

# Intensive Care Medicine

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Exams are an essential component of one's training pathway in the quest to become a Consultant. For trainees undertaking a career in Intensive Care Medicine (ICM), sadly this is no exception, however, herewith is a suitable text to aid you upon that arduous journey towards the completion of your training – hurrah!

Written in an accessible style, chapters follow a consistent layout throughout, including numerous images and tables, key learning points, and further reading. Experts in all of the main specialties provide specific and detailed knowledge of individual subject areas considered to be fundamental to one's ICM knowledge base. The authors cover a broad spectrum of topics including therapeutic interventions and organ support, paediatric care, comfort and recovery, psychiatric disorders, and end of life care.

An essential preparation textbook and revision aid for exam candidates in Intensive Care Medicine, the book is a useful guide for mentors and trainees too.

**Ned (Edward) Gilbert-Kawai**, The Royal Liverpool University Hospital, Liverpool  
Ned Gilbert-Kawai is a Consultant in Intensive Care Medicine and Anaesthesia at The Royal Liverpool University Hospital. When this book was edited, he was working as an SPR at King's College Hospital, London.

**Debashish Dutta (Dev Dutta)**, Princess Alexandra Hospital NHS Trust, Essex  
Dev Dutta is a Consultant in Anaesthesia and Critical Care Medicine at the Princess Alexandra Hospital NHS Trust in Harlow, Essex.

**Carl Waldmann**, Royal Berkshire Hospital, Reading  
Carl Waldmann is a Consultant in Intensive Care Medicine and Anaesthesia at the Royal Berkshire Hospital in Reading.

# Intensive Care Medicine

## The Essential Guide

Edited By

**Ned (Edward) Gilbert-Kawai**

Royal Liverpool University Hospital, Liverpool, UK

**Debashish (Dev) Dutta**

The Princess Alexandra Hospital, Harlow, UK

**Carl Waldmann**

Royal Berkshire Hospital, Reading, UK

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 Ned Gilbert-Kawai, Debashish Dutta, Carl Waldmann  
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Dedicated to all our fellow intensive care and hospital staff for their  
bravery and resilience in the face of this awful pandemic.  
Carl, Ned and Dev

To my father Dinesh Chandra Dutta who ignited my passion in life with  
unrivalled support. Also to my family for the gift of love, patience and  
support.  
Debashish Dutta

To Grace, Arlo and Luxley  
They say patience is a virtue, and you have all demonstrated oodles of it.  
Thank you, thank you and thank you.  
Ned GK

### **Dedication to Dr Alexander Murray Fletcher**

Alex, one of the contributing authors for several of the chapters in this book, brought boundless enthusiasm, laughter and kindness to all those with whom he worked. Greatly valued by his patients, he was able to connect with people from all walks of life with a common-sense approach to medicine.

He was a fantastic clinician, father, husband, brother, son and friend who is missed dearly by his family, friends and colleagues. He touched so many lives, though his was far too brief, and we are so grateful to be able to leave this dedication as a small way of recognising Alex's love for life and his contribution to the world.

### **Dedication to Dr Kevin Hamilton**

This book is also dedicated to Kevin Hamilton, another intensivist whose loss is so keenly felt by the many colleagues and trainees he inspired and encouraged during his too brief life. His great gift was that which is easy to recognise but hard to define, and indeed, this book cannot teach you – 'humanity'. Let this be the chapter he is not here to write. If you cannot understand the lesson, proceed no further with this book – the specialty is not for you.

*‘Every clinician must be modest enough to question their line of thinking and their decisions made.’*  
Anonymous

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Contributors

Authors	Affiliation
Alex Harvey	Senior Lecturer, Department of Clinical Sciences, Brunel University London, London, UK
Alexa Strachan	Consultant Anaesthetist, Royal Free London NHS Foundation Trust, London, UK
Alexander Fletcher	Anaesthetic and Intensive Care Medicine Consultant, Royal Surrey NHS Foundation Trust, Guildford, UK
Alison Pittard	Anaesthetic and Intensive Care Medicine Consultant, Leeds Teaching Hospitals NHS Trust, Leeds, UK
Alistair Connell	Renal Specialist Registrar, University College London Institute for Human Health and Performance, London, UK
Andrew J. Jones	Paediatric Intensive Care Medicine Consultant and Children's Acute Transport Service (CATS) Great Ormond Street Hospital, London, UK
Andy Slack	Nephrology and Intensive Care Medicine Consultant, Guy's and St Thomas' NHS Foundation Trust, London, UK
Andrew Selman	Anaesthetic Specialist Registrar, St George's Hospital, London, UK
Andrew P. Walden	Acute Internal Medicine and Intensive Care Medicine Consultant, Royal Berkshire Hospital, Reading, UK
Anil Dhadwal	Trauma and Orthopaedic Specialist Registrar, Royal Liverpool University Hospital, Liverpool, UK
Anne-Marie Leo	Anaesthetic and Intensive Care Medicine Consultant, Cork University Hospital, Wilton, Cork, Ireland
Anthony O'Dwyer	Anaesthetic Specialist Registrar, London School of Anaesthesia, London, UK
Armine Sefton	Consultant Microbiologist, The Princess Alexandra Hospital NHS Trust/Emerita, Harlow, UK
Arthur W. E. Lieveld	Acute Internal Medicine Consultant, Amsterdam Public Health Research Institute, Amsterdam UMC, Amsterdam, The Netherlands
Arun Krishnamurthy	Anaesthetic and Intensive Care Medicine Consultant, The Princess Alexandra Hospital NHS Trust, Harlow, UK
Audrey Quinn	Consultant Anaesthetist, James Cook University Hospital NHS Trust, Middlesbrough, UK
Behrad Baharlo	Anaesthetic and Intensive Care Medicine Consultant, Queen Elizabeth Hospital, University Hospitals Birmingham, Birmingham, UK
Ben Clevenger	Consultant Anaesthetist, Royal National Orthopaedic Hospital, Stanmore, UK
Benjamin Post	Anaesthetic and Intensive Care Medicine Specialist Registrar, The Royal London Hospital, London, UK
Carl Waldmann	Anaesthetic and Intensive Care Medicine Consultant, Royal Berkshire Hospital, Reading, UK
Caroline Moss	Anaesthetic and Intensive Care Medicine Consultant, Western Sussex Hospitals Foundation Trust, Chichester, UK
Charles M. Oliver	Consultant Anaesthetist, University College London Hospital, London, UK



