Essentials of Clinical Pathology
Essentials of Clinical Pathology

Shirish M Kawthalkar
Associate Professor
Department of Pathology
Government Medical College
Nagpur, Maharashtra, India
Preface

The major aims of this book are discussion of (i) use of laboratory tests in the investigation and management of common diseases, and (ii) basic biochemical and pathological principles underlying the application of laboratory tests. The book has been written keeping in mind mainly the curricula of undergraduate students of pathology. It should also prove to be appropriate for postgraduate residents and students of medical laboratory technology. The laboratory tests that are demonstrated to and performed by medical students in pathology practical class and during university examination are given in more detail. To keep pace with new knowledge and advances, principles of currently performed techniques in clinical laboratory practice have also been outlined. Most of the chapters are followed by reference ranges and critical values for ready access. Critical values or action values are those laboratory results that require immediate attention of the treating clinician. While interpreting results of laboratory tests, it is necessary to follow two fundamental rules of laboratory medicine: (i) diagnosis should never be made from a single abnormal test result (since it is affected by a number of preanalytical and analytical factors), and (ii) try to arrive at a single diagnosis (rather than multiple diagnoses) from all the abnormal test results obtained.

Clinical pathology is the second major subdivision of the discipline of pathology after anatomic pathology. It is concerned with laboratory investigations for screening, diagnosis, and overall management of diseases by analysis of blood, urine, body fluids, and other specimens. The specialties included under the discipline of clinical pathology are clinical chemistry, hematology, blood banking, medical microbiology, cytogenetics, and molecular genetics. However, scope of this book does not allow microbiology and genetics to be included in this book.

I must appreciate and recognize the unstinting support of my parents, my beloved wife Dr Anjali, and my two children, Ameya and Ashish during preparation of this book. I am thankful to Dr HT Kanade, Dean, Government Medical College, Akola, Dr Smt Deepti Donganekar, Dean, Government Medical College, Nagpur, Dr BB Sonawane, Professor and Head, Department of Pathology, Government Medical College, Akola, and Dr WK Raut, Professor and Head, Department of Pathology, Government Medical College, Nagpur, for encouraging me in undertaking this project for the benefit of medical students.

I express my thanks to Mr JP Vij and his outstanding team of M/s Jaypee Brothers Medical Publishers for undertaking to publish this book, being patient with me during the preparation of the manuscript, and bringing it out in an easy-to-read and reader-friendly format.

Although I have made every effort to avoid any mistakes and errors, some may persist and feedback in this regard will be highly appreciated.

Shirish M Kawthalkar
## Contents

**Section 1**  
Chemical Pathology and Related Studies

1. Examination of Urine ......................................................................................................... 3  
2. Renal Function Tests ......................................................................................................... 30  
3. Diabetes Mellitus ............................................................................................................ 39  
4. Liver Function Tests ......................................................................................................... 52  
5. Disorders of Lipids and Biochemical Cardiac Markers ..................................................... 69  
6. Examination of Cerebrospinal Fluid ................................................................................... 80  
7. Examination of Pleural and Peritoneal Fluids .................................................................. 91  
8. Examination of Sputum ..................................................................................................... 99  
9. Examination of Feces ....................................................................................................... 104  
10. Gastric Analysis ............................................................................................................. 121  
11. Tests for Malabsorption and Pancreatic Function ............................................................ 127  
12. Thyroid Function Tests ................................................................................................... 137  
13. Pregnancy Tests ............................................................................................................. 146  
14. Infertility ......................................................................................................................... 150  
15. Semen Analysis ............................................................................................................... 159

**Section 2**  
Laboratory Hematology

16. Hematopoiesis ................................................................................................................. 169  
17. Collection of Blood ......................................................................................................... 179  
18. Estimation of Hemoglobin ............................................................................................... 183  
19. Packed Cell Volume ....................................................................................................... 188  
20. Total Leukocyte Count .................................................................................................... 192  
21. Reticulocyte Count ....................................................................................................... 196  
22. Blood Smear .................................................................................................................... 200  
23. Red Cell Indices ............................................................................................................. 213  
24. Erythrocyte Sedimentation Rate .................................................................................... 215  
25. Examination of Bone Marrow ....................................................................................... 220  
26. Diagnosis of Malaria and Other Parasites in Blood ......................................................... 229  
27. Laboratory Tests in Anemia ............................................................................................ 244  
28. Laboratory Tests in Hematological Malignancies ........................................................... 273  
29. Laboratory Tests in Bleeding Disorders .......................................................................... 288  
30. Laboratory Tests in Thrombophilia ................................................................................. 311  
31. Laboratory Tests in Porphyrias ...................................................................................... 314  
32. Automation in Hematology ........................................................................................... 319
Section 3
Practical Blood Transfusion

33. Blood Group Systems ................................................................................................................... 329
34. Blood Grouping .......................................................................................................................... 336
35. Collection of Donor Blood, Processing and Storage ................................................................. 341
36. Screening Tests for Infections Transmissible by Transfusion .................................................. 347
37. Compatibility Test (Cross-match) ............................................................................................... 352
38. Adverse Effects of Transfusion .................................................................................................. 354
39. Blood Components ..................................................................................................................... 359

General References .......................................................................................................................... 365
Index ................................................................................................................................................... 367