ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Critical Components of the Criminal Justice System, the Medical-Legal Autopsy and Forensic Science Laboratory

MdNazeerulla Shaik[1], Niranjan Kumar Gunjan[2], Sundaragiri Suraj[3]

[1]Assistant Professor, Department of Forensic Medicine & Toxicology, Kakatiya Medical College, Warangal, Telangana, India.
[2]Associate professor, Department: Forensic Medicine & Toxicology, Veer Chandra Singh Garhwali Government Institute of Medical Science and Research, Srinagar, PauriGarhwal, Uttarakhand, India.
[3]Assistant Professor, Department of Forensic Medicine and Toxicology, Gandhi Medical College, Secunderabad, Telangana, India.

Abstract

Background: Toxic exposure claims the lives of thousands of people every year in India, making it one of the countries with the highest poisoning rates in the world. Viscera examination in a forensic science lab can help determine the sort of poison used in an attack, but it's crucial to keep in mind that chemical analysis findings aren't always accurate.

Material and Methods: In this one-year retrospective study, the viscera sent to toxicology and DNA section of FSL during autopsy at mortuary of Department of Forensic Medicine & Toxicology, Kakatiya Medical College, Warangal, Telangana, India. Out of 250 autopsied cases, in 107 cases viscera has been forwarded to Toxicology section of forensic science laboratory.

Results: From the 250 autopsied cases, 107 had viscera sent to the Toxicology division of the forensic science laboratory, and from the 17 undetermined cases, either femur bone or liver tissue was sent to the DNA section. The DNA section has been provided with viscera in 43 cases, and the resulting reports have been forwarded to the appropriate courts.

Conclusion: This research aids in understanding the function of the Forensic Science Laboratory in determining the ultimate cause of death in cases of poisoning through the identification of the specific poison through chemical analysis of viscera.

Keywords: Critical components, criminal justice system, medical-legal autopsy and forensic science laboratory.

Corresponding Author: Dr.SundaragiriSuraj, Assistant Professor, Department of Forensic Medicine and Toxicology, Gandhi Medical College, Secunderabad, Telangana, India.

Introduction

Since most incidents of poisoning go undetected, especially in third-world nations, it is estimated that poison is directly or indirectly responsible for more than 1 million illnesses worldwide annually.[1,2] There are an estimated thousands of annual deaths in India due to poisoning, making it one of the countries with the highest rates of poisoning worldwide. Whereas the poisoning death rate is about 1-2% in affluent countries, in India it ranges from a staggering 15% to 30%.[3] Every time a person dies from poisoning, an investigation must be conducted to determine whether or not the death was caused by poisoning, using conventional analytical procedures.[4-6] In order to do this, the coroner or pathologist doing the autopsy will need to collect specific bodily fluids and organs, which will then be sent to the nearest Forensic Science Laboratory via the police. Before determining the cause of death, the medical examiner should look at all available evidence, including the patient's medical records, statements from witnesses, and his personal examination of the body.[7-10]

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

The study of how medical expertise can be used in legal proceedings is the focus of forensic medicine.[11] In order to solve crimes and aid the legal system, forensic scientists apply their medical, scientific, and technical expertise. All of India's district headquarters house forensic science labs. Forensic scientists instruct law enforcement on how to properly gather evidence at a crime scene and then evaluate it, providing invaluable assistance to investigators.[12-14] The infrastructure in a modern forensic science laboratory is highly specialized, highly rationalized, and built to international standards [15,16]. It can handle any complex scientific task involving criminal activity. Criminal cases filed under the Indian Penal Code (I.P.C.), the Criminal Procedure Code (CrPC), the National Disaster Preparedness Act (NDPA), the Explosive Substances Act (ESA), the Petroleum Act (MPC), the Bombay Prohibition Act (BPA), the Motor Vehicles Act (MVA), the Intact Act (India), the Wild Life Protection Act (TATA), the Trafficking in Persons with Disabilities Act (MCOCA).

Material and Methods

In this one year retrospective study, the viscera sent to toxicology and DNA section of FSL during autopsy at mortuary of Department of Forensic Medicine & Toxicology, Kakatiya Medical College, Warangal, Telangana, India, were analyzed between the period of January 2021 to December 2021.

The following organs should be sent in any suspected case of alcohol poisoning:

1. The stomach and its contents, along with any preservatives and common salt solution.
2. Liver and kidney pieces preserved with ordinary salt solution.
3. Blood: sodium fluoride as a preservative.
4. Controlled solution of table salt.