List of Contributors

Charles Rich	Emergency Medicine and Intensive Care Medicine Specialist Registrar, Thames Valley, London, UK
Chris Danbury	Intensive Care Medicine Consultant, Royal Berkshire Hospital and Visiting Fellow in Health Law, University of Reading, Reading, UK
Chris Whitehead	Anaesthetic and Intensive Care Medicine Consultant, The Walton Centre NHS Foundation Trust, Liverpool, UK
Christopher Hellyar	Anaesthetics Core Trainee, The Princess Alexandra Hospital NHS Trust, Harlow, UK
Chun Wah So	Radiology Specialist Registrar, London North West University Healthcare NHS Trust, London, UK
Claire McCann	Anaesthetic Specialist Registrar, Central London School of Anaesthesia, London, UK
Claire Moorthy	Intensive Care Medicine Specialist Registrar, Hospital of St John and St Elizabeth, London, UK
Clare Morkane	Anaesthetic and Intensive Care Medicine Specialist Registrar, Royal Free Hospital NHS Trust, Royal Free Perioperative Research, London, UK
Debashish Dutta	Anaesthetic and Intensive Care Medicine Consultant, The Princess Alexandra Hospital NHS Trust, Harlow, UK
Dominic Moor	Anaesthetic and Intensive Care Medicine Consultant, Basingstoke and North Hampshire Hospital, Basingstoke, UK
Dominik Krzanicki	Consultant Anaesthetist, Royal Free Hospital NHS Trust and Consultant in Pre-hospital Emergency Medicine Barts Health NHS Trust and London's Air Ambulance, London, UK
Dunnya De-Silva	Consultant Haematologist, Maidstone and Tunbridge Wells NHS Trust, Tunbridge Wells, UK
Ed McIlroy	Anaesthetic Specialist Registrar, Royal London Hospital, London, UK
Edward Presswood	Palliative Medicine Consultant, Dorothy House Hospice Care, Bradford-on-Avon, UK
Edward Rintoul	Anaesthetic Specialist Registrar, The Princess Alexandra Hospital NHS Trust, Harlow, UK
Elizabeth Potter	Intensive Care Medicine and Anaesthetic Consultant, Royal Surrey County Hospital, Guildford, UK
Emmar Drasar	Consultant Haematologist, University College London Hospital, London, UK
Eve Corner	Lecturer and Research Physiotherapist, Brunel University London and Imperial College Healthcare NHS Trust, London, UK
Gabor Dudas	Anaesthetic Consultant, Royal Surrey County Hospital NHS Foundation Trust, Guildford, UK
Gary Masterson	Anaesthetic and Intensive Care Medicine Consultant, Royal Liverpool University Hospital, Liverpool, UK
Gursharan Paul	Anaesthetic and Intensive Care Medicine Consultant, BHR University NHS Trust, Romford, UK
Singh Bawa	Anaesthesia and Intensive Care Medicine Specialty Registrar, Royal Berkshire Hospital, Royal Berkshire NHS Foundation Trust, Reading, UK
Harish Venkatesh	Anaesthesia and Intensive Care Medicine Specialty Registrar, Royal Berkshire Hospital, Royal Berkshire NHS Foundation Trust, Reading, UK
Harriet Kemp	Anaesthetic and Pain Specialist Registrar, Chelsea and Westminster NHS Foundation Trust, London, UK
Helen Laycock	Anaesthetic and Pain Consultant, Great Ormond Street Hospital, London, UK
Ian Tweedie	Anaesthetic and Intensive Care Medicine Consultant, The Walton Centre NHS Foundation Trust, Liverpool, UK
James McKinlay	Senior Clinical Research Fellow, Royal Surrey NHS Foundation Trust, Guildford, UK
Jeff Phillips	Anaesthetic and Intensive Care Medicine Consultant, The Princess Alexandra Hospital NHS Trust, Harlow, UK



List of Contributors

Jenny O’Nions	Consultant Haematologist, University College London Hospital, London, UK
Jeremy Fabes	Anaesthetic Specialist Registrar, Royal Free Hospital NHS Trust, London, UK
Jo Hackney	Anaesthetic Specialist Registrar, The Princess Alexandra Hospital NHS Trust, Harlow, UK
Jo Samanta	Professor of Medical Law, De Montfort University, Leicester, UK
Joel Meyer	Intensive Care Medicine Consultant, Guy’s and St Thomas’ NHS Foundation Trust, London, UK
John Whittle	Anaesthetic and Intensive Care Medicine Consultant, Duke University Medical School, and Centre for Perioperative Medicine, Durham, NC, USA
Jon Griffiths	Anaesthetic and Intensive Care Medicine Specialty Registrar, Ipswich Hospital, East Suffolk, and North Essex NHS Foundation Trust, Ipswich and Colchester, UK
Jonathan Barnes	Anaesthetic and Intensive Care Medicine Specialist Registrar, Severn Deanery, UK
Jonny Coppel	Anaesthetic Specialist Registrar, University College London, London, UK
Jonny Price	Anaesthetic and Intensive Care Medicine Consultant, Royal United Hospital Bath & Prehospital Care Doctor, Dorset and Somerset Air Ambulance, UK
Julian Howard	Anaesthetic and Intensive Care Medicine Consultant, Royal Free Hospital NHS Trust, London, UK
Julian Millo	Consultant Anaesthetist, Oxford University Hospital, Oxford, UK
Justin Ang	Emergency Medicine Specialist Registrar, Ipswich Hospital, East Suffolk and North Essex NHS Foundation Trust, Ipswich and Colchester, UK
Karim Fouad Alber	Anaesthetic and Intensive Care Medicine Specialist Registrar, Thames Valley, London, UK
Karina Goodwin	Anaesthetic and Intensive Care Medicine Specialist Registrar, Harefield Hospital, Royal Brompton & Harefield NHS Foundation Trust, London, UK
Katarina Lenartova	Anaesthetic and Intensive Care Medicine Consultant, Harefield Hospital, Royal Brompton & Harefield NHS Foundation Trust, London, UK
Kate Tatham	Anaesthetic and Intensive Care Medicine Consultant, Royal Marsden NHS Foundation Trust, London, UK
Katie Samuel	Anaesthetic Consultant, Southmead Hospital, North Bristol NHS Trust, Bristol, UK
Katie Wimble	Anaesthetic Specialist Registrar, Royal Surrey County Hospital, Guildford, UK
Kyron Chambers	Anaesthetic and Intensive Care Medicine Specialist Registrar, Whittington Health NHS Trust, London, UK
Laura Vincent	Intensive Care Medicine Consultant, John Radcliffe Hospital, Oxford, UK
Lee Poole	Anaesthetic and Intensive Care Medicine Consultant, Royal Liverpool University Hospital, Liverpool, UK
Leon Cloherty	Anaesthetic and Intensive Care Medicine Consultant, Whangarei Base Hospital, Northland DHB, Whangarei, New Zealand
Liesl Wandrag	Nutrition & Dietetic Department, Guy’s and St Thomas’ NHS Foundation Trust, London, UK
Liza Keating	Anaesthetic and Intensive Care Medicine Consultant, Royal Berkshire NHS Foundation Trust, Reading, UK
Lola Loewenthal	Respiratory Specialist Registrar, National Heart and Lung Institute, Imperial College London, London, UK
Louise Swan	Specialist Registrar, Royal Victoria Hospital, Newcastle, UK
Mahmoud Wagih	Anaesthetic and Intensive Care Medicine Consultant, The Princess Alexandra Hospital NHS Trust, Harlow, UK
Mandy Jones	Reader in Physiotherapy, Brunel University, London, UK
Manpreet Bahra	Anaesthetic Specialist Registrar, Royal National Orthopaedic Hospital NHS Trust, London, UK

