The Pharma Innovation Journal 2019; 8(5): 06-12

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2019; 8(5): 06-12

www.thepharmajournal.com
Received: 03-03-2019
Accepted: 05-04-2019

Manoj Kumar Pathak
Professor and Head, Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Srishti Rai
Research Scholar, Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Correspondence
Manoj Kumar Pathak
Professor and Head, Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

SEM-EDX and autopsy based study of a suicidal gunshot case

Manoj Kumar Pathak and Srishti Rai

Abstract
A fatal gunshot case presents many challenging medico-legal problems which involve co-operation among the police personnel, forensic pathologist, ballistic expert, chemical and explosive analysts. Due to the increase in incidence of use of firearms, criminal investigation and trials have been assuming an ever-increasing importance. In most of the cases, ballistic evidences if processed and examined properly can link criminal with the crime.
The difficult part is to conclude about the definite manner of death i.e. if the death was homicidal, accidental or suicidal. It is very common to portray homicidal gunshot as suicidal or accidental gunshot death in order to escape punishment.
In cases where it is important to determine whether a person has fired the shot or not, the presence or absence of GSR particles play a vital role as the particles can be identified positively up to 12 hours on the hands after firing the shot. Proper crime scene investigation methods combined with sophisticated instrumental techniques lead to justice being served. Some of these instrumental techniques include ICP-AES, SEM-EDX, FTIR etc. testing comparing the efficacy of ICP-AES and automated SEM-EDX in screening living individuals suspected of having fired a gun revealed positive results in 3.9% by ICP-AES/FAAS and 31.6% by SEM-EDX.

Keywords: SEM-EDX, GSR, metallic fouling, ICP-AES, blowback phenomenon

Introduction
The world of forensic science is changing at a very fast pace. This is in provision of forensic science services, the development of technologies and knowledge as well as the interpretation of analytical and other data as is applied within forensic practice. There is no doubt that medico-legal analysis form, beyond all other branches, the most important work undertaken by an analyst. It tells us about the cause, manner and approximate time of death (in broad sense) [1]. The medico-legal analysis when combined with best sensitive instrumental techniques/equipment is capable of providing accurate opinions about death and its related Queries, so that the case can be tried without any doubt and investigations can be carried out without any fallacies.
A firearm is a thermodynamic machine in which the potential energy of the gunshot powder is transformed into the kinetic energy of the projectile [2].
Parasuicide is a conscious, often impulsive, manipulative act, undertaken to get rid of an intolerable situation. Drug ingestion is the commonest form. Most persons are psychologically disturbed. The highest rate of it prevails in female population. The term Suicide is defined as the act of taking one's own life voluntarily [3].
S. 306, I.P.C., describes abetment of suicide, if any person commits suicide , whoever abets the commission of such suicide, shall be punished with imprisonment for a term which may extend to 10 years, and shall also be liable to fine. There must be instigation, cooperation or intentional assistance given to the would be suicide [3].
S. 309, I.P.C., describes Attemt To Commit Suicide, according to it whoever attempts to commit suicide and does any act towards the commission of such offence, previously there was a law which states that the person should be punished with simple imprisonment for a term which may extend to one year, or with fine, or with both [3].
Passed in April 2017, The Mental Health ACT superseded the previous Mental Health Act 1987.It provides for mental healthcare and services for person with mental illness and to promote, protect and fulfil the rights of such persons during their healthcare. The Act decriminalized the attempt to commit suicide with the presumption that such persons to be under severe stress, and ensured that they are offered opportunities for treatment and

rehabilitation from the government to reduce the risk of recurrence [4].

Shooting, hanging and stabbing are a 'hard' way of committing suicide and typically a male choice: poisoning and drowning are 'soft' ways of committing suicide.

The use of firearm for the purpose of suicide is not uncommon in India. A particular section of the society like the army and police personnel, businessmen etc. are found to have reported more number of cases. The Indian army has been in the news and off late, and more often than not, for the right reasons. The number of defence personnel committing suicide was highest in the Army amongst the three services in the last three years, data shows.

