

Second Edition

# Forensic Toxicology

## A Comparative Approach

Taking into consideration that toxicology is a very vast subject, and the facts are difficult to remember, this book is designed to make toxicology easier for the students to learn and study. It will also help the undergraduate and postgraduate students in preparing for their examinations. Medical officers and practitioners will find it useful and handy while dealing with cases of poisoning. This is the thoroughly revised and updated edition of the book.

### SALIENT FEATURES

- It is written in a simple language to elucidate the topics.
- The different poisons of a group are discussed in a comparative point-wise manner.
- They are presented in a tabular form for better understanding, learning and easy comparison.
- Apart from the numerous tabular charts, the book includes about 65 tables and 200 photographs and figures related to poisoning and autopsy findings.
- The guidelines for collection, preservation, dispatch and disposal of viscera and other material in poisoning and other medicolegal cases are included in a separate chapter.
- Deception Detection Test like narcoanalysis, polygraph, etc. for extracting confession in crimes has been also included.
- References are included in the running literature and at the end of each chapter.
- Management of the poisoning has been upgraded to the latest trend so as to be useful in clinical practice.
- Bedside/ color test for the detection of different poisoning have been updated
- Specific Learning Objectives (SLOs), as recommended by MCI, have been incorporated
- Important questions are included to help the undergraduate and postgraduate students in preparing for their examinations
- MCQs are also included to help the students in their PG entrance examinations.

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A Comparative Approach

Ambade



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# Forensic Toxicology

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As per the latest  
CBME Guidelines |  
Competency Based Undergraduate Curriculum  
for the Indian Medical Graduate

- For MBBS, Postgraduate Students of Forensic Medicine and Toxicology, and BPMT Students
- For Students Preparing for NEET-PG and other Entrance Examinations
- Reference Guide for Clinicians and Medical Officers Dealing in Forensic-Toxicological Emergencies

Vipul Ambade



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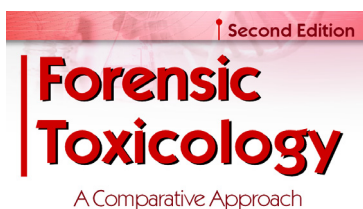


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*to*  

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*my parents*  
*Late Shri Namdeorao Ambade*  
*and*  
*Smt Chandraprabha Ambade*





## Preface to the Second Edition

I am deeply overwhelmed after completing the compilation of the material of the second edition of the book *Forensic Toxicology: A Comparative Approach*. Since publishing the first edition, students, readers, and faculty forum have shared their views, comments and suggestions, particularly regarding the references. When I started to work on the second edition I thought it would be a breeze to add modification, recent advances and references, compared to the Herculean task of creating and publishing the first edition. However, once the work commenced, I realized that this revision would require even greater effort than the first edition; and the prevailing COVID-19 pandemic added further hurdles in it.

The most obvious change in the second edition is the inclusion of the references in the running literature in superscript and at the end of each chapter. The treatment pertaining to poisoning is often overlooked in forensic texts and not considered in clinical practice. Management of poisoning has been upgraded to the latest trends to be useful in clinical practice for the physician. The bedside/color test for the detection of different types of poisoning has been greatly updated. Specific Learning Objectives (SLOs) for each chapter as per the competency based learning recommended by the Medical Council of India for medical graduates have been incorporated. Important questions and MCQs are included in this edition to help students prepare for theory as well as practical examinations.

