

ORIGINAL ARTICLE

Medicolegal Evaluation of Fatal Firearm injury Cases in Ethiopia: An Autopsy Study

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Abstract :

Gunshot wounds are commonly encountered in forensic practice. The courts quite often specifically need to know which firearm injury is entry and which is exit. Although the examination of a recent gunshot wound is often straightforward, the appearance of the firearm wound may be affected by factors like multiple firearm injuries, putrefaction, charring. The forensic practitioner sometimes faces difficulty when the entry or exit wounds present atypically like the absence of secondary effects of discharge, as in decomposed bodies, which are supposed to determine or be specific to entry wound. Sometimes feature like abrasion collar is seen at the exit wound or is present in both entry and exit wounds as in cases of shored exit wound. This study focuses not only on the typical features which determine the entry wound but also on the few cases in which the presentation of entry and exit wounds are atypical. This study can be used in those cases of firearm injuries like multiple firearm injuries and decomposed cases.

Keywords : Gunshot wounds, Entry wound, Exit wound, Atypical presentation.

Introduction :

Gunshot wounds are commonly encountered in forensic practice. Entrance wounds can be round, oval or irregular (atypical) with an abrasion ring almost always present and the secondary effect of discharge like muzzle imprint, soot deposition, stippling or blackening of the skin edges present. Exit wounds are usually irregular and there is no abrasion ring and no secondary effects of discharge in the vast majority of cases.²

The classic findings determining the entry wound are the presence of muzzle burns in contact wounds, flame burns in near-contact or close-range injuries, and soiling and tattooing in intermediate-range wounds. Similarly, the presence of an abrasion rim and grease collar around the wound also indicate that it is an entry wound. Exit wounds will be free of these secondary effects of discharge.² In contact gunshot wounds with bony tissue underlying the injury, the injuries are typically called a stellate wound.⁵

Exit wound is more irregular in shape than entry wound. The skin is perforated from the inside out, causing eversion of skin tags and protrusion of tissue from the defect. Shored exit wound is one in which the skin is in contact with another object when the bullet exits (a belt, a wall, etc.); this causes an irregular area of abrasion on the skin, which can be confused with the abrasion ring of an entrance wound.²

In perforating gunshot wounds to the head, entrance and exit wounds show a typical feature called beveling, distinguishing between entrance and exit. Entrance wounds can be round / oval or stellate in shape and show an internal beveling. Exit wounds are usually irregular and show an external beveling. Cases where there is a Keyhole lesion, a single bone defect that shows both entrance and exit wound morphologies due to a bullet that strikes the skull at a shallow angle.²

Gunshot wounds can be classified, among others, depending on the muzzle velocity of the projectile and fall into low-velocity and high-velocity firearm injuries. The higher the velocity of the bullet, the more kinetic energy and the greater the temporary cavity size, which may be more than 10 times the caliber of the bullet.¹

Total population in Ethiopia is about 12 crores. The number of cases brought for postmortem, to the institution, annually is about 6000. Out of these deaths by firearm injuries are about 300 in a year.

Materials and Methods :

The institutional review board (IRB) of St. Paul's hospital Millennium Medical College (SPHMMC) has given ethical clearance for the research on the title.

52 fatal firearm injury cases which arrived at the mortuary have been selected for this study from the year 2020 for medicolegal evaluation especially the pattern of entry and exit firearm wounds. Thorough autopsy was done on these cases and Photographs were taken in all cases included in this prospective cross-sectional study.

Inclusion: Only those cases with single firearm injury (either one entry or with one entry and one exit wound) are included in this study to understand the more subtle features of entry and exit

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wounds.

Exclusion: Firearm injury cases in which there are multiple firearm injuries and those cases in which the entry and exit wounds could not be definitively made out are excluded from the study.

Results :

Total number of deaths from firearm injury cases which arrived at the mortuary of St. Paul's hospital & Mellennium Medical College, in the year 2020 were 125. Total males 113 and total females involved by the injuries were 12.

In the present study, out of 52 cases 49 cases i.e. 94.2% are males and 3 are females i.e. 5.7% (Table 1).

Most people out of these 52 cases fall in the 21-30 year age group (51.9%). Majority of these cases are homicidal.

Table 1: Age group vs Gender distribution of deaths from firearm injury.

Age group in years	Number of deaths				Total	Percentage
	Male	Percentage	Female	Percentage		
0-10	2	3.8	1	1.9	3	5.7
11-20	6	11.5	0	0	6	11.5
21-30	27	51.9	0	0	27	51.9
31-40	6	11.5	1	1.9	7	13.4
41-50	3	5.7	0	0	3	5.7
51-60	5	9.6	1	1.9	6	9.6
Total	49	94.2	3	5.7	52	100

Table 2: Characteristic features at entry/exit wounds.