List of Contributors

Marc Wittenberg	Consultant Anaesthetist, Royal Free Hospital NHS Trust and Ex-HEMS Registrar, Essex & Herts Air Ambulance, London, UK
Marc Zentar	Intensive Care Medicine Specialist Registrar, The Royal London Hospital, London, UK
Margaret Presswood	Palliative Medicine Consultant, University Hospital of Wales, Cardiff, UK
Mari Thomas	Consultant Haematologist, University College London Hospital, London, UK
Marlies Ostermann	Nephrology and Intensive Care Medicine Consultant, Guy's and St Thomas' NHS Foundation Trust, London, UK
Matthew Gale	Radiology Specialist Registrar, Nottingham University Hospitals NHS Trust, Nottingham, UK
Megan Fahy	Intensive Care Medicine Specialist Registrar, Queen Elizabeth Hospital Birmingham, University Hospitals Birmingham NHS Foundation Trust, Birmingham, UK
Michael Hoy	Anaesthetic and Intensive Care Medicine Specialist Registrar, Harefield Hospital, Royal Brompton & Harefield NHS Foundation Trust, London, UK
Michael Spiro	Anaesthetic and Intensive Care Medicine Consultant, Royal Free Hospital NHS Trust, London, UK
Mike Peters	Intensive Care Medicine and Renal Specialty Registrar, Thames Valley Deanery, London, UK
Ned Gilbert-Kawai	Consultant in Intensive Care Medicine and Anaesthesia, Royal Liverpool University Hospital, Liverpool, UK
Nick Lees	Anaesthetic and Intensive Care Medicine Consultant, Royal Brompton & Harefield NHS Foundation Trust, London, UK
Nicola Rowe	Respiratory Specialist Registrar, Royal Shrewsbury Hospital, Shrewsbury and Telford Hospital NHS Trust, UK
Niklas Tapper	Anaesthetic and Intensive Care Medicine Consultant, St Vincent's Hospital, Sydney, Australia
Nuttha Lumlertgul	Clinical Research Fellow, Guy's and St Thomas' NHS Foundation Trust and Excellence Center for Critical Care Nephrology and Division of Nephrology, Department of Internal Medicine, King Chulalongkorn Memorial Hospital, Bangkok, Thailand
Oliver Sanders	Otolaryngology Core Surgical Trainee, Southend University Hospital NHS Foundation Trust, Westcliff-on-Sea, UK
Orlanda Allen	Anaesthetic Specialist Registrar, University College London Hospitals, London, UK
Paul Harris	Anaesthetic and Intensive Care Medicine Consultant, Harefield Hospital, Royal Brompton & Harefield NHS Foundation Trust, London, UK
Pete Odor	Consultant Anaesthetist, University College London Hospitals, London, UK
Peter Byrne	Consultant Liaison Psychiatrist, The Royal London Hospital, East London Foundation NHS Trust and Visiting Professor at University of Strathclyde, UK
Peter Remeta	Anaesthetic and Intensive Care Medicine Specialist Registrar, University Hospital of Leicester NHS Trust, Leicester, UK
Raj Saha	Anaesthetic and Intensive Care Medicine Consultant, The Princess Alexandra Hospital NHS Trust, Harlow, UK
Rajamani Sethuraman	Anaesthetic and Intensive Care Medicine Consultant, The Princess Alexandra Hospital, Harlow, UK
Ramprasad Matsa	Intensive Care Medicine Consultant, Royal Stoke University Hospitals, Stoke, UK
Ranil Soysa	Anaesthetic and Intensive Care Medicine Specialist Registrar, Imperial School of Anaesthesia, London, UK
Ravi Bhatia	Consultant Anaesthetist, King's College Hospital NHS Foundation Trust, London, UK

List of Contributors

Ravi Kumar	Anaesthetic and Intensive Care Medicine Consultant, Surrey and Sussex NHS Trust, Redhill, UK
Rebecca Brinkler	Anaesthetic Specialist Registrar, London School of Anaesthesia, London, UK
Ruth Taylor	Psychiatry Specialist Registrar, East London Foundation NHS Trust, London, UK
Sachin Mehta	Anaesthetist and Intensive Care Medicine Physician, St Paul's Hospital, Vancouver, Canada, and Honorary Clinical Senior Teaching Fellow, University College London, London, UK
Sam Bampoe	Consultant Anaesthetist, University College London Hospitals, London, UK
Sanjeev Ramachandran	Academic Clinical Fellow in Clinical Radiology, University Hospitals of Leicester NHS Trust, Leicester, UK
Scott Grier	Intensive Care Medicine Consultant, North Bristol NHS Trust and Pre-hospital Care Doctor, Great Western Air Ambulance, Bristol, UK
Selina Ho	Anaesthetic and Intensive Care Medicine Specialist Registrar, Harefield Hospital, Royal Brompton & Harefield NHS Foundation Trust, London, UK
Shankara Nagaraja (Raj Nagaratnam)	Anaesthetic and Intensive Care Medicine Consultant, Liverpool University Hospital NHS Foundation Trust, Liverpool, UK
Shona Johnson	Intensive Care Medicine Specialist Registrar, Milton Keynes University Hospital NHS Foundation Trust, Milton Keynes, UK
Shrijt Nair	Consultant Anaesthetist, St Vincent's University Hospital, Dublin, Republic of Ireland
Simon Mattison	Anaesthetic and Intensive Care Medicine Consultant, Harefield Hospital, Royal Brompton & Harefield NHS Foundation Trust, London, UK
Sridhar Nallapareddy	Anaesthetic and Intensive Care Medicine Consultant, Ipswich Hospital, East Suffolk and North Essex NHS Foundation Trust, Ipswich and Colchester, UK
Stephane Ledot	Intensive Care Medicine Consultant, Royal Brompton & Harefield Foundation Trust, London, UK
Suehana Rahman	Consultant Anaesthetist, Royal Free Hospital, London, UK
Susanna Price	Intensive Care Medicine Consultant, Royal Brompton & Harefield Foundation Trust, London, UK
Tamas Bakonyi	Consultant Anaesthetist, Guy's and St Thomas' NHS Foundation Trust, London, UK
Thomas Brick	Paediatric Intensive Care Medicine Consultant and Children's Acute Transport Service (CATS), Great Ormond Street Hospital, London, UK
Thomas Leith	Anaesthetic and Intensive Care Medicine Specialist Registrar, Royal Marsden Hospital, London, UK
Tim Hartley	Intensive Care Medicine Specialist Registrar, Hospital of St John and St Elizabeth, London, UK
Timothy Snow	Anaesthetic and Intensive Care Medicine Specialist Registrar, The Royal London Hospital, London, UK
Tom Bottomley	Anaesthetic Specialist Registrar, University College London, London, UK
Tom Parker	Anaesthetic and Intensive Care Medicine Specialist Registrar, University College London, London, UK
Valerie Page	Anaesthetic and Intensive Care Medicine Consultant, Watford General Hospital, Watford, UK
Victoria Stables	Consultant Haematologist, Maidstone and Tunbridge Wells NHS Trust, Tunbridge Wells, UK
William Townsend	Consultant Haematologist, University College London Hospital, London, UK
Wilson Fandino	Consultant Anaesthetist, Guy's and St Thomas' NHS Foundation Trust, London, UK

## Preface

As practising intensivists involved on both sides of the Intensive Care Medicine examinations ‘fence’ (the luckier ones of us examined, whilst the unlucky one was being examined!), we fully appreciate the extent of the factual knowledge required of anyone undertaking these examinations. With this in mind, and whilst we recognise that numerous excellent books relating to Critical Care/Intensive Care Medicine already exist, we set ourselves the task of writing a textbook that would have the following unique selling points:

1. It would cover the entire UK FFICM syllabus.
2. It would provide, in a uniform and consistent format, a succinct and digestible summary of each topic (1000–2500 words), rather than an exhaustive, in-depth review.
3. To supplement this approach, Key Learning Points would be listed at the start of every chapter, and it would provide recommendations for further reading should the reader wish to delve deeper into any topic and continue their own self-directed learning.
4. As well as intensivists, the contributing authors would include other affiliated specialists (haematologists, nephrologists, paediatric intensivists, psychiatrists, etc.) who importantly still work on the ‘shop floor’ on a daily basis, thus ensuring they have up-to-date knowledge and

experience of what really is, and is not, important to direct patient care.

