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EDGEWOOD ARSENAL
TECHNICAL REPORT

EATR 4432

ANALYSIS OF 500 US ARMY COMBAT FATALITIES IN VIETNAM, JULY 1967 TO NOVEMBER 1968

by

Ian Sunshine, MAJ, MC

September 1970

DEPARTMENT OF THE ARMY
EDGEWOOD ARSENAL
Research Laboratories
Wound Data and Munitions Effectiveness Team
Edgewood Arsenal, Maryland 21010

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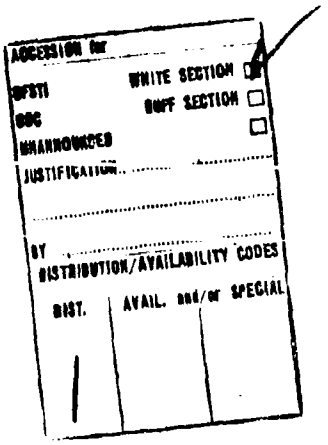

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FOREWORD

The work described in this report was authorized under funding provided by the Aberdeen Research and Development Center. This work was started in August 1969 and completed in June 1970.

Acknowledgment

The author gratefully acknowledges the assistance of Col. Joseph R. Blair, MC, Deputy Director for Medical Sciences, Research Laboratories, Edgewood Arsenal, Maryland 21010, for his technical advice on wound ballistics.

DIGEST

This report is an analysis of the causes of death of 500 casualties sustained by the US Army in Vietnam from July 1967 to November 1968. The purpose of this study is to provide information that may be helpful to body armor, wound ballistics, and medical research agencies interested in reducing battle casualties.

Thoracic trauma caused the largest number of fatalities in the series. It occurred in 182 men, 36.4% of the total sample. Injuries of the head resulted in the second largest group of casualties and caused 163 deaths (32.6%). Of these, 149 men, 29.8% of the total, succumbed to craniocerebral trauma, and 12 individuals (2.4%) sustained facial wounds that resulted in aspiration or asphyxiation. Abdominal trauma ranked third as a cause of death, accounting for 46 fatalities, 9.2% of the total. The major cause of death in this category was liver injury, which occurred in 11 men.

The 7.62-39-mm round accounted for at least 110 fatalities (22.0%). The incidence is probably higher as unidentified munitions accounted for another 57 fatalities (11.4%). The 82-mm mortar round, hand grenades, and the rocket-propelled grenades accounted for the majority of the fatalities from fragment wounds.

There did not appear to be a significant difference between the percentage of lethal bullet wounds and the percentage of lethal fragment wounds in the head and neck or in the thorax. Most of the wounds occurred when the men were upright or semiupright. Almost half of the bullet wounds and over 45% of the fragment wounds for each body region were incurred in the upright position.

CONTENTS

ANALYSIS OF 500 US ARMY COMBAT FATALITIES IN VIETNAM, JULY 1967 TO NOVEMBER 1968

I. INTRODUCTION.

This report is an analysis of the causes of death of 500 casualties sustained by the US Army in Vietnam from July 1967 to November 1968. The purpose of this study is to provide information that may be helpful to body armor and medical research agencies interested in reducing battle casualties. Branches of the Army studying the relative effects of weapons should be interested in the information on wound ballistics.

II. METHODS.

Five hundred consecutive autopsies from the files of the Wound Data and Munition Effectiveness Team (WDMET) were reviewed for this study. The methods of data collection by the WDMET team in Vietnam and analysis at Edgewood Arsenal have been described.[1] Particular attention has been given to the direct cause of death, wound distribution, causative weapons and munitions, and the influence of body position.

III. ANALYSIS.

A. Distribution of Lethal Wounds.

Table I* lists the frequency with which each body region was the site of lethal injury. The thorax and head were the most frequent sites of injury with 36.4% and 32.6% involvement respectively. The abdomen ranked third in frequency with 9.2% of the wounds, and the extremities were fourth with 6.6% of the wounds. A comparision of these results with those of other authors appears in table II. The figures reported by Maughon[2] in his review of casualties in a different zone of operations in Vietnam and the figures reported by Silliphant and Beyer[3] in Korea are similar to ours.

