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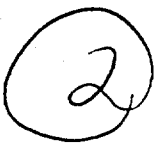

A DESCRIPTIVE ANALYSIS OF WOUNDS AMONG U.S. MARINES TREATED AT SECOND ECHELON FACILITIES IN THE KUWAITI THEATER OF OPERATIONS

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Summary

Problem

Surgical Support Companies and Collecting & Clearing Companies are medical facilities designed to provide flexibility in meeting the requirements of the seriously wounded, while selectively returning the lightly wounded back to their units. Information detailing the types of wounds treated during past operations may yield insights into the resources required for future combat scenarios.

Objective

During Operation Desert Storm, the medical companies of the second echelon were able to establish facilities forward in the operational theater and function as the primary treatment facilities for the care of combat trauma cases. The present study seeks to determine the types and causes of trauma injuries experienced by U.S. Marines during Operation Desert Shield/ Storm.

Approach

Data were examined for 120 Marine Corps trauma cases presenting at second echelon medical facilities in the Kuwaiti Theater of Operations. Descriptive statistics were computed for cause and type of injury, as well as for delay time from injury to admission at treatment facilities. Special emphasis was placed on contrasting patients admitted during the ground war with those admitted during the pre- and post-ground war periods.

Results

Penetrating wounds and lacerations were found to be the most prevalent types of injuries, while shrapnel and gunfire caused the greatest numbers of trauma admissions.

Conclusions

Medical planners must be able to anticipate the personnel and resource requirements necessary for military operations. The injuries sustained in Operation Desert Shield/Storm may provide some insight into the types of casualties which may be sustained in future scenarios.

A Descriptive Analysis of Wounds Among U.S. Marines Treated at Second Echelon Facilities in the Kuwaiti Theater of Operations

Introduction

During the recent conflict in the Persian Gulf, the second echelon Medical Treatment Facilities provided forward position medical treatment for combat casualties. The second echelon MTF's include Surgical Support Companies and Collecting & Clearing Companies. These units provide general and direct medical support to the Marine Expeditionary Force (MEF) including: establishing and maintaining treatment facilities for surgery, receiving and treating casualties evacuated from battalion aid stations, and providing temporary hospitalization of casualties[1]. The goal of the multi-echelon medical system is to provide selective evacuation of those casualties needing extended care, while returning the lightly injured to combat as soon as possible.

As mobile medical units, the second echelon companies of the medical battalion are required to operate as far forward in the theater of operations as the tactical situation allows. In the Kuwaiti Theater of Operations (KTO) this required that the companies establish, disassemble, and finally relocate within 10 to 20 miles of the Kuwaiti border prior to the ground war. With the Fleet Hospitals located approximately 100 miles from the border, the second echelon companies were the primary treatment facilities for the care of combat trauma cases during Operation Desert Storm[2].

Four hundred and two trauma cases, which include enemy prisoners of war and foreign nationals, were treated at the second echelon facilities in the KTO. The present study examines the Marine Corps trauma admissions at these facilities. With 24 infantry battalions and more than 92,000 Marines committed in the Persian Gulf, Desert Storm represents the largest operation in the history of the Marine Corps[3]. While casualties among U.S. forces were relatively few, an analysis of the wounds sustained may aid medical logisticians in determining resource needs of future operations. The present investigation examines the types of injuries, causes of injuries, and the lapse between injuries and treatment among traumas sustained by Marines.

Method

Combat casualty data were collected by field surgeons and medical personnel working at Surgical Support Companies and Collecting & Clearing Companies in the KTO. Data collected included patient demographics, date and time of admittance, time of injury, anatomical region of injury, cause of injury, and medical procedure employed. Data were available for the period between January 15, the United Nations deadline for an Iraqi withdrawal from Kuwait, and March 6, the week following the formal cease-fire announcement. Data recorded at Fleet Hospital 1 and Fleet Hospital 5 were also used to

identify traumas among personnel requiring extended care.

