



# ATLAS OF FORENSIC PATHOLOGY

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# ATLAS OF FORENSIC PATHOLOGY

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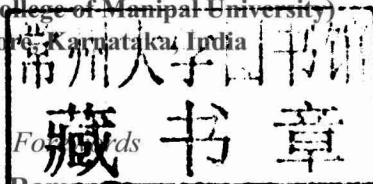
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**Atlas of Forensic Pathology**

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# Foreword

I am delighted to write this message for the *Atlas of Forensic Pathology* authored by Dr B Suresh Kumar Shetty, Dr Prateek Rastogi, Dr Tanuj Kanchan, Dr Jagadish Rao Padubidri and Dr YP Raghavendra Babu. Pictures are invaluable in capturing the interest of the reader. The clarity of the photographs and the full spectrum of the lesions provide a learning opportunity for the neophyte as well as to the specialist. The authors are not only well qualified, but also they have a commitment and experience in teaching Forensic Medicine for several years, in addition to having commendable research publications. Let me extend my warmest felicitations to all the authors and wish them many more publications in the years to come.

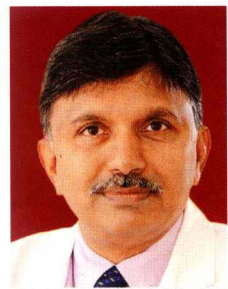


**K Ramnarayan** MBBS MD  
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# Foreword

Healthcare and law enforcement professionals that include the police and the legal fraternity have the unique opportunity to make a difference in the lives of the public by providing justice to the victims of assault, be it trauma, sexual or otherwise. It is the duty of the forensic pathologist to diagnose the various objectives of a medicolegal autopsy, assimilate the medical evidence, and present it in a manner that could be clearly understood by the legal and judicial fraternity that would enable them to deliver justice. A forensic pathologist's job does not end with an autopsy, but foresee issues that could arise, weeks, months, years or even decades after the crime has occurred; hence, a complete understanding of the subject is very essential.



As forensic pathology has progressed over the century from less evidence based to more evidence based, so have the literature and textbooks have improved over the years. *Atlas of Forensic Pathology* is such an example of an accomplishment with numerous photographs, brief but adequate description that would enable the health care, legal and police professionals achieve their goals of providing justice to the society.

The authors have designed the atlas keeping in mind the practical requirements and the needs of the doctors practicing forensic medicine, the lawmakers, and the law enforcing agencies. Every segment of the forensic pathology requirements of the body has been kept in mind while designing the core content of this atlas. The pictures speak volumes of the emphasis on various practical aspects in the practice of the forensic medicine that has been dealt with excellently through illustrations. I would like to compliment the various contributors of this manual for their commitment and efforts to make the challenging practice of forensic medicine much easier.

This manual, though the authors claim to have designed for undergraduates and general practitioners, I strongly feel that it is a very useful book for the postgraduates pursuing MD in Forensic Medicine, police officers and to the legal fraternity.

I strongly recommend this book to be an integral part of learning the art and science of forensic medicine to both the undergraduates and postgraduates of forensic medicine. Not only students, every practitioner of forensic medicine should possess a copy of this manual for ready reference.

**G Pradeep Kumar MD**

Professor

Department of Forensic Medicine

Dean

Kasturba Medical College

Manipal University

Manipal, Karnataka, India

# Foreword

The *Atlas of Forensic Pathology* written by Dr B Suresh Kumar Shetty and his team of forensic experts comprising of Dr Prateek Rastogi, Dr Tanuj Kanchan, Dr Jagadish Rao Padubidri and Dr YP Raghavendra Babu all Associate Professors in the Department of Forensic Medicine, Kasturba Medical College, Mangalore (Manipal University) is an "objective atlas" on this subject and this idea is in fact very much open to questions. The atlas presents a picture of intense subject like Forensic Medicine to a lucid one. On close observation, one may find that these observations, by the editors of this atlas are exceptional. Each individual picture in this atlas is apt and is picked without any bend because the editors would not have selected them otherwise. Details in the form of captions turn out to contain great significance and relevance to the topics. The uncommon conditions made in the various visual inventories reveal things that usually remain invisible or difficult to see in one's career. In contrast to often propagandist tenor of books, this atlas shows a complex reality that lies beyond simplistic and blinding pictorial images.

At the best, I hope that this pluralistic representation can contribute more among the undergraduates, postgraduates, forensic experts, lawyers and police officials. This potent series of alternative copyright-free images can serve as an inspiring freely available tool, which can be used to answer critical questions which are apparently objective.