The presence of such vital structures as the brain or cardiovascular and respiratory organs appears to be the major determining factor in the frequency of fatal injuries in the different anatomical regions. A small missile that might cause a negligible injury if it struck the arm or leg can cause instantaneous death if it injures the medulla or the heart. A man may survive a severe amputation injury resulting from stepping on a mine, whereas a massive wound in the head or heart is incompatible with life. Maughon[2] emphasizes that as long as small arms and fragmenting munitions are the major means of combat, the head and neck will remain the prime targets. This is also true of the thorax because most men in active combat must have this part of the body exposed in order to fire weapons or carry out their essential tasks.

Blair,[4] in a study of 3200 WDMET casualties that included survivors and those killed instantly, revealed that the head and thorax were struck with a greater frequency than one would predict from their projected body areas. In that study, 15.5% of the total hits were in the head and neck (6.5% of the total body area) and 17.5% of the hits were in the thorax (13.0% of body area). The extensive exposure of these regions undoubtedly accounts for the excess percentage of hits over the number expected from the projected body area. The extremities received 55% of the total hits in that series.

*Tables I through VII may be found in the appendix.

3. Distribution of All Wounds.

Table III summarizes the frequency of wounding of each body region and includes all wounds, even those that were not fatal. The regions most frequently struck were the head and neck (28.17) and the thorax (22.92%).

A comparison with Rich's[5] findings in a series of 750 Vietnam casualties (mostly survivors) reveals that in this study there is a lower percentage of involvement of the head and neck (10%) and the thorax (9%). Similar observations are made when comparing our findings with those of Jones et al.[6] and Feltis.[7] In those studies of Vietnam casualties admitted to hospitals, there were also lower percentages of head and neck wounds (8.2%[6] and 11.3%[7]) and thoracic trauma (12.9%[6] and 10.1%[7]). These two regions, 19.5% of the body area, incurred 51.02% of the wounds in our study, which was limited to fatalities. This distribution is a reflection of the high mortality from wounds of these areas because 73.6% of the men in this study died of head, neck, and thoracic trauma. The wound distribution in fatalities therefore should not be used to determine the general pattern of hits in all casualties, but should be considered with distribution studies in survivors.

C. Nature of Wounds.

It was possible to ascribe 89.40% of the deaths to injuries to a single region. In 30 men, 6.0% of the total, more than one body area received a wound that was fatal. In 16 men (3.20%), multiple injuries (which would not have been lethal if limited to one region) and secondary complications caused the deaths.

1. Thoracic Injuries.

Injuries of the thorax accounted for the largest number of fatalities with 182, 36.4%, of the total sample. Sixty-three men (12.6% of the total sample) succumbed to cardiac laceration, and 37 men (7.4%) received lethal injuries of major blood vessels. These cardiovascular wounds represented more than 50% of the lethal thoracic wounds. Pulmonary laceration caused the deaths of 28% of the men who were injured lethally in the thoracic region of the body. This may seem paradoxical because the lung occupies a much larger portion of the thorax than the cardiovascular structures do. The lung, however, has a better tolerance to missile wounds than the heart and blood vessels because the blood pressure in the pulmonary parenchymal circulation is extremely low. Injuries of the heart are usually fatal instantly. This is also true to a lesser degree of major vascular trauma in the thorax. When the heart is injured by a missile, death may occur from massive damage to the heart, a perforating or penetrating wound, or pericardial tamponade.

A case representative of a massive cardiac wound is that of a man who was struck by a fragment from an artillery shell that detonated 4 meters away. The dimensions of the wound of entrance over the xiphoid process were 22 by 20 mm. The missile ruptured the heart and then exited through the left lateral rib cage, fracturing the 5th, 6th, and 7th ribs. The total wound tract measured 230 mm.

