Survey of Casualty Evacuation Missions Conducted by the 160th Special Operations Aviation Regiment During the Afghanistan Conflict

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ABSTRACT

Background: Historically, documentation of prehospital combat casualty care has been relatively nonexistent. Without documentation, performance improvement of prehospital care and evacuation through data collection, consolidation, and scientific analyses cannot be adequately accomplished. During recent conflicts, prehospital documentation has received increased attention for point-of-injury care as well as for care provided en route on medical evacuation platforms. However, documentation on casualty evacuation (CASEVAC) platforms is still lacking. Thus, a CASEVAC dataset was developed and maintained by the 160th Special Operations Aviation Regiment (SOAR), a nonmedical, rotary-wing aviation unit, to evaluate and review CASEVAC missions conducted by their organization. **Methods:** A retrospective review and descriptive analysis were performed on data from all documented CASEVAC missions conducted in Afghanistan by the 160th SOAR from January 2008 to May 2015. Documentation of care was originally performed in a narrative after-action review (AAR) format. Unclassified, nonpersonally identifiable data were extracted and transferred from these AARs into a database for detailed analysis. Data points included demographics, flight time, provider number and type, injury and outcome details, and medical interventions provided by ground forces and CASEVAC personnel. **Results:** There were 227 patients transported during 129 CASEVAC missions conducted by the 160th SOAR. Three patients had unavailable data, four had unknown injuries or illnesses, and eight were military working dogs. Remaining were 207 trauma casualties (96%) and five medical patients (2%). The mean and median times of flight from the injury scene to hospital arrival were less than 20 minutes. Of trauma casualties, most were male US and coalition forces (n = 178; 86%). From this population, injuries to the extremities (n = 139; 67%) were seen most commonly. The primary mechanisms of injury were gunshot wound (n = 89; 43%) and blast injury (n = 82; 40%). The survival rate was 85% (n = 176) for those who incurred trauma. Of those who did not survive, most died before reaching surgical care (26 of 31; 84%). **Conclusion:** Performance improvement efforts directed toward prehospital combat casualty care can ameliorate survival on the battlefield. Because documentation of care is essential for conducting performance improvement, medical and nonmedical units must dedicate time and efforts accordingly. Capturing and analyzing data from combat missions can help refine tactics, techniques, and procedures and more accurately define wartime personnel, training, and equipment requirements. This study is an example of how performance improvement can be initiated by a nonmedical unit conducting CASEVAC missions.

Keywords: *casualty evacuation; CASEVAC; en route care; Tactical Combat Casualty Care; TCCC*

Introduction

The 160th Special Operations Aviation Regiment (SOAR) is a nonmedical combatant aviation unit that provides precision rotary-wing support to conventional and Special Operations Forces.[1] Missions include attack, assault, and reconnaissance, which are usually conducted at night, at high speeds and low altitudes, and on short notice. As a part of their mission, the 160th SOAR also performs casualty evacuation (CASEVAC) for those who are injured during training, combat, and other contingency operations.

A medical provider, typically a flight medic, is an integral member of the 160th SOAR aircraft crew for every mission as a contingency in the event there are casualties incurred by ground forces who need to be evacuated to a higher level of care. Within the 160th SOAR, medics are well versed in Tactical Combat Casualty Care (TCCC) and prehospital trauma life support, and receive paramedic-level training as Special Operations combat medics. Additionally, these medics receive critical care flight paramedic training and certification. There are also unit medical officers, physicians, and physician assistants, who periodically will be a part of the crew on these missions. However, use of these officers depends on the mission and their availability.

Tactical or prehospital transport of patients has historically been categorized by the Department of Defense (DoD) as either medical evacuation (MEDEVAC) or CASEVAC.[2] Conventional MEDEVAC unit transports have been defined as designated, dedicated, and regulated or unregulated prehospital patient-transfer platforms used by an ambulance unit that has medical personnel and medical equipment assets to

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perform en route care.[3] In contrast, CASEVAC unit transports have been defined as designated or nondesignated, nondedicated, and unregulated prehospital patient-transfer platforms used by a nonambulance unit that may or may not have medical personnel and medical equipment assets to provide en route care.[3] Usually, MEDEVAC platforms are marked with a red cross and CASEVAC platforms are not.