In 2018 alone, as many as 80 Army personnel are believed to have committed suicide. This number is 16 for Air Force and 08 for the Navy, Minister of State (MoS) for Defence Subhash Bhamre told the Rajya Sabha in a written reply [5].

Other incidents include Himanshu Roy. He was an Indian police officer, who served as the Additional Director General of Police of Maharashtra. He was ATS Maharashtra Chief. He shot himself in the mouth and the wound was visible right up to his skull.

Replying to a question in Rajya Sabha, the minister of state for defence Subhash Bhamre said the highest proportion of suicide falls in the Army. In last four years, 340 army men, 18 personnel from the Navy and 79 defence personnel from the IAF have committed suicide [6]. A 56-year-old police sub-inspector allegedly committed suicide by shooting himself with his service revolver at his residence in Gandhinagar.

It is a common practice to portray a homicide as suicide in order to escape punishment. The responsibility lies on the shoulders of forensic pathologist, forensic scientists and ballistic experts to prevent the case from being deviated from truth for it is the right of deceased's family to get justice and to make sure that the culprit is punished.

A Brief Case History

Body of a male aged 38 years was brought to the mortuary of Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University on 25th of July 2018. The autopsy was conducted around 2 pm. The deceased was of medium built. He had a single bullet entry hole on the temporal region nearer to temporo-mandibular joint in the right part of his skull. He had alleged history of suicide. He had shot himself with a licensed pistol in a hotel room of the city on 24th of July 2018 in the evening. He had checked in with female colleague of him. She had been missing since the morning of 24th July. It was approved by the family members of deceased that he was in severe depression. He was visited by 5 of his friends in the evening; they consumed alcohol along with snacks together and left around 6 pm. Though when the phone remained unanswered for long family members contacted one of his friends to check on him. The friend made futile attempts to get the door opened upon which hotel staffs were called and the dead body was recovered from the bed of the hotel's room along with pool of blood below his upper part of body.

Details of The Crime Scene (circumstantial evidences)

- One licensed USA made pistol with blood stains on the butt, bolt and barrel area.
- One cartridge of a 9mm bullet.
- Two mobile phones
- Bottles of alcohol and mineral water
- Packs of cigarette
- Wallet
- The body was found lying on the bed
- The pistol was held in the right hand loosely and right hand index finger was partially inside the trigger guard.
- The left arm was held upon the chest with palm and fingers in shape of close fist.
- The blood had passively flown and collected as pool which had been absorbed by the sheet. The pool of blood was adjacent to the bullet injury present on the right side of the skull.

Material and Method

Details of the post-mortem findings of the case were painstakingly explored at autopsy room of Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi. Details of the post-mortem findings were noted in the post-mortem register along with the post-mortem report and those findings were incorporated in the result and discussion section of this study along with information derived from the inquest papers and photographs taken by visiting the scene of crime. The gunshot residue was collected from the hands as well as from the skull near the entrance wound of bullet. A small cotton wool ball was moistened with dilute hydrochloric acid and each palm was swabbed separately. Area around the bullet entry point was also swabbed. Prior to SEM-EDX test calorimetric screening tests were performed. The swab was treated with triphenylmethylarsonium iodide. This is called Harrison and Gilroy test. Thin layer chromatography was performed using silica plate with the solvent being used was acetone to decide the line of exclusion for Gunshot residue. The collected sample was then sent to Department of Chemical Engineering of Indian Institute of Technology, B.H.U., Varanasi for analysis of gunshot residue using SEM-EDX. This analysis is of both qualitative and semi-quantitative type.

