CRITICAL CARE NURSING

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Leanne Aitken
Andrea Marshall
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Preface

Critical care as a clinical specialty is over half a century old. With every successive decade, advances in the education and practices of critical care nurses have been made. Over the past four years since the last edition and through the COVID-19 pandemic, we have seen enormous growth in the interest and recognition of critical care nursing, as well as an explosion of the body of evidence informing practice. Today, critical care nurses are some of the most knowledgeable and highly skilled nurses in the world, and ongoing professional development and education are fundamental elements in ensuring we deliver the highest quality care to our patients and their families.

This book is intended to encourage and challenge nurses to further develop their critical care nursing practice. Since the first edition in 2007, with a focus on Australasian practice, we have now expanded the text to reflect international practice and expertise in the field. Our authors come from many countries including Australia, Canada, England, Greece, the Netherlands, New Zealand, Northern Ireland, Scotland, Sweden, Switzerland and the USA.

This fifth edition of Critical Care Nursing has 29 chapters that reflect the collective talent and expertise of 56 contributors – a strong mix of clinicians and academics with a passion for critical care internationally. All contributors were carefully chosen for their current knowledge, clinical expertise and strong professional reputations.

The book has been developed primarily for use by practising critical care clinicians, managers, researchers and graduate students undertaking a specialty critical care qualification. In addition, senior undergraduate students studying high-acuity nursing subjects will find this book a valuable reference tool, although it may go beyond the learning needs of these students. The aim of the book is to be a comprehensive evidence-informed resource, as well as a portal to an array of other important resources, for critical care nurses. The nature and timeline of book publishing dictate that the information contained in this book reflects a snapshot in time of our knowledge and understanding of the complex world of critical care nursing. We therefore encourage our readers to continue to search also for the most contemporary sources of knowledge to guide their clinical practice. A range of website links have been included in each chapter to facilitate this process.

This fifth edition is divided into three broad sections: the scope of critical care nursing, core components of critical care nursing and specialty aspects of critical care nursing. Revisions to existing chapters were based on our reflections and suggestions from colleagues and reviewers as well as on evolving practices and emerging evidence in critical care.

Section 1 introduces a broad range of professional issues related to practice that are relevant across critical care. Initial chapters provide contemporary information on the scope of practice, systems and resources and ethical issues, with expanded information on quality and safety, and recovery and rehabilitation in critical care.

Content presented in Section 2 is relevant to the majority of critical care nurses, with a focus on concepts that underpin practice such as essential physical, psychological, social and cultural care. Remaining chapters in this section present a systems approach in supporting physiological function for a critically ill person. This edition has multiple linked chapters for some of the major physiological systems – four chapters for cardiovascular, three for respiratory and two for neurological. Chapters on support of renal function; nutrition assessment and therapeutic management; gastrointestinal, metabolic and liver alterations; management of shock; and multiorgan dysfunction complete this section.

Section 3 presents specific clinical conditions such as emergency presentations, trauma, resuscitation, postanaesthesia recovery, paediatric considerations, pregnancy and postpartum considerations and organ donation, by building on the principles outlined in Section 2. This section enables readers to explore some of the more complex or unique aspects of specialty critical care nursing practice.

Chapters have been organised in a consistent format to facilitate identification of relevant material. Where appropriate, each chapter commences with an overview of the relevant anatomy and physiology and the epidemiology of the clinical states. Nursing care of the patient, delivered independently or provided collaboratively with other members of the healthcare team, is then presented. Pedagogical features include a case study that elaborates relevant care issues and a critique of a research publication that explores a related topic. Tables, figures and practice tips have been used extensively throughout each chapter to identify areas of care that are particularly pertinent for readers. Each chapter also has specific learning activities, and model responses to these questions to further support learning can be found online. It is not our intention that readers progress sequentially through the book, but rather explore chapters or sections that are relevant for different episodes of learning or practice.

The delivery of effective, high-quality critical care nursing practice is a challenge in contemporary healthcare with a constantly evolving body of evidence. We trust that this book will be a valuable resource in supporting your care of critically ill patients and their loved ones.

Leanne **Aitken**
Andrea **Marshall**
Tom **Buckley**

About the editors

Leanne Aitken is Professor of Critical Care and Associate Dean – Research, Enterprise & Global Engagement at City University of London, United Kingdom. She holds honorary professorial appointments at both the University of Melbourne, Australia and Queen Mary University of London, United Kingdom. She has had a long career in critical care nursing, including practice, education and research roles. In all her roles, Leanne has been inspired by a sense of enquiry, pride in the value of expert nursing and a belief that improvement in practice and resultant patient outcomes is always possible. Research interests include developing and refining interventions to improve long-term recovery of critically ill and injured patients, decision-making practices of critical care nurses and a range of clinical practice issues within critical care, such as sedation management.

Leanne has been active in the Australian College of Critical Care Nurses (ACCCN) for more than 35 years and was made a Life Member and Fellow of the College in 2006 after holding positions on a range of state and national boards, panels and working groups; she has also been an Associate Editor with Australian Critical Care. Leanne is an Ambassador for the World Federation of Critical Care Nurses.

Leanne is a Fellow of both the American Academy of Nursing and the Australian College of Nursing. She is also a Fulbright Alumnus after receiving a Fulbright Senior Scholarship to undertake research at the University of Pennsylvania, Philadelphia, USA. Leanne has published more than 170 original publications in peer-reviewed journals. She is also a peer reviewer for a number of national and international journals and reviews grant applications for a range of organisations internationally.

Andrea Marshall is Professor of Intensive Care Nursing at Griffith University and Gold Coast Health, Queensland, Australia. She has been working in critical care as a clinician, educator and researcher for more than two decades. Andrea has a strong interdisciplinary focus on research, translation of research into clinical practice and implementing patient- and family-centred approaches to clinical care and research. Her program of research focuses on improving nutrition delivery to acute and critically ill patients during hospitalisation and following discharge.

Andrea has been actively involved with the ACCCN for over two decades in a variety of state- and nationally-based leadership roles. In 2014 her contribution to the College was recognised with Life Membership. She is currently Editor-in-Chief of Australian Critical Care and has played a key editorial role with this journal since 2003. She has published over 180 peer reviewed publications, is an active contributor to grant reviews for a number of national and international funding bodies and serves as a reviewer on several international journals, many of which have an interdisciplinary focus.

Thomas Buckley (Tom) is Associate Professor of Acute and Critical Care Nursing at the University of Sydney. He has been a critical care clinical nurse, educator and researcher for almost three decades and has served as an editor with Australian Critical Care over the past 7 years.

Tom is an active researcher with a strong focus on the interaction between psychological stressors and adverse health risk, as well as end-of-life care practices in intensive care. In addition to his research, Tom has a track record in nurse practitioner education and has served as the Chair of the Australian Nursing and Midwifery Accreditation Council (ANMAC) Nurse Practitioner Accreditation Committee (2015-2019). In addition, he contributed as co-investigator on research that informed the Australian Nurse Practitioner Standards for Practice (2014) and Registered Nurse Standard for Practice (2016) and led the development of the ACCCN Position Statement on Advanced Practice in Critical Care in 2021.

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Leanne **Aitken**
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Abbreviations