To this end, 132 international authors from all fields of medicine were co-opted and the ensuing pages encompass the rich fruits of their labours. Such a multidisciplinary approach will inevitably lead to small overlaps of subject matter, but we have chosen to retain these as an aid to learning and a useful revision tool. Additionally, wishing to avoid the monotony of a uniform textbook, we have also chosen to retain each author’s own (and, at times, very different) words and style.

We have undoubtedly learnt a great deal from our colleagues’ contributions, and we certainly hope that you too will fill your cup to the brim with the included factual content!

Finally, a word of advice as we leave you to inwardly digest what others far more learned than ourselves have written on the subject of Intensive Care Medicine – remember that when the odd fact or two has slipped your mind, you are never alone because even the best intensivist will also be a ‘connexist’. That is to say, someone who is ready to recognise his or her own limitations, and call on the expertise of others when required.

**Ned, Dev and Carl**  
2020

## Foreword

*Intensive Care Medicine – The Essential Guide* lives up to its name. Drs Gilbert-Kawai, Dutta and Waldmann have assembled a sterling cast of 132 intensivists and ologists from other specialties to pen 186 chapters covering the breadth of Critical Care. The chapters are brief and to the point, providing a clear overview of each topic, but with further reading suggested for the reader seeking more depth. Importantly, the book mirrors the curriculum for those aiming to become a fellow of the UK Faculty of Intensive Care Medicine. It will also aid those seeking to learn Critical Care or

refresh their knowledge, and should appeal to doctors, nurses and other allied healthcare professionals. The varied writing styles have been expressly retained to provide variation and freshness. The editors and authors should be congratulated on delivering such an enjoyable and informative text.

**Mervyn Singer**  
*Professor of Intensive Care Medicine*  
*University College London*  
6 July 2020

# Abbreviations

AAD	acute aortic dissection
AAGBI	Association of Anaesthetists of Great Britain and Ireland
AAS	acute aortic syndrome
ABA	American Burn Association
ABG	arterial blood gas
ACC	American College of Cardiology
ACCM	American College of Critical Care Medicine
ACE	angiotensin-converting enzyme
ACE2	angiotensin-converting enzyme 2
ACEI	angiotensin-converting enzyme inhibitor
A4CH	apical four-chamber
ACLF	acute-on-chronic liver failure
ACS	abdominal compartment syndrome; acute coronary syndrome
ACS NSQIP®	American College of Surgeons National Surgical Quality Improvement Program
ACT	activated clotting time
ACTH	adrenocorticotrophic hormone
ADH	anti-diuretic hormone
ADP	adenosine diphosphate
ADRT	advance decision to refuse treatment
AECC	American European Consensus Conference
AECOPD	acute exacerbations of COPD
AED	anti-epileptic drug
AF	atrial fibrillation
AFE	amniotic fluid embolism
AFLP	acute fatty liver of pregnancy
AFM	acute fulminant myocarditis
AHA	American Heart Association
AHT	abusive head trauma
aHUS	atypical haemolytic uraemic syndrome
AHVF	acute hypercapnic ventilatory failure
AI	aortic insufficiency
AIDS	acquired immune deficiency syndrome
AIN	acute interstitial nephritis

Abbreviations

AIS	Abbreviated Injury Scale
AKI	acute kidney injury
AKIKI	Artificial Kidney Initiation in Kidney Injury
AKIN	Acute Kidney Injury Network
ALI	acute lung injury
ALL	acute lymphoblastic leukaemia
alloHSCT	allogeneic haematopoietic stem cell transplant
ALP	alkaline phosphatase
ALS	advanced life support
ALT	alanine aminotransferase
AMHP	approved mental health professional
AMI	acute mesenteric ischaemia
AMP	adenosine monophosphate
AmpC	Ambler class C
ANA	anti-nuclear antibody
ANCA	anti-neutrophil cytoplasmic antibody
ANTT	aseptic non-touch technique
AoCKD	acute kidney injury on top of chronic kidney disease
AP	anteroposterior
APACHE	Acute Physiology and Chronic Health Evaluation
aPCC	activated prothrombin complex concentrate
APH	ante partum haemorrhage
APLS	advanced paediatric life support
APRV	airway pressure release ventilation
APTT	activated partial thromboplastin time
AQP	aquaporin
ARAER	ascites-to-rectus abdominis muscle echogenicity ratio
ARB	angiotensin receptor blocker
ARDS	acute respiratory distress syndrome
ARISCAT	Assess Respiratory Risk in Surgical Patients in Catalonia Tool
AS	aortic stenosis
ASA	American Society of Anesthesiologists
ASCI	acute spinal cord injury
ASIA	American Spinal Injury Association
ASO	anti-streptolysin O
ASPEN	American Society for Parenteral and Enteral Nutrition
AST	aspartate aminotransferase
ATC	acute traumatic coagulopathy
ATG	anti-thymocyte globulin
ATLS	advanced trauma life support
ATN	VA/NIH Acute Renal Failure Trial Network

Abbreviations

ATP	adenosine triphosphate
ATS	American Thoracic Society
AUC	area under the curve
autoHSCT	autologous haematopoietic stem cell transplant
AV	atrioventricular; arteriovenous
AVNRT	atrioventricular nodal re-entry tachycardia
AVP	arginine vasopressin
AVPR <sub>2</sub>	vasopressin receptor
AVPU	Alert, responsive to Voice, responsive to Pain, Unresponsive
AVR	aortic valve replacement
AVRT	atrioventricular re-entry tachycardia
AWS	alcohol withdrawal syndrome
AXR	abdominal X-ray
BAL	broncho-alveolar
B-ALL	B cell acute lymphoblastic leukaemia
BAV	balloon aortic valvuloplasty
BBB	bundle branch block
BCNIE	blood culture-negative infective endocarditis
BCPC	bidirectional cavopulmonary connection
BE	base excess
BIA	British Infection Association
BIMDG	British Inherited Metabolic Diseases Group
BiPAP	bi-level positive airway pressure
BIS	bispectral index
BISAP	Bedside Index for Severity in Acute Pancreatitis
BLUE	Bedside Lung Ultrasound in Emergency
BM	bone marrow
BMI	body mass index
BNP	B-type natriuretic peptide
BOS	bronchiolitis obliterans syndrome
bpm	beats per minute
BPS	Behavioral Pain Scale
BRAF	B-rapidly accelerated fibrosarcoma
BSA	body surface area
BSE	British Society of Echocardiography
BSG	British Society of Gastroenterology
BSH	British Society for Haematology
BSPED	British Society for Paediatric Endocrinology and Diabetes
BTS	British Thoracic Society; Blalock–Taussig shunt
BTt	bridge to transplant
BVM	bag–valve–mask



