



## Case Report

# Entrance and exit wounds of high velocity bullet: An autopsy analysis in the event of dispersing the mass rally in Bangkok Thailand, May 2010



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## ABSTRACT

Fatal mass casualties by high velocity bullets (HVBs) are rare events in peaceful countries. This study presents 27 forensic autopsy cases with 32 shots fired by  $5.56 \times 45$  mm. HVB (M-16 rifle bullets) during the dispersing the mass rally in Bangkok Thailand, May 2010. It was found that twenty-three (71.88%) typical entrance HVB wounds had round sizes less than the bullet diameters. Most entrance wounds had micro-tears but no collar abrasion since a HVB has a small streamlined spitzer tip and full metal jacket. For exit wounds, there were various sizes and shapes depending on which section of wound ballistics presented when the bullet exited the body. If a bullet exited in the section of temporally cavity formation, there would be a large size exit wound in accordance with the degree of bullet yaw. This is different from civilian bullets whereby the shape looks like a cylindrical round nose and at low velocity that causes entrance wounds with a similar size to the bullet diameter and is usually round or oval shape with collar abrasion. The temporary cavity is not as large as in a HVB so exit wounds are not quite as large and present a ragged border compared to a HVB. We also reported 9 out of 32 shots (28.13%) of atypical entrance wounds that had various characteristics depending on site of injury and destabilization of bullets. These findings may be helpful to forensic pathologists and to give physicians, who need to diagnose HVB wounds, more confidence.

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## 1. Introduction

High velocity bullets (HVBs) or military bullets are primarily used on battlefields. Those who are endangered by HVBs are mostly military armed forces personnel engaged in a firefight and are likely to be severely injured leading to sudden death. And in the case of injury, they are likely to be seriously wounded with a high mortality rate. The physicians who take care of these cases first concentrate on emergency treatment, which might fail or, at least, to partly fail, to fully record the wound morphology or wound characteristics; especially the entrance and exit wounds. These wounds are different from shootings seen among civilians, which use mainly low velocity bullets and are more likely to be completely recorded by physicians or forensic pathologists regarding the wound patterns; including the entrance and exit wounds. From the literature reviews on HVB injuries, most are reports about the location of wounds on the body [1], nature of injuries and clin-

ical courses [2] of each location affected, e.g. head [3], chest [4], and extremities, or studies of wound ballistics [5,6] from animals [7–10] and gelatin block [11,12] experiments and so on. Most describe just the size of the wound (large or small), such as a small entrance wound and a large exit wound [13–16].

This study describes the forensic autopsy casework on the firing on a mass rally and is focused on the pattern of entrance-exit wounds and explains the wound ballistics compared to the data in textbooks and previous reports. This may be helpful for forensic pathologists and physicians to diagnose HVB wounds with more confidence.

## 2. Cases

This is a forensic autopsy report of the post mortem inquest under the Criminal Procedure Code at the Division of Forensic Medicine, Department of Pathology, Faculty of Medicine Ramathibodi Hospital, Mahidol University, after the dispersal of civilians attending a mass rally in Bangkok, Thailand in May 2010 in which all cases were confirmed dead by HVB types  $5.56 \times 45$  mm. (M-16 rifle) shots. The collected data were patterns of wounds and tissue

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and organ injuries. The postmortem radiological examination found “lead snowstorm” patterns in almost all cases. The fragmented bullets and bullet retains were examined by experts of the explosive ordnance disposal (EOD) team and forensic police. This included interrogations from the local police from where the mass rally had been held and where there were requests for a post mortem inquest.

There were 27 cases of individuals shot dead by HVBs (M-16) rounds; these 32 shots have been included in this study. The age, sex and location of wounds in each case were recorded. Every corpse was photographed, had a radiological examination and an autopsy was performed, with gross and microscopic examinations. The bullets or bullet fragments removed from the corpses were examined to ascertain the types of bullet by the EOD and the Forensic police and it was confirmed that the bullets were HVBs.

### 3. Wound findings

Among the 27 shot dead by HVB bullets, there were 25 males (92.6%) and 2 females (7.4%). The men were 13–54 years old (average 31.1 years) while the women were 30 and 37 years old (average 33.5 years). Twenty-four cases received one gunshot, while two cases received two shots and one case four shots. There were 32 shots for analysis in total. All entrance wounds had no soot deposition, muzzle imprints or gun powder tattooing. The entrance-exit wounds were found to be as follows: (Table 1).

