

Marine Lethal Torso Injuries: Preliminary Findings 8/29/2005

Between March 19, 2003 and June 30, 2005, 401 Marines died from combat injuries during Operation Iraqi Freedom. Nearly 24% (93) died from a primary lethal injury of the torso (Figure 1)¹. Another 99 individuals had multiple lethal injuries with at least one lethal injury of the torso.

This summary presents our preliminary findings on the number and distribution of primary non-blunt force lethal injuries of the torso among Marines. For this review we examined 93 injuries from 89 fatalities. Over 60% percent of these injuries were due to small arms fire. Another 38% were the result of blast injuries due to explosions.

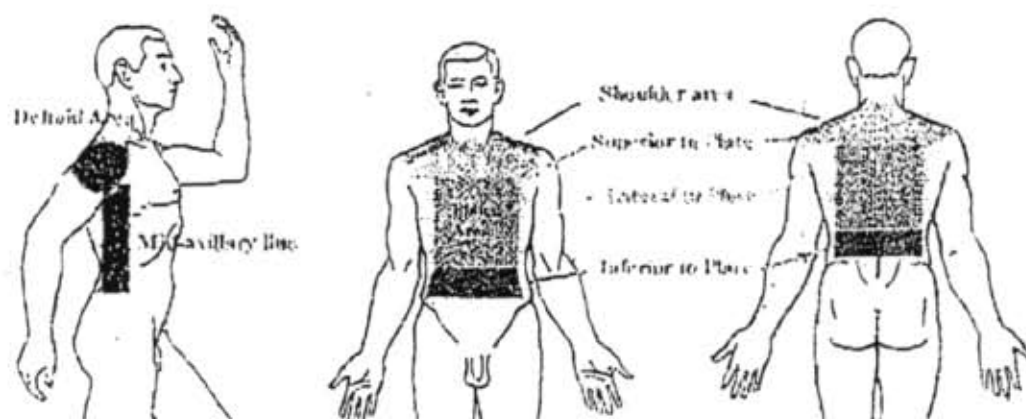
Figure 1: Marine OIF Combat Deaths by Injury Site Group: 3/19/2003-6/30/2005

Site Injury Group	Total	Percent
Head/Neck	135	33.7%
Multiple	101	25.2%
Torso	93	23.2%
Catastrophic	56	14.0%
NA	8	2.0%
Extremities	8	2.0%
Total	401	100%

Fig 2: Lethal Torso Injuries By Cause of Death

COD	Total	Percent
GSW	56	60.2%
Explosion	35	37.6%
Multiple injuries	2	2.2%
Total	93	100%

For each of these injuries, we reviewed the complete autopsy report and the photographic records for each injury. Following the review, the entry site for each penetrating injury was assigned to one of the injury entry groupings shown below:



¹ Catastrophic injuries are injuries that cannot be localized or measured. These include pre-mortem total body charring and fragmented, decomposed and skeletalized remains.

Figure 3 shows the distribution of the 93 injuries for the categories listed above by Body Region and Mechanism of Injury. We identified 11 deltoid injuries, 3 shoulder

Figure 3: Lethal Injuries By Site and Mechanism

Body Region	Explosion	Small Arms	Other	Total
Deltoid Plate (Upper Arm)	1	10	0	11
Shoulder plate (Shoulder plate)	1	2	0	3
Superior to plate (Above plate)	1	5	0	6
Plate Edge	7	4	0	11
Inferior to plate (Under plate)	1	0	0	1
Plate Edge	2	4	0	6
Lateral to plate (Next to plate)	0	1	0	1
Plate Edge	4	10	0	14
Mid-axial plate (Side plate)	9	11	1	21
Behind Plated Area	3	2	0	5
Extensive Injuries (Not categorizable)	5	8	1	14
Totals	34	57	2	93

injuries, 21 injuries in the mid-axillary area, and 39 injuries outside the plated area (Superior, Inferior and Lateral to plate). Thirty-one of the 39 injuries outside the plated area were very close to the plate edge. Five injuries appeared to have occurred in areas that would routinely be covered by the plate. It is unknown in these cases if armor was worn at the time of injury. Finally, 14 individuals had injuries that were so broad or severe that they could not be categorized using our existing categories. Armor redesign would have a negligible impact on these casualties. The distribution of anterior versus posterior entry injuries was almost evenly distributed with 45 posterior and 47 anterior injuries. One individual had both lethal anterior and posterior torso injuries.

Figure 4 shows the percentage of injuries in each armor region by mechanism of injury. Lethal injuries were least likely in the area below and beneath the plated area. Explosions were most likely to cause lethal

Figure 4: Percent of Injuries By Location & Mechanism

Body Region	Explosion	Small Arms	Total
Upper Arm/Shoulder	5.9%	21.1%	15.4%
Superior to Plate	23.5%	15.8%	18.7%
Inferior to Plate	8.8%	7.0%	7.7%
Lateral to Plate	11.6%	19.3%	16.5%
Mid-axial Plate	26.5%	19.3%	22.0%
Plated Area	8.8%	3.5%	5.5%
Totals	85.3%	86.0%	85.7%

injuries that were superior to the plate or along the mid-axial line. Injuries from small arms were most likely in the shoulder and upper deltoid area. Nearly 39 percent of all lethal injuries for both explosions and small arms occurred in the entire area lateral to the plate including the mid-axillary area. This makes the lateral area of the torso the most vulnerable unprotected area.

Figure 5 summarizes the wounds that might be impacted by a change in armor design.

Figure 5: Injuries Potentially Impacted By Armor Redesign

Lethal Wounds by Site	Total	%
Deltoid & Shoulder	14	15.1%
Mid-axillary line	21	22.6%
Outside of plated area (31 Close to edge)	39	41.9%
Total wounds	74	79.6%

* Percent is the percent of lethal torso injuries.

Fourteen wounds might have been prevented or less extensive if deltoid or shoulder protection had been available. Twenty-one injuries might have been prevented or minimized by protection around the mid-axillary line. Finally, the areas around the plate (generally above and to the side) accounted for nearly 42% of the lethal wounds we examined. Thirty-one of these were in close proximity to the plate edges. Either a larger plate or superior protection around the plate would have had the potential to alter the fatal outcome.

Our preliminary research suggests that as many as 42% of the Marine casualties who died from isolated torso injuries could have been prevented with improved protection in the areas surrounding the plated areas of the vest. Nearly 23% might have benefited from protection along the mid-axillary line of the lateral chest. Another 15% died from impacts through the unprotected shoulder and upper arm.