

Contents

*Contributors to the First Edition*   xiii  
*List of Contributors*   xv  
*Preface*   xxi

Section 1 Medicine

|        |                                                                         |    |
|--------|-------------------------------------------------------------------------|----|
| 1.1    | <b>Bone, Joint and Connective Tissue</b>                                | 1  |
| 1.1.1  | Rheumatoid Arthritis                                                    | 1  |
|        | Jade A Loughran and Sarah F Bell                                        |    |
| 1.2    | <b>Cardiovascular</b>                                                   | 7  |
| 1.2.1  | Preoperative Assessment and Management of Patients with Cardiac Disease | 7  |
|        | Timothy JB Wood and Andrew Weir                                         |    |
| 1.2.2  | Arrhythmias                                                             | 12 |
|        | Rebecca A Leslie and Sophia Henderson                                   |    |
| 1.2.3  | Hypertension                                                            | 17 |
|        | Matthew JC Thomas and Andrew Weir                                       |    |
| 1.2.4  | Ischaemic Heart Disease and Congestive Cardiac Failure                  | 20 |
|        | Alexander Midgley-Hunt                                                  |    |
| 1.2.5  | Postoperative Management of Myocardial Ischaemia                        | 27 |
|        | Michael John Scerri and Andrea Binks                                    |    |
| 1.2.6  | Valvular Defects                                                        | 31 |
|        | Nirav D Patel and Mari H Roberts                                        |    |
| 1.2.7  | Cardiomyopathy                                                          | 38 |
|        | Richard LI Skone and Andrew Weir                                        |    |
| 1.2.8  | Pacemakers                                                              | 41 |
|        | Menanta van Velze and William A English                                 |    |
| 1.3    | <b>Endocrine and Metabolic</b>                                          | 46 |
| 1.3.1  | Hormonal and Metabolic Response to Trauma                               | 46 |
|        | Ashley C Davis                                                          |    |
| 1.3.2  | Endocrine Disease and Perioperative Steroid Management                  | 51 |
|        | Niladri Das                                                             |    |
| 1.3.3  | Obesity                                                                 | 54 |
|        | Caroline SG Janes                                                       |    |
| 1.3.4  | Perioperative Management of Diabetes                                    | 60 |
|        | Andrea Binks                                                            |    |
| 1.3.5  | Calcium and Magnesium Homeostasis                                       | 69 |
|        | Farzad Saadat and Sarah F Bell                                          |    |
| 1.3.6  | Hypokalaemia and Hyperkalaemia                                          | 72 |
|        | Farzad Saadat and Sarah F Bell                                          |    |
| 1.3.7  | Hyponatraemia and Hypernatraemia                                        | 75 |
|        | Farzad Saadat and Sarah F Bell                                          |    |
| 1.3.8  | Hypothermia                                                             | 79 |
|        | Ashley C Davis                                                          |    |
| 1.3.9  | Hyperthermia                                                            | 83 |
|        | Steffan Morgan and Ami Jones                                            |    |
| 1.3.10 | Thyroid Disease and Thyroid Surgery                                     | 88 |
|        | Helen L Jewitt and Stephanie Wallis                                     |    |
| 1.3.11 | Phaeochromocytoma                                                       | 91 |
|        | Caroline SG Janes and Prakash Vadukul                                   |    |
| 1.4    | <b>Gastrointestinal</b>                                                 | 98 |
| 1.4.1  | Enteral and Parenteral Nutrition                                        | 98 |
|        | Caroline SG Janes and Prakash Vadukul                                   |    |

