

CASE REPORT

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Boomerang of bullet from the chest cavity— an autopsy case

Mohd Kaleem Khan¹ and Jitendra Kumar^{1*}

Abstract

Background What if you fire a bullet and, like a boomerang, it comes back towards you after hitting the target, leaving no trace in the body.

Case presentation A similar case was presented to us for an autopsy at the district mortuary, Aligarh, with a bullet unusually ricocheting within the thoracic cavity and taking almost path of incidence after grazing over the 3rd rib and coming out just closure to the entry wound towards the musketeer. The presence of stippling at both the entrance and exit wounds poses a challenge to interpreting the track of the injury.

Conclusion Thorough and detailed examination at autopsy and crime-scene investigation revealed a strange ricochet event within the chest cavity.

Keywords Firearm injury, Bullet, Internal ricochet, Chest cavity, Autopsy, Aligarh

Background

Ricocheting of the bullet inside the body cavity, also known as internal ricochet, is a well-known phenomenon where a bullet changes its trajectory after impacting the hard tissues. Internal ricochet has been reported from the inner table of the skull cavity (Shkrum and Ramsay 2007; Kirkpatrick and Maio 1978; Grey 1993), vertebral body (Farrugia et al. 2010; Tekavcic and Smrkolj 1996), and eye socket (Bersudsky et al. 2000). A rib cage with flat and twisted ribs satisfies the fundamental requirement to provide a ricochet to the bullet. Also, the trajectory after the ricochet can be unpredictable because of its curvature and twisting. In the present case, a bullet strangely ricocheted inside the chest cavity, passing almost along the entrance path after grazing over the internal surface of 3rd rib and coming out close to the entry wound towards the gunman.

Case presentation

A 40-year-old male has shot in a homely quarrel about 30 km from Aligarh City. He was brought to the nearby community health center, where he was declared dead. Further, the deceased's body was shifted to the district mortuary by the police for post-mortem examination.

An autopsy was performed approximately 12 h after the alleged incident. On external examination, the body was of an average-built and moderately nourished adult male with a supine length of about 164 cm, weighing about 62 kg, and a body mass index of approximately 23. He was wearing the white vest on the trunk. Examination of the vest showed stippling on the right front, corresponding with the stippling pattern seen over the body. Post-mortem lividity was present over the back and fixed in nature with developed rigor mortis. No sign of putrefaction was present. After general external examination and collection of samples for gunshot residue, the body was shifted for whole-body radiological examination. On radiological examination, no evidence of any metallic or foreign particle was present in any of the X-ray films. An undisplaced fracture of the left third rib was present at the middle third of its curvature.

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Fig. 1 Showing firearm wounds over the body. Entry wound (blue arrow). Exit wound (red arrow). Stippling (black arrow)

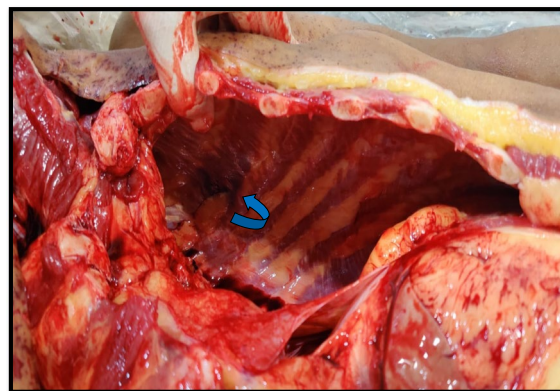


Fig. 2 Showing the ricochet site of the bullet (blue arrow)

Further, on autopsy examination, gunshot wounds, two in number, were present along the upper border of the right shoulder with a gap of about 6 cm. Stippling was present unusually around both wounds (Fig. 1). Due to stippling, deciding on entry and exit wounds was challenging. So, based on the features like the size of the injury and conditions of the margins, it was agreed that damage on the right side of the neck measuring 0.6 cm in diameter with inverted margins present 10 cm from the midline and just above the right sternoclavicular joint must be an entry wound (FAEn) (Fig. 1). The track of the bullet inside the body further supported this. No blackening or singeing was present around the wound.

Another large size wound measuring 6 cm × 3.5 cm × body cavity deep with everted margins was present at the shoulder tip without any blackening or singeing. It was taken as an exit wound (FAEx) (Fig. 1). On exploration at autopsy, the bullet's path traversed through the skin, subcutaneous tissues, and muscles and passed behind the sternum via the thoracic inlet to cross the midline. Furthermore, it punctured the upper lobe of the left lung. Then bullet struck over the curved inner surface of the left 3rd rib producing an indent (Fig. 2). The bullet further grazed over there and glanced back clockwise in almost the same direction with an angle of about 20° to the incident angle and punctured again on the left lung's upper lobe, making a large laceration on the upper lobe.

Furthermore, it obliquely crossed the midline, passing front to the lower part of the second thoracic vertebrae, and entered the right side of the chest cavity, puncturing the right lung's upper lobe. It came out through the thoracic inlet passing behind the right clavicle and through muscles and subcutaneous tissue to produce an exit wound (FAEx). A large hematoma in the upper lobe of the left lung and about three liters of blood were

present in the left side of the chest cavity. The heart and other organs were intact. No further injury was present over the body. The person died due to hemorrhage and shock. The direction of the bullet was downwards, backward, and towards the left, while the ricochet bullet was upwards, forwards, and rightwards. Further investigating authorities recovered the ammunition from the crime scene later, per our findings.