Given that patients on the battlefield benefit from rapid transport and en route care,[4] this study proposed to analyze after action reviews (AARs) and characterize patients who underwent CASEVAC as provided by 160th SOAR rotary-wing aircraft. These CASEVAC data will establish a baseline for future reference and will help guide protocols and procedures, training and equipping initiatives, and research efforts.

Methods

Approval for this project was obtained from the 160th Regimental Commander and the University of Texas Institutional Review Board. It was determined that this project qualified as nonregulated research. A retrospective review and descriptive analysis were performed on 129 separate CASEVAC missions conducted by the 160th SOAR in Afghanistan from January 2008 through May 2015. Descriptive statistics were used to analyze data for 227 casualties who were transported from the point of injury (POI) to an established medical treatment facility (MTF).

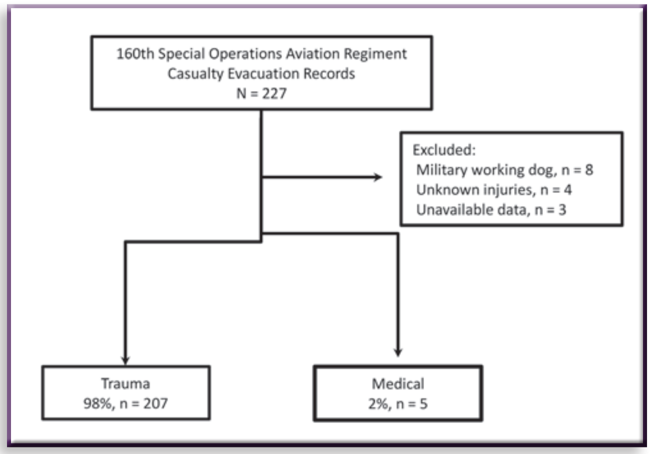
Original data were in narrative AAR format as documented in near real time by the medic or medical officer who treated the patients. Unclassified, nonpersonally identifiable medical data were extracted from the AARs and consolidated into a database for detailed analysis. Data points extracted included demographics (i.e., affiliation, sex); time of flight (from injury scene to MTF arrival); number and type of medical provider (i.e., medic, physician assistant, physician), mechanism of injury (i.e., gunshot wound, blast, other), body region injured; outcome (i.e., lived, died); and medical interventions provided by ground-force nonmedical and medical personnel, as well as CASEVAC medical personnel. Data were abstracted from AARs by a 160th SOAR physician who was intimately familiar with the unit and the unit's missions. Raw data were organized in accordance with an established data dictionary (Appendix A). In cases where data were unclear, the author of the AAR was queried to provide additional detail and clarity. The final database was evaluated in conjunction with the En Route Care Division of the US Army Institute of Surgical Research. Data analysis was performed using JMP software, version 10 (SAS Institute, https://www.sas.com).

Results

There were 227 individual CASEVAC cases reviewed, of which eight were military working dogs, four had unknown injuries or illnesses, and three had minimal data. These 15 casualties were excluded from further analysis. Thus, the final study population consisted of 212 patients, as depicted in Figure 1. Trauma (n = 207; 98%) was the primary reason for conducting these CASEVAC missions, followed by other medical reasons (n = 5; 2%).

US, Afghanistan, and coalition military forces comprised most of the transported trauma casualties (n = 189; 91%). There

FIGURE 1 *Flow diagram for study population available for detailed analysis.*



were 15 local nationals (7%), six of whom were male and nine were female. Three wounded children (one boy, two girls) also were transported. For this analysis, enemy wounded were included in the local national category because sometimes their affiliation status was unclear. In addition to the nine local national women, there were two female US military casualties attached to Special Operations units, for a total of 11 women transported. Both US female Soldiers were categorized as killed in action (KIA; died before reaching a MTF) as a result of improvised explosive devices (IEDs). All CASEVAC missions conducted for medical reasons were for US and coalition male Soldiers.