Characteristic feature	Number
Abrasion collar at entry	18
Blackening	6
Abrasion collar + blackening	2
Abrasion collar + tattooing	1
Abrasion collar + blackening + Tattooing	1
Abrasion collar + Muzzle impression	3
Punched-in skin/sc tissue at entry	5
Punched-out skin/sc tissue at exit	3
Abrasion collar at exit	1
Abrasion collar at both entry and exit	2
Satellite wounds	1
Stellate wounds	5
Common entry and exit	1
Punched-in outer table of skull with blackening around	2
Pellet fragment recovered at entry	1
Total	52

Table 3: Different projectiles recovered from bodies during autopsy.

Projectile type recovered from body	Number
Silver colored ball bearing-like	5
Small blunt nosed copper color jacketed	2
Relatively bigger than the blunt nosed copper color jacketed with body and nose of different colors	3
From high velocity weapon	1
Silver colored long bullet	1
Piece of projectile	1
Total	13

The characteristic features mentioned in Table no. 2 are the prominent features which helped to determine whether the injury is entry or exit in a case.

Abrasion collar is definitely the most common finding (Table 2) associated with the entry wounds seen in 18 out of 52 cases. There are cases in this study in which there is no abrasion collar or cases in which the abrasion collar is present at both entry and exit wounds (Fig. 1 and Fig. 2). In these cases the wound type is determined by the presence of punched-in skin or subcutaneous tissue at the entry wound or punched-out skin or subcutaneous tissue at the exit wound. In this study, there are 5 cases in which the entry wound showed punched-in skin or subcutaneous tissue and 3 cases in which the exit wound showed punched-out skin or subcutaneous tissue and are the determining factors as to whether wound is entry or exit. The latter 3 cases include 1 case which show abrasion collar at exit wound and 2 cases in which abrasion collar is present at both the entry and exit wounds. Also it is noted that the margins of entry wound are more regular than the margins of exit wound.

In this study, there are 4 cases in which the entry wound is bigger than the exit wound. 2 of them in skull, 1 out of the 4 involved the neck and 1 involved the abdomen. In 1 another case there is a large central hole surrounded by smaller holes i.e. satellites (Fig.3) which is the entry wound from penetration of multiple projectiles discharged from a shotgun firearm weapon but with exit wound smaller with punched-out skin and subcutaneous tissue. A deformed bullet is retrieved from the track of this wound deep in the thigh.

There are 4 cases in this study, in which the entry wound is relatively bigger than typically seen and the exit wounds are bigger than the exit wounds seen typically. These wounds are produced by projectiles discharged from high-velocity firearm weapons which is consistent with the study mentioned by Vellema and Scholtz.

In 2 cases there is contusion present in the surrounding tissue near the exit wound. The contusion should not be mistaken for abrasion collar when it circumscribes the firearm wound (Fig. 4) as is present in 1 of the 2 cases. In the other case the contusion around the exit wound was spread over an area and was not circumscribing the wound.

In cases where bowels are seen protruding out of a firearm wound in abdomen, the wound should be cautiously assessed and not labeled as exit wound in haste. As in this study, there are 3 cases in which the bowel loops are seen protruding through the entry wound and in 2 of these 3 cases the protrusion was due to decomposition. The margins of the entry wounds are regular. The exit wounds in these cases showed punched out skin or subcutaneous tissue, and the margins are less regular than the entry wound. In one case out of the 3 cases, there is blackening around the entry wound and blackening is also seen on the protruding bowel loops.

Stellate-shaped wounds (seen in 5 cases) are seen in firearm wounds of the head and face. Such wounds are more frequently found to be associated with ball-bearing-like small spherical projectiles, 3 out of 5 and are seen on the scalp. In 2 out of these

above 3 cases the entry through the skull showed key-hole or bird-like shape and the projectile entered the skull at an angle travelling toward left. 1 out of the 5 stellate-shaped wounds, is seen on face, at the root of the nose and is due to a small sized Copper jacketed bullet with blunt nose. In 1 out of the 3 cases the stellate-shaped wound is seen at the exit wound and is seen on the skull but the nature of projectile is unknown.

The most common projectiles (Table 3) seen are silver colored spherical ball-bearing like projectile (Fig. 5), blunt-nose copper jacketed bullet and a relatively bigger blunt-nose jacketed bullet



Fig. : 1 Abrasion collar at entry.



Fig. : 2 Abrasion collar at exit.



Fig. : 3 Shot gun entry with satellites.

in which the nose and the body are of different colors. In 3 cases, projectile is not retrieved even after thorough dissection. Gauze pieces or a cloth should be placed beneath the body to avoid losing the projectile. Hence imaging is a mandatory procedure to be done before start of examination and dissection of the body.