**Vipul Ambade**

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## Acknowledgments

Since the release of the first edition in 37th Annual Conference of Indian Academy of Forensic Medicine held at BJ Medical College, Ahmedabad, Gujarat, on 17th January, 2016, many students, readers and faculty forums have shared their views, comments and suggestions. To all of them, including in particular the following, my deepest sincere thanks: Dr Chetan Jani, Dr Kalidas Chavan, Dr Numan Hussaini, Dr Rajesh Bardale, Dr Harshwardhan Khartade, Dr Ravindra Deokar, Dr Ulhas Gonnade, Dr Shailendra Dhawne, Dr Jaideo Borkar, Dr Ajit Malani, Dr Manish Tiwari, Dr Ajay Taware, Dr Amol Shinde, Dr Naresh Zanzad, Dr SK Singhal, Dr Ajit Pathak, Dr Mohan Pawar, Dr Pawan Sable, Dr Swapnil Akhade, Dr Pawan Tekade, Dr Sharad Kuchewar, Dr Sachin Gadge, Dr Ravi Meshram, Dr Arun Jaiswani, Dr Ashok Najan, Dr Dayanand Kolpe, Dr Amol Maiyyar, Dr Arti Narde, Dr Shailesh Wakde, Dr Ajay Shendarkar, Dr Praveen Jadhav, Dr Pratik Gilbe, Dr Indrajeet Khandekar and many more with special thanks to Dr Manu Sharma for his overall technical support during the correction of revised edition of this book.

I would also like to acknowledge the unquestionable support of CBS Publishers & Distributors and Mr YN Arjuna (Senior Vice President—Publishing, Editorial and Publicity) along with his entire team for excellent formatting of this book.

Lastly, I am thankful to my wife Dr Hemlata, lovely daughters Vidhi and Aarohi, and my relatives and friends for helping me accomplish the task and extend their support even during the prevailing COVID-19 pandemic.

**Vipul Ambade**



## Preface to the First Edition

It is a great pleasure that I am presenting the book *Forensic Toxicology: A Comparative Approach*. Taking into consideration that toxicology is very vast and difficult to remember, this book is presented in a simple and lucid language. The most important distinguishing feature of this book is that the different poisons of a group are discussed in a comparative point-wise manner in a tabular form for better understanding, learning and easy comparison. Apart from the numerous tabular charts, more than 180 photographs and figures related to poison/autopsy findings are included in this book. A separate chapter on preservation of viscera and other materials containing guidelines for collection, preservation and dispatch; and a new chapter on biological and chemical warfare are also included. Latest trends in the management of poisoning cases have been tried to cover in the book.

While preparing this book, I have gone through various textbooks and journals, and I am indebted to these authors. This book is primarily designed for undergraduate students and I hope it will make toxicology easier for students to learn and study. It will surely help the postgraduate students in preparing for examination and prove useful to the medical officers/practitioners while dealing the case of poisoning. I would definitely welcome the valuable suggestion and healthy criticism, which will be of immense help for future improvement of this book.

**Vipul Ambade**

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# Acknowledgments

I began my career in forensic medicine about 20 years back under the guidance of my teacher Dr AC Mohanty, a man with great vision and tremendous knowledge. While working with him, he not only made me realize the importance of the subject but also changed my outlook towards the dead victim. I gratefully acknowledge him for his guidance and influence which made me to persist my career in forensic.

It is with a great pleasure and deep sense of gratitude that I acknowledge my debt to my respected teacher Dr AP Dongre (Ex-Dean, Government Medical College, Yeotmal) for his affectionate guidance and constant support.

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Finally, I express my sincere gratitude and acknowledgment to my wife Dr Hemlata and lovely daughters Vidhi and Aarohi in accomplishing the task.

**Vipul Ambade**



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# Competencies

## COMPETENCIES RELATED TO TOXICOLOGY FOR COMPETENCY BASED LEARNING AS RECOMMENDED BY MEDICAL COUNCIL OF INDIA FOR MEDICAL GRADUATES

*Number*      *Competency: The student should be able to*

### Topic: Forensic Pathology

- FM2.14** Describe and discuss examination of clothing, preservation of viscera on postmortem examination for chemical analysis and other medico-legal purposes, postmortem artefacts
- FM2.19** Investigation of anaesthetic, operative deaths: Describe and discuss special protocols for conduction of autopsy and for collection, preservation and dispatch of related material evidences
- FM2.35** Demonstrate professionalism while conducting autopsy in medicolegal situations, interpretation of findings and making inference/opinion, collection preservation and dispatch of biological or trace evidences

