

NINTH EDITION

Manual *of* Pulmonary Function Testing

GREGG L. RUPPEL

MOSBY
ELSEVIER

Contents

- CHAPTER 1** Indications for Pulmonary Function Testing, 1
Pulmonary Function Tests, 2
Indications for Pulmonary Function Testing, 7
Patterns of Impaired Pulmonary Function, 11
Preliminaries to Patient Testing, 25
Test Performance and Sequence, 29
- CHAPTER 2** Spirometry and Related Tests, 36
David A. Kaminsky
Vital Capacity, 37
Forced Vital Capacity, Forced Expiratory Volume, and Forced Expiratory Flow, 40
Flow-Volume Curve, 53
Peak Expiratory Flow, 61
Maximum Voluntary Ventilation, 63
Before- and After-Bronchodilator Studies, 65
Maximal Inspiratory Pressure and Maximal Expiratory Pressure, 68
Airway Resistance and Conductance, 70
Pulmonary Compliance, 75
- CHAPTER 3** Lung Volumes and Gas Distribution Tests, 90
Jack Wanger
Lung Volumes: Functional Residual Capacity, Residual Volume, Total Lung Capacity, and Residual Volume/Total Lung Capacity Ratio, 91
Gas Distribution Tests: Single-Breath Nitrogen Washout, Closing Volume, and Closing Capacity, 105
- CHAPTER 4** Ventilation and Ventilatory Control Tests, 117
Tidal Volume, Rate, and Minute Ventilation, 118
Respiratory Dead Space and Alveolar Ventilation, 120
Ventilatory Response Tests for Carbon Dioxide and Oxygen, 123
- CHAPTER 5** Diffusing Capacity Tests, 133
Carbon Monoxide Diffusing Capacity, 134
Significance and Pathophysiology, 144
- CHAPTER 6** Blood Gases and Related Tests, 157
pH, 158
Carbon Dioxide Tension, 158

Oxygen Tension, 158
Hemoximetry, 168
Pulse Oximetry, 170
Capnography, 172
Shunt Calculation, 175

CHAPTER 7 Cardiopulmonary Exercise Testing, 185

Carl Mottram

Exercise Protocols, 187
Exercise Workload, 189
Cardiovascular Monitors During Exercise, 192
Ventilation During Exercise, 200
Oxygen Consumption, Carbon Dioxide Production, and Respiratory
Exchange Ratio During Exercise, 208
Exercise Blood Gases, 214
Cardiac Output During Exercise, 219

CHAPTER 8 Pediatric Pulmonary Function Tests, 238

Deborah K. White

Spirometry, 239
Lung Volumes, 254
Diffusion Capacity, 258
Infant, Toddler, and Preschool Pulmonary Function Testing, 260
Standards for Testing, 275
Future for Pediatric Pulmonary Function Laboratories, 277

CHAPTER 9 Specialized Test Regimens, 284

Bronchial Challenge Testing, 285
Exhaled Nitric Oxide, 298
Forced Oscillation Technique, 302
Preoperative Pulmonary Function Testing, 304
Pulmonary Function Testing for Disability, 307
Metabolic Measurements: Indirect Calorimetry, 309

CHAPTER 10 Pulmonary Function Testing Equipment, 327

Volume Displacement Spirometers, 328
Flow-Sensing Spirometers, 335
Peak Flow Meters, 346
Body Plethysmographs, 347
Breathing Valves, 351
Pulmonary Gas Analyzers, 354
Blood Gas Analyzers, Oximeters, and Related Devices, 362
Computers for Pulmonary Function Testing, 375

CHAPTER 11 Quality Assurance in the Pulmonary Function Laboratory, 384

Elements of Laboratory Quality Control, 385
Calibration and Quality Control of Pulmonary Function Equipment, 387
Calibration and Quality Control of Blood Gas Analyzers, 402

Criteria for Acceptability and Repeatability of Pulmonary
Function Studies, 408
Infection Control and Safety, 411

APPENDIX A Answers to Self-Assessment Questions, 421

APPENDIX B Reference Values, 423

APPENDIX C Conversion and Correction Factors, 435

APPENDIX D Regulations and Regulatory Agencies, 437

APPENDIX E Some Useful Equations, 441

APPENDIX F Sample Calculations, 445

APPENDIX G The Mean and the Standard Deviation, 449

Glossary, 451

Index, 465