Descriptive statistics were computed for injury types and causative agents, as well as for elapse time from injury to treatment at the second echelon MTF. Patients admitted during the ground war were contrasted with those admitted during the period directly preceding or following ground hostilities. The ground war period used in this analysis includes the two days prior to the announced beginning of hostilities thereby providing a clear separation between periods of engaged activity and periods of preparation or disengagement. The two-day period preceding the ground war saw a dramatic increase in trauma cases, as more than 700,000 allied troops took part in the final mobilization for battle.

Analysis

Data were available for one hundred twenty Marines treated at the second echelon facilities in the KTO. Figure 1 shows a distribution of injury admissions by date. Sixty-five percent of admissions occurred during the period from February 22, two days prior to the start of the ground war, through the morning of February 28 when victory was declared. The remaining 35% of the trauma cases occurred during the period prior to, or directly following the ground war. Mean trauma admissions during the ground war were 11.3 per day, while admissions for the non-ground war period were 2.3 per day.

The distribution of types of injuries is shown in Table 1. Of the 120 trauma admissions, 94 were recorded as a single injury type, 19 as two injury types, and one as three injury types; six admissions had no data on injury type. Penetrating wounds represented one-third of the overall number of injuries, while lacerations account for over one-eighth of trauma injuries.

Table 2 represents the distribution of injuries by anatomical region. Of 116 trauma admissions with data recorded, 88 injuries were confined to a single region, 19 to two regions, 8 to three regions, and one as five separate wound regions. Extremities were shown to be the most prevalent region of injury, with wounds to the

FIGURE 1. INJURY ADMISSIONS FOR U.S. MARINES AT SECOND ECHELON FACILITIES (KTO)

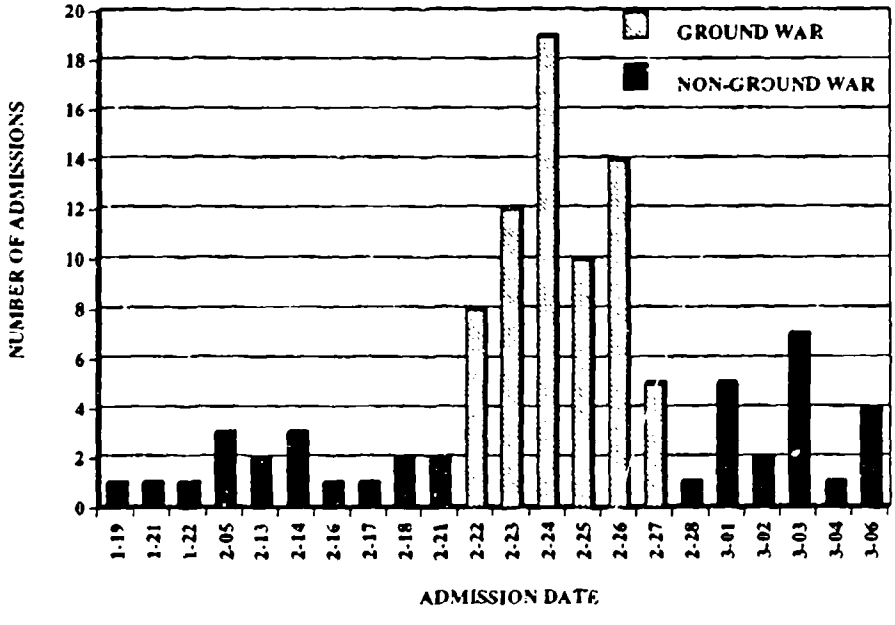


Table 1

INJURY TYPE FOR MARINE TRAUMA ADMISSIONS

INJURY TYPE	No.	%
Penetrating Wound	45	33.33
Laceration	17	12.59
Open Fracture	13	9.63
Closed Fracture	10	7.41
Closed Injury	9	6.67
Abrasion	6	4.44
Strain	6	4.44
Burn	5	3.70
Contusion	5	3.70
Crush	4	2.96
Puncture	3	2.22
Amputation	2	1.48
Concussion	2	1.48
Foreign Body	2	1.48
Sprain	2	1.48
Electric Shock	1	0.74
Compressed Fracture	1	0.74
Internal Derangement	1	0.74
Rupture	1	0.74
TOTAL	135	100.00

leg, arm, foot, and hand accounting for over sixty percent of the total number of admissions.