A thorough proforma was created for the study that includes the status of chemical analysis reports, including whether they have been received or are still pending, the status of poison detection in chemical analysis reports, and the kind of poison that has been found. SPSS Statistic 17 and Microsoft Office Excel 2003 were used to statistically evaluate the data. Data were examined as percentages (%) and proportions.

In all unidentified bodies, the following viscera should be sent for DNA testing:

1. Femur bone, which doesn't need to be preserved.
2. Liver-preservative-normal saline pieces.

Sample collection technique in the forensic science lab:

1. Steam distillation was used to separate blood, finely minced tissue samples, and preservative. The distillate was then collected.
2. At acidic, neutral, and basic pH, finely minced tissue samples, blood, and preservative were treated to Liquid-Liquid Extraction (LLE) using dichloromethane/diethyl ether/ethyl acetate. Phase separation was followed by purification, drying by evaporation, and reconstitution with methanol of the organic layer.
3. Blood was mixed with zinc granules as a preservative, along with finely diced tissue samples. After that, the fumes were run through the SDDC-morpholine reagent.
4. Wet digestion/protein precipitation was applied to finely diced tissue samples, blood, and preservative, and then the mixture was filtered.

The forensic science lab's method of analysis and identification is as follows:

1. Volumetric titration/gas chromatography and color tests were used to check the distillate from sampling procedure 1 for the presence of alcohols.
2. Take a sample approach extract Color tests, thin-layer chromatography techniques, and high-performance thin-layer chromatography were used to examine 2 for the presence of pesticides, medicines, and alkaloids.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

3. Color tests were used to check the distillate from sampling procedure 1 for the presence of cyanide.
4. Color tests were used to check the filtrate from sampling technique 4 for hazardous metal ions and anions.
5. Color assessments and UV-visible spectrophotometry were used to check the reagent from sampling procedure 3 for the presence of phospide ions.

RESULTS

Table 1: statistical data from toxicological testing

Months	Total no of autopsies	Viscera sent to toxicology section	Viscera sent to DNA section
January	30	10	01
February	20	11	02
March	18	08	06
April	20	06	00
May	25	09	03
June	25	11	00
July	20	15	00
August	30	06	00
September	10	03	01
October	21	14	02
November	21	11	00
December	10	03	02
Total	250	107	17

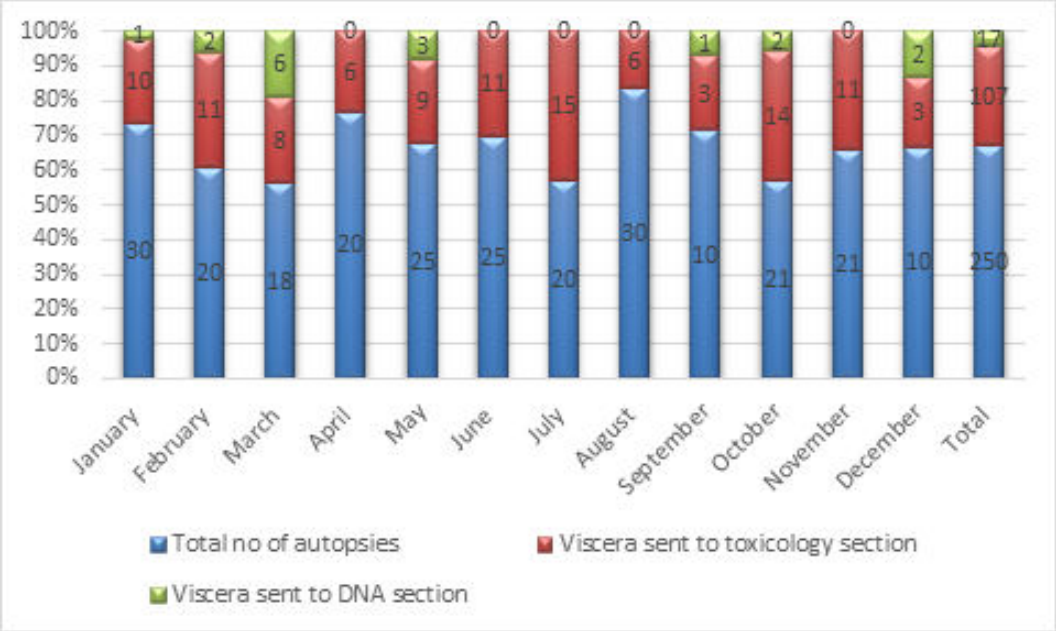

Figure 1: statistical data from toxicological testing

In 107 of the 250 cases that were subjected to an autopsy, the viscera was sent to the Toxicology division of the Forensic Science Laboratory, and in 17 of the instances involving unidentified remains, either the femur bone or liver tissue was sent to the DNA section.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Viscera have been sent to the DNA section in 43 of the cases, and the reports on those cases have been sent to the honorable court [Table 1 and Figure 1].