Another man sustained a perforating (through-and-through) chest wound from a rifle bullet fired at a distance of 10 meters. The bullet entered the thorax through the 3d left costosternal junction, causing an entrance wound of 8 by 5 mm. It lacerated the heart tangentially for a distance of 105 mm, but it possessed enough kinetic energy to cause cardiac

avulsion. It then injured the lung and exited through the left lateral thorax after traveling a total distance of 228 mm. There were 1500 ml of blood in the left pleural cavity.

Another man was injured by a rifle bullet fired from a distance of 25 meters. The entrance wound in the left lateral chest was 5 by 5 mm. After striking the 5th rib, the bullet lacerated the left lung and caused an extensive wound of the base of the heart. It traveled a total distance of 345 mm and exited through the right lateral chest wall.

Another man was wounded by an AK47 rifle bullet fired at a distance of 100 meters. The bullet perforated the thorax and traveled 311 mm. The missile passed through the heart and caused massive destruction of the intraventricular septum.

Several cases are representative of lethality resulting from pericardial tamponade. In one case a mortar round exploded 15 to 20 meters from a man. A small fragment (10 by 5 by 5 mm) perforated the pulmonary conus and caused hemorrhege into the pericardial sac. The missile finally lodged in the left auricular appendage. The cause of death was hemopericardium with cardiac tamponade.

Pericardial tamponade also caused the death of a man injured by a fragment from a booby-trapped grenade. The dimensions of the skin entrance wound were 13 by 7 mm. The sternum was fractured, and the upper lobe of the right lung was perforated. The dimensions of the pulmonary entrance and exit wounds were 10 by 6 mm and 10 by 4 mm respectively, and the length of tissue traversed was 20 mm. The missile then caused a through-and-through perforation of the intrapericardial aorta. The entrance wound in this structure measured 6 by 2 mm, and the exit wound from the lumen was 5 by 1 mm. The total distance traveled by the missile was 100 mm.

In a third instance, a fragment (5 by 8 by 1 mm), suspected of being from a mine, perforated the cartilage of the 7th intercostal space. The skin entrance wound was 14 by 11 mm, and the total extent of the wound tract was 98 mm. The missile passed through the middle lobe of the right lung for a distance of 13 mm. The entrance wound in this tissue measured 6 by 2 mm, and the exit wound was 7 by 3 mm. The missile then perforated one wall of the right ventricle and exited through the other wall, causing wounds measuring 2 by 2 mm and 5 by 4 mm respectively. The fragment was found lying loose in the pericardial sac. The cause of death was pericardial tamponade. A 6- by 3-mm perforation was present at the site of entrance into the pericardial sac.

Three cases are representative of lethal pulmonary injuries inflicted by bullets from AK47 rifles. One man sustained a thoracoabdominal wound, 433 mm long, from a bullet fired from a rifle at a distance of 45 meters. The skin entrance wound was 5 by 5 mm. The bullet passed through 100 mm of the right lung, causing an entrance wound in this tissue of 12 by 10 mm and an exit wound measuring 80 by 60 mm. After passing through the left lung, the bullet entered the abdomen and caused tangential, negligible injuries to the kidney and liver. There were 1100 ml of blood in the right pleural cavity.

A second man was wounded at a distance of 20 to 30 meters. The wound tract measured 435 mm, and the skin entrance wound was 13 by 9 mm. The right scapula and the posterior aspect of the right 4th rib were fractured. After perforating the posterior aspect of the lower lobe of the right lung, the bullet fractured the bodies of the 8th to 10th thoracic vertebrae and severed the spinal cord. It then passed through the left lung for a distance of 34 mm, causing entrance and exit wounds of 65 by 40 and 60 by 38 mm respectively. Before exiting from the left side of the thorax, the bullet fractured the 10th rib.