Result

Autopsy findings

External

On external examination the left eye was swollen and black (racoons eye). The right eye was partially opened. Bleeding was seen through from both nostrils, angle of mouth and both ears. Blood spatter was present on both sides of face, around the cheek region, blood spatter was more on the left side, less on the right side. Clotted blood was seen over the lips, below and downwards from both the ala of nose, below nasal septum on both sides of the nose, especially on right side, up to the inner canthus of eye and all over the nose up to glabella region. Clotted blood was also seen on both the lips and both angles of mouth traversing laterally and downwards in a strip like fashion over the chin area 12 cm below and downward from both pinna. Blood spatter were also seen in a scattered manner over upper part of chest and adjacent neck region. A single bullet entry hole was seen on the right side of the temporal region of the skull bone near to temporo-mandibular joint. Bruising was visible around the entry which was star shaped. Dimension of the wound was 2×1 cm in size and brain deep; externally the wound was cruciate in shape. The cruciate/stellate shaped bullet entrance wound was situated on the skull 1 cm medial from the right pinna, 17 cm lateral from nasal crest and 10 cm from right outer angle of mouth. There was no evidence of blackening, burning, singeing of hairs, tattooing, abrasion collar or grease collar around the cruciate

shaped bullet entry wound. Blowback phenomenon is responsible for these findings. Contusion collar was present around the wound. Cadaveric spasm was observed in left hand. Rigor mortis was present all over the body. Post-mortem hypostasis was found to be fixed over the dependent parts of the body.

Internal

On opening the injury present over the skull region, it was found that a gutter fracture was present on the temporal region nearer to temporo-mandibular joint. The entrance wound of bullet was brain deep extending up to the base of brain. The bullet was lodged below the frontal lobe of brain adjacent to sella tersica part of the base of skull. Bevelling was present on the inner table of temporal bone. Sub arachnoid haemorrhage was present all over the brain. Anterior and middle cranial fossa i.e. base of the skull was fractured.

Ballistic Findings

A 9mm bullet was recovered from the base of the brain. The bullet had primary and secondary markings. They were seen over the bullet along with deformity at the tip of bullet due to internal ricocheting effect of the bullet inside the skull with absence of exit wound.

Gunshot Residue Findings

The GSR samples from different places of the body, mainly head region and hand were collected and analysed by us in the presence of technical support of SEM-EDX technician in the Department of Chemical Engineering of Indian Institute of Technology, BHU, Varanasi. To analyse the GSR samples used in this particular gunshot incident. The analysis of GSR began with Harrison and Gilroy test as well as thin layer chromatography as described in material and method. Then these GSR samples were subjected to SEM-EDX test as this is the most common method available in the present time for GSR detection. With the use of semi-automatic pistol the chances of deposition of GSR particles is more on the right quadrant of the face.

Elemental Composition

The gunshot residues when subjected to SEM-EDX test gives the elemental profile of the constituents of GSR detected. It consisted of C, O, Pb, S, Zn, Fe, Cl, Cu, K.

Photograph

The physical form of GSR particles as shown in the SEM-EDX images H-1, H-2, W-1, and W-2 consist of discreet micro-meter sized particles often of a characteristic shape and size. The physical form of GSR particles showed evidence of rapid solidification in the form of spheroid or various other shapes described as non-crystalline, condensed, rounded, fused together or irregular. The size of the particle vary from 0-400 micro-meter in dimension within the meshwork of cotton swab as shown as irregular fibrils used for collecting the GSR from different body regions.