Table 1 shows the average time of flight for medical and for trauma patients was less than 20 minutes. The time of flight was broken down into medical and trauma, with median CASEVAC times of 11 and 13 minutes, respectively. In this dataset, total time from initial injury to arrival at a MTF was not captured. Rather, the time of flight recorded was only for the time from injury-scene departure to arrival at the nearest appropriate facility (i.e., a small Role 2 MTF may have been overflown to go to a more robust Role 3 MTF with a neurosurgeon). Additionally, findings also show that one flight medic was the most common number and type of medical provider for 160th SOAR CASEVAC flights.

Table 1 also displays patient injury data and patient outcomes after CASEVAC. Injuries to the extremities (n = 139; 67%) were seen most commonly. The primary mechanisms of injury were gunshot wound (n = 89; 43%) and blast injury (n = 82; 40%); however, the incidence of these mechanisms was not statistically different (p = .55). For those who incurred trauma, there was a 15% (n = 31) mortality rate. Of those who died, most were KIA—they died before reaching a MTF and surgical care (26 of 31; 84%); the remainder of the trauma fatalities (five of 31; 16%) were categorized as having died of wounds, because they died after reaching a MTF and surgical care.

The most common treatments provided at the POI were for hemorrhage control (n = 141) and medication administration (n = 113; Table 2). Of hemorrhage control interventions, dressings or gauze were used most frequently. Of medications, analgesics (particularly fentanyl) were administered most frequently. Of note, only 17% (n = 35) of trauma casualties were transferred with POI care documented on a TCCC Card.

TABLE 1 *Characteristics of Study Population (N = 212), Flight, and Providers*

Characteristic	Medical (n = 5) No. (%)[a]	Trauma (n = 207) No. (%)[a]
Local or foreign national	0 (0)	15 (7)
Pediatric	0 (0)	3 (1)
Female sex	0 (0)	11 (5)
Time of flight, mean ± SD; median (IQR)	19 ± 14.2; 11 (10–35)	16 ± 13.4; 13 (10–20)
≤15 min	2 (67)	104 (71)
16-30 min	0 (0)	34 (23)
>30 min	1 (33)	9 (6)
No. of casualties		
≤2	3 (75)	113 (55)
>2	1 (25)	94 (45)
Lowest provider type		
Medic	4 (80)	183 (90)
Physician assistant	1 (20)	12 (6)
Physician	0 (0)	9 (4)
Highest provider type		
Medic	4 (80)	157 (77)
Physician assistant	1 (20)	27 (13)
Physician	0 (0)	26 (13)
Medic only	4 (80)	157 (77)
More than one provider	0 (0)	26 (13)
Mechanism of injury		
Gunshot wound	—	89 (45)
Blast injury	—	82 (41)
Other	—	28 (14)
Body region injured		
Head	—	33 (16)
Neck	—	7 (3)
Face	—	16 (8)
Chest	—	35 (17)
Abdomen	—	25 (12)
Upper extremity	—	55 (27)
Pelvis	—	9 (4)
Lower extremity	—	84 (41)
Skin	—	9 (4)
No. of body regions, mean ± SD; median (IQR)	—	1.4 ± 0.6; 1 (1–2)
Outcome, no./total (%)		
Lived	4/5 (80)	176/207 (85)
Stable	4/4 (100)	151/176 (86)
Unstable	—	25/176 (14)
Died	0/0 (0)	31/207 (15)
Killed in action	—	26/31 (84)[b]
Died of wounds	—	5/31 (16)
Unknown	1/5 (20)	—

IQR, interquartile range; SD, standard deviation.
[a]Unless otherwise indicated.
[b]Four fatalities were categorized as "Angel Flights" because they passed away before casualty evacuation.

The most common intervention during en route care was patient monitoring (n = 101), followed by hemorrhage control (n = 67) and medications (n = 47; Table 3). Airway interventions provided during en route care (n = 31) were slightly more common than those provided at the POI (n = 27). Tourniquets were applied less commonly during en route care (n = 11) than at the POI (n = 48).