6MWT	6 minute walk test
AACN	American Association of Critical-Care Nurses
AAST	American Association for the Surgery of Trauma
ABCDEF	awakening and breathing coordination, choice of sedatives and analgesic exposure, delirium monitoring and management, early mobility, family engagement
ABG	arterial blood gas
ABIC	age, serum bilirubin, INR and serum creatinine score
A/C	assist control ventilation
ACCCN	Australian College of Critical Care Nurses
ACCESS	assistance, coordination, contingency, education, supervision, support
ACEI	angiotensin-converting enzyme inhibitor
ACEP	American College of Emergency Phsyicians
ACh	acetylcholine
ACLF	acute-on-chronic liver failure
ACS	abdominal compartment syndrome
ACS	acute coronary syndrome
ACT	activated clotting time
ADH	antidiuretic hormone
ADL	activities of daily living
ADVOS	advanced organ support
AE	adverse event
AED	automatic external defibrillator
AF	atrial fibrillation
AFE	amniotic fluid embolism
AGREE II	Appraisal of Guidelines for Research and Evaluation II
AHF	acute heart failure
AIDS	acquired immune deficiency syndrome
AIMS–ICU	Australian Incident Monitoring Study–ICU
AIS	Abbreviated Injury Score
AKI	acute kidney injury
ALARP	as low as reasonably possible
ALF	acute liver failure
ALI	acute lung injury
ALS	advanced life support
AMI	acute myocardial infarction
AMR	antimicrobial resistance
AMS	automatic mode switching
ANLH	acute native lung hyperinflation
ANP	atrial natriuretic peptide
ANS	autonomic nervous system
ANZ	Australia and New Zealand
ANZBA	Australia and New Zealand Burns Association
AODR	Australian Organ Donor Register
AOTA	Australian Organ and Tissue Authority
AP	anteroposterior
APACHE	Acute Physiology And Chronic Health Evaluation (score)
APH	antepartum haemorrhage
APRV	airway pressure release ventilation
APSIC	Asia Pacific Society of Infection Control
APTT	activated partial thromboplastin time
ARAS	ascending reticular activating system
ARB	angiotensin receptor blocker
ARC	Australian Resuscitation Council
ARDS	acute respiratory distress syndrome
ARF	acute renal failure
ARF	acute respiratory failure
ARP	absolute refractory period
ASV	adaptive support ventilation
AT	atrial tachycardia
ATC	automatic tube compensation
ATLS	advanced trauma life support
ATN	acute tubular necrosis
ATP	adenosine triphosphate
ATS	Australasian Triage Scale
AUD	Australian dollar
AV	atrioventricular
AVNRT	atrioventricular nodal re-entry tachycardia
AVRT	atrioventricular re-entrant tachycardia
AWS	alcohol withdrawal syndrome
BACCN	British Association of Critical Care Nurses
BCL	bandage contact lenses
BE	base excess
βHCG	beta-human chorionic gonadotropin
BiPAP	bi-phasic positive airways pressure
BLS	basic life support
BMI	body mass index
BP	blood pressure
BPS	Behavioural Pain Scale
BSLTx	bilateral sequential lung transplantation
BURP	backwards, upwards, rightward pressure
CABG	coronary artery bypass graft
CACCN	Canadian Association of Critical Care Nurses
CALD	culturally and linguistically diverse
CAM-ICU	Confusion Assessment Method for the Intensive Care Unit
CAP	community-acquired pneumonia
CAPD	Cornell Assessment for Pediatric Delirium
CAUTI	catheter-associated urinary tract infection
CAVH	continuous arteriovenous haemofiltration
CBF	cerebral blood flow
CBT	cognitive behavioural therapy
CBV	cerebral blood volume

CCRN	critical care registered nurse
CCU	coronary/cardiac care unit
CDC	Centers for Disease Control and Prevention
CHB	complete heart block
CHD	congenital heart disease
CHD	coronary heart disease
CHF	congestive heart failure
CHF	chronic heart failure
CHG	chlorhexidine gluconate
CI	cognitive impairment
CI	cardiac index
CIM	critical illness myopathy
CINM	critical illness neuromyopathy
CIP	critical illness polyneuropathy
CIRCI	critical illness-related corticosteroid insufficiency
CIWA-Ar	Clinical Institute Withdrawal Assessment of Alcohol Scale
CK	creatine kinase
CKD	chonic kidney disease
CLABSI	central line associated blood stream infection
CLL	chronic lymphocytic leukaemia
cLMA	classic laryngeal mask airway
CMV	controlled mandatory ventilation
CN	cranial nerve
CNC	clinical nurse consultant
CNE	clinical nurse educator
CNM	clinical nurse manager
CNS	central nervous system
CO	carbon monoxide
CO	cardiac output
CO_2	carbon dioxide
COPD	chronic obstructive pulmonary disease
CoV-2	coronavirus 2
COVID-19	coronavirus disease 2019
COX	cyclo-oxygenase
CPAP	continuous positive airway pressure
CPAx	Chelsea critical care physical assessment tool
CPB	cardiopulmonary bypass
CPE	carbapenemase-producing Enterobacteriaceae
CPG	clinical practice guidelines
CPOE	computerised provider order entry
CPOT	Critical-care Pain Observation Tool
CPP	cerebral perfusion pressure
CPR	cardiopulmonary resuscitation
CQR	clinical quality registries
CR	cardiac rehabilitation
CRP	C-reactive protein
CRRT	continuous renal replacement therapy
CRS	cytokine release syndrome
CRT	cardiac resynchronisation therapy
CSF	cerebral spinal fluid
CT	computerised tomography
CTA	computed tomography angiography
CTAS	Canadian Triage and Acuity Scale
CTG	cardiotocograph
CTI	cavotricuspid isthmus
CTPA	computerised tomography pulmonary angiogram
CUSP	comprehensive unit-based safety program
CVAD	central venous access device
CVC	central venous catheter
CVD	cardiovascular disease
CVP	central venous pressure
CVVH	continuous venovenous haemofiltration
CVVHDf	continuous venovenous haemodiafiltration
CX	circumflex coronary artery
CXR	chest X-ray
DAOH	days alive and out of hospital
DCDD	donation after circulatory determination of death
DCR	damage-control resuscitation
DCS	damage-control surgery
DDD	dual-chamber pacing, dual-chamber sensing and dual responses
DEMMI	De Morton Mobility Index
DES	dry eye syndrome
DIC	disseminated intravascular coagulation
DKA	diabetic ketoacidosis
DLT	double-lumen endotracheal tubes
DNA	deoxyribonucleic acid
DNS	Dependence Nursing Scale
DPL	diagnostic peritoneal lavage
DRG	diagnostic related groups
DVT	deep vein thrombosis
E	expiration
EAST	Eastern Association for the Surgery of Trauma
EBP	evidence-based practice
EC	extracorporeal circuit
ECC	external cardiac compressions
ECG	electrocardiography
ECLS	extracorporeal life support
ECMO	extracorporeal membrane oxygenation
ED	emergency department
EDD-f	extended daily dialysis filtration
EEG	electroencephalogram/electroencephalography
EfCCNa	European federation of Critical Care Nursing associations
EM	early mobilisation
EMDR	eye movement desensitisation and reprocessing
EMR	electronic medical records
EMS	emergency medical service
EMSB	early management of severe burns
EN	enteral nutrition
EoL	end of life
EPAP	expiratory positive airway pressure
EQ-5D	EuroQol Five dimension
ERAS	early/enhanced recovery after surgery
ERC	European Resuscitation Council
ESI	emergency severity index
ESRD	end-stage renal disease
ETT	endotracheal tube
EVD	external ventricular drain

F	frequency
FAST	focused assessment with sonography in trauma
FBC	full blood count
FCC	family-centred care
FEES	flexible endoscopic evaluation of swallowing
FES	fat embolism syndrome
FEV1	forced expiratory volume in one second
FFP	fresh frozen plasma
FH	fetal heart
FICM	Faculty of Intensive Care Medicine
FIM	Functional Independence Measure
FiO_2	fraction of inspired oxygen
FLACC	Faces Legs Activity Cry Consolability
FRC	functional residual capacity
FSS	functional status score
FTE	full-time equivalent
FTND	Fagerström Test for Nicotine Dependence
f/V_T	frequency/tidal volume
FVC	forced vital capacity
GABA	gamma-aminobutyric acid
GAH	Glasgow Alcoholic Hepatitis
GCS	Glasgow Coma Scale
GEDV	global end-diastolic volume
GEDVI	global end-diastolic volume index
GFR	glomerular filtration rate
GIT	gastrointestinal tract
GRADE	grading of recommendations, assessment, development and evaluation
GRV	gastric residual volume
H^+	hydrogen ion
H_2CO_3	carbonic acid
H2RA	histamine-2 receptor antagonist
HAC	hospital-acquired complication
HADS	Hospital Anxiety and Depression Scale
HAI	hospital-acquired/healthcare-acquired infection
Hb	haemoglobin
HBV	hepatitis B virus
HCM	hypertrophic cardiomyopathy
HCO_3^-	bicarbonate ion
HCV	hepatitis C virus
HD	haemodialysis
HDU	high-dependency unit
HE	hepatic encephalopathy
HELLP	haemolysis, elevated liver enzymes and low platelets
HEMS	helicopter emergency medical service
HEPA	high-efficiency particulate air
HFNC	high-flow nasal cannulae
HFO	high-flow oxygen
HFOV	high-frequency oscillation ventilation
HFpEF	heart failure with preserved ejection fraction
HFrEF	heart failure with reduced ejection fraction
HHFNC	humidified high-flow oxygen via nasal cannulae
HHS	hyperosmolar hyperglycaemic state
Hib	*Haemophilus influenzae* type b
HIV	human immunodeficiency virus
HME	heat and moisture exchanger
HMGB1	high-mobility group box 1
HPA	hypothalamic–pituitary–adrenal
HPIV	human parainfluenza virus
HOB	head of bed
HR	heart rate
HRO	high-reliability organisation
HRQOL	health-related quality of life
HRS	hepatorenal syndrome
HRS-AKI	hepatorenal syndrome acute kidney injury
HRS-NAKI	hepatorenal syndrome non-acute kidney injury
HSV	herpes simplex virus
Hz	frequency, hertz
I	inspiration
IABP	intra-aortic balloon pump
IAD	incontinence-associated dermatitis
IAH	intraabdominal hypertension
IAP	intraabdominal pressure
ICC	intercostal catheter
ICC	intraclass correlation coefficient
ICD	implantable cardioverter defibrillator
ICDSC	Intensive Care Delirium Screening Checklist
ICF	International Classification of Functioning, Disability and Health
ICN	International Council of Nurses
ICP	intracranial pressure
ICS	Intensive Care Society (UK)
ICTRP	International Clinical Trial Registry Platform
ICU	intensive care unit
ICU-AW	intensive care unit-acquired weakness
IDC	indwelling catheter
I:E	inspiratory/expiratory ratio
IESR	Impact of Event Scale Revised
IHPA	Independent Hospital Pricing Authority
ILCOR	International Liaison Committee on Resuscitation
ILV	independent lung ventilation
IMD	invasive meningococcal disease
IMS	ICU Mobility Scale
IMT	inspiratory muscle training
INR	international normalised ratio
IP	inflation point
IPAP	inspiratory positive airway pressure
IPC	infection prevention and control
IPC	intermittent pneumatic compression
IPH	interventional patient hygiene
IPV	intimate partner violence
ISTAP	International Skin Tear Advisory Panel
ITBV	intrathoracic blood volume
ITBVI	intrathoracic blood volume index
IV	intravenous
IVC	inferior vena cava
JVP	jugular venous pressure