The distribution of casualties by weapon type is displayed in Table 3. While many admissions had no recorded causative agent because the agent was truly unknown or the information was never recorded, shrapnel wounds represented the largest number of recorded injuries (27%), while gunshot wounds accounted for one-tenth of all injury admissions. Figure 2 shows the distribution of causative agents for ground war and non-ground war periods. As would be expected, the largest numbers of shrapnel wounds, gunfire injuries, and unrecorded causative agents occurred during the period in which the ground war was in progress.

Figure 3 shows the percentage of admissions distributed by the time interval from time of injury to the time of admission to the

Table 2

ANATOMICAL REGION FOR MARINE TRAUMA ADMISSIONS

ANATOMICAL REGION	No.	%
Leg	45	29.03
Head	31	20.00
Hand	20	12.90
Arm	19	12.25
Foot	12	7.74
Shoulder	8	5.16
Back	7	4.52
Neck	6	3.87
Abdomen	3	1.94
Chest	2	1.20
Groin	1	0.65
Pelvis	1	0.65
TOTAL	155	100.00

second echelon facilities. The median, or value above and below which 50% of all observed values fall, was also employed in an effort to account for extremes in elapse time. The median elapse time for the entire period for which data were available was 3.42 hours. Figure 4 displays the percentage distribution of injury to admission intervals for the ground war period. The median delay increased from .67 hours during the non-ground war period, to 4.41 hours during the ground war.

Follow-up data for many of the Marine trauma admissions at the second echelon

Table 3

CAUSATIVE AGENT FOR MARINE ADMISSIONS

CAUSATIVE AGENT	No.	%
Shrapnel	33	27.50
Gunfire	12	10.00
Mine	6	5.00
Auto Accident	4	3.33
Fall	4	3.33
Blast Injury	2	1.67
Grenade	1	0.83
Recreational Injury	1	0.83
Unknown Agent	57	47.50
TOTAL	120	100.00