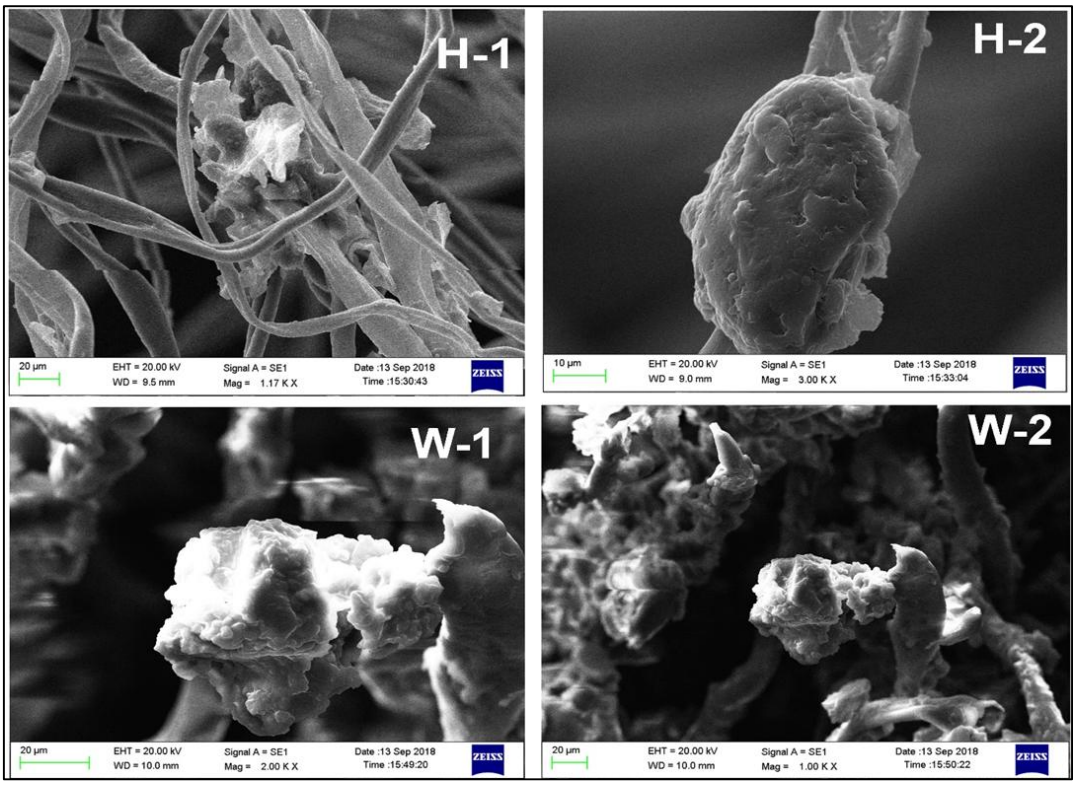

Fig 1: Images H1 and H2are SEM-EDX images of GSR particles taken from head region of the body by cotton swab, which is white in H1 and mixture of white and black in H2, irregular in h1 and spheroid in H2. Irregular white and crystalline in nature ranging from0-400 micro meter in dimension. Images of W1 and W2 are SEM-micrographs of GSR taken from wound track showing spheroidal, irregular and coalesced form of condensed GSR particles.

Tables

Table 1-4 are showing atomic percentage of elements and its weight detected by SEM-EDX of samples collected from Head and Hand region. The chances of detection of GSR is more on the back of the palm as bolt part/action part of semi-automatic 9mm pistol is closer to the hand mainly on its dorsal aspect. The presence of carbon is most abundant in all the four tables, more than 50% weight by percentage as charcoal is one of the main constitutions of black gun powder. i.e. 15 percent of Gunshot Residue. The other major

constituent of element detected from our sample during testing by SEM-EDX were oxygen (O) and Potassium (K), they were slightly less than 50% in almost three samples. The major source of potassium is from potassium nitrate ($KN0_3$), which is 75% of the propellant mixture of the GSR constituents. The main characteristic elements are (Pb, Sb, Ba), out of these three leads was recovered from most of the samples, so it is suggestive of presence of GSR in the sample. The oxygen (O) whose percentage is almost equal to percentage of potassium is derived from potassium nitrate (propellant) and lead peroxide (constituent of Primer Mixture). Elemental sulphur was also detected via SEM-EDX as it is constituent of black gun powder (10% in quantity). The presence of copper (Cu) as a constituent of GSR originates from either cartridge case or bullet jacketing. The presence of iron and zinc in the GSR sample originates from part of the firearm used in this particular case which is known as metallic fouling.