A third man was injured from a distance of 10 meters. The length of the wound tract was 202 mm, and the dimensions of the entrance wound in the skin were 20 by 15 mm. After fracturing the 9th rib, the bullet perforated the lower lobe of the right lung. It passed through 65 mm of pulmonary tissue, causing an entrance wound of 60 by 40 mm and an exit wound measuring 50 by 40 mm. The bullet then exited from the thorax.

2. Head Injuries.

Head injuries caused the deaths of 163 men, 32.60% of the total sample. Of these, 149 (29.8%) succumbed to craniocerebral injuries, 12 (2.4%) were wounded lethally in the face, and 2 sustained combined facial and brain trauma. Of the men with craniocerebral trauma, 53 (34%) had injuries of more than one skull bone, and 89 (60%) sustained extensive brain injuries consisting of massive damage to one cerebral lobe or extensive wound tracts involving multiple lobes. A study of craniocerebral trauma in survivors revealed a substantially lower incidence of extensive skull and brain injuries.[8]

Lethal brain trauma usually is characterized by massive cerebral damage (to either single or multiple lobes), transection of the ventricular system, a wound tract involving several lobes, or brainstem damage.

Several cases demonstrate the nature of lethal craniocerebral trauma. One man sustained a grazing bullet wound of the occipital region. An autopsy revealed diffuse subarachnoid hemorrhage, comminuted fractures of the skull, laceration of the occipital lobes, and hemorrhage of the medulla. Several men were killed instantly when bullets fired from AK47 rifles transected the medulla and cervical spine. One man was injured by a bullet fired from an AK47 rifle at an estimated distance of 25 to 30 meters. The bullet perforated the helmet and entered the brain after going through the frontal sinus. It then traveled through the entire left cerebral hemisphere and exited through the occipital bone. The total wound tract measured 192 mm.

Another man was injured by a bullet fired from an AK47 rifle at a distance of 50 meters. The bullet passed through his helmet, entered the brain through the occipital area, and traversed the right occipital and right parietal lobes. There was marked destruction of tissue around the ventricular system and total destruction of the right cerebellar hemisphere. The total wound tract was 290 mm, and the bullet was recovered from the right parietal lobe.

In another case a man sustained a brain injury from a 7.62-39-mm bullet that perforated his helmet. The bullet was fired from a distance of 30 to 40 meters. The frontal and parietal bones were fractured, and the bullet injured the frontal and parietal lobes, causing massive cerebral damage. The bullet traveled 130 mm.

Two men were injured when an 81-mm mortar round detonated 5 meters away; they both sustained lethal head trauma. In one man a missile passed through the head from the occipital area to the mastoid area and transected the medulla. The other man sustained fractures of the left temporal and parietal bones, laceration of the temporal lobe, and subarachnoid hemorrhage. Both men also sustained multiple injuries of the entire body.

Facial wounds are lethal when hemorrhage causes aspiration or when displacement of severed structures causes airway obstruction. A representative case is that of a man wounded by a bullet that entered the left jaw, transected the tongue, and fractured the maxilla and mandible. The exit wound was on the right side of the face. The total wound tract measured 285 mm. Aspiration of blood caused death.

3. Abdominal Injuries.

Injuries of the abdomen were the primary cause of death in 46 men, 9.2% of the sample. Liver laceration, multiple-organ injury, and transection of major blood vessels were responsible for over 50% of the deaths in this category.

One man was injured by a 7.62-39-mm bullet fired from a distance of 25 to 30 meters. The entire wound tract measured 240 mm. The bullet entered the epigastric region and passed through the liver for a distance of 49 mm. The diameter of the liver wound tract was 175 mm. The bullet then transected the duodenum, perforated the pancreas, and grazed the right kidney before exiting through the right flank. There were 1300 ml of blood in the peritoneal cavity, most of it apparently caused by the liver laceration.

Another man was injured by a pistol bullet fired from an estimated distance of 15 to 20 meters. The bullet entered the chest, went through the diaphragm, and caused small, negligible wounds of the liver, spleen, and pancreas. Avulsion of the abdominal aorta led to fatal hemorrhage. The missile traveled a total distance of 228 mm and finally lodged in a lumbar vertebra.