| viii | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | 1.4.2 Nutritional Requirements and Malnutrition 103<br><b>Caroline SG Janes and Prakash Vadukul</b><br>1.4.3 Postoperative Nausea and Vomiting (PONV) 108<br><b>Alison J Brewer</b><br>1.4.4 Oesophageal Reflux 112<br><b>Michael B Clarke</b><br>1.4.5 Pancreatitis 116<br><b>Matt Thomas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 1.5  | <b>Haematological 122</b><br>1.5.1 Blood Groups 122<br><b>Sophia Henderson and Rebecca A Leslie</b><br>1.5.2 Anaemia and Abnormal Haemoglobins 127<br><b>Farzad Saadat and Sarah F Bell</b><br>1.5.3 Abnormalities of Coagulation and Haemostasis including Massive Haemorrhage 132<br><b>Philip Harrington and Justin C Mandeville</b><br>1.5.4 Anticoagulant, Antiplatelet and Anti-fibrinolytic Agents 140<br><b>Benjamin Hofland-Ward, Alexandra K Freeman and Susanna T Walker</b><br>1.5.5 Thromboembolism 150<br><b>Steffan Morgan and Ami Jones</b>                                                                                                                                                                                                                                                                                                                                                    |
| 1.6  | <b>Hepatic Medicine 158</b><br>1.6.1 Hepatic Failure 158<br><b>Matt Thomas</b><br>1.6.2 Jaundice 164<br><b>Dana L Kelly and Andrew Weir</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 1.7  | <b>Neurological and Muscular 169</b><br>1.7.1 Myasthenia Gravis and Muscle Diseases 169<br><b>Helen L Jewitt and Stephanie Wallis</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 1.8  | <b>Respiratory 174</b><br>1.8.1 Pneumothorax 174<br><b>Matthew P Morgan and Stephen Pearson</b><br>1.8.2 Chronic Obstructive Pulmonary Disease and Asthma 177<br><b>Matthew P Morgan and Andrew Weir</b><br>1.8.3 Pneumonia 183<br><b>Matthew P Morgan and Andrew Weir</b><br>1.8.4 Lung Cancer and Interstitial Lung Disease 186<br><b>Alexander Midgley-Hunt</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1.9  | <b>Renal 193</b><br>1.9.1 Renal Failure 193<br><b>Rosada Jackson and Jessie R Welbourne</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|      | <b>Section 2 Surgery</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 2.1  | <b>Cardiothoracic 199</b><br>2.1.1 Anaesthesia for Cardiac Surgery, Cardiopulmonary Bypass and Cardioplegia 199<br><b>Jessie R Welbourne and Katharine Smurthwaite</b><br>2.1.2 Anaesthesia of the Cardiac Patient for Non-cardiac Surgery 206<br><b>Michael John Scerri and Andrea Binks</b><br>2.1.3 Congenital Heart Disease 211<br><b>Luke Foster</b><br>2.1.4 Care of the Postoperative Cardiac Surgery Patient 218<br><b>Luke Foster</b><br>2.1.5 Anaesthesia for Bronchoscopy 228<br><b>Neil Rasburn and Zoe Riddell</b><br>2.1.6 One-Lung Ventilation 233<br><b>Carl J Morris and Zoe Riddell</b><br>2.1.7 Anaesthetic Management of Patients with Transplanted Organs including Heart, Lungs and Kidneys 238<br><b>Asim Iqbal</b><br>2.1.8 Off-Pump Cardiac Surgery 245<br><b>Anandh Balu</b><br>2.1.9 Intra-aortic Balloon Counterpulsation and Other Assist Devices 247<br><b>Philip Harrington</b> |
| 2.2  | <b>DayCase 250</b><br>2.2.1 Daycase Selection 250<br><b>Alison J Brewer</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|        | Contents                                                              | ix |
|--------|-----------------------------------------------------------------------|----|
| 2.3    | <b>ENT</b> 256                                                        |    |
| 2.3.1  | Difficult Airway 256                                                  |    |
|        | <b>Kate Leaper and Jonathan J Gatward</b>                             |    |
| 2.3.2  | Performing a Tracheostomy 262                                         |    |
|        | <b>James W Pearlman and Jonathan J Gatward</b>                        |    |
| 2.3.3  | Bleeding Tonsil and Foreign Body 266                                  |    |
|        | <b>Caroline SG Janes</b>                                              |    |
| 2.3.4  | Obstructive Sleep Apnoea 272                                          |    |
|        | <b>Jade A Loughran and Sarah F Bell</b>                               |    |
| 2.3.5  | Upper Airway Infections 275                                           |    |
|        | <b>Jade A Loughran and Sarah F Bell</b>                               |    |
| 2.3.6  | Anaesthesia and Facial Fractures 280                                  |    |
|        | <b>Gary Thomas</b>                                                    |    |
| 2.4    | <b>Enhanced Recovery</b> 286                                          |    |
| 2.4.1  | Principles of Enhanced Recovery 286                                   |    |
|        | <b>Ruth Doolin</b>                                                    |    |
| 2.4.2  | Minimally Invasive Surgery 290                                        |    |
|        | <b>Lucinda Williams</b>                                               |    |
| 2.5    | <b>Neurosurgery</b> 294                                               |    |
| 2.5.1  | Head Injury and Control of ICP 294                                    |    |