Table 1-4: showing atomic percentage of elements detected by SEM-EDX of samples of GSR collected from different body regions.

Element	Weight%	Atomic%
C K	51.83	58.95
O K	47.98	40.97
Cl K	0.19	0.07
Totals	100.00	

Element	Weight%	Atomic%
C K	67.09	73.41
O K	32.17	26.42
Si K	0.31	0.14
Pb M	0.43	0.03
Totals	100.00	

Element	Weight%	Atomic%
C K	56.24	63.43
O K	42.98	36.39
Fe K	0.73	0.18
Zn K	0.04	0.01
Totals	100.00	

Element	Weight%	Atomic%
C K	70.86	79.34
O K	22.81	19.18
S K	0.55	0.23
Fe K	2.27	0.55
Zn K	3.39	0.70
Pb M	0.11	0.01
Totals	100.00	

Images

Images H1 and H2 are samples of hand swab; W1 and W2 are samples of the wound track. These images are showing individual peaks of the elements present in the sample.

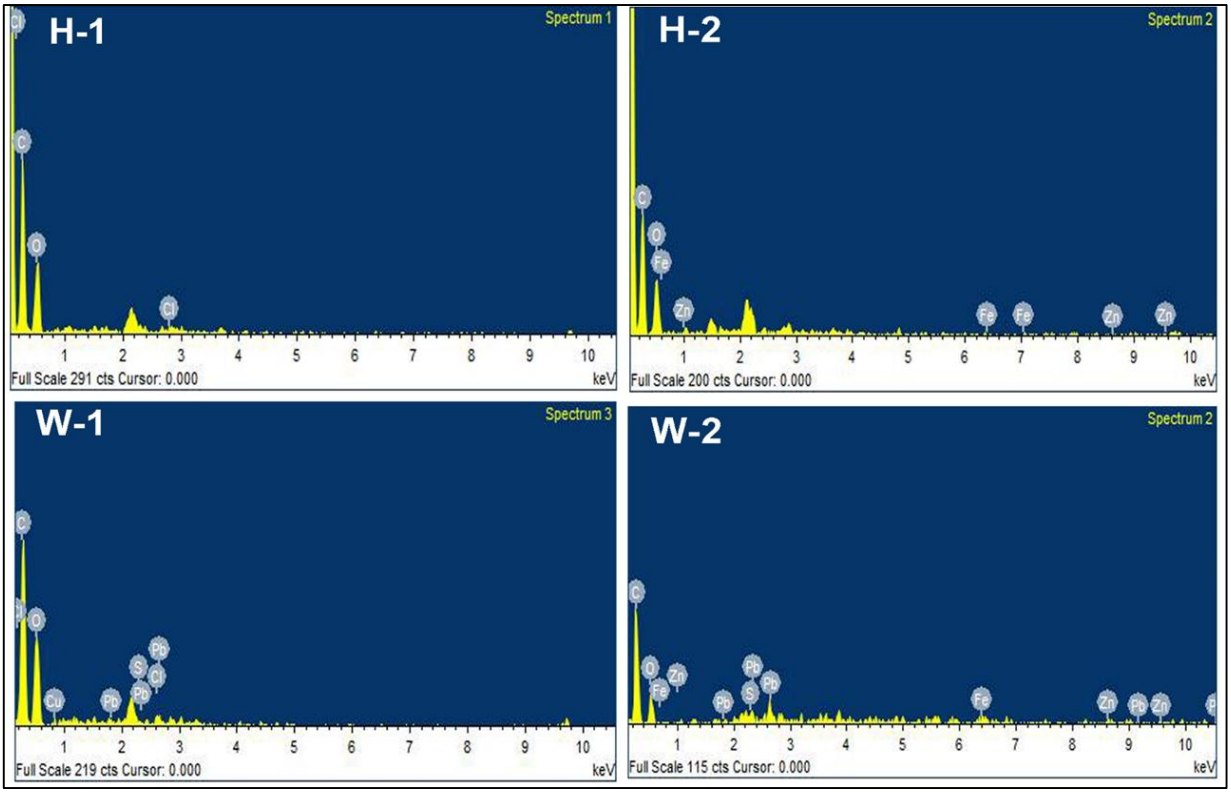

Fig 2: Spectra H1 and H2 are elemental peaks of GSR taken from hand region of the victim. Spectra W1 and W2 are elemental peaks of GSR collected from the wound track of suicide victim.

Cause of Death

The person died due to coma as a result of firearm injury to head and brain region.

Discussion Of Post mortem Findings

The physical evidence, in shooting cases, consist of firearms, ammunition and the injuries. Their evaluations provide answers to many questions. It has been found that males show a higher percentage of suicide rate. In 2005, 57.6% of men and 30.9% of women committed suicide using firearms (United States).

The most common site of suicidal entrance wound is head. The region involved includes temple region, centre of forehead, under the chin, inside mouth, left side of chest and rarely epigastrium. Of the 203 -gunshot suicide (by Molina et al) the head was the most common location for a suicidal

shotgun wound (74%) followed by chest (20%). Analysis of the specific head location reveals the most common location to be intra-oral (50%), followed by submental, i.e., under the chin (19%), side of head, including parietal and temporal wounds (15%): and the face, including the forehead [7] and usually only one entrance wound is found. In this case the head was involved. The bullet had entered from the temporo-mandibular joint. It was lodged in the brain. After passing through the brain, there is no velocity left in bullet to penetrate the skull. It may richochet from the inner table of the skull, producing a second track. If it ricochets for a second time, a third track is produced [8]. Bleeding from nose indicated fracture of anterior cranial fossa, bleeding from ears was suggestive of fracture of medial cranial fossa. Due to the bullet hitting the middle cranial fossa temporo-mandibular joint bleeding was prominent from the mouth as well.