Abbreviations

BWPS	Burch–Wartofsky Point Scale
Ca <sup>2+</sup>	calcium
CABG	coronary artery bypass graft
CABSI	catheter-associated bloodstream infection
CAD	coronary artery disease
CAM-ICU	Confusion Assessment Method for the ICU
CANH	clinically assisted nutrition and hydration
CaO <sub>2</sub>	arterial oxygen content
CAP	community-acquired pneumonia
CAR	chimeric antigen receptor
CBF	cerebral blood flow
CBRN	chemical, biological, radiological and nuclear defence
CBT	cognitive behavioural therapy
CCG	Clinical Commissioning Group
CCT	conventional coagulation test; Certificate of Completion of Training
CCU	critical care unit
CDI	cranial diabetes insipidus
CDOP	Child Death Overview Panel
CEI	continuous epidural infusion
CERO <sub>2</sub>	cerebral oxygen extraction ratio
CF	cystic fibrosis
CFF	citrated functional fibrinogen
CFU	colony-forming units
CHD	congenital heart disease
CICO	Can't Intubate Can't Oxygenate
CIM	critical illness myopathy
CIN	calcineurin inhibitor
CIP	critical illness polyneuropathy
CIPNM	critical illness polyneuromyopathy
CIWA	Clinical Institute Withdrawal Assessment for Alcohol
CJD	Creutzfeldt–Jakob disease
CK	creatine kinase
CKD	chronic kidney disease
Cl <sup>−</sup>	chloride
CLF	chronic liver failure
cmH <sub>2</sub> O	centimetre of water
CMR	cardiac magnetic resonance
CMRO <sub>2</sub>	cerebral metabolic rate of oxygen
CMV	cytomegalovirus
CNI	calcineurin inhibitor
CNS	central nervous system

Abbreviations

CO	carbon monoxide; cardiac output
CO <sub>2</sub>	carbon dioxide
CoBaTrICE	Competency Based Training programme in ICM for Europe and other regions
COHb	carboxyhaemoglobin
COM	cardiac output monitoring
COPD	chronic obstructive pulmonary disease
CoV	coronavirus
COVID	coronavirus disease
COVID-19	coronavirus disease 2019
COX-2	cyclo-oxygenase 2
COX-3	cyclo-oxygenase 3
CPAP	continuous positive airway pressure
CPAx	Chelsea Critical Care Physical Assessment tool
CPB	cardiopulmonary bypass
CPET	cardiopulmonary exercise testing
CPO	cardiogenic pulmonary oedema
CPOT	Critical Care Pain Observation Tool
CPP	cerebral perfusion pressure; child protection plan
CPR	cardiopulmonary resuscitation
CRBSI	catheter-related bloodstream infection
CRCI	critical illness-related corticosteroid insufficiency
CrCl	creatinine clearance
CRE	carbapenem-resistant <i>Enterobacteriaceae</i>
CRF	chronic renal failure; corticotrophin-releasing factor
CRP	C-reactive protein
CRRT	continuous renal replacement therapy
CRS	cardio-renal syndrome; cytokine release syndrome
CRT	cardiac resynchronisation therapy; capillary refill time
CRT-D	CRT defibrillator
CRT-P	CRT pacemaker
CS	cardiogenic shock
CSE	convulsive status epilepticus
CSF	cerebrospinal fluid
CSW	cerebral salt wasting
CTG	cardiotocography
CTPA	computed tomography pulmonary angiography
CVA	cerebrovascular accident
CVC	central venous catheter/catheterisation
CVP	central venous pressure
CVR	cerebral vascular resistance
CVS-AKI	cardiac and vascular surgery-associated acute kidney injury

Abbreviations

CVVH	continuous veno-venous haemofiltration
CVVHD	continuous veno-venous haemodialysis
CVVHDF	continuous veno-venous haemodiafiltration
CVVHF	continuous veno-venous haemofiltration
CXR	chest X-ray
Da	dalton
DAMP	damage-associated molecular pattern
DAS	Difficult Airway Society
DAT	difficult airway trolley; direct anti-globulin test
DBD	donation after brainstem death
DBP	diastolic blood pressure
DC	direct current
DCD	donation after circulatory death
DCM	dilated cardiomyopathy
DCS	damage control surgery
DDAVP	desmopressin
DE	diaphragmatic excursion
DI	diabetes insipidus
DIC	disseminated intravascular coagulation
DIT	di-iodothyronine
DKA	diabetic ketoacidosis
dl	decilitre
DLCO	diffusion capacity of carbon monoxide
DM	diabetes mellitus
DNA	deoxyribonucleic acid
DNACPR	Do Not Attempt Cardiopulmonary Resuscitation
DOAC	direct oral anticoagulant
DoH	Department of Health
DoLS	Deprivation of Liberty Safeguards
dsDNA	double-stranded deoxyribonucleic acid
DTF	diaphragm thickening fraction
DTs	delirium tremens
DVLA	Driver and Vehicle Licensing Agency
DVT	deep vein thrombosis
EBV	Epstein–Barr virus
ECF	extracellular fluid
Echo	echocardiography
ECLS	extracorporeal life support
ECMO	extracorporeal membrane oxygenation
ECT	electroconvulsive therapy
EDH	extradural haemorrhage

Abbreviations

EDTA	ethylene diaminetetraacetic acid
EEG	electroencephalography
eGFR	estimated glomerular filtration rate
EHR	electronic health record
e-ICM	e-learning for intensive care medicine
ELSO	Extracorporeal Life Support Organization
EMB	endomyocardial biopsy
EMC	enhanced maternity care
EMG	electromyography
ENA	extractable nuclear antigen
ENT	ear, nose and throat
ePEEP	extrinsic positive end-expiratory pressure
EPUAP	European Pressure Ulcer Advisory Panel
ERCP	endoscopic retrograde cholangiopancreatography
ERF	Emergency Response Framework
ESA	erythropoietin-stimulating agent
ESBL	extended-spectrum $\beta$ -lactamase
ESC	European Society of Cardiology
ESICM	European Society of Intensive Care Medicine
ESLD	end-stage liver disease
ESR	erythrocyte sedimentation rate
ESRD	end-stage renal disease
ET	essential thrombocythaemia
ETC	early total care
ETCO <sub>2</sub>	end-tidal carbon dioxide
ETT	endotracheal tube
EU	European Union
EuroSCORE	European System for Cardiac Operative Risk Evaluation
EVD	external ventricular drain
EWS	Early Warning Score
EXTRIP	EXtracorporeal TReatments In Poisoning
FAST	focussed assessment with sonography in trauma; Face, Arm, Speech, Time
FBC	full blood count
FEAST	Fluid Expansion as Supportive Therapy (trial)
FEEL	focussed echocardiography in emergency life support
FEIBA	factor eight inhibitor bypassing agent
FE <sub>Na</sub>	fractional excretion of sodium
FEV <sub>1</sub>	forced expiratory volume in 1 second
FFP	fresh frozen plasma
FGF	fresh gas flow
FICE	focussed intensive care echocardiography

Abbreviations

FICM	Faculty of Intensive Care Medicine
FII	fabricated or induced illness
FiO <sub>2</sub>	fraction of inspired oxygen
FOB	fibreoptic bronchoscopy
Fr	French
FRC	functional residual capacity
FSGS	focal segmental glomerulosclerosis
FSS-ICU	Functional Status Scale for ICU
ft3	free T3
ft4	free T4
FVC	forced vital capacity
γGT	gamma-glutamyl transferase
G	gauge
GA	general anaesthetic
GABA	gamma aminobutyric acid
GAS	group A <i>Streptococcus</i>
GBM	glomerular basement membrane
GBS	Guillain–Barré syndrome
GCS	Glasgow Coma Score
GDI	gestational diabetes insipidus
GFR	glomerular filtration rate
GHb	gamma hydroxybutyrate
GI	gastrointestinal
GIT	gastrointestinal tract
GMC	General Medical Council
GMP	guanosine monophosphate
GOJ	gastro-oesophageal junction
GOLD	Global Initiative for Chronic Obstructive Lung Disease
GOS	Glasgow Outcome Score
GP	general practitioner
G6PD	glucose-6-phosphate dehydrogenase
GPICS	Guidelines for the Provision of Intensive Care Services
GTN	glyceryl trinitrate
GUCH	grown-up congenital heart disease
GVHD	graft-versus-host disease
GVT	graft-versus-tumour
HAART	highly active anti-retroviral therapy
HAP	hospital-acquired pneumonia
HAPS	Harmless Acute Pancreatitis Score
HAS	human albumin solution
HAT	hepatic artery thrombosis