|        | <b>Justin C Mandeville and Menanta van Velze</b>                      |    |
| 2.5.2  | Principals of Craniotomy (including Epilepsy Surgery) 298             |    |
|        | <b>Alexandra K Freeman</b>                                            |    |
| 2.5.3  | Subarachnoid Haemorrhage 303                                          |    |
|        | <b>Justin C Mandeville and Philip Harrington</b>                      |    |
| 2.5.4  | Management of Acute Spinal Cord Injury 307                            |    |
|        | <b>Carl J Morris and Robert Penders</b>                               |    |
| 2.5.5  | Late Management of Spinal Cord Injury 311                             |    |
|        | <b>Carl J Morris and Robert Penders</b>                               |    |
| 2.5.6  | Brainstem Death Testing 316                                           |    |
|        | <b>Benjamin Hofland-Ward and Susanna T Walker</b>                     |    |
| 2.5.7  | Anaesthesia during an MRI Scan 322                                    |    |
|        | <b>Farzad Saadat and Sarah F Bell</b>                                 |    |
| 2.5.8  | Depth of Anaesthesia Monitoring 327                                   |    |
|        | <b>Benjamin Hofland-Ward and Susanna T Walker</b>                     |    |
| 2.5.9  | Electroconvulsive Therapy (ECT) and Anti-psychotics 334               |    |
|        | <b>Amin Elkhawad</b>                                                  |    |
| 2.5.10 | Epilepsy 338                                                          |    |
|        | <b>Imran Mohammad and Stephen Pearson</b>                             |    |
| 2.5.11 | Spinal Surgery and Neuromuscular Monitoring 342                       |    |
|        | <b>Alexandra K Freeman</b>                                            |    |
| 2.5.12 | Anaesthesia for Awake Craniotomy 345                                  |    |
|        | <b>Alexandra K Freeman</b>                                            |    |
| 2.6    | <b>Obstetrics</b> 349                                                 |    |
| 2.6.1  | Physiological and Anatomical Changes of Pregnancy 349                 |    |
|        | <b>Jade A Loughran and Sarah F Bell</b>                               |    |
| 2.6.2  | Anaesthesia in Early Pregnancy 352                                    |    |
|        | <b>Farzad Saadat and Sarah F Bell</b>                                 |    |
| 2.6.3  | Complications of Pregnancy 356                                        |    |
|        | <b>Farzad Saadat and Sarah F Bell</b>                                 |    |
| 2.6.4  | Pre-eclampsia 361                                                     |    |
|        | <b>Jade A Loughran and Sarah F Bell</b>                               |    |
| 2.6.5  | Labour Analgesia 367                                                  |    |
|        | <b>Shakira Nathoo</b>                                                 |    |
| 2.6.6  | Placenta Praevia 370                                                  |    |
|        | <b>Shakira Nathoo</b>                                                 |    |
| 2.6.7  | Grown-up Congenital Heart Disease (GUCHD) in Pregnancy and Labour 372 |    |
|        | <b>Eluned Fisher</b>                                                  |    |
| 2.6.8  | Amniotic Fluid Embolism and Postpartum Haemorrhage (PPH) 376          |    |
|        | <b>Farzad Saadat and Sarah F Bell</b>                                 |    |

| x    | Contents                                   |
|------|--------------------------------------------|
| 2.7  | <b>Ophthalmic</b> 382                      |
|      | 2.7.1 Orbital Anatomy 382                  |
|      | <b>Sethina Watson</b>                      |
|      | 2.7.2 Control of                           |
|      | Intraocular Pressure 388                   |
|      | <b>Sethina Watson</b>                      |
|      | 2.7.3 Penetrating Eye Injury 391           |
|      | <b>Jade A Loughran and Sarah F Bell</b>    |
|      | 2.7.4 Cataract and                         |
|      | Detached Retina 396                        |
|      | <b>Alice Braga</b>                         |
|      | 2.7.5 Strabismus 399                       |
|      | <b>Joy M Sanders and Zoe Riddell</b>       |
|      | 2.7.6 Ophthalmology Local                  |
|      | Anaesthetic Techniques 401                 |
|      | <b>Charlotte Morris</b>                    |
| 2.8  | <b>Orthopaedic</b> 405                     |
|      | 2.8.1 Procedures under Tourniquet,         |
|      | Reperfusion Injury                         |
|      | and Antioxidants 405                       |
|      | <b>Matthew J Aldridge</b>                  |
|      | 2.8.2 Major Trauma, Hospital Triage        |