This was a contact shot with skin over shallowly situated bone i.e. skull. Here the gas and other effects are forced through the scalp, but the shallowly situated bone serves as a barrier to the rapid deep expansion of gases. The skull tends to blast out around the muzzle of the firearm, everting the tissue and imparting it an 'explosive' or 'eruptive appearance' or blowback phenomenon or blast effect. When the gas volume is large the dome may then split, resulting in a cruciate, stellate, tri-radiate or ragged wound with skin flaps [9].

In case of a contact shot of the head with a revolver or as is the case here i.e, semiautomatic pistol the wound is frequently star shaped due to tears which radiate from the sides of wounds. These tears are caused by the blast effect which follows the sudden release of gases into a confined area, between the tightly adhered skin and underlying bone [10].

The suicide was supported by previous history of depression. It has been found that many times suicide is backed by previous psychiatric illness, insanity or financial loss [4].

In 1641 of the gunshot suicide cases reported by Kuhlmeier et al, toxicological analysis was performed. In 31.9% of these cases the alcohol level was 0.05g/dl or higher. Most individuals who commit suicide with a firearm, like suicide victims in general, do not leave a suicide note [7].

The subcutaneous tissues in and immediately adjacent to the bullet track may have a "cherry red" colour as a result of localized carboxyhaemoglobin formation created by carbon monoxide in the muzzle blast [11].

When a number of shots are fired through a rifle small portions of the outside of the bullet are frequently removed during its passage down the bore and left adhering to the surface of bore. At first only the smallest particles of the bullet strip, but these may become almost fused on to the inside of the barrel by the extreme heat generated, and are not easily removed. The uneven projections thus formed scrape the surface of each successive bullet and gradually increase in size until the barrel becomes badly fouled with what is termed 'metallic fouling' [12].