Discussion

Ricocheting of a bullet is a phenomenon where a bullet striking the solid surface below the critical angle of impact changes its path rather than penetrating the surface. Critical angles are when a particular bullet begins to rebound, which depends on the surface's nature, construction, and velocity (Vincent 1999). Commonly phenomenon of ricochet is considered when bullets ricochet from physical surfaces before hitting the target, i.e., external ricochet. In external ricochet, round to elliptical, large, and irregular-shaped entrance wounds are seen depending upon the shape and direction of the projectile. Pseudo-stippling or pseudo-gunpowder stippling, pseudo-soot blackening, and tumbling abrasions surrounding the entry wound are features of ricochet events. Most wound tracks after ricochet are short, of large diameter, and irregular, as ricocheted bullets are unpredictable and have reduced ability for tissue penetration (Yong 2017).

Internal ricochet of bullets occurs when bullets hit over hard tissues like bones with curved margins inside the body. Literature has provided ricocheting of the bullet within the cranial cavity from the inner table of the calvarium. Kirkpatrick and Di Maio (1978) reported a study on about 42 fatal gunshot cases to look for tracks of the projectile inside the cranial cavity. About 11 instances showed ricocheting inside the skull cavity, with most patients showing ricocheting over the inner table

producing gutter fracture along the curved surface of the calvarium before coming to rest after traversing the brain. In a few cases, the projectile re-entered the brain producing another track inside the brain. In one case reported by T. C. Grey (1993), the projectile ricocheted from the inner table of the skull after penetrating through the brain and further unusually departed through the entrance wound. An almost similar event was observed in the present case, with a bullet ricocheting almost along the path of the entrance like a boomerang.

Audrey Farrugia et al. (2010) and Igor Tegavcic et al. (1996) reported ricocheting of the bullet inside the spinal canal due to a change in the direction of the bullet after hitting the bone. According to Farrugia et al. (2010), bullet migration inside the spinal canal is a passive phenomenon that is caused primarily due to gravitational pull. However, ricocheting is an active phenomenon.

In another isolated case of a ricochet inside the ocular cavity, Valery Bersudsky et al. (2000) reported an intra-ocular ricochet of the pellet in which the projectile could not perforate the bones but rather ricocheted inside the ocular cavity. The ricocheting phenomenon was explained due to comparatively lower kinetic energy, the pellet's spherical shape, and the sclera's elasticity, including the ocular cavity's curvature. Similarly, in the present case, the bullet fired from an intermediate range did not have sufficient energy to penetrate the bones but rather ricocheted due to oblique impact and curvature of bones.

Internal ricochets inside the chest cavity are very scarcely reported in the literature. It has been observed that firearm injuries in the chest region cause both passive and active ricochet phenomena. After hitting the ribcage or sternum, projectile skids along the inner surface lie on the back, or bullet slips in the chest cavity due to gravity or body postures after losing their kinetic energy. The present case highlights an unusual chance of a ricochet inside the chest cavity where a bullet ejects out of the body after the ricochet. Also, the bullet erupted almost along the incidence path, so it became challenging to rule out entry and exit wounds.

Here, the stippling pattern was present unusual due to the clothes worn by the deceased and country-made firearms, which use disproportionate gunpowder mixtures. It is essential to mention that Aligarh in India is a known hub for country-made guns. The semi-skilled workers in a small household industry usually make Aligarh firearms. So, it has been prevalent to find atypical and unpredictable firearm wounds produced by such weapons.

In the present case, the projectile ricocheted over the inner margin of the curved surface of the 3rd rib. As the 3rd rib has twisted textures, the exact impact angle over the surface is difficult to determine. Still, the twisted character opens up several possibilities of the impact

angle on which the bullet strikes at an angle below the critical angle producing a ricochet. Also, ribs are curved in their course, giving a turn to the projectile like a swing boat resulting in a projectile getting redirected towards the entrance path.

It has been observed that after ricocheting and passing inside the body, the projectile loses its kinetic energy to the surrounding tissues, has a short course, and usually doesn't eject out of the body. In the present case, the bullet discharged out of the body even after ricocheting and took such a long course. The possible explanation could be multifactorial, which includes the type of firearm, position of the assailant, body posture of the victim, the intermediate range of fire, and passing of the bullet through soft tissues causing not much loss of kinetic energy. Also, the curvature of the ribs provided a swing to the projectile so that the bullet could eject from the body.

Conclusions

An internal ricochet of the bullet from the chest cavity in which the bullet ejected out of the body has been scarcely reported in the literature. The present case highlights the unique possibility of the bullet spewing out of the body even after ricocheting from the chest cavity. This was possible due to the unpredictable caliber of country-made pistols, the bullet track passing through the body's soft tissue, and the rib cage being a favorable ricocheting surface giving swing to the projectile.

The case features to decide entry and exit wounds where stippling is present at both wounds. Also, the case identifies that correctly knowing the path of the ricochet can help to determine the assailant's position and recover the bullet from the crime scene for further examination.

Abbreviations

FAEn	Firearm entry wound
FAEx	Firearm exit wound
Fig	Figure

Acknowledgements

Kin and next to kin

Authors' contributions

First author—case and data. Second author—manuscript drafting.

Funding

Nil.

Availability of data and materials

Case of first author.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Taken from next to kin.

Competing interests

The authors declare that they have no competing interests.

Received: 10 March 2023 Accepted: 21 June 2023

Published online: 30 June 2023

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