In another man a 7.62-mm bullet entered the abdomen through the left iliac crest and transected the left internal iliac artery and vein, causing fatal hemorrhage. The bullet was found in the urinary bladder. The total length of the wound tract was 150 mm.

One individual sustained a wound of the epigastrium from a bullet fired by a sniper 3 feet away. The aorta and inferior vena cava were transected. There were 1500 ml of blood located retroperitoneally. The bullet traveled 250 mm and exited through the lower back.

In a significant number of cases, it was observed that a small high-velocity missile was capable of causing fragmentation or extensive damage to a solid organ such as the liver, kidney, or spleen. In one instance a man received a wound from a small, unidentified missile. The entrance wound measured 5 by 5 mm. The missile caused stellate lacerations of the spleen (maximum diameter, 100 mm) and left kidney (maximum diameter, 60 mm).

4. Extremity Injuries.

Injuries of the extremities accounted for the fourth largest category of lethal trauma with 6.60% of the total. The extensive use of mines and booby traps in Vietnam accounts for the majority of the wounds in this category. Exsanguination was the cause of immediate death from injury to the arms or legs. One man on ambush patrol died after he stepped on a hostile mine and suffered massive mutilating injuries of both legs and the pelvis.

Another individual was injured lethally on a search mission when he stepped on a hostile booby trap and sustained bilateral, above-the-knee, traumatic amputations of the legs.

In another case a man was struck by a fragment from an 81-mm mortar round. The missile traveled 136 mm through the thigh. A 35-mm segment of the right femoral artery was avulsed, and the man exsanguinated within a few minutes. The autopsy revealed no fractures of the femur. There was marked pallor of the thoracic and abdominal viscera.

Another soldier was struck by a bullet fired from an AK47 rifle at a distance of 50 meters. The missile entered the left thigh posteriorly, traversed the muscles, transected the

femoral artery and vein, and exited from the thigh anteriorly. The femur was not fractured, and the femoral nerve was intact.

5. Neck Injuries.

Lethal injuries of the neck were present in 23 men, 4.60% of the total. The causes of death in this group were transection of the trachea or larynx, laceration of blood vessels, and severance of the spinal cord. In some cases combinations of injuries to major structures occurred; either injury would have been fatal if it had occurred alone. One soldier was on patrol when struck by fragments from a hostile booby trap. One fragment severed the larynx and the left common carotid artery. Aspiration of blood caused immediate death.

In another individual a bullet fired from an AK47 rifle at a distance of 50 to 60 meters entered the back over the right scapula and passed cephalad. After transecting the cervical spinal cord, it exited through the neck. The total wound tract measured 240 mm.

Another man was wounded by a 7.62-mm bullet fired from a distance of 10 to 15 meters. The bullet caused comminuted fractures of several cervical vertebrae and fracture of the occipital bone. The left temporal bone was injured when the missile exited from the left side of the head.

One soldier sustained a wound of the neck from an 81-mm mortar round. The larynx was severed above the thyroid cartilage, and aspiration of blood caused death.

D. Weapons and Munitions Causing Fatalities.

Table IV lists all the weapons and munitions causing the lethal injuries in this study. Bullets were responsible for 45.0% of the fatalities, and fragments caused 43% of the deaths. In 11.4% of the men the munition was undetermined. Of the 7801 casualties studied by WDMFT in its 2 years of operation in Vietnam, only 29.9% received bullet wounds. The larger percentage of bullet wounds in the fatalities attests to the greater lethality of this type of munition.

The 7.62-39-mm ball bullet was the small-arms munition encountered most frequently. This bullet can be fired from the Soviet SKS carbine, the Chinese Communist light machine gun, and the AK47 assault rifle. One hundred and ten men (22.0%) were lethally wounded by this bullet. Twenty-two men (4.4%) received lethal injuries from US 5.56-mm M193 ball bullets fired from M16 rifles. In many cases the rifles were captured from US troops in combat. In some instances the men were injured because of mistaken identity, but these casualties are included in this study because they occurred under combat circumstances.

