July - December 2025 Volume 34 Issue 2
PRINT ISSN: 2277-1867
ONLINE ISSN: 2277-8853

JOURNAL OF FORENSIC MEDICINE SCIENCE AND LAW

Official Publication of Medicolegal Association of Maharashtra

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MULTISPECIALITY, MULTIDISCIPLINARY, NATIONAL
PEER REVIEWED, OPEN ACCESS, MLAM (SOCIETY) JOURNAL
Indexed with Scopus (Elsevier)

Editorial Office Address
Department of Forensic Medicine & Toxicology, Third Floor, Mortuary Building, Lokmanya Tilak Municipal Medical College & LTMG Hospital, Sion, Mumbai, Maharashtra, India. Pin-400 022. Email id: mlameditor@gmail.com Phone: 022-68660000/ +91-9423016325.

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(Official Publication of Medicolegal Association of Maharashtra)
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PRINT ISSN: 2277-1867

ONLINE ISSN: 2277-8853

Editorial

Need of Establishing Mini Forensic Science Laboratories at Every Tertiary Care Institutions

Ravindra B Deokar[a*], Sachin S Patil[b]

[a]Professor (Additional), Department of Forensic Medicine & Toxicology, Lokmanya Tilak Municipal Medical college & LTMG Hospital, Sion, Mumbai-400022. Orcid Id: 0000-0003-1539-1035.
[b]Professor (Additional), Department of Forensic Medicine & Toxicology, Seth G S Medical college & KEM Hospital, Parel, Mumbai-400012.

1. Introduction

In recent years, with transformative advancement in Forensic Medicine and toxicology, there is enhanced scope, precision and efficiency of medicolegal investigations.[1,2] Abiding the technological development and innovations leading Innovative analytical methods helpful for criminal investigations.[3,4] Forensic science laboratories plays crucial role in the criminal investigation system and facilitate collection, analysis and interpretation of physical evidence from crime scenes as well as from the human body examined at hospital before and after death.

In many cases necessary sample preservation and sending the sample for further examination is the integral part of the medicolegal examination at hospitals. There are well set hospital laboratories under department of biochemistry, pathology and microbiology who dealt with analysis and processing of antemortem samples from the patient at hospitals. The samples preserved during autopsy (Postmortem examination) and antemortem examination generally sent to Forensic Science Laboratory as there is no well-developed bed-side analytical laboratories at hospitals which facilitate easy and speedy analysis and further immediate interpretation by forensic experts to aid in criminal investigation. There is need of establishing and developing such mini- forensic laboratory under department of Forensic Medicine at every tertiary care institutions which facilitates the speedy and précised sample analysis at Hospital level. Creating such facilities will increase the future avenues and scope to forensic expert and aid in administering speedy and timely justice.[5, 6]

2. Forensic Medicine & Toxicology:

The tertiary care institution is having Forensic Medicine and Toxicology department under medical college and the forensic experts catering various medicolegal services at the hospitals besides the routine academic work in medical college. It includes antemortem services, post-mortem services and expert advises/ opinions. It involves examining living individuals (cases of injury, sexual assault, alcoholics, addiction, poisoning, age estimation, etc.) and deceased person with collection of biological and other sample helpful as evidence in civil or criminal cases. Various subfields includes Forensic Pathology, Clinical Forensic Medicine, Forensic Psychiatry and Clinical Psychology, Forensic Toxicology including Clinical Toxicology, Forensic Odontology and Forensic Radiology. Besides multiple avenues in improving the forensic services, due to insufficient manpower and other resources these services are

How to cite this article: Deokar RB, Patil SS. Need of Establishing Mini Forensic Science Laboratories at Every Tertiary Care Institutions. J Forensic Med Sci Law. 2025;34(2):1-3. doi: 10.59988/jfmsl.vol.34issue2.1

***Corresponding author**: Dr Ravindra B Deokar, Professor (Additional), Department of Forensic Medicine, Lokmanya Tilak Municipal Medical College & LTMG Hospital, Sion, Mumbai, Maharashtra, India- 400022. Email: ravideo803@gmail.com (M): +91-9423016325.

Article Info: **Received on:** 10.07.2025; **Accepted on:** 25.08.2025. doi: 10.59988/jfmsl.vol.34issue2.1

not well developed.

