

ORIGINAL ARTICLE

To Evaluate the Knowledge, Attitude, and Perception of Students towards Forensic Pharmacology: A cross-sectional study

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Abstract :

The study of forensic pharmacology holds paramount importance among MBBS students due to its vital role in the realm of legal medicine. Understanding the interactions between drugs and the human body is essential in accurately determining the cause of death or injuries in cases of poisoning, drug-related crimes, and overdose incidents. MBBS students equipped with knowledge in this specialized field can help identify the presence of illicit substances in post-mortem examinations, analyse toxicological reports, and provide crucial evidence in criminal investigations. Furthermore, a comprehensive understanding of forensic pharmacology enhances the ability to prescribe medications safely and responsibly, reducing the risk of adverse drug reactions and medical malpractice. Thus, this study is planned to determine the knowledge of Forensic pharmacology among 378 Indian medical graduates through a predesigned google form. Informed consent was obtained, and a brief objective and goals of the study were explained to the students. The obtained results were analysed, which implies that most students were aware of and comprehended the importance of forensic pharmacology. However, a lot of students had trouble understanding how forensic pharmacology would help with victim justice, law enforcement support, and the resolution of drug-related crime cases. Thus, awareness on forensic pharmacology is of utmost importance in preparing the next generation medical professionals to navigate the complex interface between medicine and law.

Keywords: Forensic pharmacology; Toxicological crimes; Expert opinion; Pharmacological jurisprudence.

Introduction :

The branch of medicine known as "forensic medicine" is concerned with using medical knowledge to investigate crimes, particularly for determining what caused injuries or fatalities. Forensic pharmacology is concerned with using pharmacologist expertise for legal purposes. It is a significant and developing topic that presents an opportunity to increase our understanding of medications and how they affect biological systems.¹ In forensic pharmacology, toxicities from frequently consumed pharmaceuticals, often abused pharmaceuticals, pharmaceuticals with no medicinal purpose, and "street" or "designer" drugs are discussed. Although Forensic toxicology and forensic pharmacology are frequently used the same way, the two fields of medicine have important distinctions. Pharmacology deals with the experimentation and synthesis of drugs, while the study of drug effects on biological systems in the context of legal or medical investigations is known as forensic toxicology. It is the application of pharmacological knowledge to legal issues including drug regulation, lawsuit resolution, and criminal justice system functions like identifying the cause of death at a crime scene. Forensic toxicologists examine for signs of toxicological interferences when poisoning or drug use is suspected in criminal

cases include pill bottles, dirty needles, illegal drugs, and trace residue. Whereas forensic pharmacologists investigate drug effects, abuse, and duration of action for the medicolegal process.² A distinct and understandable explanation of pharmacological techniques and knowledge is provided by forensic pharmacology, together with an explanation of the manner in which these are applied to the resolution of various legal issues.³ Pharmacologists' roles in supporting the legal team include interpreting drug action, assessing possible interactions between drugs, assessing how likely it is that drugs will interact with related disease processes, estimating the timescale of events based on the characteristics of the drugs involved, and confirming other evidence by supplying associated data. With this knowledge and the importance of this particular field, this research is being proposed to evaluate medical students knowledge and awareness about the forensic pharmacology and also to create awareness of Forensic Pharmacology in health care.

Materials and methods:

The analysis was carried out upon obtaining of ethical approval from the Institutional Ethics Committee. Data were collected from 378 Indian medical graduates. All the voluntary participants from phase III/I students and Interns were included in the study. A preformed, 20 close-ended questionnaires (Awareness questions – 4, Knowledge based questions – 11, Clinical application - 5) were formulated through a review of the existing literature. Questionnaires were given them after obtaining informed consent. All of the volunteered participants were informed of the study's goal and given instructions concerning how to honestly respond to questions. The responses from students were recorded

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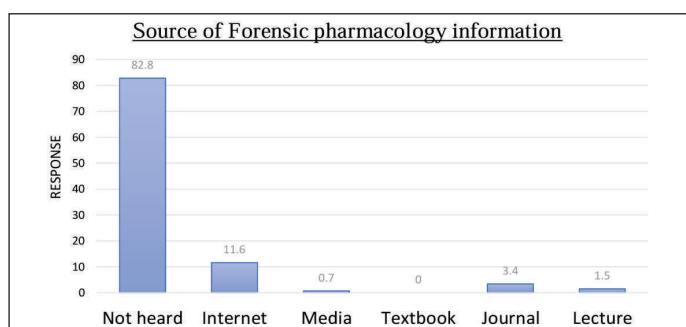


Figure 1. The figure presents a bar graph depicting the sources that provides students with information about forensic pharmacology. The X-axis represents different sources like internet, media, textbook or not heard. Y-Axis represents the number of responses. Each bar on the graph represents the number of responses for each source.

