorized for organ donation (conversion rate 75.5%). This group was matched with a civilian cohort of 116 organ donors.

As shown in Table 2, of the 40 military patients who donated organs, all were male versus 62% male in the civilian cohort ($p < 0.05$). The mean age in the military cohort was 25.8 years (standard deviation, SD 0.99) versus 44.2 years (SD 1.4) in the civilian cohort ($p < 0.05$). There was not a significant difference in body mass index (BMI) between the military (27.2 SD 3.2) and civilian groups (27.8 SD 6.3). The military and civilian groups were also categorized by type of donor including standard criteria donor (SCD), expanded criteria donor (ECD), or donation after determination of circulator death (DCD). All military donors were SCD. Of the civilian donors, 73 (63%) were SCD, 34 (29%) ECD, and 9 (8%) DCDD.

On univariate analysis as shown in Table 3, the military group recovered and donated significantly more hearts, liver, and

Table 2
Demographics of organ donors.

	Military (n = 40)	Civilian (n = 116)	p-value
Sex (% male)	100%	62%	<0.05
Age	25.8 ± 0.99	44.2 ± 1.4	<0.05
Weight (kg)	86.7 ± 10.9	81.5 ± 18.1	0.04
Height (meters)	1.78 ± 0.06	1.71 ± 0.1	<0.05
BMI	27.2 ± 3.2	27.8 ± 6.3	0.55
Donor type			
Standard criteria	40	73	<0.05
Extended criteria	0	34	
Donation after Circulatory Death	0	9	

BMI: body mass index.

Table 3
Univariate analysis of military versus civilian organ recovery and transplantation rates.

	Military (n = 40)	Civilian (n = 116)	p-value
Hearts			
Recovered	29 (73%)	38 (32%)	<0.05
Transplanted	26 (65%)	34 (29%)	<0.05
Lungs			
Recovered	15 (38%)	27 (23%)	0.06
Transplanted	14 (35%)	22 (18%)	0.03
Kidneys			
Recovered	38 (95%)	114 (95%)	1.0
Transplanted	36 (90%)	93 (87%)	0.61
Livers			
Recovered	40 (100%)	97 (81%)	<0.05
Transplanted	39 (98%)	87 (73%)	<0.05
Split Livers			
Transplanted	5 (12%)	1 (0.8%)	<0.05
Pancreata			
Recovered	25 (63%)	21 (18%)	<0.05
Transplanted	19 (48%)	11 (9%)	<0.05