### Topic: Forensic Laboratory Investigation in Medico-legal Practice

- FM6.1** Describe different types of specimen and tissues to be collected both in the living and dead: Body fluids (blood, urine, semen, faeces, saliva), skin, nails, tooth pulp, vaginal smear, viscera, skull, specimen for histo-pathological examination, blood grouping, HLA typing and DNA fingerprinting. Describe Locard's Exchange Principle
- FM6.2** Describe the methods of sample collection, preservation, labelling, dispatch, and interpretation of reports
- FM6.3** Demonstrate professionalism while sending the biological or trace evidences to Forensic Science laboratory, specifying the required tests to be carried out, objectives of preservation of evidences sent for examination, personal discussions on interpretation of findings
- FM7.1** Enumerate the indications and describe the principles and appropriate use for: DNA profiling, Facial Reconstruction, Polygraph (Lie Detector), Narcoanalysis, Brain Mapping, Digital autopsy, Virtual Autopsy, Imaging technologies

### Topic: Toxicology: General Toxicology

- FM8.1** Describe the history of Toxicology
- FM8.2** Define the terms Toxicology, Forensic Toxicology, Clinical Toxicology and poison
- FM8.3** Describe the various types of poisons and diagnosis of poisoning in living and dead
- FM8.4** Describe the Laws in relations to poisons including NDPS Act, Medico-legal aspects of poisons
- FM8.5** Describe Medico-legal autopsy in cases of poisoning including preservation and dispatch of viscera for chemical analysis
- FM8.6** Describe the general symptoms, principles of diagnosis and management of common poisons encountered in India
- FM8.7** Describe simple bedside clinic tests to detect poison/drug in patient's body fluids
- FM8.8** Describe basic methodologies in treatment of poisoning: Decontamination, supportive therapy, antidote therapy, procedures of enhanced elimination
- FM8.9** Describe the procedure of intimation of suspicious cases or actual cases of foul play to the police, maintenance of records, preservation and despatch of relevant samples for laboratory analysis.

**FM8.10** Describe the general principles of Analytical Toxicology and give a brief description of analytical methods available for toxicological analysis: Chromatography—Thin Layer Chromatography, Gas Chromatography, Liquid Chromatography and Atomic Absorption Spectroscopy

**Topic: Toxicology: Chemical Toxicology**

**FM9.1** Describe General Principles and basic methodologies in treatment of poisoning: Decontamination, supportive therapy, antidote therapy, procedures of enhanced elimination with regard to: Caustics Inorganic—sulphuric, nitric, and hydrochloric acids; Organic—Carbolic Acid (phenol), Oxalic and acetylsalicylic acids

**FM9.2** Describe General Principles and basic methodologies in treatment of poisoning: Decontamination, supportive therapy, antidote therapy, procedures of enhanced elimination with regard to Phosphorus, Iodine, Barium

**FM9.3** Describe General Principles and basic methodologies in treatment of poisoning: Decontamination, supportive therapy, antidote therapy, procedures of enhanced elimination with regard to arsenic, lead, mercury, copper, iron, cadmium and thallium

**FM9.4** Describe General Principles and basic methodologies in treatment of poisoning: Decontamination, supportive therapy, antidote therapy, procedures of enhanced elimination with regard to ethanol, methanol, ethylene glycol

**FM9.5** Describe General Principles and basic methodologies in treatment of poisoning: Decontamination, supportive therapy, antidote therapy, procedures of enhanced elimination with regard to Organophosphates, Carbamates, Organochlorines, Pyrethroids, Paraquat, Aluminium and Zinc phosphide

**FM9.6** Describe General Principles and basic methodologies in treatment of poisoning: Decontamination, supportive therapy, antidote therapy, procedures of enhanced elimination with regard to ammonia, carbon monoxide, hydrogen cyanide and derivatives, methyl isocyanate, tear (riot control) gases