Discussion Related to Sem-Edx

There are several techniques for the examination of GSR. However, Scanning Electron Microscope coupled with an EDX (Energy Dispersive X-Ray) analyser is considered the best for elemental analysis of unique GSR trio elements (Pb, Sb, Ba). The energy source of SEM shoots a beam of electrons directly on to the GSR particle on an adhesive stub. The primary electron beam interacts with the material. This process releases energy in the form of characteristics X-rays of the relevant elements [13]. Moseley's law is the basis for elemental analysis with EDS [14].

The spectrum provides both qualitative/quantitative analysis. Computers have facilitated the location of particles on the stub and the identification/quantization of various elements through dedicated software [13].

The most common methods for analysing GSR in use today are ICP-AES a variant of FAAS and SEM-EDX. ICP-AES and SEM-EDX methods are based on metallic elements principally Sb-Pb-Ba originating from primers. ICP-AES is an analytical technique used for the detection of trace metals. The deficiency in this procedure is that it lacks specificity for GSR. Particles of lead- antimony-barium are considered characteristic of GSR, analysis on the hands of firer by SEM has been positive up to 12 hours after they fired the weapon. Testing comparing the efficacy of ICP-AES and automated SEM-EDX in screening living individuals suspected of having fired a gun revealed positive results in 3.9% by ICP-AES/FAAS and 31.6% by SEM-EDX.

Black gunpowder is a mixture of KNO_3, sulphur and charcoal with proportion of 75:15:10. It is not suitable for high velocity ammunition. Gunpowder is commonly used in muzzle loading firearm, mining and rifling of shotgun cartridge [15].

The authors concluded that with a pistol, the maximum quantity of GSR is in the right front quadrant with maximum number of GSR particles in an inside environment, several hundred in an outside environment approximately 3m from shooting arm. Detection of primer residue on the palm of hand instead of the back of suspected firing hand is suggestive of homicidal firearm wound hand. In suicide with hand guns primer residue on the palm may be due to cradling the gun with this hand at the time of firing. Stone found that of individuals who committed suicide with centrefire revolvers, in only 50% of the cases were hand washings positive for GSR whereas in case of semi-automatic pistols this dropped down to 32%. In case of auto-loading pistols, 29% of individuals were found to have metallic residues detected on the hands. The term gunshot residue should be used rather than primer residue or cartridge discharge residue. GSR originates in part from firearm, cartridge case and bullets with most of the inorganic residue resulting from primer.

The classic 3components (Pb- Sb- Ba) are spheroid particles present in GSR and they are characteristic of GSR rather than unique to GSR. Particles containing only two of the three components should be described as commonly associated with GSR, consistent with GSR, and/or indicative of GSR.

In regard to collection of GSR, by De Gaetano and Harrison revealed that GSR collected from the hands of suicide victim at the morgue was positive 76% of the time whereas GSR collected from the hands of suicide victims at the scene of crime was positive 92% times [7].

Fig 3: Close contact wound shoeing pistol grasped in the right hand with index ginger over the trigger guard. Cadaveric spasm present in both the hands along with blood spatter over the face and chin region.

Fig 4: Image of the victim showing him lying in the pool of blood after shooting himself.

Fig 5: Semi-automatic pistol recovered from victims hand from crime scene

Fig 6: Twin images of the crime scene prior to shooting incident

Fig 7: Image of the frontal view of face with bleeding through mouth, ear and nostrils along with ectopic bruise on the left eye

Fig 8: Cruciate shaped firearm entrance wound on the temporal region, sidewise below and medially to right pinna, with blood spatter

Fig 9: Left hand of the victim in cadaveric spasm after shooting himself.

Fig 10: Temporal, Parietal and Occipital lobe of right cerebral hemisphere showing sub-dural and sub arachnoid haemorrhage due to bullet entry wound.

Fig 11: The sella turcica region of the base of skull where bullet was ultimately lodged.