**DS Badkur** MBBS MD DFM LLB FIAFM

Former President

Indian Academy of Forensic Medicine

# Preface

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It is our pleasure to place before you the *Atlas of Forensic Pathology*, the maiden venture from Department of Forensic Medicine and Toxicology, Kasturba Medical College, (A constituent college of Manipal University), Mangalore, Karnataka, India. Forensic Pathology is one of the major portions of broad specialty of Forensic Medicine comprising mainly of traumatology and thanatology. This atlas has been designed to incorporate a wide range of pictures from topics such as postmortem changes, mechanical injuries, firearm injuries, thermal injuries, road traffic accidents, regional injuries, mechanical asphyxia, transportation injuries, etc.

We hope that it will be useful to practitioners of forensic medicine, casualty medical officers, police persons, undergraduate and postgraduate students of forensic medicine.

**B Suresh Kumar Shetty  
Prateek Rastogi  
Tanuj Kanchan  
Jagadish Rao Padubidri  
YP Raghavendra Babu**



# Acknowledgments

We are grateful to Dr Ramdas M Pai, Chancellor, Manipal University; Dr HS Ballal, Pro-Chancellor, Manipal University; Dr K Ramnarayan, Vice-Chancellor, Manipal University; Dr Surendra V Shetty, Pro Vice-Chancellor, Manipal University (Mangalore Campus), and Dr M Venkatraya Prabhu, Dean, Kasturba Medical College (KMC) (a constituent college of Manipal University), Mangalore, for their constant encouragement and guidance.

Dr G Pradeep Kumar, Professor and Dean, Kasturba Medical College, Manipal, and Dr Vikram Palimar, Professor and Head, Department of Forensic Medicine, Kasturba Medical College, Manipal, for their enriching support.

We like to pen down special thanks to former Heads of our department Late Dr KM Saralaya and Late Dr Anand Menon, for their motivating words in coming out with this book.

We wish to thank Professors and Heads of Department of Forensic Medicine of all neighboring colleges in and around Mangalore, for their valuable feedback and suggestions.

We wish to express our solemn sentiments and sincere thanks to all our colleagues of KMC, Manipal, friends, undergraduates and postgraduate students, and non-teaching staffs of KMC, Mangalore and Manipal.

We wholeheartedly thank Shri Jitendar P Vij (Group Chairman), Mr Ankit Vij (Managing Director) and Mr Tarun Duneja (Director-Publishing) of M/s Jaypee Brothers Medical Publishers (P) Ltd, New Delhi, India, for publishing the book in the same format as wanted well in time.

We acknowledge the wonderful work done by Ms Sunita Katla (Publishing Manager), Ms Samina Khan (PA to Director-Publishing), Mr KK Raman (Production Manager), Mr Rajesh Sharma (Production Coordinator), Ms Seema Dogra (Cover Designer), Mr Sumit (Graphic Designer), Mr Kapil Dev Sharma (DTP Operator) and Mr Sarvesh Kumar Singh (Proofreader) of M/s Jaypee Brothers' typesetting unit, New Delhi, India.

Our sincere thanks to Mr Venugopal V and Mr Vasudev H of M/s Jaypee Brothers' Bengaluru Branch, for taking this book to every corner of Karnataka.



# Contents

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<b>Chapter 1</b>	<b>Thanatology</b>	<b>1</b>
<b>Chapter 2</b>	<b>Mechanical Injuries</b>	<b>33</b>
<b>Chapter 3</b>	<b>Thermal Injuries</b>	<b>81</b>
<b>Chapter 4</b>	<b>Electrical Injuries</b>	<b>103</b>
<b>Chapter 5</b>	<b>Firearm Injuries</b>	<b>106</b>
<b>Chapter 6</b>	<b>Regional Injuries</b>	<b>115</b>
<b>Chapter 7</b>	<b>Transportation Injuries</b>	<b>150</b>
	7a Road Traffic Accidents	
	7b Railway Mishaps	
	7c Aircraft Mishaps	
<b>Chapter 8</b>	<b>Mechanical Asphyxia</b>	<b>164</b>
	<i>Index</i>	<b>189</b>

# Thanatology

Thanatology, (from Greek thanatos, “death”) the description or study of death and is concerned with the notion of death as the branch of science that deals with death in all its aspects.

The following changes are seen after death is classified as:

1. **Immediate Changes (Somatic death)**

2. **Early Changes (Cellular death)**

a. **Skin changes**

The blood circulation to the skin is stopped resulting in pallor and loss of elasticity.

b. **Eye changes**

An early change in eye seen as opacity of cornea and flaccidity of eyeball due to loss of intra-ocular tension, which progressively comes down to zero in about 2 hours.

c. **Algor mortis (Postmortem cooling)**

Is a progressive loss of heat due to; conduction, convection and radiation after death resulting in cooling of body.

d. **Livor mortis (Postmortem lividity)**

A passive pooling imparts reddish-purple or bluish discoloration of skin in dependent parts of the dead body is called as livor mortis with “contact flattening” on pressure areas of the body.

e. **Rigor mortis (Postmortem rigidity)**

A state of stiffening of muscles after death due to physiochemical process due to ATP is progressively and irreversibly destroyed by dephosphorylating and deamination leading to accumulation of lactates and phosphates in the muscles.

