

MYTH BUSTING:

CURRENT SURGICAL BELIEFS ABOUT GUNSHOT WOUNDS

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INTRODUCTION

Poorly designed experiments and popular media have led to a number of myths about wound ballistics. Some of these myths have been incorporated into the trauma literature, are accepted as fact, and are included in the Advanced Trauma Life Support (ATLS) course. These myths include: shotguns are only lethal at close range, excision of the bullet tract with wide debridement is crucial, antibiotics are unnecessary in the absence of penetration of a hollow viscus, cavitation leads to wound cavities 30-100 times the diameter of the bullet, all bullets must be removed to prevent lead poisoning, and kinetic energy transfer adequately explains wounding mechanism. We hypothesized that these erroneous beliefs would be prevalent among those frequently providing care for patients with gunshot wounds, but could be addressed by education.

METHODS

A critical review of the wound ballistics literature, including ATLS, was performed and several myths identified.

The study was created using a pre and post intervention design. A total of 7 myths were tested. Unique questions testing the same concept relating to the individual myths were constructed for both the pre and posttest (figure 2). The intervention consisted of a 40 minute lecture designed to educate subjects on gunshot wounds and dispel the relevant myths.

The study was performed at three academic trauma centers: UCSF Fresno, UC San Diego, and UCSF East Bay. UCSF Fresno is a 633 bed ACS verified Level I trauma center with approximately 2600 annual admissions and 15% penetrating trauma. UC San Diego is a 365 bed ACS verified Level I trauma center with approximately 3200 annual admissions and 12% penetrating trauma and UCSF East Bay, a 220 bed level II Trauma center with approximately 1100 annual admissions and 30% penetrating trauma. All three institutions have residencies in surgery and emergency medicine. Participation was voluntary and included providers on the trauma and emergency medicine services.

RESULTS

A total of 115 clinicians participated in the study. The mean pre and posttest scores for individual concepts are listed in Table 1. There was no significant difference in pre test scores among the institutions ($p=0.764$) and there was significant improvement on the post test after the intervention at all of the participating centers ($p < 0.001$).

Demographic data was collected and correlated with test results. Years of postgraduate medical experience correlated with higher pretest score ($p=0.021$) suggesting knowledge was gained from experience and/or education. However, ATLS status did not correlate with higher pretest scores ($p=0.774$). Previous firearm/wound ballistics experience did not correlate with higher pretest scores; however, there was an overall lack of firearm/wound ballistics experience in the study group with 84% having minimal to no experience.

After the intervention, 94% of subjects indicated they had a better understanding of wound ballistics and 68% indicated that this education would alter their management.

TABLE 1

Concepts	Pretest %	Post test %	p value
Shotguns	25	93	<0.001
Antibiotics	21	86	<0.001
Initial reaction	81	97	<0.001
Cavitation	12	86	<0.001
Wounding mechanism	5	22	<0.001
Importance of debridement	57	88	<0.001
Lead poisoning	32	75	<0.001
Overall average	34	78	<0.001

FIGURE 1: Representative human silhouette showing a 9mm or .380 caliber projectile in yellow and in red a cavity 30 times the diameter

FIGURE 2: Pretest on Management of Gunshot Wounds

Ballistics in Medicine: Pretest

- Have you taken ATLS (Advanced Trauma Life Support) and if so within how many years
 - No, I have not taken ATLS
 - Yes, I have had ATLS within the last 1-4 years
 - Yes, but was more than 4 years ago
- Please rate your firearms/ballistics experience
 - None (never used a firearm)
 - Minimal experience (limited experience with firearms)
 - Some experience (understand and feel comfortable using a firearm)
 - Expert (performed research with firearms or on wound ballistics)
- Please choose answer that corresponds to your years of post graduate medical experience
 - 1 yr
 - 2-3 years
 - 4-5 years
 - 5-10 years
 - 10+ years
- Shotguns are typically only lethal at a range of
 - 20 yards or less
 - 40 yards or less
 - 60 yards or less
 - Can be lethal over 100 yards
- A 24 year old male presents to the ED with a gunshot to his right thigh from an assault rifle. Last tetanus shot was 7 years ago. After a primary and secondary survey which demonstrate intact sensation, movement and pulses to the affected extremity, initial management should consist of:
 - tetanus booster alone
 - xray of the thigh, and arterial pressure indices
 - xray of the thigh, arterial pressure indices, and tetanus booster
 - xray of the thigh, arterial pressure indices, tetanus booster, and IV antibiotics
 - CT angiogram of the thigh and tetanus booster
- You see a police officer fire a gun at an assailant, the bullet hits him in the chest
 - When the bullet hits him in the chest it will knock him off his feet
 - He will immediately collapse to the ground
 - Blood will spurt from the chest
 - There will be little to no outward sign that he has been shot
- A 16 year old male is dropped off at the emergency department after sustaining a gunshot wound to the right chest. The police say it was from a high velocity assault rifle. Which of the following statement is most correct
 - The patient will likely need extensive debridement beyond the edges of the wound because cavitation can stretch the tissue up to 100 times the diameter of the bullet
 - Cavitation can be up to 30-40 times the diameter of the bullet and can cause injury far from the bullet tract.
 - Cavitation type injury to the lung will be more significant than the liver because it is mostly full of air.
 - The majority of penetrating chest trauma does not require operative intervention
- A 23 year old male is shot with a gun. Of the following which is the greatest determinant of damage from a ballistic missile
 - Kinetic energy transferred to the tissue
 - Type of missile (i.e. hollow point, full metal jacket, vs. shotgun)
 - Bullet caliber
 - none of the above
- A 35 year old female sustains a high velocity gunshot wound to her right thigh. Debridement is
 - Not important.
 - Important to remove obviously non-viable tissue.
 - Important to remove obviously non-viable tissue and then close the wound to prevent contamination
 - Important to remove tissue beyond areas of obviously non-viable tissue because microscopic cell death occurs far from the edge bullet hole.
- A 4 year old female was shot in the thigh. Of the following statement is most correct
 - The majority of bullets made today are not made of lead, hence there is little need to worry about lead poisoning
 - The lead bullet should be removed to prevent lead poisoning because the bullet is large compared to the size of the child
 - dimercaprol (BAL) should be given as chelation therapy because of the large sized lead bullet
 - Unless the bullet is in contact with a joint space there is no need to worry about lead poisoning

DISCUSSION

The low pretest scores in this study suggest high prevalence of myths among medical providers, even at busy urban trauma centers with significant experience with penetrating trauma. These myths persist from either a lack of education or false information in the literature. The significant improvement on the posttest after the focused educational intervention suggests that these myths can be successfully debunked with education.

ATLS status did not have a positive effect on pretest scores. The overall positive experience of ATLS would be enhanced by the correction of the myths included in the course and manual.

CONCLUSION

Erroneous beliefs involving wound ballistics are prevalent among clinicians who treat victims of gunshot wounds. Focused education markedly improved knowledge. The current ATLS course and manual promulgate some of these myths and should be revised.