Abbreviations

Hb	haemoglobin
hCG	human chorionic gonadotrophin
HCO <sub>3</sub>	bicarbonate
Hct	haematocrit
HCV	hepatitis C
HDFN	haemolytic disease of the fetus and newborn
HDU	high dependency unit
HE	hepatic encephalopathy
HELLP	haemolysis, elevated liver enzymes and low platelets
HEMS	helicopter emergency medical services
HF	heart failure
HFNC	high-flow nasal cannulae
HFOV	high-frequency oscillatory ventilation
HFPEF	heart failure with preserved ejection fraction
HFREF	heart failure with reduced ejection fraction
HHS	hyperosmolar hyperglycaemic state
Hib	<i>Haemophilus influenzae</i> type b
HIT	heparin-induced thrombocytopenia
HITT	heparin-induced thrombocytopenic thrombosis
HLA	human leucocyte antigen
HLH	haemophagocytic lymphohistiocytosis
HM	haematological malignancy
HME	heat and moisture exchanger
HPA	hypothalamic–pituitary–adrenal
HPS	hepatopulmonary syndrome
hr	hour
H2RB	histamine-2 receptor blocker
HRS	hepatorenal syndrome
hsCRP	high-sensitivity C-reactive protein
HSC	haematopoietic stem cell
HSCT	haematopoietic stem cell transplant
hsTrP	high-sensitivity troponin
HSV	herpes simplex virus
HU	Hounsfield units
HUS	haemolytic uraemic syndrome
Hz	hertz
IA	intrinsic activity
IABP	intra-aortic balloon pump
IAH	intra-abdominal hypertension
IAP	intra-abdominal pressure
IBA	impact brain apnoea

Abbreviations

ICANS	immune effector cell-associated neurotoxicity syndrome
ICD	implantable cardioverter–defibrillator; International Statistical Classification of Diseases and Related Health Problems
ICDSC	Intensive Care Delirium Screening Checklist
ICG	International Coordinating Group
ICH	intracerebral haemorrhage
ICM	intensive care medicine
ICNARC	Intensive Care National Audit and Research Centre
ICP	intracranial pressure
ICS	Intensive Care Society; inhaled corticosteroid
ICU-AW	intensive care unit-acquired weakness
ID	infectious disease
IDSA	Infectious Diseases Society of America
IE	infective endocarditis
I:E	inspiratory/expiratory ratio
IEM	inborn errors of metabolism
IgA	immunoglobulin A
IgD	immunoglobulin D
IgE	immunoglobulin E
IGFBP-7	insulin-like growth factor binding protein 7
IgG	immunoglobulin G
IgM	immunoglobulin M
IHD	intermittent haemodialysis; ischaemic heart disease
IIH	idiopathic intracranial hypertension
IJV	internal jugular vein
IL	interleukin
IL-6	interleukin-6
ILD	interstitial lung disease
IM	intramuscular
IMCA	Independent Mental Capacity Advocate
IMER	Ionising Radiation (Medical Exposure) Regulations
IMS	Incident Management System
IMV	invasive mechanical ventilation
INARC	Intensive Care National Audit & Research Centre
INR	international normalised ratio
INTERMACS	Interagency Registry for Mechanically Assisted Circulatory Support
IO	intraosseous
IOCS	intraoperative cell salvage
IPD	intra-pleural distance
IQR	interquartile range
IRIS	immune reconstitution inflammatory syndrome

Abbreviations

ISCoS	International Spinal Cord Society
ISS	Injury Severity Score
ISTH	International Society on Thrombosis and Haemostasis
IU	international unit
IV	intravenous
IVC	inferior vena cava
IVDU	intravenous drug user
IVIG	intravenous immunoglobulin
J	joule
JRCALC	Joint Royal Colleges Ambulance Liaison Committee
JVP	jugular venous pressure
K	J(Kell)
K <sup>+</sup>	potassium
kcal	kilocalorie
KCl	potassium chloride
KCO	carbon monoxide transfer coefficient
KDIGO	Kidney Disease: Improving Global Outcomes
KIM-1	kidney injury molecule-1
kPa	kilopascal
LA	left atrial/atrium
LABA	long-acting beta-2 agonist
LAD	left axis deviation
LAMA	long-acting muscarinic antagonist
LAP	left atrial pressure
lb	pound
LBBS	left bundle branch block
LBO	large bowel obstruction
LCOS	low cardiac output syndrome
LDH	lactate dehydrogenase
LDL	low-density lipoprotein
L-FAB	liver fatty acid-binding protein
LFT	liver function test
LLN	lower limit of normal
LMWH	low-molecular-weight heparin
LOS	length of stay
LP	lumbar puncture
LPA	lasting power of attorney
LPR	lactate/pyruvate ratio
LRINEC	Laboratory Risk Indicator for Necrotising Fasciitis
LSD	lysergic acid diethylamide
LT	liver transplantation; lung transplant



Abbreviations

LTA	light transmission aggregometry
LTi	laryngotracheal injuries
LTOT	long-term oxygen therapy
LV	left ventricular/left ventricle
LVAD	left ventricular assist device
LVEDV	left ventricular end-diastolic volume
LVESD	left ventricular end-systolic diameter
LVESV	left ventricular end-systolic volume
µg	microgram
µmol	micromole
MAHA	microangiopathic haemolytic anaemia
MALDI	matrix-assisted laser desorption/ionisation
MALDI-TOF	matrix-assisted laser desorption/ionisation time-of-flight
MALT	mucosa-associated lymphoid tissue
MAOI	monoamine oxidase inhibitor
MAP	mean arterial pressure
MARS	molecular adsorbent recirculating system
MBC	minimum bactericidal concentration
MBRRACE-UK	Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK
MCA	Mental Capacity Act
MCS	mechanical circulatory support
MC&S	microscopy, culture and sensitivity
MCV	mean corpuscular volume
MDMA	3,4-methylenedioxymethamphetamine
MDR	multidrug-resistant
MDRD	Modification of Diet in Renal Disease
MDT	multidisciplinary team
MEGX	monoethylglycinexylidide
MELD	Model for End-Stage Liver Disease
MERS	Middle Eastern respiratory syndrome
MERS-CoV	Middle East respiratory syndrome coronavirus
MET	metabolic equivalent
Mg	magnesium
MG	myasthenia gravis
MHA	Mental Health Act
MHC	major histocompatibility complex
MHRA	Medicine and Healthcare products Regulatory Agency
MI	myocardial infarction
MIC	minimum inhibitory concentration
MIP	maximal inspiratory pressure