Discussion

The Wound Data and Munitions Effectiveness Team database was established during the Vietnam conflict to comprehensively evaluate casualties from that conflict. Of note is that Bellamy[5] highlighted information from this database through his seminal article in 1984 on the causes of death in conventional land warfare. Specifically, Bellamy observed that the vast majority of combat casualties in Vietnam died before reaching an MTF, denoting a need for improved trauma care delivery in the prehospital environment. He also stated, "The appropriately trained combat medic should be able to assume a position of importance equal to that of the combat surgeon."[5]

Prompted by subsequent combat during Operation Gothic Serpent in Somalia, Bellamy's article was followed by another seminal article written by Butler et al.[6] in 1996 entitled "Tactical Combat Casualty Care in Special Operations." The Butler et al. article established evidence-based guidelines for optimizing prehospital combat trauma care. Since then, numerous authors have contributed publications to the study of prehospital combat trauma care. Notably, the 75th Ranger Regiment developed and established a novel prehospital trauma registry[7] from which they published multiple studies, including a detailed analysis of their prehospital treatment practices and subsequent casualty outcomes.[8]

Following the success of the Ranger example, the Joint Trauma System also developed a prehospital trauma registry to capture prehospital data from throughout the DoD.[9,10] Some casualties found in both of these registries may have been transported by the 160th SOAR; therefore, a few POI care and injury data points included in our study may be found in those registries. However, an overlap is preferred to an underlap in data. Regardless, it is important to initiate unit-based documentation, data collection, and data analysis to facilitate internal performance improvement programs, because such programs have the potential to capture lessons learned and unmask opportunities for organizational growth.[8,11]

The blast-wound category, which captures injuries from IEDs, grenades, rockets, and other explosive munitions, only accounted for 41% of traumatic injuries in our study. In contrast, other studies of the Afghanistan and Iraq conflicts have observed that 65%–78% of injuries are from blasts.[4,8,12–14] The relatively fewer blast injuries and more gunshot wounds in our article may represent differences in tactical mission as well as the tactics, techniques, and procedures used to prosecute and support that mission. Most 160th SOAR missions were conducted at night in support of air assault forces performing primarily direct action raids, so small-arms fire encountered during these missions may account for more nocturnal injuries as compared with the myriad of other missions (e.g., ground assaults, convoy operations, security patrols, logistics support, base operations) that occur during the daytime and that may be more susceptible to incurring

TABLE 2 *Treatment Interventions Rendered by Ground Forces at Point of Injury*

Intervention	Medical, n = 5 mean ± SD; median (IQR)[a]	Trauma, n = 207 mean ± SD; median (IQR)[a]
Circulation, hemorrhage control, no. (%)	0 (0)	141 (68)
Dressings or gauze		84/141 (60)
Hemostatic agent	—	9/141 (6)
Tourniquet	—	48/141 (34)
Airway interventions, no. (%)	0 (0)	27 (13)
Bag-valve-mask	—	5/27 (19)
Nasopharyngeal airway	—	6/27 (22)
Supraglottic airway (King LT; Ambu, http://www.ambuusa.com)	—	4/27 (15))
Cricothyroidotomy	—	9/27 (33)
Endotracheal tube	—	2/27 (7)
Automated ventilator (SAVe; Automedx, http://automedx.com/)	—	1/27 (4)
Breathing interventions, no. (%)	0 (0)	45 (22)
Needle decompression	—	13/45
Chest seal, no./total	—	30/45
Chest tube, no./total	—	2/45
Circulation, access, no. (%)	1 (20)	27 (13)
Intraosseous	—	2/27 (7)
Intravenous	1/1 (100)	25/27 (93)
Circulation, fluids	1 (20)	9 (4)
Normal saline	1/1 (100)	5/9 (56)
Hextend	0 (0)	4/9 (44)
Medications	1 (20)	112 (54)
Antibiotic		30/112 (27)
Analgesic	—	55/112 (49)
Morphine	—	11/55 (20)
Fentanyl	—	35/55 (64)
Ketamine	—	11/55 (20)
Combination	—	7/55 (13)
Combat wound pill pack	—	17/112 (15)
Metoprolol	1/1 (100)	8/112 (9)[b]
Cervical collar	0 (0)	3 (1)
Splint/sling/pelvic binder	0 (0)	16 (8)
Hypothermia prevention	1 (20)	27 (13)
Documentation (TCCC card)	—	35 (17)
Patient communication/handoff: all voxbox	0 (0)	4 (2)
Monitoring, pulse oximetry	0 (0)	1 (<1)
Cardiopulmonary resuscitation	0 (0)	4 (2)
Declined care or no treatment	1 (20)	9 (4)
No. of POI interventions, mean ± SD; median (IQR)	1 ± 1.3; 0 (0–2)	2 ± 1.8; 2 (0–3)