Mortar rounds and grenades were the most frequent causes of lethality from fragmenting munitions. Next in order of frequency were rocket-propelled grenades. The 82-mm mortar is the one most frequently used by enemy troops. This mortar enables them to use the US 81-mm mortar rounds that they occasionally capture during engagements with US troops. Hand grenades, which were deployed as booby traps in a large number of cases, were responsible for the second largest category of deaths from fragments. Rocket-propelled grenades are used against tanks and men in armored personnel carriers.

Table V lists 406 instances in which the causative missile and the entrance site of the fatal wound both are known. Multiple injuries are not included. The site of the entrance wound was identified in 211 men who were wounded by bullets and 195 men who were wounded by

fragments. In 88 men (41.7%) injured by bullets, lethal wounds were present in the head; in 84 men (39.8%), lethal wounds were in the thorax. In the group that suffered lethal fragment wounds, 35.9% sustained head injury, and 41.5% incurred lethal thoracic wounds. Most of the fragment wounds with entrance sites in the thorax were caused by hand grenades, and most of the lethal head injuries were caused by mortar rounds. Booby traps, mines, and grenades (several of which had been set as booby traps) caused most of the fatal leg wounds.

E. Influence and Position.

Tables VI and VII summarize the positions of the 319 casualties whose activities at the time of wounding were known. Those who were in the upright position (153, 48%) when wounded formed the largest category (table VI). The semiupright and horizontal positions were next in frequency. When the distribution of all wounds by anatomical region is correlated with the positions at the time of wounding, it can be seen that all regions were wounded more frequently when the men were upright or semiupright than when they were horizontal (table VII). Approximately half of the bullet wounds and over 45% of the fragment wounds for each region were incurred in the upright position. For the horizontal position, fragments caused a larger percentage of injuries for each region than did bullets.

IV. CONCLUSIONS.

1. Thoracic trauma caused the largest number of fatalities in this series. It occurred in 182 men, 36.4% of the total sample.

2. Injuries of the head resulted in the second largest group of casualties, causing 163 deaths (32.6%). Of these, 149 men, 29.8% of the total, succumbed to craniocerebral trauma and 12 individuals (2.4%) sustained facial wounds that resulted in aspiration or asphyxiation.

3. Abdominal trauma ranked third as a cause of death, accounting for 46 fatalities, 9.2% of the total. The major cause of death in this category was liver injury, which occurred in 11 men.

4. The percentages of wounds in the head and neck and the thorax found in this study of fatalities are higher than those cited in samples of Vietnam casualties that included survivors. This is a reflection of the high mortality of wounds of these regions.

5. The Soviet SKS carbine, the Chinese Communist light machine gun, and the AK 47 assault rifles, which fire the 7.62-39-mm round, accounted for at least 110 of the total fatalities (22.0%). The incidence is probably higher as unidentified munitions accounted for another 57 fatalities (11.4%).

6. The 82-mm mortar round, hand grenades, and the rocket-propelled grenades accounted for the majority of the fatalities from fragment wounds.

7. There did not appear to be a significant difference between the percentage of lethal bullet wounds and the percentage of lethal fragment wounds in the head and neck or in the thorax.

8. Most of the wounds occurred when the men were in the upright or semiupright position. Almost half of the bullet wounds for each body region were incurred in the upright position.