FIGURE 2. CAUSATIVE AGENT FOR U.S. MARINE TRAUMA ADMISSIONS

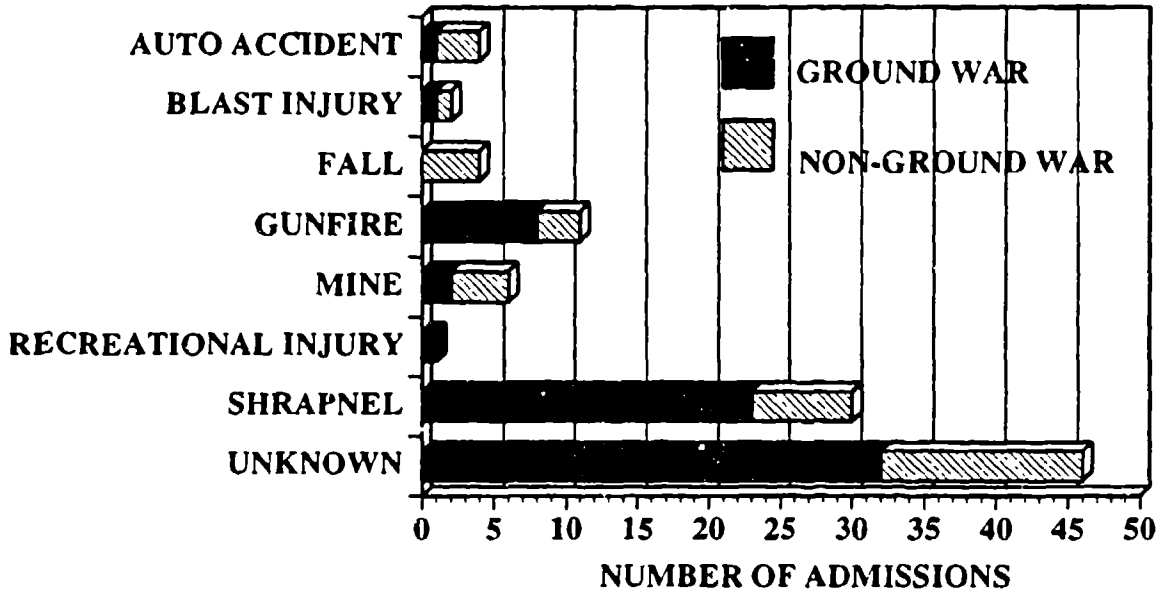


FIGURE 3. INJURY TO ADMISSION INTERVAL: OVERALL

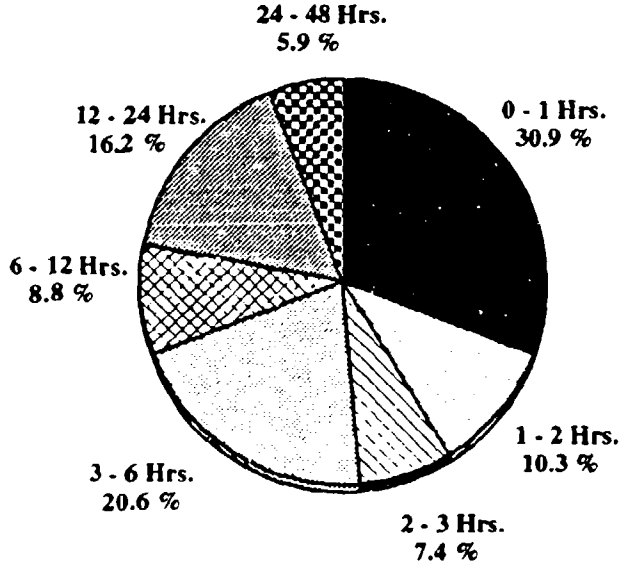
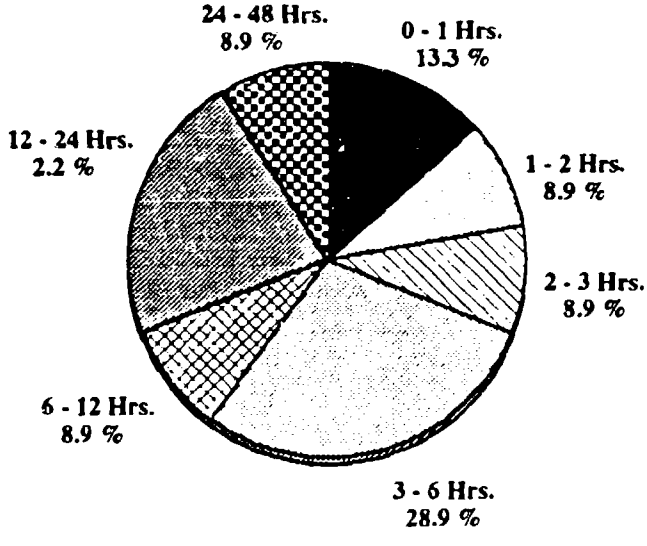


FIGURE 4. INJURY TO ADMISSION INTERVAL: GROUND WAR



facilities was also obtained from fleet hospitals. It was found that, of the 120 Marines admitted to second echelon facilities, 45% also had records at a fleet hospital, indicating that further medical attention was received.