At present, the main focus at Government medical institution given to autopsy services and some institution providing the clinical Forensic Medicine services as Examination of survivor/accused of sexual assault. The other antemortem medicolegal services generally dealt by casualty medical officer or the speciality expert from Medicine, Surgery, Obstetrics and Gynaecology, paediatrics or super-speciality expert as per need. The Forensic Radiology services are in primitive stage and very few institution started virtual autopsy centre of excellence. Even, Forensic Toxicology services (Poison Information centre, Clinical toxicology, analytical toxicology, etc.) not well developed in most of the medical institutions in India. Very few institutions providing Forensic Odontology medicolegal services which is also in primitive stage and having key issue of expert manpower recruitment.[7]

In many states like Maharashtra, private medical institutions are not given authorization to conduct postmortem examinations and hence, it affects the start of new postgraduate courses in Forensic Medicine leading to scarcity of required forensic experts with increasing medicolegal work. In coming days, more emphasis to be given on starting the most of the core medicolegal services at tertiary care medical institutions through forensic experts catering quality medicolegal services. This will give increased visibility, acceptability, respect, dignity and positive social recognition to the Forensic Experts.

3. Forensic Science Laboratories

The forensic Science Laboratories established to provide for scientific analysis of physical, chemical, biological and digital evidence which is useful for criminal investigations and judicial proceedings. It deals with application of science and technology to aid in detection and investigation of crime. Core functions of Forensic Science Laboratories (FSL) are mainly includes collection, examination, analysis and facilities the interpretation of the biological and other evidence samples by medical officers to link the suspects to victims, crime scenes or criminal acts. It provides the unbiased scientific opinion based on analytic results to assist investigation agencies, police and courts. It facilitates the fact-based decision in important civil and criminal matters. FSLs provides wide range of services in the country such as DNA typing, toxicological analysis, fingerprinting, trace evidence analysis and digital evidence analysis.[8] FSL experts delivers talk with scientific updates their innovative ideas in various scientific gatherings of medicolegal associations.[9-11]

In Maharashtra, we have one (01) Divisional Forensic Science Laboratory at Mumbai, Seven (07) Regional Forensic Laboratories (Nagpur, Pune, Chattrapati Sambhajinagar, Nashik, Amaravati, Nanded & Kolhapur) and five (05) Mini-Forensic Science Laboratories (Chandrapur, Ratnagiri, Dhule, Thane & Solapur). The wide range of analytical services provided through these laboratories with different sections such as Toxicology, Biology, DNA, General Analytical and Instrumentation (Narcotics & Explosives), Prohibition & Excise, Ballistics, Tape Differentiation & Speaker Identification, Psychology, Cyber Forensics and Wild-life DNA Sections. However, considering the large volume of samples from all parts of Maharashtra, the result are generally delayed with waiting period of three (03) months to two (02) Years or more. Also, many times thee is time delay and break in chain of custody from collection of sample to the end test. This leads to negative results in large number of cases.[6, 12]

4. Need of Establishing Mini-Forensic Science Laboratories at every Tertiary Care Institution

In consideration with the huge pendency affecting the timely justice and to facilitate speedy and timely collection and analysis of biological and other evidences collected at tertiary care centres is important. For this, a Mini-Forensic Laboratory (may be named as **Bed-side Forensic Science Laboratory**) can be established to analyse the collected sample immediately at the bed-side at the tertiary care institution under Department of Forensic Medicine of the medical college. The Mini-Forensic Laboratory established at Medical institutions under Forensic Medicine may include followings sections on priorities

a. Forensic Toxicological Analysis.
b. Forensic Biological Analysis
c. DNA Analysis.
d. Cybercrime & Digital Forensic Analytical Services.
e. Forensic Psychological analysis.

5. Merits of establishing Mini-Forensic Science Laboratories at Hospitals

1. **Faster medico-legal investigations:** These labs permit speedy analysis of biological samples (blood, tissues, toxicology), shortening delays in serious crime cases.
2. **Better evidence Preservation:** Handling evidence (DNA, fluids, and trace materials) within the hospital reduces contamination risks and maintains chain of custody.
3. **Reduced burden on central labs:** Centralized forensic labs often face backlogs. Mini labs decentralize workload, improving efficiency and turnaround time.
4. **Enhanced teaching and training:** Medical students and residents gain hands-on exposure to forensic science, strengthening fields like forensic medicine and pathology.
5. **Support in emergency and disaster situations:** In mass casualty events or disasters, on-site labs help in quick identification and analysis.
6. **Strengthening legal system:** Timely forensic reports improve conviction rates and reduce delays in judicial proceedings.

6. Conclusions:

With scientific and technological advancement, starting such facility at tertiary care institutions is need of Hour. This will help for speedy, precise, quality analysis, reporting, interpretation and further aid in administration of justice in court of law.

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