KDIGO	Kidney Diseases Improving Global Outcomes
KT	knowledge translation
LAD	left anterior descending
LAP	left atrial pressure
LBBB	left bundle branch block
LMA	laryngeal mask airway
LMICs	low- and middle-income countries
LOS	length of stay
LP	lumbar puncture
LSD	lysergic acid diethylamide
LV	left ventricle
LVAD	left ventricular assist device
LVEDV	left ventricular end-diastolic volume (preload)
LVEF	left ventricular ejection fraction
LVF	left ventricular failure
LVSWI	left ventricular stroke work index
MAP	mean arterial pressure
MARSI	medical adhesive-related skin injuries
MASD	moisture-associated skin damage
MCS	mechanical circulatory support
MDR-TB	multi-drug-resistant TB
MDT	multidisciplinary team
MELD	model of end-stage liver disease
MELD-NA	model of end-stage liver disease-sodium
MERS	Middle East respiratory syndrome
MERS-CoV	Middle East respiratory syndrome coronavirus
MET	medical emergency team
MEWS	modified early warning score
MI	myocardial infarction
MIS-C	multisystem inflammatory syndrome in children
MI-E	mechanical insufflation: exsufflation
mmHg	millimetres of mercury
MMP	matrix metalloproteinase
MoCA	Montreal Cognitive Assessment
MODS	multiple organ dysfunction syndrome
MP	mechanical power
MRC	Medical Research Council
MRI	magnetic resonance imaging
MRO	multi-resistant organism
MRSA	methicillin-resistant *Staphylococcus aureus*
MSCT	multi-slice CT
MTS	Manchester Triage Scale
MV	mechanical ventilation
MV	minute ventilation
MVA/C	motor vehicle accident/collison
MVE	Murray Valley encephalitis
nAchR	nicotinic acetylcholine receptor
NAM	National Academy of Medicine
NAS	Nursing Activities Score
NASA-TLX	NASA Task Loading Index
NAVA	neurally adjusted ventilatory assist
NEMS	Nine Equivalents of nursing Manpower use Score
NETS	newborn emergency transfer service
NEWS	National Early Warning Score
NFR	not for resuscitation
NGAL	neutrophil gelatinase-associated lipocalin
NHMRC	National Health and Medical Research Council
NHPPD	nursing hours per patient day
NHS	National Health Service (UK)
NICE	National Institute for Health and Care Excellence (UK)
NICU	neonatal intensive care unit
NIPPV	non-invasive positive pressure ventilation
NIPSV	non-invasive pressure support ventilation
NIPT	non-invasive prenatal testing
NIV	non-invasive ventilation
NMBA	Nursing and Midwifery Board of Australia
NMBA	neuromuscular blockade agent
NMES	neuromuscular electrical stimulation
NO	nitric oxide
NOC	nurses' observation checklist
NP	nurse practitioner
NPC	nurse practice coordinator
NPWT	negative pressure wound therapy
NRT	nicotine replacement therapy
NSAID	non-steroidal anti-inflammatory drug
NTS	National Triage Scale
NTS	non-technical skills
Nu-DESC	Nursing DElirium Symptom Checklist
NUM	nursing unit manager
NUTRIC	NUTritional RIsk in the Critically ill score
O_2	oxygen
OECD	Organisation for Economic Co-operation and Development
ONS	oral nutrition supplements
OSA	obstructive sleep apnoea
OT	operating theatre
OUD	opioid use disorder
ΔP	driving pressure
***P*a**	arterial pressure
***P*A**	alveolar pressure
PA	phlebostatic axis
PA	posterioanterior
PA	*Pseudomonas aeruginosa*
PAC	pulmonary artery catheter
$PaCO_2$	partial pressure of carbon dioxide in arterial blood
PACU	post-anaesthesia care unit
PaO_2	partial pressure of oxygen in arterial blood
PAOP	pulmonary artery occlusion pressure
PAP	pulmonary artery pressure
PAPR	powered air purifying respirators
PAT	Paediatric Assessment Triangle
PAV	proportional assist ventilation
***P*aw**	airway pressure
PAWSS	Prediction of Alcohol Withdrawal Severity Scale
PCA	patient-controlled analgesia
PCI	percutaneous coronary intervention

PCP	phencyclidine
PCR	polymerase chain reaction
PCV	pressure-controlled ventilation
PCWP	pulmonary capillary wedge pressure
PD	peritoneal dialysis
PDSA	plan-do-study-act
PE	pulmonary embolism
PEA	pulseless electrical activity
PEEP	positive end-expiratory pressure
PELD	paediatric end-stage liver disease
PER	passive external re-warming
PEST	political, economic, social, technical
***P*etCO$_2$**	partial pressure of end-tidal carbon dioxide
PEth	phosphatidylethanol
PFIT	Physical Function ICU Test
***P/F* ratio**	ratio of PaO_2 to FiO_2
PGD	primary graft dysfunction
pH	acid–alkaline logarithmic scale
PICC	peripherally inserted central venous catheter
PICO	population, intervention, comparator, outcome
PiCCO	pulse-induced contour cardiac output
PICS	post-intensive care syndrome
PICS-F	post-intensive care syndrome – family
PICS-p	post-intensive care syndrome – paediatrics
PICU	paediatric intensive care unit
PICU-MAPS	paediatric intensive care unit Multidimensional Assessment Pain Scale
PIMS-TS	paediatric inflammatory multisystem syndrome temporally associated with COVID-19
PIP	peak inspiratory pressure
***P*insp**	inspiratory pressure
PIRO	predisposition, infection, response, and organ failure (score)
PMCS	perimortem caesarean section
pMDI	pressurised metered-dose inhalers
PMT	pacemaker-mediated tachycardia
PN	parenteral nutrition
PNS	peripheral nervous system
POD	postoperative delirium
POUR	postoperative urinary retention
PP	prone positioning
PPE	personal protective equipment
PPH	postpartum haemorrhage
PPI	proton pump inhibitors
***P*Plat**	plateau pressure
PR	pulse rate
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PS	pressure support
PSG	polysomnography
PSI	Pneumonia Severity Index
PSV	pressure support ventilation
PTSD	post-traumatic stress disorder
PTSS	post-traumatic stress symptoms
PV	per vagina
***P*v**	venous pressure
PVR	pulmonary vascular resistance
QD	qualitative description
QOL	quality of life
qSOFA	quick Sequential Organ Failure Assessment
QTc	corrected QT
R	respiration
RAP	right atrial pressure
RASS	Richmond Agitation Sedation Scale
RAT	rapid antigen test
RBANS	Repeatable Battery for the Assessment of Neuropsychological Status
RBC	red blood cell
RCA	right coronary artery
RCA	root cause analysis
RCSQ	Richards–Campbell Sleep Questionnaire
RCT	randomised controlled trial
REBOA	resuscitative endovascular balloon occlusion of the aorta
REE	resting energy expenditure
REM	rapid eye movement
RHD	rheumatic heart disease
RIFLE	risk, injury, failure, and outcome criteria of loss and end-stage disease
RM	recruitment manoeuvres
RN	registered nurse
ROM	range of motion
ROMPIS	Reaper Oral Mucosa Pressure Injury Scale
ROSC	return of spontaneous circulation
ROTEM	rotational thromboelastometry
RR	relative risk, risk ratio
RR	respiratory rate
RRP	relative refractory period
RRS	rapid response system
RRT	rapid response team
RRT	renal replacement therapy
RSV	respiratory syncytial virus
RV	right ventricular
RVEDV	right ventricular end-diastolic volume
RVEDVI	right ventricular end-diastolic volume index
RVEF	right ventricular ejection fraction
RVESV	right ventricular end-systolic volume
RVF	right ventricular failure
RVSWI	right ventricular stroke work index
SA	sinoatrial node
***S*aO$_2$**	saturation of oxygen in arterial blood
SAPS	Simplified Acute Physiology Score
SARS	severe acute respiratory syndrome
SATS	South African Triage Scale
SBP	systolic blood pressure
SBS	State Behavioural Scale
SBT	spontaneous breathing trial
SCA	sudden cardiac arrest
SCD	sudden cardiac death
SCI	spinal cord injury
SCUF	slow continuous ultrafiltration
SD	standard deviation
SEIPS	Systems Engineering Initiative for Patient Safety