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APPENDIX

TABLES

Table I. Regional Distribution of Lethal Injuries

Region of primary trauma and primary cause of death	Casualties	
	No.	*%*
Head:		
Brain injury	149	29.8
Facial wounds	12	2.4
Combined facial and brain wounds	2	0.4
Total within group	163	32.6
Neck:		
Wounds of larynx and trachea	6	1.2
Blood vessel laceration	5	1.0
Severed cervical spinal cord	3	0.6
Combined injuries	7	1.4
Unspecified	2	0.4
Total within group	23	4.6
Thorax:		
Cardiac wounds	63	12.6
Pulmonary laceration	52	10.4
Major vascular injury	37	7.4
Massive avulsion of thorax	1	0.2
Transection of spinal cord	1	0.2
Unspecified and other types of injuries	28	5.6
Total within group	182	36.4
Abdomen:		
Liver laceration	11	2.2
Multiple organ injury	7	1.4
Laceration of abdominal aorta	5	1.0
Laceration of iliac blood vessels	4	0.8
Evisceration	2	0.4
Laceration of spleen	1	0.4
Other sources of hemorrhage and unspecified injuries	16	3.2
Total within group	46	9.2
Upper extremities:		
Avulsion of left shoulder	2	0.4
Laceration of axillary artery	2	0.4
Hemorrhage, unspecified	1	0.2
Amputation	1	0.2
Total within group	6	1.2

Table I. Continued

Region or primary trauma and primary cause of death	Casualties	
	No.	*%*
Lower extremities:		
Laceration of iliac and femoral arteries	12	2.4
Bilateral traumatic amputations of lower limbs	6	2.4
Hemorrhage (site unspecified)	3	0.6
Massive avulsion of thigh with hemorrhage	2	0.4
Hemorrhage, laceration and multiple fractures of lower limbs	1	0.2
Traumatic amputation of one extremity	2	0.4
Laceration of popliteal artery	1	0.2
Total within group	27	5.4
Multiple lethal injuries:		
Head and neck	1	0.2
Head and thorax	11	2.2
Head and abdomen	1	0.2
Head, thorax, and abdomen	1	0.2
Head, thorax, and extremity	1	0.2
Thorax and abdomen	10	2.0
Thorax and extremities	1	0.2
Massive body trauma (including burns and blast injuries)	4	0.8
Total within group	30	6.0
Miscellaneous:		
Shock, infection, pulmonary edema, multiple injuries, atelectasis, pneumonia, and cardiac arrest	16	3.2
Undetermined causes	7	1.4
Grand total	500	100.0

Table II. Comparison of Regional Distribution of Lethal Injuries With That Reported by Others

Region	Vietnam[a]	Vietnam[b]	Korea[c]
	%	%	%
Head	32.60	39.3	40.0
Neck	4.60	7.3	3.0
Thorax	36.40	37.0	37.2
Abdomen	9.20	9.0	9.2
Upper extremities	1.20	1.7	2.0
Lower extremities	5.40	5.7	7.0
Other categories	10.60	–	1.5

[a]Present WDMET study – most of casualties not wearing chest armor.

[b]Maughan, D.S. An Inquiry Into the Nature of Wounds Resulting in Killed in Action in Vietnam. Military Med. *135*, 8-13 (1970). Proportion of casualties wearing protective armor unknown.

[c]Silliphant, W. M., and Beyer, J.C. Wound Ballistics. Military Med. *113*, 238-246 (1954). Casualties not wearing armor.

Table III. Regional Frequency of Wounding

Region	Frequency		Body area	Difference between frequency and body area
	No.	%	%	%
Head and neck	260	28.11	6.50	21.61
Thorax	212	22.92	13.00	9.92
Abdomen	126	13.62	10.60	3.02
Upper extremities	167	18.05	20.40	2.35
Lower extremities	160	17.30	49.40	32.10
Total	925	100.00	–	–

Table IV. Missiles Causing Wounds

Missile	Casualties	
	No.	*%*
Bullets:		
7.62-39-mm ball	110	22.0
Other 7.62-mm bullets	29	5.8
5.56-mm M193 (M16 rifle)	22	4.4
Others (including those without positive identification)	64	12.8
Subtotal	225	45.0
Fragments:		
Mortar	47	9.4
Hand grenade	47	9.4
40-mm grenade launcher (M79)	13	2.6
Rocket-propelled grenade (RPG)	27	5.4
Claymore mine	9	1.8
Booby trap, munition not known	10	2.0
Bomblet	6	1.2
75-mm Recoilless rifle	7	1.4
105-mm Howitzer round	7	1.4
122-mm Soviet rocket	6	1.2
Antipersonnel mines	7	1.4
Unidentified	25	5.0
Others	7	1.4
Subtotal	218	43.6
Munition type unknown	57	11.4
Total	500	100.0