IQR, interquartile range; LT, laryngeal tube; POI, point of injury; SAVe, simplified automated ventilator; SD, standard deviation; TCCC, Tactical Combat Casualty Care. [a]Unless otherwise indicated. [b]Factor VIIa, one dose; tranexamic acid, three doses; antiemetic (ondansetron or promethazine) three doses; diazepam, one dose.

casualties and injury from ambushes, IEDs, and other blast mechanisms.

This study has several limitations. First, data were collected through nontraditional methods. The AARs were written in paragraph format, using a play-by-play narrative that discussed tactical and medical issues, and then data were extracted from the narrative to populate pertinent fields in the CASEVAC database. Vital signs were frequently noted as having been taken; often, however, numeric values were not documented. Calculation of injury severity scores for casualties were attempted; however, wound descriptions were not detailed enough, and internal injuries would not and could not have been fully described, given the prehospital setting. Although these limitations prevented additional points of comparisons with other studies, they are areas for improvement and focus for the next iteration of the CASEVAC database.

When our CASEVAC study is compared with studies that evaluate MEDEVAC,[3,4,15–19] there are differences pertaining to measurement of crude mortality rates. For example, to determine crude mortality rates, Mabry et al.[15] used injury severity scores based on data extracted from hospital records. Their study also used a mortality cutoff of 48 hours. In four instances within our database, the injured person had already died before the CASEVAC mission. Because these individuals, categorized as "Angel Flight" fatalities, did not receive en route care and were not transferred to an MTF, they ultimately

TABLE 3 *Treatment Interventions Rendered by Flight Crew During Transport*

Intervention	Medical, n = 5 No./Total (%)[a]	Trauma, n = 207 No./Total (%)[a]
Circulation, hemorrhage control, no. (%)	0 (0)	67 (32)
Dressings or gauze	—	49/67 (73)
Hemostatic agent	—	7/67 (10)
Tourniquet	—	11/67 (16)
Airway interventions, no. (%)	1 (20)	30 (14)
Bag-valve-mask		4/30 (13)
Nonrebreather mask	—	16/30 (53)
Naso- or oropharyngeal airway	—	3/30 (10)
Nasal cannula	—	2/30 (7)
Supraglottic airway (King LT; Ambu, http://www.ambuusa.com)	—	3/30 (10)
Cricothyroidotomy	—	1/30 (3)
Automated ventilator (SAVe; Automedx, http://automedx.com/)	1/1 (100)	1/30 (3)
Breathing interventions, no. (%)		25 (12)
Needle decompression	—	15/25 (60)
Chest seal	—	10/25) (40)
Chest tube	—	—
Circulation, access, no. (%)	1 (20)	36 (17)
Intraosseous	0 (0)	6/36 (17)
Intravenous	1/1 (100)	30/36 (83)
Circulation, fluids, no. (%)	1 (20)	27 (13)
Lactated Ringer's	0 (0)	2/27 (7)
Normal saline	1/1 (100)	18/27 (67)
Hextend	0 (0	7/27 (26)
Medications	0 (0)	47 (23)
Antibiotic	—	13/47 (28)
Analgesic	—	30/47 (64)
Morphine	—	7/30 (23)
Fentanyl	—	19/30 (63)
Ketamine	—	3/30 (10)
Other	—	4/47 (9)[b]
Cervical collar	1 (20)	3 (1)
Splint/sling/pelvic binder	0 (0)	3 (1)
Hypothermia prevention	1 (20)	36 (17)
Other interventions	1 (20), IV warmer	7 (3)[c]
Monitoring	1 (20)	100 (48)
Pulse oximetry	1/1 (100)	64/100 (64)
Electronic (Propaq; ZOLL Medical Corp, https://www.zoll.com) or manual vital signs	—	36/100 (36)
Cardiopulmonary resuscitation	0 (0)	9 (4)
Declined care or no treatment	1 (20)	9 (4)
No. of en route care interventions	2 ± 1.9; 3(0–3.5)	2.3 ± 2.2; 2(0–4)