Abbreviations

MIT	mono-iodothyronine
MLSB	macrolides/azalides, lincosamides and the streptogramin B group of antibiotics
M&M	morbidity and mortality
mmHg	millimetres of mercury
mmol	millimole
MODS	Multiple Organ Dysfunction Score; multiple organ dysfunction syndrome
MOF	multiple organ failure
MOH	massive obstetric haemorrhage
mOsm	milliosmole
MOST	multi-organ support therapy
MPC	mutant prevention concentration
MPM	Mortality Prediction Model
MR	mitral regurgitation
MRC	Medical Research Council
MRCP	magnetic resonance cholangiopancreatography
mRNA	messenger ribonucleic acid
MRSA	meticillin-resistant <i>Staphylococcus aureus</i>
MS	mitral stenosis
MSCT	multi-slice computed tomography
MSSA	meticillin-sensitive <i>Staphylococcus aureus</i>
MSU	midstream urine
MSW	mutant selection window
MTC	major trauma centre
MV	mitral valve
MVF	mean flow velocity
Na <sup>+</sup>	sodium
NaCl	sodium chloride
NAFLD	non-alcoholic fatty liver disease
NAG	<i>N</i> -acetyl- $\beta$ - <i>D</i> -glucosaminidase
NAP4	4th National Audit Project
NAPQI	<i>N</i> -acetyl- <i>p</i> -benzoquinone imine
NASH	non-alcoholic steatohepatitis
NCAA	National Cardiac Arrest Audit
NCS	nerve conduction study
NDI	nephrogenic diabetes insipidus
NEWS	National Early Warning Score
NEX	nose, earlobe, xiphisternum
NEXUS	National Emergency X-Radiography Utilisation Study
NF	necrotising fasciitis
NG	nasogastric
NGAL	neutrophil gelatinase-associated lipocalin

Abbreviations

NGT	nasogastric tube
NICE	National Institute for Health and Care Excellence
NIHSS	National Institute for Health Stroke Scale
NIV	non-invasive ventilation
NJT	nasojejunal tube
NMBA	neuromuscular-blocking agent
NMDA	<i>N</i> -methyl- <i>D</i> -aspartate
NMES	neuromuscular electrical stimulation
NMS	neuroleptic malignant syndrome
NNBC	National Network for Burn Care
NNT	number needed to treat
NO	nitric oxide
NOAC	novel oral anticoagulant
NOMI	non-occlusive mesenteric ischaemia
NPSA	National Patient Safety Agency
NPUAP	National Pressure Ulcer Advisory Panel
NRLS	National Reporting and Learning System
1/2 NS	0.45% normal saline
NSAID	non-steroidal anti-inflammatory drug
NSTEMI	non-ST-segment elevation myocardial infarction
NT-pro-BNP	N-terminal pro-B-type natriuretic peptide
NTSCI	non-traumatic spinal cord injury
NVE	native valve endocarditis
NYHA	New York Heart Association
OCP	ova, cysts and parasites
OD	overdose
ODS	osmotic demyelination syndrome
OI	oxygenation index
OOHCA	out-of-hospital cardiac arrest
OSI	oxygen saturation index
PA	pulmonary artery; posterior–anterior
P-A	postero-anterior
PABA	para-aminobenzoic acid
PAC	pulmonary artery catheter
PaCO <sub>2</sub>	partial pressure of carbon dioxide
PACU	post-anaesthesia care unit
PAE	post-antibiotic effect
PAF	platelet-activating factor
PAH	pulmonary arterial hypertension
PAI-1	plasminogen activator inhibitor-1
PALF	paediatric acute liver failure

Abbreviations

PAMP	pathogen-associated molecular pattern
PaO <sub>2</sub>	partial pressure of oxygen
pARDS	paediatric acute respiratory distress syndrome
PAWP	pulmonary artery wedge pressure
PB	peripheral blood
PBM	patient blood management
PBP	penicillin-binding protein
PBS	protected brush specimen
PbtO <sub>2</sub>	parenchymal tissue oxygen tension
PCA	patient-controlled analgesia
PCC	prothrombin complex concentrate
PCEA	patient-controlled epidural analgesia
PCI	percutaneous coronary intervention
PCR	polymerase chain reaction
PCT	procalcitonin; Primary Care Trust
PCW	pulmonary capillary wedge
PD	pharmacodynamics
PD-1	programmed death-1
PDOC	prolonged disorders of consciousness
PDPH	post-dural puncture headache
PDT	percutaneous dilatational tracheostomy
PE	pulmonary embolism
PEA	pulseless electrical activity
PEEP	positive end-expiratory pressure
PEF	peak expiratory flow
PEG	percutaneous endoscopic gastrostomy
PEJ	percutaneous endoscopic jejunostomy
PELOD	Pediatric Logistic Organ Dysfunction
PETCO <sub>2</sub>	partial pressure of end-tidal carbon dioxide
PEX	plasma exchange
PF4	platelet factor 4
PFIT-s	Physical Functional Scale for ICU–score
PGD	primary graft dysfunction
PGE2	prostaglandin E2
PH	portal hypertension; pulmonary hypertension
PICANet	Paediatric Intensive Care Audit Network
PICC	peripherally inserted central catheter
PICS	post-intensive care syndrome
PICS-F	PICS-family
PICU	paediatric intensive care unit
PIM	paediatric index of mortality

Abbreviations

PIP	peak inspiratory pressure
PIRRT	prolonged intermittent RRT
PJP	<i>Pneumocystis jirovecii</i> pneumonia
PK	pharmacokinetics
PLAPS	posterolateral alveolar and/or pleural syndrome
PLAX	parasternal long axis
PLEX	plasma exchange
pLVAD	percutaneous left ventricular assist device
PMA	paramethoxyamphetamine
PMCS	peri-mortem Caesarean section
PN	parenteral nutrition
PO	orally
PO <sub>4</sub>	phosphate
POCT	point-of-care test
PONV	post-operative nausea and vomiting
POPS	Perioperative Care of the Older Person
PPCM	peripartum cardiomyopathy
PPE	personal protective equipment
PPH	post-partum haemorrhage
PPI	proton pump inhibitor
PPM	permanent pacemaker
P-POSSUM	Portsmouth Physiological and Operative Severity Score for the enUmeration of Mortality and morbidity
PRIS	propofol infusion syndrome
PRISM	paediatric risk of mortality
PROPPR	Pragmatic, Randomized, Optimal Platelet and Plasma Ratios (trial)
PRSP	penicillin-resistant <i>Streptococcus pneumoniae</i>
PRV	polycythaemic rubra vera
pRVAD	percutaneous right ventricular assist device
PS	performance score
PSAX	parasternal short axis
PSB	protected specimen brush
PSI	Pneumonia Severity Index
PT	prothrombin time
PTH	parathyroid hormone
PT-INR	international normalised ratio
PtiO <sub>2</sub>	parenchymal tissue oxygen tension
PTP	post-transfusion purpura
PTSD	post-traumatic stress disorder
PTU	propylthiouracil
PVE	prosthetic valve endocarditis