Fig 12: Bullet recovered from the brain showing primary as well as secondary marking along with deformity at the apex of images.

Conclusion

Autopsy, ballistic, forensic chemistry and lab findings were evaluated in order to conclude our study as a case of suicide. These days suicide by use of firearm weapons is on a rise in male population of each and every class. These types of cases are found frequently both in highly educated to undereducated group of people in order to come out with a solution to tackle the miseries or hardship of life. Frankly speaking suicide by whatsoever means is not a solution of stress and strain which we encounter in day to day life in this modern era.

Acknowledgement

We are sincerely thankful to all the technical and supportive staff of Department of Forensic Medicine, I.M.S., B.H.U., Varanasi (India) and Department of Chemical Engineering IIT, BHU., Varanasi (India) for providing all necessary help as when needed.

Conflict of Interest

Nil

Source of Funding

This research was financially supported by University Grant Commission.

Ethical Clearance

The present study was approved by "Institutional Ethical Committee" of Institute of Medical Sciences, Banaras Hindu University, Varanasi. All the information has been taken under consideration of medical ethical committee

Statement of Informed Consent

As this case report was prepared from medico-legal autopsy done at our departmental mortuary, hence we had statutory authorization to do post-mortem examination as well as to publish the findings in the field of scientific journals for literary benefit of young and budding Forensic Science as well as Forensic Medicine aspirants. As per the rules of consent described in Forensic medicine textbooks as well as different scientific literatures of Forensic Medicine, informed consent is needed only in pathological autopsy not in medico-legal autopsy.

References

1. Heard JB. Handbook of Firearms and Ballistics. 2nd edition. A John Wiley & Sons, Ltd., Publications, 2008.
2. Aggrawal A. Textbook of Forensic Medicine and Toxicology. Avichal Publishing Company, 2016.
3. Reddy KSN. The Essentials of Forensic Medicine and Toxicology. 33rd edition. Jaypee Brothers Medical Publishers, 2014.
4. Biswas G. Review of Forensic Medicine & Toxicology. 3rd edition. Jaypee Brothers Medical Publishers, 2015.
5. The Economic Times. Number of suicides highest in Army amongst three services, 2019. [online] Available at:https://economictimes.indiatimes.com/news/defence/number-of-suicides-highest-in-army-amongst-three-services/articleshow/67422380.cms [Accessed 25 Apr. 2019].
6. More Indian soldiers killed by themselves than by enemies [Internet]. The Week, 2019. [Cited 25 April 2019]. Available from: https://www.theweek.in/news/india/2018/08/06/more-indian-soldiers-killed-by-themselves-than-by-enemies.html.
7. DiMaio JMV. Practical Aspects of Firearms, Ballistics, and Forensic Techniques. 3rd edition. CRC Press, 2016.
8. Magendran J. Forensic Medicine Nothing Beyond for PGMEE. 2nd edition. CBS Publishers, 2018.
9. VIJ K. Textbook of Forensic Medicine and Toxicology: principles and practice. Elsevier India, 2014.
10. Spitz UW, Fisher SR. Medico-legal Investigation of Death: Guidelines for the application of pathology to crime investigation. 1st edition. Charles C Thomas Publisher, 1972.
11. Adelson L. The Pathology of Homicide. 1st edition. Charles C Thomas Publisher, 1974.
12. Metallic Fouling and Wear - Forensic Ballistics [Internet]. Bevfitchett.us, 2019. [cited 25 April 2019]. Available from: https://www.bevfitchett.us/forensic-ballistics/metallic-fouling-and-wear.html
13. Sharma BR. Firearms in Criminal Investigation and Trials. 5th Edition. Universal Law Publications, 2017.
14. Hafner B. Energy Dispersive Spectroscopy on SEM: A Primer.
15. Rao MS, Maithil BP. Explosion Cases: Crime Scene Management-a Forensic Approach. 2nd edition. Selective and Scientific Books.