Case Study

Crime Scene Reconstruction from Analysis of Injuries in a Case of Self-Inflicted Fatal Gunshot Injury: A Case Report

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Abstract

Firearm suicides, though less common than poisoning and hanging in India, have been increasing due to rising gun availability and insufficient mental health evaluations in firearm licensing. This case report examines the wound ballistics of a 45-year-old security officer who died from a self-inflicted gunshot wound to the forehead at one of the Sessions Court, Kolkata. Autopsy findings revealed a hard-contact gunshot wound with a stellate entry laceration, muzzle imprint, soot deposition, and characteristic skull fractures, including inward beveling at the entry site and outward beveling at the exit. The bullet passed through the brain, causing severe trauma, including deep bruising and bleeding, which led to a fatal buildup of pressure inside the skull. The presence of cadaveric spasm and the CCTV footage supported the conclusion of suicide. This case highlights the forensic significance of wound ballistics in reconstructing firearm-related deaths, distinguishing between contact, close-range, and distant gunshot wounds, and establishing the manner of death through ballistic analysis and forensic medicine, and pathology.

Keywords: Firearm suicide, wound ballistics, contact gunshot wound, forensic pathology, case report.

Introduction

Suicide is a complex issue influenced by biological, psychological, social, and environmental factors, affecting individuals of all ages and leaving a lasting impact on those left behind[1]. Contributing factors include stress, depression, academic struggles, relationship issues, substance abuse, financial problems, and chronic pain[2]. Globally, suicide rates have returned to their peak since 2022, with over 49000 reported cases of suicide and 1 death every 11 minutes[3]. According to National Crime Records Bureau (NCRB) data, the national suicide rate stood at 12.4 per lakh, while it has been reduced to 9.87 per lakh in 2024[4]. It is particularly concerning among young adults aged 15-49, making up 4.8% of female deaths and 5.7% of male deaths[5]. Most suicides (84%) occur in low- and middle-income countries (LMICs), with India and China alone accounting for 49% of cases[6]. In India, suicide is most common among people aged 20-29, with females having higher rates under the age of thirty, but the trend reverses after the age of thirty[4].

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While poisoning and hanging remain the most common suicide methods in India, deaths due to suicidal firearm injuries are rising, with gunshot fatalities making up 5% of intentional firearm injuries, mostly in the 21-40 age group[7]. Increased gun availability, the lack of mental health checks in licensing, financial stressors, and the shift to nuclear families contribute to this trend[8]. In most cases, victims target vital areas, with 71.43% of gunshot suicides affecting the head and neck and 28.57% the trunk[9].

Case Report

On one fine morning of February 2025, at approximately 07:00 hrs., police personnel received information about an incident at one of the Sessions Court premises in Kolkata. Upon arrival, officers discovered a 45-year-old male seated on a chair in a pool of blood. He was immediately referred to the emergency department of Medical College and Hospital, Kolkata, where he was declared dead by the on-duty medical officer. Arrangements were made for a post-mortem examination to reconstruct the sequence of events and determine the cause of death.

Examination Findings:

On external examination:

1. An average-built and nourished male subject wearing apparel stained by dried blood and dust in places. There were no ammunition holes present on the wearing apparel. Thick, blackish clotted blood coming out from the wound to the right side of the forehead to the upper helix, clotted blood dribbling right cheek to the right side of the neck. Blood clots were also present around the nostrils, coming down to the right side of the lower lip, up to the chin.
2. Postmortem staining was distributed over the lower portion of the upper limbs and the lower portion of the lower limbs. Both hands were in a state of cadaveric spasm.
3. One cruciate entry wound at middle of forehead measuring 2″ x 2″ with a bony gap of 0.5″ at the frontal bone of the skull, lower border 1.2″ above the fronto-nasal junction and upper end 1″ above an imaginary line connecting to frontal eminence, with brain matter noted at the entry wound, blackish abrasion collar with blacking of skin noted with a circular hole measuring 0.5″ x 0.5″, 1.5″ above glabella.
4. Cruciate-shaped exit wound at the middle of the occipital bone, 7″ below the external occipital protuberance.

On internal examination:

There is an extraduralhemorrhage just below the frontal bone with a global subdural hemorrhage. The tract of the bullet wound diverges through the structure of the brain between two cerebral hemispheres towards the exit wound, and on the right cerebral hemisphere, on the back, is associated with cerebral contusion.