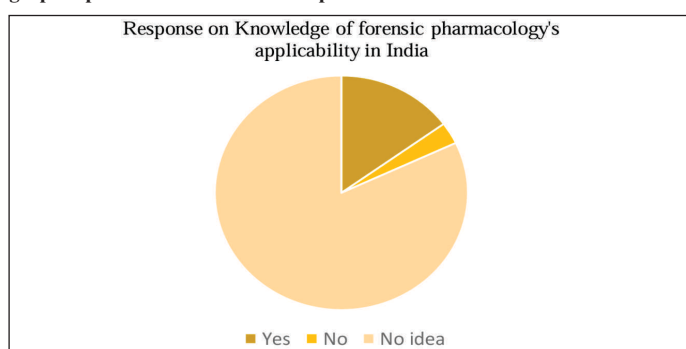


Figure 2. The figure presents a pie chart depicting the response on forensic pharmacology's applicability in India.

in a pre-designed Google form and entered in Microsoft® Excel 2016. Statistical analysis was performed using the Chi-square test for proportionality using IBM SPSS version 20.

Results:

The study involved 400 students in all, 378 of whom provided informed consent to be included in the research. Among them 59% were male and 41% were female. Most of the students (80%) had never heard of forensic pharmacology, around 15% heard the word from Journal and the Internet (Figure 1). In response to questions on knowledge of forensic pharmacology, 95% of students knew that Forensic pharmacologists determine the cause of death in cases involving drug overdose by assessing drug levels and their effects on the body. Only 54% of students knew that by comparing the deceased's medication levels to established reference ranges, forensic pharmacologists can distinguish between therapeutic and toxic drug levels. Only 40% students had knowledge about hair analysis in forensic pharmacology. 77% of students had mentioned forensic pharmacology is a subset of clinical pharmacology which is not true (Table 1). In response to questions on clinical application of forensic pharmacology 95% of students had knowledge on role of forensic pharmacology on post-mortem analysis. Only 34% had knowledge on commonly available methods used for drug testing in forensic pharmacology and only 33% knew the purpose of a chain of custody in forensic pharmacology (Table 3). In response to applicability of forensic pharmacology in India majority of students had no idea of it (Figure 2). In cases where it came to knowledge and clinical application, the test for proportionality

Table 1. Knowledge of forensic pharmacology.

Questions	Number of students n=378		
	Yes (%)	No (%)	No idea (%)
1. Forensic pharmacology deals with the application of pharmacological principles in legal investigations	95	3	2
2. It helps to assess the cause of death and possible drug involvement.	90	1	9
3. Forensic pharmacologists determine the cause of death in cases involving drug overdose by assessing drug levels and their effects on the body	93	4	5
4. Forensic pharmacologists differentiate between therapeutic and toxic drug levels in the deceased by comparing drug levels to established reference ranges	54	5	41
5. Role of forensic pharmacology in cases of impaired driving or DUI (Driving under the influence) by identifying the type and amount of substances in the driver's body	80	3	17
6. Hair analysis in forensic pharmacology provide a long-term history of drug use	40	7	53
7. Technology has had no impact on forensic pharmacology	79	5	16
8. Hair analysis used to assess the deceased person's genetic makeup	43	7	46
9. Forensic pharmacology used to determine the time of death	34	43	23
10. Forensic pharmacology is a subset of clinical pharmacology	77	4	19
11. Forensic pharmacology used to determine whether the drugs were a factor in a person's behaviour or actions	68	17	15

Table 2. Clinical application of Forensic pharmacology.