**Topic: Toxicology : Pharmaceutical Toxicology**

**FM10.1** Describe General Principles and basic methodologies in treatment of poisoning: Decontamination, supportive therapy, antidote therapy, procedures of enhanced elimination with regard to: (a) Antipyretics: Paracetamol, Salicylates (b) Anti-Infective, (Common antibiotics—an overview), (c) Neuropsychotoxicology: Barbiturates, benzodiazepines; phenytoin, lithium, haloperidol, neuroleptics, tricyclics, (d) Narcotic Analgesics, Anaesthetics, and Muscle Relaxants, (e) Cardiovascular Toxicology Cardiotoxic plants—oleander, odollam, aconite, digitalis, (f) Gastrointestinal and Endocrinal Drugs—Insulin

**Topic: Toxicology: Biotoxicology**

**FM11.1** Describe features and management of Snake bite, scorpion sting, bee and wasp sting and spider bite

**Topic: Toxicology: Sociomedical Toxicology**

**FM12.1** Describe features and management of abuse/poisoning with following chemicals: Tobacco, cannabis, amphetamines, cocaine, hallucinogens, designer drugs and solvent

**Topic: Toxicology: Environmental Toxicology**

**FM13.1** Describe toxic pollution of environment, its medico-legal aspects & toxic hazards of occupation and industry

**FM13.2** Describe medico-legal aspects of poisoning in Workman's Compensation Act

**Topic: Skills in Toxicology**

**FM14.2** Demonstrate the correct technique of clinical examination in a suspected case of poisoning and prepare medico-legal report in a simulated/supervised environment

**FM14.3** Assist and demonstrate the proper technique in collecting, preserving and dispatch of the exhibits in a suspected case of poisoning, along with clinical examination

- FM14.16** To examine and prepare medico-legal report of drunk person in a simulated/supervised environment
- FM14.17** To identify and draw medico-legal inference from common poisons: Datura, castor, cannabis, opium, aconite copper sulphate, pesticides compounds, marking nut, oleander, Nux vomica, abrus seeds, Snakes, capsicum, calotropis, lead compounds and tobacco.

#### Integration Topics

- PH1.22** Describe drugs of abuse (dependence, addiction, stimulants, depressants, psychedelics, drugs used for criminal offences)
- PH5.7** Demonstrate an understanding of the legal and ethical aspects of prescribing drugs
- IM20.1** Enumerate the poisonous snakes of your area and describe the distinguishing marks of each
- IM20.2** Describe, demonstrate in a volunteer or a mannequin and educate (to other health care workers/patients) the correct initial management of patient with a snake bite in the field
- IM20.3** Describe the initial approach to the stabilisation of the patient who presents with snake bite
- IM20.4** Elicit and document and present an appropriate history, the circumstance, time, kind of snake, evolution of symptoms in a patient with snake bite
- IM21.2** Enumerate the common plant poisons seen in your area and describe their toxicology, clinical features, prognosis and specific approach to detoxification
- IM21.3** Enumerate the common corrosives used in your area and describe their toxicology, clinical features, prognosis and approach to therapy
- IM21.4** Enumerate the commonly observed drug overdose in your area and describe their toxicology, clinical features, prognosis and approach to therapy
- IM21.5** Observe and describe the functions and role of a poison center in suspected poisoning
- IM21.6** Describe the medico-legal aspects of suspected suicidal or homicidal poisoning and demonstrate the correct procedure to write a medico legal report on a suspected poisoning
- IM21.7** Counsel family members of a patient with suspected poisoning about the clinical and medico legal aspects with empathy
- IM21.8** Enumerate the indications for psychiatric consultation and describe the precautions to be taken in a patient with suspected suicidal ideation/gesture

#### Reference

Medical Council of India, Competency Based Undergraduate Curriculum for the Indian Medical Graduate. Volume-1 (2018). UG-Curriculum-Vol-I.pdf (nmc.org.in)