In 4 cases blackening is seen on the clothes of victim upon the entry wound. In one case, there is tattooing on the skin at the entry wound along with blackening on the overlying cloth. In 1 another case there is abrasion collar at the entry wound along with stippling, and in 2 out of the 4 cases the entry wound showed punched-in skin/subcutaneous tissue. The police should be informed and instructed not to remove clothes from the body until autopsy is performed.

There are 2 cases in this study which involved death by accidental firearm discharge and both of them are children and only 3 cases in which the deaths are by suicide.

Discussion :

Abrasion collar is definitely the most common finding associated with firearm entry wounds seen in 18 out of 50 cases as seen in



Fig. : 4 Contusion around exit.

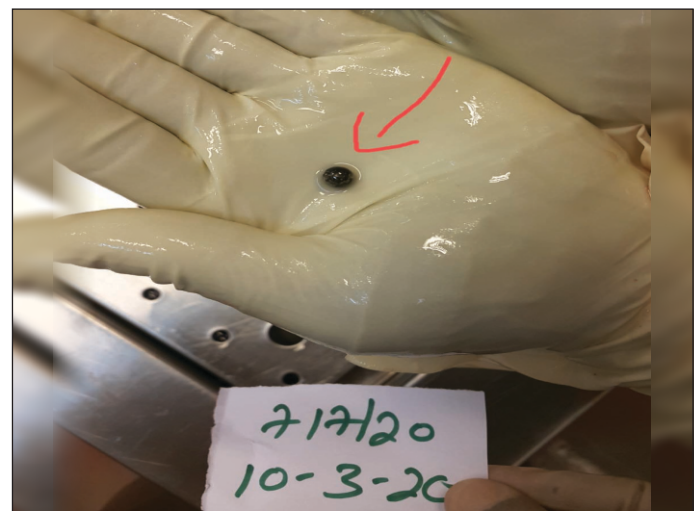


Fig. : 5 Ball bearing projectile.

study by Gitto and Stopaccher.² But there are cases in this analytic group which show abrasion collar at both entry and exit wounds and cases in which there is no abrasion collar at neither the entry nor the exit wound, as in decomposed bodies. It becomes important in such cases to accurately determine the entry and exit wounds.

There is 1 case in this study which showed abrasion collar at the exit wound as can be seen in shored exit wounds and also the margins of the entry wound are found to be more regular than exit wound as was found in study by Gitto and Stopaccher² as well as in the article by Shrestha, Kanchan, Krishna.⁵ cases are seen to have abrasion collar at both entry and exit wounds. However, the finding which helped in determining the wound as entry or exit is the associated punched-in skin or subcutaneous tissue and punched-out skin or subcutaneous tissue respectively. Such findings can help in determining the type of wound whether entry or exit when the wound is atypical.

Size of wound should never be taken as a criteria to determine whether the wound is entry or exit. Sites on the body, other than skull, with no bone underneath and are soft like neck, thigh and especially abdomen are observed in some cases to have entry wounds larger than the exit wounds than the common belief that entry wounds are smaller than exit wounds. Also relatively bigger entry and exit wounds than typically seen are present in firearm injuries produced by high velocity firearm weapons as was shown in study by Vellema and Scholtz.⁶ Injuries caused by shotgun firearm weapon with multiple projectiles penetrating the body one should be cautious in deciding which wound is entry and which is exit. In this study, the helpful determining findings again are regular margins at the entry wound and the punched-out skin and subcutaneous tissue at the exit wound.

Stellate shaped wounds are seen more in the injuries present on the scalp and majority of these are associated with spherical shaped ball-bearing like projectiles. These wounds are close range wounds which left little space for the expansion of gases released from the firearm weapon and hence caused this kind of wounds as was seen in the study by Shrestha, Kanchan, Krishna.⁵

This study stresses on the subtle findings to look for in the determination of firearm entry or exit wounds which holds significant medicolegal value. Knowing the various kinds of ammunition used in the region or the country can give an idea about the type of weapon used and by which group of people or criminals it is used. Cooperation from the police is required to

make such valuable conclusions.

X rays should be done in all cases of firearm injuries because small projectiles may easily be lost while dissection. It is found useful to keep a cloth beneath the part of the body which was being dissected to retrieve the projectile.

The police should bring the body of the dead person to the mortuary with the clothes intact so that certain secondary effect findings shall not be missed.

Death by accidental firing was seen in only 2 cases out of 52 and both of them are children. Clearly, firearms should be kept away from children.

A bigger sample size is required to be taken for epidemiological purposes.

Conflict of interest: The Authors declare that there is no conflict of interest.

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