|      | and Scoring Systems 409                    |
|      | <b>Anandh Balu</b>                         |
|      | 2.8.3 Blood                                |
|      | Conservation Strategies 411                |
|      | <b>Niladri Das</b>                         |
|      | 2.8.4 Bone Cement                          |
|      | Implantation Syndrome 415                  |
|      | <b>Joseph Swani</b>                        |
|      | 2.8.5 Management of                        |
|      | Hip Fractures 418                          |
|      | <b>Daniel El-Dalil</b>                     |
| 2.9  | <b>Paediatric</b> 423                      |
|      | 2.9.1 Principles of                        |
|      | Neonatal Physiology 423                    |
|      | <b>Helen L Jewitt</b>                      |
|      | 2.9.2 Neonatal Resuscitation and the       |
|      | Effects of Prematurity 426                 |
|      | <b>Helen L Jewitt</b>                      |
|      | 2.9.3 Anaesthesia in Infancy               |
|      | and Childhood 429                          |
|      | <b>Jade A Loughran and Sarah F Bell</b>    |
|      | 2.9.4 Pyloric Stenosis 435                 |
|      | <b>Penelope S Colter, Sarah F Bell and</b> |
|      | <b>Caroline SG Janes</b>                   |
|      | 2.9.5 Intussusception 440                  |
|      | <b>Penelope S Colter, Sarah F Bell and</b> |
|      | <b>Caroline SG Janes</b>                   |
|      | 2.9.6 Oesophageal Atresia,                 |
|      | Diaphragmatic Hernia                       |
|      | and Exomphalos 444                         |
|      | <b>Helen L Jewitt</b>                      |
|      | 2.9.7 Child Protection and Non-            |
|      | accidental Injury 448                      |
|      | <b>Nicholas Marsden</b>                    |
| 2.10 | <b>Perioperative Medicine</b> 453          |
|      | 2.10.1 Cardiopulmonary                     |
|      | Exercise Testing 453                       |
|      | <b>Niladri Das</b>                         |
|      | 2.10.2 Preoperative Assessment             |
|      | and Prehabilitation 456                    |
|      | <b>Joseph Swani</b>                        |
|      | 2.10.3 Anaesthetic Considerations          |
|      | for Cancer Surgery 460                     |
|      | <b>Matthew Townsend</b>                    |
|      | 2.10.4 Anaesthesia for the                 |
|      | Elderly 465                                |
|      | <b>Joseph Swani</b>                        |
| 2.11 | <b>Vascular</b> 473                        |
|      | 2.11.1 Abdominal Aortic                    |
|      | Aneurysm Repair 473                        |
|      | <b>Jessie R Welbourne and</b>              |
|      | <b>Kate Palmer</b>                         |
|      | 2.11.2 Anaesthesia for                     |
|      | Carotid Endarterectomy 477                 |
|      | <b>Will H Spencer, Emily K Johnson</b>     |
|      | <b>and Jessie R Welbourne</b>              |
|      | 2.11.3 Anaesthesia for Lower Limb          |
|      | Peripheral Arterial Surgery 486            |
|      | <b>Gary Thomas</b>                         |
|      | 2.11.4 Interventional                      |
|      | Radiology 491                              |
|      | <b>James Harrison</b>                      |
|      | <b>Section 3 Emergency Medicine</b>        |
|      | <b>and Intensive Care</b>                  |
| 3.1  | <b>Emergency Medicine</b> 497              |
|      | 3.1.1 Acute Poisoning 497                  |
|      | <b>Ami Jones</b>                           |

|                                                                                                                           | Contents                                                                                                                                                     | xi |
|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 3.1.2 Burns, Electrocution and Drowning 501<br>Helen L Jewitt, Philip Harrington and Stephanie Wallis                     | 4.1.5 Cranial Nerve Anatomy 569<br>Poonam M Bopanna                                                                                                          |    |
| 3.2 Intensive Care 508                                                                                                    | 4.1.6 Anatomy of the Intrathecal Space 573<br>Alexandra K Freeman                                                                                            |    |
| 3.2.1 The High-Risk Surgical Patient 508<br>Matt Thomas                                                                   | 4.1.7 Trunk Blocks 575<br>Farzad Saadat and Sarah F Bell                                                                                                     |    |