Table V. Relationship of Causative Missiles to Wound Entrance Sites

Missile	Region					Wounds caused by each bullet/fragment	
	Head and neck	Thorax	Abdomen	Upper extremities	Lower extremities	*No.*	*%*
Bullets:							
7.62 mm	60	45	21		3	129	61.0
5.56 mm	4	10	4		1	19	9.0
Other bullets and unspecified bullets	24	29	8		2	63	30.0
Total	88	84	33		6	211	100.0
%	41.7	39.8	15.6		2.8		
Fragments:							
Mortar	25	17	2		2	[illegible]	23.6
Grenade	11	23	1		15	50	25.6
Booby traps and mines	12	18	2		8	40	20.5
Rockets	1	3	2			6	3.0
RPG rounds	11	8	2	1	1	23	11.8
Recoilless rifle	1	1	1	1	1	5	2.5
Artillery	3	5				8	4.2
Unknown fragments	6	6		2	3	17	8.8
Total	70	81	10	4	30	195	100.0
%	35.9	41.5	5.1	2.1	15.4		

Table VI. Influence of Body Position on Fatalities

Position	Casualties	
	No.	*%*
Upright	153	48.0
Semiupright	91	28.5
Horizontal	75	23.5
Total	319	100.0

Table VII. Correlation Between All Regions Wounded and Body Position

Position	Region										Total	
	Head and neck		Thorax		Abdomen		Extremities					
							Upper		Lower			
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
Bullets:												
Upright	31	51.6	30	47.6	18	56.2	20	47.6	19	52.7	118	50.6
Semiupright	20	32.7	24	38.1	12	37.5	15	35.7	14	38.8	85	36.5
Horizontal	9	15.7	9	14.3	2	6.3	7	16.7	3	8.5	30	12.9
Total and %	60	25.8	63	27.0	32	13.7	42	18.0	36	15.5	233	100.0
Fragments:												
Upright	42	45.1	47	48.4	29	48.3	41	50.0	41	52.6	200	48.8
Semiupright	30	32.2	28	28.9	19	31.7	22	26.8	22	28.2	121	29.5
Horizontal	21	22.7	22	22.7	12	20.0	19	23.2	15	19.2	89	21.7
Total and %	93	22.7	97	23.7	60	14.6	82	20.0	78	19.0	410	100.0

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13. ABSTRACT

This report is an analysis of the causes of death of 500 casualties sustained by the US Army in Vietnam from July 1967 to November 1968. The purpose of this study is to provide information that may be helpful to body armor, wound ballistics, and medical research agencies interested in reducing battle casualties. Thoracic trauma caused the largest number of fatalities in this series. This was followed by injuries of the head and abdomen in that order. The 7.62-39-mm round accounted for at least 22.0% of the total fatalities. The incidence is probably higher as unidentified munitions accounted for another 11.4% of the fatalities. The 82-mm mortar round, hand grenades, and the rocket-propelled grenades accounted for the majority of the fatalities from fragment wounds. There did not appear to be a significant difference between the percentage of lethal bullet wounds and the percentage of lethal fragment wounds in the head and neck or in the thorax. Most of the wounds occurred when the men were upright or semiupright. Almost half of the bullet wounds and over 45% of the fragment wounds for each body region were incurred in the upright position.

14. KEYWORDS

Combat fatalities
Vietnam
Thoracic trauma
Pericardial tamponade
Lethal pulmonary wound
Craniocerebral trauma
Abdominal trauma
AK47
Distribution of lethal wounds
Distribution of all wounds

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