Fracture of both tables of skull bone with separation of coronal sutures, with separation of the anterior one-third of the sagittal suture. One of the most notable features is the presence of soot deposition and a muzzle imprint on the skin's surface caused by the high-pressure gases expelled from the firearm upon discharge. These gases often cause stellate lacerations around the wound, particularly in areas with tight skin, such as the forehead or scalp. The interaction of the bullet with the skull results in specific fracture patterns.

At the point of entry, the skull commonly displays inward beveling, where the outer table remains relatively intact while the inner table exhibits coning due to the forceful penetration of the projectile. If the projectile has a high velocity, the bone may fragment significantly, creating secondary missiles that can cause further damage to brain tissue. The extent of soft tissue damage in contact gunshot wounds is also significant. The passage of the bullet through the brain creates both a temporary and a permanent cavity, with the temporary cavity expanding rapidly due to the energy transfer from the projectile.

However, since the brain is enclosed within the rigid skull, its expansion is limited, resulting in increased intracranial pressure and secondary brain injuries. The negative pressure effect of cavitation can also draw in external elements such as skin, hair, or fabric into the wound. Another key forensic phenomenon in close-range shootings is "back spatter," where blood and tissue are expelled backward against the direction of fire, sometimes depositing on the shooter or firearm.

Additionally, the extreme intracranial pressure caused by the bullet's force can severely impact the brainstem, often leading to immediate fatality. In contact gunshot injuries, there is disruption of underlying tissues, as discussed, due to expansile gases, and intact underlying structures are rarely found, however, the case discussed below exhibited an unusual finding of intact internal tissue structure despite it being a contact gunshot wound. The forensic characteristics of the gunshot wound were notable. The presence of soot deposition and a distinct muzzle imprint on the forehead indicated a hard-contact firearm discharge. Stellate lacerations formed due to high-pressure gases expelled into the tight skin of the forehead. The skull exhibited inward beveling at the entry site and outward beveling at the occipital exit, consistent with the expected bullet trajectory. Interestingly, despite being a contact wound, internal brain structures were relatively preserved, which is uncommon in such cases. Additionally, evidence of "back spatter" was noted, with blood and tissue deposited in the reverse direction of fire, a feature often seen in close-range shootings.

All relevant evidence, including biological samples, was collected and forwarded for forensic examination.

Discussion

An analysis of the peer-reviewed literature reveals a lack of recent articles examining the survival time and physical activity following gunshot wounds, even though a careful determination of these can be crucial in reconstructing a crime[10]. It is necessary to interpret the injuries of the deceased to determine the probable sequence of events, particularly in cases with conflicting evidence and testimony[11]. Following a complete autopsy, the cause of death, as determined by the forensic pathologist, was attributed to the injury sustained due to a gunshot wound to his forehead. As stated by the investigating officer, a pistol was found under the chair in front of him, along with one discharged and disfigured bullet nearby. However, a closer observation as to the general description of the dead body and the pattern of injuries was made as follows: The gunshot to the head entered through the mid-frontal region of the scalp and exited through the occipital region, almost in the midline but with a propensity more towards the left side. The entrance wound, as depicted, was a stellate-shaped laceration with a prominent muzzle impression and without any abrasion collar, grease collar, contusion collar, or tattooing- indicative of a hard contact shot.

i. The exit wound, at the back of the head, was a roughly oval defect with beveling on the outer table of the skull.

ii. Evidence of back spatter and the blowback phenomenon.

iii. Typical distribution of hypostasis only over the upper and the lower limbs.

iv. Evidence of cadaveric spasm noted in both hands.

If an analysis from the above observations is made, the victim has allegedly held the firearm in both the hands and pulled the trigger using both the thumbs (observation no. iii and observation no. v), while being seated on a chair, pressing the muzzle end of the firearm quite hard to the skin surface (observation no. i). As to observation no. iv) The victim has dropped down the firearm, following discharge, with both hands hanging by the sides of the chair.

Research on firearm types used in suicides shows no major difference between rifles, shotguns, and handguns in terms of range[12]. However, 96% of firearm suicides involve contact wounds, meaning the gun is pressed directly against the skin[13]. Injuries to the head are more common with handguns and rifles than with shotguns[12].