| 3.2.2 Management of Multiorgan Failure and Scoring Systems in the Critically Ill 513<br>Matt Thomas and Philip Harrington | 4.2 Regional Anaesthesia 581                                                                                                                                 |    |
| 3.2.3 ARDS and Ventilation Difficulties 520<br>Matt Thomas                                                                | 4.2.1 Brachial Plexus, Interscalene and Axillary Blocks 581<br>Pascal J Boddy and Laura A Beard                                                              |    |
| 3.2.4 The Management of Sepsis 527<br>Daniel El-Dalil, Charlotte Morris and Gareth J Gibbon                               | 4.2.2 Stellate Ganglion and Coeliac Plexus Blocks 588<br>Rosie Trumper and Jonathan J Gatward                                                                |    |
| 3.2.5 Oxygen Toxicity 530<br>Will H Spencer, Emily K Johnson and Jessie R Welbourne                                       | 4.2.3 Ulnar, Median and Radial Nerve Blocks 594<br>Poonam M Bopanna and Laura A Beard                                                                        |    |
| 3.2.6 Renal Replacement Therapies 536<br>Emily K Johnson and Antonia Stone                                                | 4.2.4 Caudal Block 595<br>Corinna J Hughes and Philip Harrington                                                                                             |    |
| 3.2.7 Organ Donation 545<br>Philip Harrington                                                                             | 4.2.5 Ankle and Knee Blocks 599<br>Matthew P Morgan and Andrew Weir                                                                                          |    |
| 3.2.8 COVID-19 548<br>Philip Harrington                                                                                   | 4.2.6 Lumbar Plexus, Femoral and Sciatic Nerve Blocks 602<br>Rosie Trumper and Jonathan J Gatward                                                            |    |
|                                                                                                                           | 4.2.7 Local Anaesthetic Toxicity 610<br>Andrew P Georgiou                                                                                                    |    |
| Section 4 Anatomy and Regional Anaesthesia                                                                                |                                                                                                                                                              |    |
| 4.1 Anatomy 552                                                                                                           | 4.3 Pain 616                                                                                                                                                 |    |
| 4.1.1 Anatomy of Central Venous Access 552<br>Catherine Challifour                                                        | 4.3.1 Pain Pathways 616<br>Michael B Clarke                                                                                                                  |    |
| 4.1.2 Anatomy of the Extradural Space and Spinal Cord Blood Supply 556<br>Matthew J Aldridge                              | 4.3.2 Neuropathic Pain including Complex Regional Pain Syndrome, Trigeminal Neuralgia and Post-herpetic Neuralgia 621<br>Shelley Barnes and Sarah Love-Jones |    |
| 4.1.3 Anatomy of the Trachea and Bronchi 560<br>Nirav D Patel and Mari H Roberts                                          | 4.3.3 Low Back Pain 627<br>Murli Krishna and Kat Ng                                                                                                          |    |
| 4.1.4 The Anatomy of the Autonomic Nervous System 565<br>Charlotte Morris, Daniel El-Dalil and Gareth J Gibbon            | 4.3.4 Assessment of Acute and Chronic Pain 633<br>Shelley Barnes, Sarah Love-Jones and Santhosh Gopalakrishnan                                               |    |

|                                             |          |
|---------------------------------------------|----------|
| xii                                         | Contents |
| 4.3.5 Analgesic Techniques                  | 636      |
| Michael B Clarke                            |          |
| Section 5 Miscellaneous                     |          |
| 5.1 Environmentally Sustainable Anaesthesia | 642      |
| Rebecca Taylor-Smith and Paul Southall      |          |
| 5.2 Ethics and Consent                      | 647      |
| Ruth Doolin                                 |          |
| 5.3 Critical Incidents                      | 651      |
| Ruth Doolin                                 |          |
| <hr/>                                       |          |
| Index                                       | 654      |