IV, intravenous; LT, laryngeal tube; SAVe, simplified automated ventilator. [a]Unless otherwise indicated. [b]Tranexamic acid, three doses; diazepam, one dose. [c]End-tidal carbon dioxide monitor, suction of cricothyroidotomy, removal of foreign body from airway.

were not captured through hospital documentation and records. Because most prior MEDEVAC studies have been based on data extracted from hospital records and not from a prehospital database, there will be variance in the numbers and calculation of mortality rates, depending on the inclusion or exclusion criteria of the study and supporting data source.

Findings from the Eastridge et al.[14] study showed that approximately 25% of those who died on the battlefield had potentially survivable wounds. The Mabry et al.[15] study used only those casualties who had a medical chart made and injuries documented; therefore, it is most probable that some casualties who died in the prehospital environment were not accounted for in that study, because they would have been transferred directly to mortuary affairs. Additionally, other prior MEDEVAC studies may not have accounted for all these patients.[3,4,16–19] In contrast, the 160th SOAR prehospital dataset captured all casualties that were transported on its helicopters.

The majority (98%) of CASEVAC flights in our study were for patients with traumatic injuries. This was expected, given the mission of a nonmedical combatant aviation unit in a war zone. Although total time from initial injury to MTF arrival was not captured, the time of flight from the scene to MTF arrival was captured and can be used as a metric for comparison. In a comprehensive study of time and prehospital helicopter transport of casualties in Afghanistan, Kotwal et al.[4] noted mean and median times interval from scene to MTF arrival of 28 and 17 minutes, respectively. In comparison, our study depicted faster times for transport of trauma casualties during this same interval with mean and median times of 16 and 13 minutes, respectively. Although it is reassuring that the 160th SOAR evacuated casualties rapidly to hospitals and surgical care, flight medical personnel were probably task saturated and may not have had time to accomplish all required interventions during this time. In addition to conducting comprehensive head-to-toe assessments, usually while wearing night-vision goggles, flight medical personnel needed to check and reinforce previous treatments and initiate new or advanced treatments and monitoring as time permitted.

From our study, an interesting finding was seen in 11 casualties who received limb tourniquets that were applied initially during en route care after flight medic assessments revealed substantial extremity hemorrhage. One of these casualties was wounded on 160th SOAR aircraft by ground small-arms fire during infiltration to the mission objective. Although others were also wounded by ground fire while on 160th SOAR aircraft, no others required a tourniquet. Of the 11 casualties who received initial limb tourniquets on 160th SOAR aircraft, one ultimately died of wounds at an MTF. Although it is optimal to apply tourniquets and control hemorrhage immediately after an injury occurs, it can prove challenging for air and ground forces to identify and appropriately treat all wounds during nighttime combat operations. Regardless, this finding reinforces the need for flight medical personnel to conduct comprehensive head-to-toe assessments as soon as casualties are loaded onto the aircraft by ground personnel. As time permits, comprehensive serial assessments performed by all prehospital providers in the continuum of care will help to mitigate harm and missed injuries.

For our CASEVAC database, availability of more data and details on fatalities would have proved helpful in eliminating preventable death, through mortality analysis, trends, and comparisons. In addition to prehospital casualty cards, Kotwal et al.[8] used Purple Heart records, medical records, DoD Trauma Registry data, and Armed Forces Medical Examiner autopsy records to analyze casualty injuries and wounding patterns, establish injury severity scores, and determine cause of death. For US patients in the CASEVAC database, follow-on efforts should include using data from the DoD Trauma Registry and Armed Forces Medical Examiner autopsies to increase fidelity of injury data, assign injury severity scores, and determine cause of death to improve performance and compare morbidity and mortality outcomes and findings between studies.