Fig 1: Place where the body was discovered

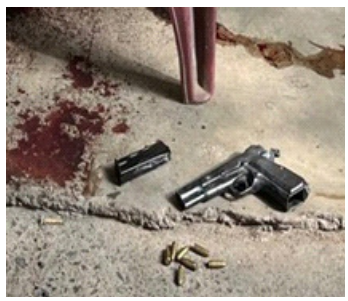

Fig 2: Blood of the deceased due to the firearm injury along with the firearm and cartridge

Fig 3: Entry wound over the forehead as per the autopsy report

Fig 4: Exit wound over the occipital region as per the autopsy report

Fig 5: Back spatter over the dorsal aspect of the right hand

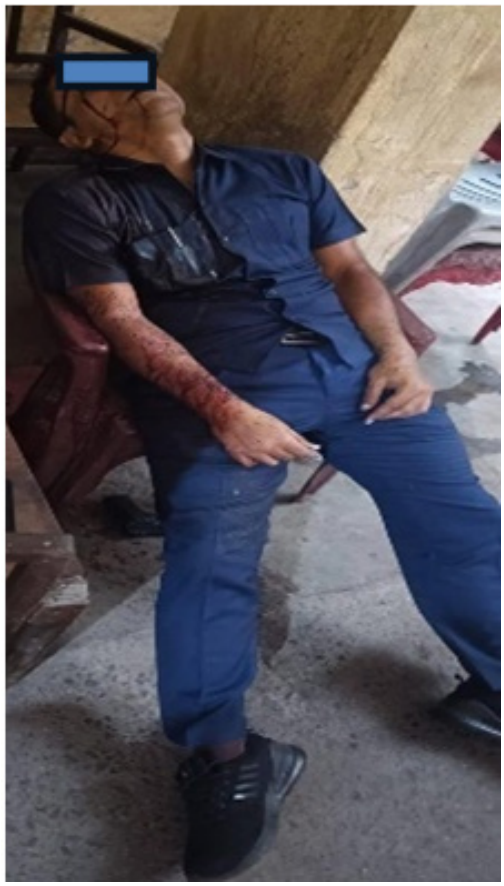

Fig 6: Deceased at the crime scene

Unique Findings:

This case presented several unusual yet significant forensic findings that merit emphasis. While contact gunshot wounds to the head typically result in extensive disruption of both soft and hard tissues, this case revealed a surprising preservation of internal brain structures, despite the hard-contact nature of the shot. Such conservation is rare and underscores the variability in wound dynamics even within standard ballistic scenarios. The presence of back spatter and the pattern of blood distribution further align with forensic expectations in a contact-range gunshot wound, reinforcing the reconstruction's reliability.

Moreover, the availability of CCTV footage documenting the incident provided a rare opportunity to correlate forensic findings with real-time actions, enhancing the evidentiary strength of the conclusions drawn. These combined elements make this case a valuable reference for forensic pathologists and crime scene investigators in distinguishing between suicidal and homicidal gunshot wounds. A subsequent inquiry revealed that the deceased had been on night duty, and his body was discovered in the morning when another officer arrived to clear the area. Reviewing CCTV footage provided crucial insights into the incident. The footage showed the officer sitting down, removing his glasses and mobile phone, placing them beside him, then drawing his firearm, positioning it against his forehead, and pulling the trigger. The bullet passed through his forehead and struck the wall behind him, where it was later recovered. Blood was present at the scene, and the total ammunition found included 12 bullets in his belt and seven in the pistol's magazine, in addition to the discharged bullet.

Forensic pathologists who perform autopsies in gunshot cases may be asked to determine the bullet trajectories in the body to elucidate the circumstances of an unnatural death following a gunshot injury and answer questions about the range of fire, the order of shots fired, and the relative position of the victim at the crime scene. Thus, it is necessary for the forensic pathologist to objectively analyze the pattern of injury to testify whether the witnesses' testimonies are consistent with the scene, evidence, and autopsy findings.

Conclusion

This case underscores the critical role of comprehensive forensic analysis in confirming the manner of death in firearm-related fatalities. The autopsy findings, supported by scene examination and cadaveric evidence, were consistent with a self-inflicted contact gunshot wound. Unique forensic markers such as the presence of rigor mortis, external gunshot residue, and intact internal structures

despite a contact wound offered rare insights into the wound dynamics.

The case further emphasizes the need for psychological evaluation in firearm licensing and highlights the value of integrating forensic pathology with crime scene reconstruction. The findings advocate for continued education on wound ballistics among forensic professionals and point toward the necessity for standardized protocols when distinguishing between homicidal and suicidal gunshot injuries. Future studies may focus on expanding the database of wound characteristics correlated with CCTV-supported suicides to refine diagnostic accuracy.

Conflict of Interest: The authors have no conflict of interest in this case report.

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Consent: Written informed consent for publication of clinical details, post-mortem findings, and images was obtained from the autopsy surgeon, investigating police personnel, and the patient's relative.

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