SGA	supraglottic airway
SGLT2	sodium–glucose cotransporter-2
SIADH	syndrome of inappropriate antidiuretic hormone
SIMV	synchronised intermittent mandatory ventilation
SIRS	systemic inflammatory response syndrome
SLED	slow low-efficiency dialysis
SLTx	single lung transplantation
SNS	sympathetic nervous system
SOFA	sequential organ failure assessment
SOMANZ	Society of Obstetric Medicine of Australia and New Zealand
SOS-PD	Sophia Observation withdrawal Symptoms-Paediatric Delirium
SpO_2	saturation of oxygen in peripheral tissues
SR	sinus rhythm
SSD	subglottic secretion drainage
SSRI	selective serotonin reuptake inhibitors
ST	sinus tachycardia
STEMI	ST-elevation myocardial infarction
SUP-ICU	stress ulcer prophylaxis in the intensive care unit
SV	stroke volume
SVG	saphenous vein graft
SvO_2	saturation of oxygen in venous system
SVR	systemic vascular resistance
SVT	supraventricular tachycardia
SWAN	Subjective Workload Assessment for Nurses
SWOT	strengths, weaknesses, opportunities, threats
SWS	slow wave sleep
TAD	thoracic aortic dissection
TAP	transverse abdominis plane
TAP	treatment action plan
TBI	traumatic brain injury
TBSA	total body (or burn) surface area
TBW	total body weight
TdP	torsades de pointes
TEAM	treatment with early activity and mobilisation
TEG	thromboelastograph
TEVAR	thoracic endovascular aortic repair
TIA	trans-ischaemic attack
TICS-M	Telephone Interview of Cognitive Status – Modified version
TIPSS	transjugular intrahepatic portosystemic shunt/stent
TISS	Therapeutic Intervention Scoring System
TNF-α	tumour necrosis factor alpha
TOE	transoesophageal echocardiography
TRALI	transfusion-related acute lung injury
TST	total sleep time
TTE	transthoracic echocardiography
TURP	transurethral resection of the prostate
UK	United Kingdom
URTI	upper respiratory tract infection
USA	United States of America
VA	venoarterial
VAD	ventricular assist device
VAD	voluntary assisted dying
VAE	ventilator-associated event
VAP	ventilator-associated pneumonia
VAS	visual analogue scale
VAS-A	visual analogue scale – anxiety
VATS	video-assisted thoracopic surgery
VCA	vascularised composite allotransplantation
VCV	volume-controlled ventilation
$\dot{V}E$	expired minute volume
VEES	videoendoscopic swallowing study
VF	ventricular fibrillation
VILI	ventilator-induced lung injury
$\dot{V}/Q$	ventilation/perfusion
VRE	vancomycin-resistant enterococci
V_T	tidal volume
VT	ventricular tachycardia
VTE	venous thromboembolism
VV	venovenous
VVIR	Ventricular pacing,Ventricular activity, Inhibiting pacing, Rate responsiveness
VOO	Ventricular pacing, no (O) sensing capability, no (O) capability to respond
WAT-1	Withdrawal Assessment Tool
WBC	white blood cell
WBCT	whole-body CT
WEST	Western Association for the Surgery of Trauma
WCC	white cell count
WFCCN	World Federation of Critical Care Nurses
WFSICCM	World Federation of Societies of Intensive and Critical Care Medicine
WHO	World Health Organization
WHODAS 2.0	World Health Organization Disability Assessment Scale 2.0
WSACS	World Society of Abdominal Compartment Syndrome

Chapter 6

Patient comfort and psychological care

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KEY WORDS

agitation
alcohol, benzodiazepine, nicotine and opioid withdrawal
anxiety
delirium
depression
pain assessment and pain management
sedation assessment and management
sedation protocols
sleep promotion and maintenance

Learning objectives

After reading this chapter, you should be able to:

- implement appropriate evidence-based strategies to manage patient anxiety and depression
- describe the subtypes of delirium
- discuss strategies to potentially prevent, or reduce the duration and severity of, delirium in the critically ill patient
- implement and evaluate delirium assessment screening instruments for the critically ill
- implement screening strategies to identify patients at risk of substance dependence
- implement alcohol withdrawal assessment monitoring instruments
- integrate best practice into pain assessment and management
- describe the different instruments available to assess sedation needs in critically ill patients and discuss the benefits and limitations of each
- determine methods to promote rest and sleep for critically ill patients.

Introduction

Promotion of comfort, psychological health and well-being of patients is an essential aspect of care for critically ill patients. Patients experience significant discomfort and ongoing compromise of their psychological health both while in the critical care environment and beyond. Effective management of both patients' comfort and their psychological health also influences their physical health. Aspects of patient comfort and psychological health that are most relevant in the care of the critically ill include the recognition and management of anxiety, depression, delirium, withdrawal from alcohol or other substances, pain, sedation and sleep. Inclusion of the patient's family in promoting comfort and psychological health is an important consideration. Despite widespread recognition of the need for regular assessment using validated instruments and targeted management to achieve patient comfort, there are repeated reports indicating absent or infrequent and incomplete assessment, with a lack of subsequent care, internationally.[1–4]

Although each of the concepts of anxiety, depression, delirium, pain, sedation and sleep are reviewed sequentially through this chapter, in reality it is often difficult to separate them as their effects are additive or synergistic. While it is important to ensure that assessment incorporates each of the individual concepts, management may often target multiple aspects concurrently.

Anxiety and depression

Patients may experience anxiety and depression both during and following a period of critical illness. Anxiety has been defined as an unpleasant emotional arousal or condition caused by a perceived threat or stressor.[5] It can be classified as an underlying mental health disorder, as well as a transient emotional state, known as state anxiety, which manifests as 'subjective feelings of tension, apprehension, nervousness, and worry'.[6] Depression is characterised by a persistent low mood and loss of interest in general activities, and may also be accompanied by sleep disturbances and cognitive changes.[7]

Factors contributing to symptoms of anxiety or depression include:[8–14]

- pre-existing high trait anxiety
- current or previous dependence on alcohol or illicit substance/opioids
- previous mental illness
- unwanted symptoms such as pain, sleeplessness, thirst, and discomfort and immobility
- interventions including mechanical ventilation, invasive devices, repositioning and suctioning
- increased severity of illness
- use of certain medications such as vasopressors and benzodiazepines
- adverse and unfamiliar environmental conditions such as noise and light
- extended ICU length of stay
- concerns about current illness together with underlying chronic disease and the ongoing impact of illness on recovery.