However, notable is that no other individual tactical ground force has documented care, consolidated data, and replicated a comprehensive unit-based study and publication as have Kotwal et al.[8] Also notable is that no individual CASEVAC unit (air or ground) has documented care, consolidated data, and published a unit-based study, until this current study. Although comparing data from a tactical ground unit to that of a tactical air unit has its limitations, comparing study methodologies will help improve future unit-based performance improvement efforts.

During the initial stage of our study, it was noted that information and data variability occurred between data analysts because of a lack of understanding or unfamiliarity with colloquial or unit-specific terms. This unfamiliarity of terms required a data dictionary to be constructed to ensure correct categorization of interventions. This is a novice issue that can be obviated through a data dictionary, business rules, and abstractor training. Fortunately, guidance and assistance were provided to us in this respect from specialists at the Joint Trauma System who currently maintain the DoD Trauma Registry. Now that the foundation of the 160th SOAR CASEVAC database has been established, data fields can be further refined to permit advancement of future queries regarding treatments, comparisons between helicopter type, and many other questions. The database will also serve as a historical record that can be referenced by providers to ensure realistic preparatory training for combat and other contingency operations during interwar periods.

Maintaining a CASEVAC database is important for quality assurance and quality improvement initiatives because doing so will help in development and maintenance of organizational treatment standards and identification of deficiencies and areas for improvement. Successful treatment practices that improve casualty outcomes can also be identified and shared throughout the medical community. However, within the military, the medical leadership at the battalion and brigade level is often transient, and quality assurance or quality improvement practices are frequently overshadowed by other priorities of effort. Thus, to ensure a continuous state of organizational performance improvement, medical and nonmedical leadership must integrate these practices through policy and procedures.

Conclusion

Performance improvement efforts directed toward prehospital treatment of combat casualties have the potential to positively and markedly influence battlefield morbidity and mortality. Documentation of care is a requisite for conducting performance improvement; therefore, medical and nonmedical leaders must mandate and enforce this documentation. Capturing and analyzing data from individual combat missions, as well as multiple combat missions in aggregate, can help refine tactics, techniques, and procedures, and more accurately define wartime personnel, training, and equipment requirements. Although limited, this novel dataset and its analysis are initial examples of how documentation, data collection and analysis, and performance improvement can be accomplished by a nonmedical unit conducting CASEVAC missions.

Dedication

This article is dedicated to SFC Marcus V. Muralles and SSG Shawn H. McNabb, 160th SOAR Special Operations combat medics who were killed in action in Afghanistan on 28 June 2005 and 26 October 2009, respectively.

Previous Presentation

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Disclosure

The authors have nothing to disclose.

Author Contributions

TR abstracted the data, AM provided data analysis, and TR, KM, BB, ER, JM, and RK wrote and edited the article.

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APPENDIX A *Data Dictionary*

Data Category	Format	Description
Date	**DD–MM–YY**	**Date of casualty evacuation**
Medic	Last Name/s	Names of medics on transport (e.g., if one name, one provider on flight; if two names, two providers on flight). On occasion, there may be a ground-force medical provider who came onboard the aircraft. This usually was noted in comments.
No. of patients	X of X	Casualty number and total number of patients transported (e.g., one of six, two of six)
Time of flight	Numeric	How long it took the helicopter to fly from the point of injury to the Role 2 or 3 hospital. This did not include how long it took 160th SOAR aircraft to fly to the point of injury.
Wounds	Text	Description
Interventions		
Tourniquets	Text	Tourniquet name and number. In general, these will be C-A-T tourniquets (C-A-T Resources Inc, http://combattourniquet.com/), unless otherwise noted.
Intravenous fluids	Text	Vascular access type and fluid type
Antibiotics	Text	Antibiotic name
Pain medications	Text	Medication name, dose, route
Other	Text	List of other procedures (e.g., dressings, oxygen, needle decompression)
Hypothermia	Text	Hypothermia prevention type
Monitoring	Text	Monitoring type
Documentation	Text	Documentation type
Outcomes	Text	Killed in action, died of wounds, unstable, stable
Comments	Text	Free-text comments

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