- a) Five cases were shot in the head in which there were entrance and exit wounds for three cases while in the other two cases the wound course was tangential.
- b) Four cases were shot in the face in which two cases were found with exit wounds in their necks; one case was found with three exit wounds across the face and one case was not found to have any exit wound but a full metal jacketed bullet was found to have been retained in the thoracic cavity.
- c) Three cases were found with entrance wounds in the neck but only two cases had exit wounds on the opposite side of their necks, while one case was not found to have an exit wound but retained multiple fragments of the bullet in the neck and in the thoracic cavity.
- d) Two cases were shot in the shoulder; in one case the exit wounds were found in the axilla on the opposite side while in the other case the exit wound was not found but retained multiple fragments of the bullet, which were found in the lower parts of the lungs and the upper part of the peritoneal cavity.
- e) Four cases had entrance wounds in the chest in which only one case had an exit wound at the chest while the other three cases had exit wounds in the back.
- f) Four cases were found to have entrance wounds in the abdomen in which one case had an exit wound in the back while the other three cases were found to have no exit wounds but retained the full metal jacketed bullets.
- g) Four cases were found to have entrance wounds in the back in which three cases were found to have exit wounds in the chest whereas one other case was found to have an exit wound in the abdomen.
- h) Two entrance wounds were found in the upper extremities in which one was found to have an exit in the forearm while the other was found to have no exit wound with the retained bullet in the elbow.
- i) Four entrance-exit wounds were found in the lower extremities of which two wound tracks were in the thighs, one was at the knee and the other was at the ankle.

The examination the shapes of entrance and exit wounds found the following:

- a) Twenty-three entrance wounds or 71.88% (23/32) were typical entrance, which was round with a small size and a diameter of not more than 0.5 cm. Microtears without abrasion rings were mostly found. There were two cases that were headshots, four cases were face-shots, two cases were neck-shots, two cases were shoulder-shots, three cases were chest-shots, three cases were abdomen-shots, four cases were shot in the back, and three cases were shot in the extremities. The pattern of the exit wounds were as follows: (Table 2)
  - (1) Four wounds had a stellate shape, sized  $1.5 \times 1-6 \times 4.5$  cm and 2–6 V-shaped projections were also found (wounds 1, 2, 6 and 26) (Fig. 1a).
  - (2) Seven wounds had an oval shape and were small in size, (wounds 13, 16, 17, 23, 30, 31 and 32) (Fig. 1b).
  - (3) Two wounds had an oval shape and were medium in size, at  $2 \times 1$  cm of each (wounds 19 and 25) (Fig. 1c).
  - (4) Two wounds had small round shapes with diameters between 0.6 cm and 1.0 cm. (wounds 15 and 24).
  - (5) Two cases had more than one exit wound (wounds 7 and 8).
  - (6) Four cases had no exit wound: three cases retained a full metal jacket bullet. (wounds 9, 20, 21) (Fig. 1d), and there were multiple fragmented bullets in one case. (wound 14)
  - (7) In two cases we were unable to estimate the exit wound size due to post-surgical debridement (wounds 10 and 11).
- b) Nine atypical entrance wounds were patterned as follows: (Table 3)
  - (1) One case was found to have a large round shaped entrance wound with a diameter of 1.6 cm with the exit wound being large stellate shaped with a size of  $7 \times 6$  cm (wound 18).
  - (2) There were four oval shaped entrance wounds sized between  $0.8 \times 0.5$  to  $1 \times 0.4$  cm and two oval shaped exit wounds which had the same relative size as the entrance wounds (wounds 28, 29) and two cases had no exit wound but retained the full metal jacketed bullet in one case (wound 22) and the retained tip of the bullet fragment in the other (wound 27).
  - (3) Two entrance wounds were stellate shaped, one of which one case had a stellate exit wound (wound 3) (Fig. 2) while the other had no exit wound but retained multiple fragmentation of the bullet (wound 12).
  - (4) Two cases had lacerated tangential wounds in the head (wounds 4 and 5).

### 4. Discussion

A high velocity bullet (HVB) is one that has a muzzle velocity of more than the speed of sound [17] – i.e. more than 1100 feet per second or 330 m per second. The modern model has a range of between 2400 and 4000 feet per second [15]; such as the M-16 rifle ( $5.56 \times 45$  mm bullet), which has a muzzle velocity (of the bullet) of approximately 3150 feet per second and the AK-47 rifle ( $5.45 \times 39$  mm bullet), which is 2985 feet per second [15]. They are used in military affairs and to enforce the law. Many countries, including Thailand, have prohibited civilian ownership of such weapons. The M-16 rifle is popularly used by the US army and the AK-74 rifle is popularly used in Russia. All these modern military bullets are designed to be small, streamlined, spitzer pointed

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