Anxiety has been identified in approximately half of critically ill patients, and symptoms of depression in approximately one-third.[7,8,15–17] Patterns of anxiety vary widely; high levels of anxiety early or later in the ICU stay are frequent.[18] The prevalence of anxiety in critically ill patients appears to be similar across countries and cultures.[10,16,19]

Both anxiety and depression can lead to negative outcomes for critical care patients during and after their stay in ICU. Physiological and psychological responses to anxiety reflect a stress response and incorporate avoidance behaviour, increased vigilance and arousal, activation of the sympathetic nervous system and release of cortisol from the adrenal glands.[20] The humoral response, mediated by the hypothalamic–pituitary–adrenal (HPA) axis, regulates this activity. Physiological changes occur to multiple body systems, with the most relevant including constriction of blood vessels, increased heart rate, relaxation of airways, increased secretion of adrenaline (epinephrine) and noradrenaline (norepinephrine), as well as increased glucose production,[20] and result in behavioural, psychological/cognitive and social manifestations (Table 6.1).[21–23] Symptoms of depression such as low mood and motivation can result in these patients not participating in beneficial therapies during the ICU admission, such as early mobilisation and physiotherapy.[24] Depression is also associated with significantly higher mortality rates after patients have been discharged from ICU.[7,25,26]

Anxiety and depression assessment

The importance of psychological and emotional assessment, with the aim of ameliorating the adverse effects of anxiety and depression, is widely accepted.[27] However, recognition

TABLE 6.1
Clinical indicators of anxiety

PHYSIOLOGICAL	BEHAVIOURAL	PSYCHOLOGICAL/COGNITIVE	SOCIAL
Heart rate	Restlessness	Confusion	Seeking reassurance
Blood pressure	Agitation	Anger	Need for attention/ companionship
Chest pain	Sleeplessness	Negative thinking	Limiting interaction
Respiratory rate	Hypervigilance	Verbal expression of stress/anxiety	
Shortness of breath	Fighting ventilator	Crying	
Altered O_2 saturation	Facial grimacing/tension	Inability to retain and process information	
Coughing/choking feeling	Uncooperative		
Diaphoresis	Rapid speech		
Pallor	Difficulty verbalising		
Cold and clammy	Distrustful/suspicious		
Dry mouth	Avoidance/desire to leave stressful area		
Pain			
Headache			
Nausea and vomiting			
Swallowing difficulty			

and interpretation of anxiety and depression is complex, particularly when signs and symptoms are masked by critical illness and its treatment. History and previous experience are vital adjuncts to patient assessment and diagnosis and often provide information that is vital to effective care and treatment.[28] Alterations in levels of biochemical markers, such as cortisol and catecholamines, that are frequently associated with anxiety may also be attributed to physiological stress.[23] Hence, validated rating scales are advocated and may offer benefits not found with unstructured clinical assessment.[29]

Practice tip

Remember, a patient's history and previous experiences are vital to 'knowing the person' so if a patient is unable to communicate then ask their family and friends about past experiences of illnesses, hospitalisations, phobias, likes and dislikes and usual coping strategies.

A structured approach to assessment is needed to accurately and consistently understand patients' psychological problems. A number of self-report scales are available to assess anxiety and depression (Table 6.2).[6,22,30–38] These scales require a degree of cognitive acumen and an ability to communicate responses – a challenge for many critically ill patients. In addition, some scales have up to 21 items, making them both time consuming and unmanageable for routine use. Patients with visual and auditory impairments may require additional assistance, such as larger print, hearing aids or glasses, in order to complete the forms.

The visual analogue scale for anxiety (VAS-A) is a single-item measure which is fast and simple to complete, and has been shown to have good reliability and validity.[35] It comprises a 100-millimetre vertical line, with the bottom marker labelled 'not anxious at all' and the top marker labelled 'the most anxious I have ever been'.

Similarly, the Faces Anxiety Scale, another single-item self-reporting scale which was developed by Australian researchers, accurately detects anxiety in critically ill patients.[22] There are five possible responses to assess anxiety (Fig. 6.1).

Anxiety and depression management

The detrimental short- and long-term effects of anxiety and depression, and importance of ameliorating or managing these unpleasant psychophysiological states, are widely accepted.[29,39,40] Although pharmacological interventions such as anxiolytic medications and analgesia are well recognised and frequently used, non-pharmacological treatments (i.e. environmental and nurse-initiated interventions) are also useful.

Non-pharmacological treatments

An advantage of non-pharmacological treatments is that they can be nurse initiated. Environmental aspects may be implemented when units are designed or refurbished (Table 6.3).[41–51] Although the benefits of some complementary therapies may be widely accepted in the community, use of them in critical care is dependent on their acceptance, safety, efficacy and patient consent. While the level of evidence is low, beneficial effects for some complementary therapies such as music therapy and massage have been reported and include lowered blood pressure, heart rate and respiratory rate; improved sleep; and

TABLE 6.2
Anxiety and depression self-report assessment scales

SCALE	NUMBER OF ITEMS	COMMENTS
Hospital Anxiety and Depression Scale (HADS)[30]	14	Easy and fast to complete Extensively used and therefore international comparisons are available Demonstrated validity
Depression Anxiety and Stress Scale 21 (DASS 21)[31]	21	Items measured on scale of 0 (did not apply to me at all) to 3 (applied to me very much or most of the time) Demonstrated validity in clinical populations[32]
Spielberger State Anxiety Inventory (SAI)[33]	20	Items measured on a scale of 1 (not at all) to 4 (very much so) Validity demonstrated in various populations[6] Too long for routine clinical use, but may be useful in associated research; attempts to shorten the SAI have provided inconsistent results[6,34]
Visual Analogue Scale – Anxiety (VAS-A)[35]	1	10 cm/100 mm line from 'not at all anxious' to 'very anxious' Demonstrated validity[35]
Faces Anxiety Scale[22]	1	5 possible responses or 'faces' to reflect anxiety Fast and easy to use Validity has been demonstrated in a small number of ICU cohorts[22,36–38]

FIGURE 6.1 Faces Anxiety Scale.[22]

Source: Adapted from McKinley S, Coote K, Stein-Parbury J. Development and testing of a Faces Scale for the assessment of anxiety in critically ill patients. J Adv Nurs 2003;41(1):73–9, with permission.

TABLE 6.3
Non-pharmacological measures to reduce anxiety

NURSE-INITIATED TREATMENTS	ENVIRONMENTAL FACTORS
Patient massage[41,42]	Provision of natural light[45]
Aromatherapy[48,49]	Calming wall colours such as blue, green and violet
Music therapy[43,44,50]	Noise reduction with consideration of alarms, paging systems, talking, etc.[51]

reduced stress (and concomitant sedative medication requirements), anxiety and pain.[41–45] More-structured non-pharmacological therapies, such as cognitive behavioural therapy, have also been reported to reduce the symptoms of anxiety as well as potentially having other effects such as a reduction in duration of mechanical ventilation.[46,47] As with any therapy, each non-pharmacological treatment may have different effects on individual patients; consequently, ongoing assessment is essential. In addition, the safety of these therapies during critical illness has not been well demonstrated, necessitating thorough monitoring and caution throughout administration.

Practice tip

Consider using music as an adjunct for patient care. If the patient likes music, ask about their music likes and dislikes (styles, instruments, artists) and when they like to listen to music. Document this information, then request the family to bring a music player with a selection of their preferred music and headphones. Then, prepare the patient for a rest period. Ensure that analgesia is sufficient, there are no planned interventions and the patient is comfortable, then commence at least 30 minutes of uninterrupted music. See Chlan and colleagues[52] for more information about providing music as an adjunct to care.

Practice tip

Review your patient's past medical history for the presence of a pre-existing mental health disorder and consider how this will affect how you deliver their care. For example, they may require additional support and encouragement to engage in rehabilitation activities within the ICU. Also consider whether referrals to support services such as social work, consultation liaison psychiatry or an ICU psychologist (if available) may be appropriate.