Questions	Number of students n=378		
	Yes (%)	No (%)	No idea (%)
1. In clinical practice, post-mortem pharmacology provide insight into the possible cause of death in cases with drug involvement	95	3	2
2. Difference between therapeutic and toxic drug levels is the minimum concentration required to achieve the desired therapeutic effect, while toxic drug levels are the maximum concentration that can cause harm	80	11	9
3. Common methods used for drug testing in forensic pharmacology are Gas chromatography-mass spectrometry (GC-MS), High-performance liquid chromatography (HPLC), Enzyme-linked immunosorbent assay (ELISA)	34	13	53
4. Purpose of a chain of custody in forensic pharmacology is to ensure that the samples collected are not contaminated or tampered with	33	5	62
5. Gas chromatography is used for separating and identifying drugs in forensic pharmacology	36	3	61

was used to see if there was any statistical difference between correct and incorrect answers. It was found that a statistically significant number of students had sufficient knowledge of forensic pharmacology, but a statistically significant number of students lacked sufficient knowledge of the clinical implications of forensic pharmacology.

Discussion:

The branch of pharmacology primarily focuses on drug classifications, actions, side effects, and therapeutic applications. Pharmacology is described in standard textbooks used in educational institutions as a broad field that encompasses knowledge of the physiological effects, chemical and physical

makeup, absorption, metabolism, excretion, and medical applications of medications. One such textbook is "Goodman & Gillman's The Pharmacological Basis of Therapeutics." Additionally, it defines a drug as an agent that affects living protoplasm.⁴ Poisons and toxic substances are also included in this definition of drugs. The harmful effects of poisons and chemical agents on all biological systems are the focus of toxicology.⁵ In India's medical curriculum, toxicology is a component of forensic medicine. It is defined as the scientific study of identifying medications and toxins in biological samples and using that knowledge to legal and medical issues.⁶ Forensic pharmacology is the study of how drugs affect the body, how long they last, and how they affect people. It helps in the medicolegal process.⁷ Forensic Pharmacology is included as a component of forensic medicine in Parikh's textbook on medical law, Forensic Medicine & Toxicology. It explores the side effects of medications used therapeutically, drugs that are abused, and substances that have no medicinal use. The intersection of pharmacology, toxicology, and forensic medicine is characterised by forensic pharmacology.

The field of pharmacology can now be extended beyond treatments owing to advancements in technology and pharmacology. For pharmacologists, a specialty such as "Forensic Pharmacology" might be beneficial in applying their knowledge to medicolegal difficulties. The basis of forensic pharmacology is the understanding that drug pharmacokinetics and pharmacodynamics alter following death, leading to varying interpretations of test results and potential medical-legal repercussions.⁸ The use or abuse of drugs, personal injury or death from drug exposure, exposure to chemicals in the environment, doping, forensic pharmacokinetics, drug interactions or adverse drug reactions leading to medicolegal issues, and forensic pharmacovigilance are the other areas of forensic pharmacology.⁹

With a few exceptions, it is clear from the graphs and tables that most students understood the significance of forensic pharmacology and were aware of it. However, many students found it difficult to understand how forensic pharmacology would aid in resolving drug-related crime cases, supporting law enforcement, and providing victims' justice. As a result, although the students were interested in and had solid understanding of forensic pharmacology overall, they lacked understanding of its application and interpretation. Numerous universities and educational institutions across the world have specialised departments that teach forensic pharmacology. However, the MBBS program does not have an integrated semester that emphasises forensic pharmacology as a specialty subject. For this reason, a reformed forensic pharmacology teaching system is required. The number of medicolegal cases involving drug usage is rising, which is concerning for the need for forensic pharmacologists. In conclusion, awareness among students on forensic pharmacology is of utmost importance in preparing the next generation of medical professionals to navigate the complex interface between medicine and law.

Conclusion:

The application of medications and poisons that practising doctors encounter, as well as how to assess their medico-legal

role in determining the cause of an illness, damage, or death, are fundamental concepts of forensic pharmacology. It also covers postmortem toxicology and important ideas regarding the medicolegal ramifications of drug usage in humans and its impacts and hazardous actions.⁹ Students should be able to appropriately evaluate pharmacological and toxicological data for medicolegal reasons using forensic pharmacology.

Additionally, they must be able to defend and explain their scientific conclusions, which they will need to do when they testify in court. Toxicological data from various biological sources will be compiled and analysed using precise procedures, which will be further helpful. In the period of growing and changing scientific disciplines, the understanding of these disciplines is becoming more and more important. Investigating the medico-legal cases in India will also provide fresh resources and altogether new perspectives. Also understanding of forensic pharmacology empowers medical students to become competent and responsible prescribers, ensuring patient safety and minimizing the risks of drug-related incidents.

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