DISCUSSION

The major purposes of a forensic science lab are to analyze trace evidence (blood, hair, fiber, etc. from victim, accused, and the scene of the crime and link the three together) and to reconstruct crimes. Services for the objective scientific evaluation of evidence are offered by forensic science laboratories. When providing medicolegal services, doctors must submit the evidence gathered during medical examinations to a forensic science lab for review. As a result, medical professionals require familiarity with laboratory infrastructure, procedures, and services. Federal, state, county, and municipal crime laboratories whose funding comes exclusively from the government or whose parent organization is a government entity are the targets of the Census of Publicly Funded Forensic Crime Laboratories (CPFFCL).[16,17] All organizations whose primary function is to examine physical evidence in criminal matters and provide reports and testimony to courts of law regarding such evidence fall under the purview of the CPFFCL. This includes organizations whose scientists have a bachelor's degree or higher in chemistry, physics, biology, criminalistics, or a closely related forensic science field. Crime labs (forensic labs) in the United States can be run by the government or the private sector, with the latter often not dispatched to crime scenes to collect evidence. Each municipality, county, state, and nation has its own network of public crime labs. If a police department does not have its own crime lab, it can often use the services of a more advanced lab at no cost to the department.[18]

Oklahoma, for example, has the Office of State Bureau of Investigation (OSBI), and many other states have their own, often smaller but still adequate, crime labs. Both the first American crime laboratory (1923) and the precursor to the Federal Bureau of Investigation (1926) were established by the Los Angeles Police Department. Connie Fletcher interviewed the director of a forensics lab for her 2006 book, Every Contact Leaves a Trace (St. Martin's Press: New York). Research by Pelicao found that acute cyanide toxicity was the cause of death in both cases because of high concentrations found in the blood, stomach content, and hepatic exudate (only in Case 2). The circumstances of death in Case 1 are consistent with suicide based on evidence gathered at the site, including the location of the body, signs of self-administration of the cyanide salt, and the suicide note. Death circumstances in instance 2 have not been established pending further inquiry (accidental death and suicide are the main hypothesis).[19,20]

Research by Roya confirmed the presence of drugs in the bodies of people who had committed suicide by analyzing postmortem samples in a forensic toxicology lab. Thin-layer chromatography, high-performance liquid chromatography, gas chromatography/mass spectrometry, headspace gas chromatography, and a gas chromatograph with a nitrogen phosphorus detector were all used to analyze the drugs and toxins. Autopsy records of all instances with a verified self-poisoning suicide cause of death were combed through for demographic data. In a five-year study period, 674 cases of self-poisoning deaths were examined, and the results showed that 68.55 percent of the victims were male. Among the youthful population, self-poisoning was the most common means of suicide. Opioids, methamphetamine, organophosphates, cyanide, and strychnine were the next most toxic substances found in postmortem samples, followed by phosphine gas released from aluminum phosphide tablets. Viscera and blood samples from all of the deceased were positive for Endosulfan, Pentazocine, Phenargan, and Ketamine in a research by Sharma.[20,21] A syringe, some food, and Chitarmal's urine were all found to contain endosulfan. Another needle was found to contain ketamine. Homicidal poisoning was indicated by the presence of Pentazocine, Phenargan, Ketamine, and Endosulfan poison, as determined by postmortem

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

examination, laboratory analysis of viscera and blood of the deceased, and food material and exhibits retrieved from the suspect.

CONCLUSION

A thorough autopsy supported by laboratory analysis can greatly aid police investigations in determining guilt or innocence and bringing about quick and proper justice for victims of crimes. The above research suggests that all crimes and crime scenes leave traces in the form of physical evidence corpus delict, which must be processed by a physician at autopsy level and analyzed, evaluated, and opined upon with the assistance of a forensic science laboratory to ensure that the criminal justice system is fairly and impartially served. In order to help bring criminals to justice or clear innocent people of false accusations, medical examiners frequently seek the advice of the experts at the Forensic Science Laboratory when conducting autopsies on unusual or suspicious deaths. Our study found that forensic science laboratory services were used in the majority of autopsies and were crucial to the success of criminal investigations, helping to ensure the integrity of the criminal justice system as a whole.