Other strategies to improve patients' psychological health include communication and information sharing by the healthcare team and inclusion of family members in care processes.[27] The presence of a family member can provide additional reassurance and inner strength (see Chapter 7). In addition, the very presence of the nurse has been reported to be a great source of security, reducing feelings of vulnerability.[53]

Pharmacological treatments

Treatment for pain and other reversible physiological causes of anxiety and agitation should be a priority. If anxiety and agitation continue, despite the incorporation of non-pharmacological interventions, pharmacological treatment with relevant medications may be initiated. A brief overview of these medications in the treatment of unrelieved anxiety is provided in Table 6.4.[54–57] Generally, non-benzodiazepine sedative medications such as propofol are recommended in preference to benzodiazepines.[54] A thorough medication history should also be conducted, as the abrupt cessation of outpatient psychoactive medications in the ICU may increase agitation or lead to withdrawal symptoms.[55] If the patient is medically stable, it may be more appropriate to restart medications they were previously taking rather than commencing other therapies to treat agitation.[56]

Delirium

Delirium is a significant concern for critically ill patients and clinicians. It is a central nervous dysfunction in which behaviours and physiological responses are not conducive to healing and recovery. Arguably, the condition has been underrecognised and undertreated[58] and is only recently receiving the attention it deserves. Early detection and treatment of delirium is vital, as it is associated with adverse clinical outcomes such as prolonged duration of ventilation and hospitalisation and higher rates of morbidity and mortality.[59–61] Furthermore, long periods of delirium have been associated with long-term cognitive impairment[62] and an increase in delusional memories.[63,64]

There are three subtypes of delirium: *hypoactive*, *hyperactive* and *combined* (a combination of both).[65] Disturbances in attention (e.g. reduced ability to direct,

TABLE 6.4
Pharmacological treatment for anxiety[54, 57]

DRUG GROUP	DRUG/DOSE RANGE	ACTION	SIDE EFFECTS	COMMENT
Sedative hypnotic agent	Propofol 10–100 micrograms/kg/min (infusion)	General anaesthetic agent	Hypotension Respiratory depression Myocardial depression when given as bolus Reported to affect memory May cause dreams	Dedicated intravenous line Infusions recommended High metabolic clearance Patient's conscious level increases more quickly once drug is ceased Expensive
Non-benzodiazepine sedative	Dexmedetomidine 0.2–0.7 micrograms/kg/h (infusion)	Highly selective alpha-2-adrenoceptor agonist	Initial hypertension may be experienced Hypotension Bradycardia may persist Hyperglycaemia	Minimal respiratory depression Rapid onset Infusions preferred Not suitable when deep sedation is required May reduce incidence of delirium
Benzodiazepine sedative	Diazepam 5–10 mg bolus	Block encoding on GABA receptors	Long-acting metabolites Hypotension Respiratory depression	No analgesia properties Used to treat alcohol withdrawal
	Midazolam 0.5–10 mg/h (infusion) 1–2 mg (bolus)		Less likely to have above side effects, but they may still occur	Useful as continuous infusion Rapid onset No analgesia properties Amnesic effect
	Lorazepam 0.01–0.1 mg/kg/h (≤10 mg/h)		Less likely to have above side effects, but they may still occur	Not licensed for use in some countries Strong anxiolytic

Sources: Devlin JW, Skrobik Y, Gelinas C, et al. Clinical practice guidelines for the prevention and management of pain, agitation/sedation, delirium, immobility, and sleep disruption in adult patients in the ICU. Crit Care Med 2018;46:e825–73; Zaal Zaal IJ, Devlin JW, Peelen LM, et al. A systematic review of risk factors for delirium in the ICU. Crit Care Med 2015;43:40–7. doi: 10.1097/CCM.0000000000000625.

focus, sustain and shift attention) and awareness (e.g. reduced orientation to the environment) that develop over a short period of time (e.g. hours to a few days) are characteristic of all subtypes of delirium.[66] This contrasts with dementia, in which cognitive decline occurs over months and years. Cognitive and perceptive ability often fluctuates through the day, worsening at night. A change in an additional cognitive domain such as memory deficit, disorientation or language disturbance that is not better accounted for by a pre-existing, established or evolving other neurocognitive disorder and does not occur in the context of a severely reduced level of arousal such as coma is diagnostic of delirium. There should also be evidence from the patient's history, physical examination or laboratory findings that the disturbance is a direct physiological consequence of another medical condition or substance intoxication or withdrawal.[67] Alcohol, nicotine or illicit substance/opioid dependence is more common than many clinicians suspect and this is often a result of history taking that lacks detail.[68] This topic is explored more thoroughly in the next section.

Lethargy, slow quiet speech and reduced alertness are typical behaviours of hypoactive delirium. This is the most common type of delirium; however, given that many patients with hypoactive delirium appear 'quietly' confused, it may not be recognised and treated.[65] Behaviours evident in hyperactive delirium such as hyperactivity and agitation cannot go unnoticed by clinicians and present overt risks of self-injury such as unintentional extubation/decannulation and intravenous/arterial device removal. Combined delirium is characterised by fluctuations in activity and attention levels including the behaviours of both hyperactive and hypoactive subtypes.

Delirium occurs in approximately one-third of ICU patients, although reports from individual studies vary widely,[61,65] an unsurprising finding given that it is notoriously difficult to diagnose in patients who are

unable to communicate verbally. The prevalence in other critical care areas such as emergency departments is generally reported to be lower,[69] probably because the patients' severity of illness varies.

The exact pathophysiology of delirium is not yet fully understood; however, imbalances in brain cholinergic and dopaminergic neurotransmitter systems are thought to be responsible.[70,71] Many predisposing and precipitating risk factors have been identified (Table 6.5)[49,54,70,72–75] and current opinion suggests that there is an additive effect: patients with more than one predisposing factor will require less noxious precipitating factors to develop delirium than patients who have none.[72] Predisposing risk factors are those that exist prior to the occurrence of critical illness, while precipitating risk factors occur during the course of critical illness and may be disease-related or iatrogenic. Prevention and therapeutic management of risk factors is the mainstay delirium treatment.

Practice tip

Perform a patient assessment to identify predisposing and contributing risk factors for delirium (see Table 6.5). Interview the family if the patient is unable to provide a history. Discuss your findings with the multidisciplinary healthcare team and develop a plan for prevention (using the strategies suggested in this chapter). Document and evaluate.

TABLE 6.5
Risk factors for delirium

PREDISPOSING RISK FACTORS	PRECIPITATING RISK FACTORS[54,57,73–75]
Advanced age	Increased severity of illness
Dementia	Emergency surgery or multitrauma
Illicit substance use	Metabolic, fluid and electrolyte disturbance (particularly uraemia)
Excessive intake of alcohol	Systemic inflammatory response (particularly infection)
Smoking	Hypoxia
Sensory deficits	Acute injury affecting the CNS
Renal insufficiency	Medications that affect acetylcholine transmission, e.g. atropine, fentanyl
Previous cerebral damage	Psychoactive medications, e.g. benzodiazepines
Hypertension	Prolonged pain
Congestive heart failure	Excessive noise
History of depression	Sleep deprivation
Genetic propensity	Immobility
Functional dependence and frailty	Blood transfusion administration

Assessment of delirium

The increased morbidity and mortality associated with delirium make it imperative to incorporate reliable and valid assessment in routine care.[76] A practical delirium assessment screening instrument for the critically ill cannot be reliant on patient–assessor verbal communication. Both the Intensive Care Delirium Screening Checklist (ICDSC)[76] (Fig. 6.2) and the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU)[77] (Fig. 6.3) have been shown to fulfil these requirements, although clinical judgement should also be retained in the screening process.[54,78,79]

The ICDSC contains eight items based on the Diagnostic and statistical manual of mental disorders (DSM-IV) criteria for delirium and was validated in a study conducted within ICU.[76] It is also simple to use and easily integrated into patient documentation. All features of delirium are incorporated such as sleep pattern disturbances and hypo- or hyperactivity. The first step in using the ICDSC is an assessment of conscious level using a five-point scale (A–E). Only patients whose conscious level is sufficient for them to respond to moderate physical stimuli (C–E on the scale) are able to be assessed. The eight items of the ICDSC are rated present (1) or absent (0). A score of four or higher is considered to be indicative of delirium.[76]

The CAM-ICU was also validated for screening delirium in the ICU population (see Further reading for more information).[77,80] Acute onset of mental status changes or fluctuating course is assessed using neurological observations conducted over the previous 24 hours. Inattention is tested in patients who are unable to communicate verbally by using either picture recognition or a random letter test. Disorganised thinking is assessed by listening to the patient's speech and, for patients who are unable to verbally communicate, a simple command is provided such as 'hold up the same number of fingers as me' (while the assessor holds up their fingers). Any conscious level other than 'alert' is considered 'altered'. An overall score is not derived from the CAM-ICU; delirium is either present or absent.[77]

Prevention and treatment of delirium

Although the causes of delirium are thought not to be strictly 'psychological' in nature, many interventions and preventative strategies focus on reducing anxiety, maintaining safety and providing a calming and low stimulus environment together with ameliorating or eliminating risk factors. Individual patient risk factors should be identified and where possible modified (even in the absence of delirium). Potential preventative measures include:

- adequate pain relief
- reassurance to reduce anxiety
- judicious use of sedative medications, particularly benzodiazepine medications (avoidance of continuous infusions)

FIGURE 6.2 Intensive Care Delirium Screening Checklist (ICDSC).[76]

PATIENT EVALUATION	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
Altered level of consciousness* (A-E)					
If A or B do not complete patient evaluation for the period					
Inattention					
Disorientation					
Hallucination – delusion – psychosis					
Psychomotor agitation or retardation					
Inappropriate speech or mood					
Sleep/wake cycle disturbance					
Symptom fluctuation					
TOTAL SCORE (0-8)					

Level of consciousness*:		Score
	A: no response	none
	B: response to intense and repeated stimulation (loud voice and pain)	none
	C: response to mild or moderate stimulation	1
	D: normal wakefulness	0
	E: exaggerated response to normal stimulation	1

SCORING SYSTEM:
The scale is completed based on information collected from each entire 8-hour shift or from the previous 24 hours.
Obvious manifestation of an item = 1 point. No manifestation of an item or no assessment possible = 0 point.
The score of each item is entered in the corresponding empty box and is 0 or 1.