Discussion

Overall, the numbers of casualties sustained by U.S. Marines during the Gulf War were relatively low. The number of injuries stemming from mines and shrapnel can be attributed in part to the fashion in which Iraqi ordnance was deployed in the KTO. With over 500,000 mines scattered throughout Kuwait by Iraqi troops[4], Marine forces moving in the area were particularly susceptible to mine- and shrapnel-related injuries. Mines were also a factor in determining the anatomical region of injury. Of known injuries, 57.1% were to extremity regions, with the largest number of extremity wounds (69.4%) caused by either mines or shrapnel. An increase in mine and shrapnel injuries as a percentage of known injuries was particularly apparent during the ground war; mine/shrapnel injuries rose from 45.5% of the total during the non-ground war period to 69.5% of overall injuries when ground forces were moving rapidly within Kuwait.

Comparisons of traumas from the present study with Marine inpatient admissions during the Vietnam conflict[5] yielded some similarities. The wound proportions among the most prevalent injury types for the Gulf War and Vietnam are, respectively: Penetrating Wounds/Lacerations, 45.9% and 55.9%; Fractures, 17.0% and 16.3%; Burns, 3.9% and 1.4%. The contrasts of the most frequently affected anatomical regions for the Gulf and Vietnam wars are: Leg, 29.0% and 21.7%; Head, 20.0% and 14.2%; Hand, 12.9% and 5.6%; Arm, 12.2% and 14.0%; Foot, 7.7% and 4.0%; Back/Abdomen/Chest, 7.7% and 10.2%. It should be noted that the percentages from the Vietnam War were calculated on the basis of 51,959 admissions and are likely to be much more stable proportions than those from the considerably fewer Gulf War admissions.

The increase in injury-to-admission elapse time experienced during the ground war period can be attributed to a heightened level of activity, as well as to increased distance to treatment facilities. The rise in median elapse time, from less than an hour during the non-ground war period to more than four hours during the ground war, can be explained in part by the methods employed to evacuate casualties from forward echelons of care. First, each Battalion Aid Station (BAS) in the KTO was supported by one or more M1035 high-mobility multipurpose wheeled vehicle ambulances (HMMWV)[6], which are canvas-covered vehicles capable of carrying two stretchers. The primary function of the HMMWV's was to transport casualties from front-line units to the BAS's. This method of transport, however, was not particularly conducive to the timely evacuation of casualties from engaged areas because they provided only limited protection from enemy ordnance. Second, after casualties had been recommended for transfer from the BAS to advanced care facilities in the rear, the severity of the injury determined the method of evacuation. Urgent medivac patients were transported by CH-46 helicopter, while priority and routine medivacs were transported by bus or on the empty beds of off-loaded

trucks[7]. As the BAS moved further away from the advanced care facilities, elapse time for all but the most urgent cases naturally increased.

While it is impossible to predict the form future military conflicts will take, recent changes in global politics have reduced the liklihood of large scale conventional and ground wars. Though no operation can be wholly representative of future engagements, the joint operation which liberated Kuwait may give some indication of the type of scenarios in which the U.S. may become involved. The descriptive data in the present study, albeit based on a very small number of trauma cases, may provide insight to the types of casualties which may be sustained in future operations.

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13. ABSTRACT *(Maximum 200 words)*

Medical data from 120 U.S. Marines Corps trauma admissions to second echelon facilities during Operation Desert Shield/Storm were examined. Sixty-five percent of the admissions occurred between February 22 and February 28, the time frame corresponding to the ground war and the preliminary mobilization period. Penetrating wounds were the most prevalent type of injury, followed by lacerations, open fractures, and closed fractures. The most frequent anatomical regions sustaining injuries were the leg, head, hand, and arm, respectively. Shrapnel was the causative agent of 63% of the admissions that had this variable recorded while gunfire was the cause in 20% of the cases. The median injury-to-admission interval increased from 0.67 hours in the non-ground war period to 4.41 during the ground war.

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