**Conditions simulating Rigor Mortis**

**Heat stiffening:** Temperature  $> 65^{\circ}\text{C}$

**Cold stiffening:** Temperature  $< 3.5^{\circ}\text{C}$

**Gas stiffening:** After putrefaction sets in.

**Cadaveric Spasm/Instantaneous Rigor**

In cases of sudden death from excitement, fear, severe pain, exhaustion etc. muscles that were contracted during life become stiff and rigid immediately after death without passing through stage of primary flaccidity due to which exact attitude of person at the time of death is preserved usually limited to single group of muscles frequently involving hands as seen here. This condition is known as Cadaveric Spasm or Instantaneous Rigor or Cataleptic Rigidity of the body.

### 3. Late Changes (Decomposition)

a. **Putrefaction:** Early sign of decomposition is greenish discoloration on right iliac fossa due to hemolysis of red blood cells and the liberated hemoglobin is converted into sulfmethemoglobin by hydrogen sulfide gas may be seen around 12–18 hours after death.

b. **Saponification (Adipocere)**

c. **Mummification**



Modified form of Putrefaction

**Skeletonization** is the removal of tissues from the bones or skeleton, it may be **complete**; where all soft tissues are removed and **partial**, where only a few portions of the bones are exposed.

## Artefacts

It may be regarded as any change caused or feature introduced in the natural state of the body that is likely to be misinterpreted at autopsy. These injuries may be produced by aquatic bites, ants and scavengers, etc.

Postmortem artefacts are due to any changes caused or features introduced in a body after death.

It is duty of medicolegal expert to differentiate artefacts from that of injuries thereby preventing false interpretation of finding and misleading of investigation.

## Types of Artefacts

- A. Resuscitation artefacts
- B. Agonal artefacts
- C. Postmortem artefacts due to:
  - a. Improper handling of the body
  - b. Postmortem changes
  - c. Refrigeration in cold chamber
  - d. Decomposition
  - e. Animal and insect bites
  - f. Autopsy surgeon induced
  - g. Embalming
  - h. Exhumation.

## Forensic Entomology (Entomology of Cadaver)

**Entomology:** Study of insects.

**Forensic entomology:** Use of insect knowledge in the investigation of crime, used in estimation of time since death or postmortem interval (PMI).

**Principle:** As the insects arrive on the body soon after death, estimating age of insects can help in estimation of postmortem interval (PMI).

**Based on:** 1. Directly from the life cycle  
2. Waves of succession! Time of arrival of different species.

**Stages of life cycle**

Egg→Larvae→Pupa→Adult



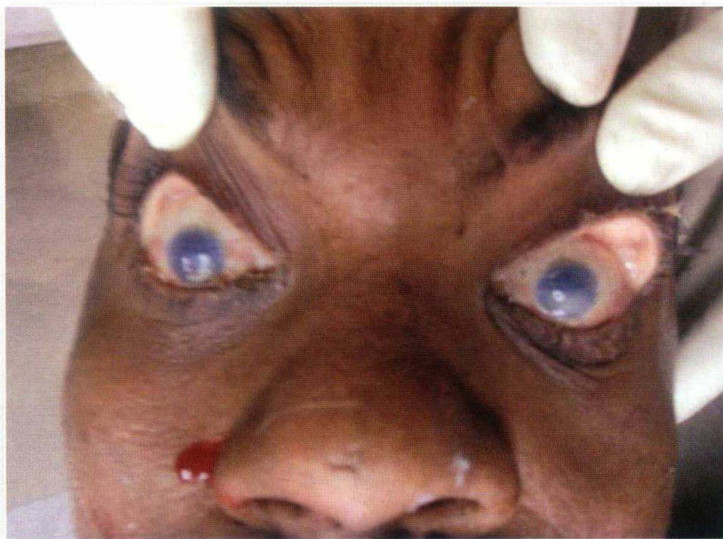


**Figure 1** Tache Noire; an early postmortem change seen in eyes



**Figure 2** Tache Noire seen in the outer angle of left eye





**Figure 3** Clouding and haziness of cornea seen in both eyes



**Figure 4** Sunken eyeballs and corneal opacity in both eyes



**Figure 5** Postmortem lividity on the back



**Figure 6** Postmortem lividity with contact flattening on the back



**Figure 7** Entire body in rigor indicating the posture of the body after death



**Figure 8** Cadaveric spasm in the upper limbs; driver holding the steering wheel at the time of death





**Figure 9** Instantaneous rigor of hand in a case of drowning



**Figure 10** Heat stiffening of the body





**Figure 11** Gas stiffening of the body



**Figure 12** Greenish discoloration on the right iliac fossa and inguinal region