1. Altered level of consciousness:
A) No response or B) the need for vigorous stimulation in order to obtain any response signified a severe alteration in the level of consciousness precluding evaluation. If there is coma (A) or stupor (B) most of the time period then a dash (-) is entered and there is no further evaluation during that period.
C) Drowsiness or requirement of a mild to moderate stimulation for a response implies an altered level of consciousness and scores 1 point.
D) Wakefulness or sleeping state that could easily be aroused is considered normal and scores no point.
E) Hypervigilance is rated as an abnormal level of consciousness and scores 1 point.

2. Inattention: Difficulty in following a conversation or instructions. Easily distracted by external stimuli Difficulty in shifting focuses. Any of these scores 1 point.

3. Disorientation: Any obvious mistake in time, place or person scores 1 point.

4. Hallucination, delusion or psychosis: The unequivocal clinical manifestation of hallucination or of behaviour probably due to hallucination (e.g. trying to catch a non-existent object) or delusion. Gross impairment in reality testing. Any of these scores 1 point.

5. Psychomotor agitation or retardation: Hyperactivity requiring the use of additional sedative drugs or restraints in order to control potential dangerousness (e.g. pulling out IV lines, hitting staff), hyperactivity or clinically noticeable psychomotor slowing. Any of these scores 1 point.

6. Inappropriate speech or mood: Inappropriate, disorganised or incoherent speech. Inappropriate display of emotion related to events or situation. Any of these scores 1 point.

7. Sleep/wake cycle disturbance: Sleeping less than 4 hours or waking frequently at night (do not consider wakefulness initiated by medical staff or loud environment). Sleeping during most of the day. Any of these scores 1 point.

8. Symptom fluctuation: Fluctuation of the manifestation of any item or symptom over 24 hours (e.g. from one shift to another) scores 1 point.

Source: Adapted from Bergeron N, Dubois MJ, Dumont M, et al. Intensive care delirium screening checklist: evaluation of a new screening tool. Intensive Care Med 2001;27(5):859–64.

- correction of the physiological effects of critical illness (e.g. hypoxia, hypotension, infection and fluid and electrolyte imbalance)
- optimisation of the sleep cycle
- early mobilisation
- treatment of the underlying illness
- family participation and involvement in patient care.

Research investigating the prevention and management of delirium in ICU is growing; however, evidence for the majority of interventions is low. There is emerging evidence that intervention bundles directed towards preventing delirium among other aspects of care in ICU patients may be beneficial.[51,81–83] Given the hypothesised underlying pathophysiology of delirium, it is not surprising that strategies to promote and maintain good-quality

FIGURE 6.3 Confusion Assessment Method – Intensive Care Unit (CAM-ICU).[80]

CAM-ICU Worksheet

Feature 1: Acute Onset or Fluctuating Course Positive if you answer 'yes' to either 1A or 1B.	Positive	Negative
1A: Is the patient different than his/her baseline mental status? Or 1B: Has the patient had any fluctuation in mental status in the past 24 hours as evidenced by fluctuation on a sedation scale (e.g. RASS), GCS, or previous delirium assessment?	Yes	No
Feature 2: Inattention Positive if either score for 2A or 2B is less than 8. Attempt the ASE letters first. If patient is able to perform this test and the score is clear, record this score and move to Feature 3. If patient is unable to perform this test or the score is unclear, then perform the ASE Pictures. If you perform both tests, use the ASE Pictures' results to score the Feature.	Positive	Negative
2A: ASE Letters: record score (enter NT for not tested) Directions: Say to the patient, "*I am going to read you a series of 10 letters. Whenever you hear the letter 'A', indicate by squeezing my hand*." Read letters from the following letter list in a normal tone. SAVEAHAART Scoring: Errors are counted when patient fails to squeeze on the letter "A" and when the patient squeezes on any letter other than "A".	Score (out of 10):_____	
2B: ASE Pictures: record score (enter NT for not tested) Directions are included on the picture packets.	Score (out of 10):_____	
Feature 3: Disorganised Thinking Positive if the combined score is less than 4	Positive	Negative
3A: Yes/No Questions (Use either Set A or Set B, alternate on consecutive days if necessary): Set A: 1. Will a stone float on water? 2. Are there fish in the sea? 3. Does one pound weigh more than two pounds? 4. Can you use a hammer to pound a nail? Set B: 1. Will a leaf float on water? 2. Are there elephants in the sea? 3. Do two pounds weigh more than one pond? 4. Can you use a hammer to cut wood? Score___(Patient earns 1 point for each correct answer out of 4) 3B: Command Say to patient: "Hold up this many fingers" (Examiner holds two fingers in front of patient) "Now do the same thing with the other hand" (Not repeating the number of fingers). (If patient is unable to move both arms, for the second part of the command ask patient "Add one more finger") Score___(Patient earns 1 point if able to successfully complete the entire command)	Combined Score (3A + 3B): _____ (out of 5)	
Feature 4: Altered Level of Consciousness Positive if the Actual RASS score is anything other than "0" (zero)	Positive	Negative
Overall CAM-ICU (Features 1 and 2 and either Feature 3 or 4):	Positive	Negative

Source: © E. Wesley Ely, MD, MPH. Pulmonary and Critical Care and Health Services Research. Vanderbilt University and VA-GRECC. https://www.icudelirium.org.

sleep and avoidance of benzodiazepines are emphasised in these 'bundles'. Regardless of the efficacy of the interventions[84] to date, the creation of environmental conditions that are conducive to rest and sleep, in particular sound reduction and adjusting light levels appropriate for the time of day, as well as sedation minimisation, delirium monitoring and early mobilisation, have not been shown to cause harm and therefore represent good practice.

In cases where non-pharmacological strategies are not successful, antipsychotic medications (e.g. olanzapine) or the selective alpha-2-adrenoceptor agonist dexmedetomidine may be considered.[54] Although frequently used, there is little evidence showing the efficacy of haloperidol and atypical antipsychotics in reducing the duration of delirium in adult ICU patients (and humans generally).[85,86] Evidence is inconsistent,[87] but dexmedetomidine has shown promise in reducing both the duration and the incidence of delirium in

critically ill patients.[88–90] It should also be noted that any medication designed to enhance cognition has the potential to make delirium worse and there are many potential unwanted side effects (e.g. Q–T interval prolongation for some antipsychotics[91] and bradycardia and hypotension for alpha-2-adrenoceptor agonists[88]); therefore these medications should be used judiciously in the critically ill.

Alcohol, benzodiazepine, nicotine and opioid withdrawal

Patients who are dependent on alcohol (ethanol), benzodiazepines, nicotine or opioids are at risk of developing a withdrawal syndrome in the initial stages of treatment in ICU. Withdrawal from opioids may also occur later in the illness trajectory for patients who receive large doses of analgesics for painful injuries and conditions ('iatrogenic dependency'). Unrecognised and therefore untreated withdrawal from any substance may lead to prolonged length of stay and duration of mechanical ventilation and increased risk of infection and delirium, and even mortality.[92] Opioid and nicotine withdrawal is unpleasant but rarely physiologically dangerous. However, sudden cessation of ethanol or benzodiazepines in the setting of prolonged use and neurobiological adaptation may lead to alcohol withdrawal syndrome (AWS) or benzodiazepine withdrawal and serious complications.[93] Therefore, early identification of the possibility of withdrawal (within 24 hours for alcohol) is essential to ensure timely treatment.