REFERENCES

1. Pillay VV. Modern Medical Toxicology. 4th edition; Delhi (India): Jaypee Brothers Medical Publishers (P) Ltd; 2013. Pg. 1-36.
2. Job C. A retrospective study of poisoning cases in Thrissur district of Kerala for the year 1995. JIST 2009;5(1):23-27.
3. Gannur DG, Maka P, Reddy KSN. Organophosphorus compound poisoning in Gulbarga region - A five year study. Indian Journal of Forensic Medicine & Toxicology 2008;2(1):3-11.
4. Karmakar RN. J. B. Mukherjee's Forensic Medicine and Toxicology. 3rded; Kolkata (India): Academic publisher; 2007. pg. 921-925.
5. Reddy KSN. The essentials of Forensic Medicine and Toxicology. 29th Ed. Hyderabad: K Suguna Devi; 2010: p 454-460.
6. Vij K. Textbook of Forensic Medicine and Toxicology: Principles and Practice. 5th Ed. New Delhi: Elsevier; 2011: p 446-447.
7. No of Administrative Units. Census of India, 2011. Government of India. [Internet]. [Cited 2017 June 20]. Available from: http://www.censusindia.gov. in/2011-prov-results/paper2/data_files /india/ paper 2_4.pdf.
8. Directorate of Forensic Science Services. Ministry of Home Affairs. Government of India. [Internet]. [Cited 2017 June 20]. Available from: http://dfs.nic. in/sfsl.aspx. 7. Lok Sabha Unstarred Question No.3300. Ministry of Home Affairs. Government of India.
9. Anil A (2016) Forensic medicine and toxicology. Edition 1. Delhi: Avichal publishing company.Forensic science laboratory.
10. Sharma V.K. Poisons, viscera analysis, report and its interrelation. Ind J Medical Tox Legal Med. 2004; 6(2):49-54.
11. Jaiswal AK, MilloT. Handbook of Forensic Analytical Toxicology. New Delhi: Jaypee Brother's; 2014: p450-462.
12. Batra AK, Keoliya AN, Jadhav GU. Poisoning : An Unnatural Cause of Morbidity and Mortality in Rural India. JAPI. 2003;51:955-959.
13. Mohanty MK, Siddhartha P, Arun M, Menezes RG, Palimar V. Correlation between Postmortem diagnosis and survival time in poisoning deaths. J IndAcad Forensic Medicine. 2005; 27(1): 23-27.
14. Pathak AK, Rathod B, Mahajan A. Significance of Gastric Lavage in Viscera of Death Due to Poisoning. J IndAcad Forensic Medicine. 2013; 35 (1): 7-9.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

15. Malik Y, Chaliha RR, Malik P, Jaswal M. Toxicology Unit in Department of Forensic Medicine Emphasis from a Study from North East India. J IndAcad Forensic Medicine. 2012; 34(4): 23-27.
16. Chowdhury, U.K., B.K.Biswas, T.R.Chowdhury, G.Samanta, B.K.Mandal, G.C. Basu, C.R.Chanda, D.Lodh, K.C.Saha, S.K.Mukherjee, S.Roy, S.Kabir, Q. Quamruzzaman, and D.Chakraborti. 2000. Groundwater arsenic contamination in Bangladesh and West Bengal, India. Environ. Health Perspect. 108(5):393– 397.
17. Rajesh B (2011) Principles of forensic medicine & toxicology. Edition 1. Delhi: Jaypee brother's medical publishers. Forensic science laboratory.
18. https://www.bjs.gov/index.cfm?ty=dcdetail&iid=244 5. https://en.wikipedia.org/wiki/Crime_lab
19. Pelicao FS, De-Paula DML, Botelho ED, Hampel G, Pissinate JF, et al. (2018) Forensic toxicological analysis in cyanide poisoning: Two case reports. J Toxicol Anal 1: 1-5.
20. Roya K, Maryam A, Maryam A, Masoud G, Kamran A. (2017) Forensic toxicology analysis of self-poisoning suicidal deaths in Tehran, Iran; trends between 2011-2015. DARU J Pharm Sci 25:15.
21. Sharma M, Khajja BS, Vashistha KN, Bairwa T, Sharma S, et al. (2010) Trace evidence crack a suicide proved homicide: A case study. J Forensic Res 1: 103