Abbreviations

PVR	pulmonary vascular resistance
pVT	pulseless ventricular tachycardia
qSOFA	quick SOFA
RA	right atrium/right atrial
RAAS	renin–angiotensin–aldosterone system
RACHS	Risk Adjustment for Congenital Heart Surgery
RAD	right axis deviation
RAI	renal anginal index
RAP	right atrial pressure
RASS	Richmond Agitation Sedation Scale
RBC	red blood cell
RC	responsible clinician
RCA	regional citrate anticoagulation
RCOG	Royal College of Obstetricians and Gynaecologists
RCP	Royal College of Physicians
RCT	randomised controlled trial
RDT	rapid diagnostic test
REBOA	resuscitative endovascular balloon occlusion of the aorta
RFR	renal functional reserve
Rh	rhesus
RIFLE	Risk, Injury, Failure, Loss, End-stage kidney disease
RIG	radiologically inserted gastrostomy
RMN	registered mental health nurse
ROC	receiver operator characteristic curve
ROSC	return of spontaneous circulation
ROTEM®	rotational thromboelastometry
RRT	renal replacement therapy
rRT-PCR	real-time reverse transcription polymerase chain reaction
RSI	rapid sequence induction
RSV	respiratory syncytial virus
rT3	reverse T3
RTA	road traffic accident
RV	right ventricle; right ventricular; residual volume
RVAD	right ventricular assist device
RVOT	right ventricular outflow tract
RWMA	regional wall motion abnormality
SA	sinoatrial
SAAG	serum–ascites albumin gradient
SA-AKI	sepsis-associated acute kidney injury
SADS	sudden adult death syndrome
SAH	subarachnoid haemorrhage

Abbreviations

SALT	speech and language therapy
SAM	systolic anterior motion
SaO <sub>2</sub>	arterial oxygen saturation
SAPS	Simplified Acute Physiology Score
SARS	severe acute respiratory syndrome
SARS-CoV	severe acute respiratory syndrome coronavirus
SARS-CoV-1	severe acute respiratory syndrome coronavirus 1
SARS-CoV-2	severe acute respiratory syndrome coronavirus 2
SBO	small bowel obstruction
SBP	systolic blood pressure; spontaneous bacterial peritonitis
SBT	Sengstaken–Blakemore tube
SCAI	Society for Cardiovascular Angiography and Interventions
SCCM	Society of Critical Care Medicine
SCD	sudden cardiac death; sickle cell disease
SCIWORA	spinal cord injury without radiographic abnormality
SCORTEN	SCORe of Toxic Epidermal Necrolysis
SCr	serum creatinine
SCUF	slow continuous ultrafiltration
ScVO <sub>2</sub>	central venous oxygen saturation
SDD	selective decontamination of the digestive tract
SDH	subdural haemorrhage
SDT	single dilator technique
SGLT-2	sodium–glucose co-transporter 2
SHOT	Serious Hazards of Transfusion
SIADH	syndrome of inappropriate anti-diuretic hormone secretion
S-ICD	subcutaneous implantable cardioverter–defibrillator
SID	strong ion difference
SIDS	sudden infant death syndrome
SIGN	Scottish Intercollegiate Guidelines Network
SIMV	synchronous intermittent mandatory ventilation
SIRS	systemic inflammatory response syndrome
SJS	Stevens–Johnson syndrome
SjvO <sub>2</sub>	jugular venous oxygen saturation
SLED	slow low-efficiency dialysis
SMR	standardised mortality ratio
SNOD	specialist nurse for organ donation
SNRI	serotonin–noradrenaline reuptake inhibitor
SOAD	second opinion approved doctor
SOD	selective oral decontamination
SOFA	Sequential Organ Failure Assessment
SOP	standard operating procedure

Abbreviations

SORT	Surgical Outcome Risk Tool
SpO <sub>2</sub>	peripheral oxygen saturation
spp.	species
SS	serotonin syndrome
SSI	surgical site infection
SSRI	selective serotonin reuptake inhibitor
ssRNA	single-stranded ribonucleic acid
SSTI	skin and soft tissue infection
ST	surgical tracheostomy
STEC	Shiga-toxin producing <i>Escherichia coli</i> infection
STEMI	ST-segment elevation myocardial infarction
SUDEP	sudden unexplained death in epilepsy
SUDI	sudden unexpected death in infancy
SV	stroke volume
SVC	superior vena cava; slow vital capacity
SVCO	superior vena cava obstruction
SvO <sub>2</sub>	mixed venous oxygen saturation
SVR	systemic vascular resistance
SVV	stroke volume variation
T3	tri-iodothyronine
T4	thyroxine
TACO	transfusion-associated circulatory overload
TAPSE	tricuspid valve annular plane systolic excursion
TAPVD	total anomalous pulmonary venous drainage
TAVI	transcatheter aortic valve implantation
TAVR	transcatheter aortic valve replacement
TB	tuberculosis
TBG	thyroid-binding globulin
TBI	traumatic brain injury
TBSA	total body surface area
TCA	tricyclic antidepressant
TCD	transcranial Doppler ultrasound
TDM	therapeutic drug monitoring
TEG®	thromboelastography
TEN	toxic epidermal necrolysis
TEVAR	thoracic endovascular aortic repair
TF	tissue factor
TGA	transposition of the great arteries
TH	Tandem Heart®
TIC	trauma-induced coagulopathy
TIMP2	tissue inhibitor metalloproteinase



Abbreviations

TIPSS	transjugular intrahepatic portosystemic shunt
TLC	total lung capacity
TLCO	transfer factor for carbon monoxide
TLR	Toll-like receptor
TLS	tumour lysis syndrome
TMA	thrombotic microangiopathy
TNF	tumour necrosis factor
TOE	transoesophageal echocardiography
TOF	train-of-four; tetralogy of Fallot
tPA	tissue plasminogen activator
TPN	total parenteral nutrition
TPPPS	Toddler–Preschooler Postoperative Pain Scale
TR	tricuspid regurgitation
TRALI	transfusion-related acute lung injury
TRH	thyrotropin-releasing hormone
TRICC	Transfusion Requirements in Critical Care
TRISS	Trauma Injury Severity Score
TRM	transplant-related mortality
tRNA	transfer ribonucleic acid
TSCI	traumatic spinal cord injury
TSH	thyroid-stimulating hormone
TSS	toxic shock syndrome
TT	thrombin time
TTE	transthoracic echocardiography
TTM	targeted temperature management
TTP	thrombotic thrombocytopenic purpura
TXA	tranexamic acid
U	unit
UA	unstable angina
UAO	upper airway obstruction
U&Es	urea and electrolytes
UF	ultrafiltration
UFH	unfractionated heparin
UGIB	upper gastrointestinal bleeding
UKOSS	UK Obstetric Surveillance System
URL	upper reference limit
USS	ultrasound scanning
VA	alveolar volume; veno-arterial
VAC	vacuum-assisted closure
VAD	ventricular assist device
VA-ECMO	veno-arterial extracorporeal membrane oxygenation

Abbreviations

VALI	ventilator-associated lung injury
VAP	ventilator-associated pneumonia
VBG	venous blood gas
VC	vital capacity
V <sub>d</sub>	volume of distribution
VET	viscoelastic test
VF	ventricular fibrillation
VHD	valvular heart disease
VILI	ventilator-induced lung injury
VKA	vitamin K antagonist
V/Q	ventilation/perfusion
VRE	vancomycin-resistant <i>Enterococcus</i>
Vt	tidal volume
VT	ventricular tachycardia
VTE	venous thromboembolism
VV	veno-venous
VV-ECMO	veno-venous extracorporeal membrane oxygenation
vWF	von Willebrand factor
VZV	varicella-zoster virus
WBC	white blood cell
WCC	white cell count
WHO	World Health Organization
WPW	Wolff–Parkinson–White
WSACS	World Society of the Abdominal Compartment Syndrome