As ethanol mimics gamma-aminobutyric acid (GABA) in the brain, regular and excessive intake of ethanol leads to changes in the inhibitory GABA and excitatory glutamate systems, decreased endogenous GABA levels, fewer and less-sensitive GABA receptors and glutamate system activation.[93] Postsynaptic *N*-methyl-D-aspartate (NMDA) receptors are more reactive and glutamate concentration increases. Therefore, cessation of ethanol may lead to unopposed neuronal excitation and resulting autonomic hyperactivity.

Criteria for classifying withdrawal are based on history of heavy alcohol use, symptoms and effect of symptoms on physical and mental functioning which cannot be accounted for by another mental disorder.[94] Frequency and quantity of alcohol consumption, together with other factors including previous detoxification episodes and withdrawal seizures and structural brain lesions, are thought to be predictive of AWS symptom severity.[92, 95] Withdrawal may occur 6–24 hours after cessation or significant reduction in intake. The physiological basis of benzodiazepine withdrawal is similar, resulting in autonomic hyperactivity. The severity is in part dependent on the half-life of the type of benzodiazepine. The most severe form of AWS, delirium tremens, occurs from 12 to 72 hours after cessation and is characterised by fluctuating consciousness level, including attention and cognitive deficits (hallucinations, confusion and delirium), and severe hyperthermia and hypertension. The result of untreated delirium tremens may be withdrawal seizures, cardiovascular and respiratory failure, multiorgan dysfunction and death.[93]

The international estimation of opioid use disorder (OUD) in the population is approximately 5%.[96–98] Given the concomitant adverse health effects of OUD, a significant number of people with OUD who are at risk of opioid withdrawal are treated in an ICU. Data for nicotine withdrawal in critical care are also likely to reflect population rates for daily tobacco smoking, which range from 11% in Australia, North America and parts of Europe[99–101] to over 30% in parts of Asia.[102] The underlying physiology of withdrawal symptoms is similar for these chemicals. Opioids act on the dopaminergic mesolimbic system. Dependency results in lower levels of endogenous opioids and down-regulation of the dopaminergic system[103] so withdrawal produces unpleasant symptoms such as dysphoria, anxiety, joint pain, diarrhoea and vomiting.[104] Similarly nicotine dependency results in neurological adaptation that is desensitisation to nicotine which causes up-regulation of nicotinic acetylcholine receptors (nAchRs). The nAchRs modulate many mood-enhancing neurotransmitters, dopamine and acetylcholine causing a physiological 'need' and nicotine-seeking behaviour. Withdrawal symptoms related to reduced levels of neurotransmitters are unpleasant. Neither opioid nor nicotine withdrawal is life threatening but may result in delirium or agitation, which increases the risk of self-injury.

It is estimated that up to 33% of patients treated in ICU with continuous infusions of opioids for an extended time experience iatrogenic opioid withdrawal.[92,105] The incidence of iatrogenic benzodiazepine withdrawal is estimated to be 8%,[100] although opioid and benzodiazepine withdrawal often occurs simultaneously and the signs are non-specific so the exact incidence for either iatrogenic withdrawal is unclear. The risk of withdrawal can be reduced by using all opioids and sedative medications judiciously based on individual patient needs (to maintain comfort and a calm and cooperative patient).[54] It is also recommended that medications are tapered for patients who require continuous opioid and sedative infusions for several days or a program of methadone replacement is instituted to facilitate a gradual reduction (5–10% per day) of the infusion doses.[92]

Screening for and assessment of withdrawal symptoms

Identification of withdrawal is challenging because symptoms may be the same for the underlying illness unless the reason for treatment in ICU is related to alcohol, benzodiazepine or opioid consumption (in which case the likelihood of withdrawal is high).[92] Hence no screening or assessment scales have been specifically validated for use in ICU and history taking is a vital adjunct to assessment and diagnosis. As highlighted earlier,

history taking regarding alcohol and substance use often lacks detail. A brief interview schedule such as the 4-item CAGE questionnaire[106] (administered to the patient's proxy if the patient is unable to participate, ensuring confidentiality is maintained) is a recommended approach to guide history taking. Screening questions pertain to previous intentions to '**C**ut down' drinking, **A**nnoyance about being criticised for drinking, previous **G**uilty feelings about drinking and need to drink first thing in the morning ('**E**ye opener'). The presence of two or more of these features indicates that alcohol dependency is likely and requires further investigation. An alternative is the Prediction of Alcohol Withdrawal Severity Scale (PAWSS).[95] Although the frequency and amount of a substance consumed is important, it should also be noted that the definition of 'excessive intake' of any substance varies and is dependent on factors such as gender, body size and fat composition, liver function and genetic composition.

In cases in which alcohol withdrawal is suspected, it is recommended that withdrawal assessment scales (Table 6.6) are used to guide treatment and monitor progress particularly in the first 24–48 hours.[92] Although not necessarily tested in ICU, both the Clinical Institute Withdrawal Assessment of Alcohol Scale, revised (CIWA-Ar) and the AWS Scale have been shown to perform well in clinical practice[107] so the context and patient specifics should dictate choice of scale.[108–110] To overcome the limitations of using the CIWA-Ar with non-verbal patients (e.g. mechanically ventilated),[92,108,110] clinicians recommend using it with a sedation or agitation scale. The AWS[109,110] scale overcomes the difficulty of requiring a verbal response and may be more appropriate for the ICU population.

The Fagerström Test for Nicotine Dependence (FTND) is a commonly used validated tool to assess likelihood of nicotine withdrawal.[111] The score ranges from 0 to 10; higher scores indicate higher dependency. The FTND relies on self-report so has some limitations for use in the ICU. Recent pack-year history (packs per day × number of years smoking) may also provide the clinician with useful information about the likelihood of withdrawal.

Withdrawal screening and assessment tools specifically designed for other substances such as opioids have poor validity and reliability.[112] Clinical judgement is primarily used to monitor and guide treatment.

Practice tip

The CAGE ('**C**ut down' drinking, **A**nnoyance about being criticised for drinking, previous **G**uilty feelings and need to drink first thing in the morning ('**E**ye opener')) screening approach can be adapted for use for detecting dependence to other substances such as benzodiazepines. Practise using the adapted screening approach next time you care for a patient who is suspected of being dependent on benzodiazepines and opioids.

Management of withdrawal

Comprehensive supportive care underpins the management of any withdrawal syndrome. Withdrawal from many substances does not necessarily require pharmacological

TABLE 6.6
Widely used alcohol withdrawal assessment scales

SCALE	DESCRIPTION	COMMENT
The Clinical Institute Withdrawal Assessment for Alcohol (CIWA-Ar) scale[110]	10-item scale. Maximum score 67; higher scores indicate more severe withdrawal; <8 = mild withdrawal; 8–15 = moderate withdrawal; >20 = severe withdrawal. Administer a minimum of every hour until symptoms subside.	Widely used in ICU setting. Patient must be able to verbally communicate to complete 4 items (7–10). Best used together with the sedation-agitation scale to guide treatment. Scores <8–10 indicate that pharmacological treatment probably not necessary.
Alcohol Withdrawal Syndrome (AWS) Scale[110]	Consists of two subscales; somatic symptoms = s, and mental symptoms = m S subscale: pulse rate, diastolic blood pressure, temperature, breathing rate, sweating, tremor M subscale: agitation, contact, orientation, hallucination, anxiety. Maximum score: 55; higher scores indicate more severe withdrawal; 5 = mild; 6–9 = moderate; and ≥10 = severe. Administer every hour until symptoms subside.	Allows separate assessment of somatic and mental withdrawal symptoms. Developed specifically for patients with severe withdrawal or delirium (but not for ICU patients); does not need verbal response from patient.

treatment and depends on the substance and the severity of withdrawal. Supportive care (e.g. maintenance of fluid and electrolyte balance and serum thiamine levels) may be all that is required for minor alcohol withdrawal. Clinicians should be aware that the psychological 'need' for alcohol or any other substance may continue beyond the period of physiological withdrawal. People with a pre-existing substance dependency may require ongoing psychological support and understanding; the involvement of specialist 'drug and alcohol' healthcare teams is advised.

Treatment for alcohol withdrawal comprises pharmacological agents guided by symptom severity. A loading dose of benzodiazepine followed by tapering doses should be used. Diazepam is the conventional approach; however, other medications such as barbiturates, dexmedetomidine, clonidine, ketamine and propofol (often in combination with benzodiazepines) have been explored.[113] Barbiturates are indicated in the setting of severe withdrawal requiring escalating benzodiazepine doses.[114] Further research is required before recommendations for treatment of AWS with other pharmacological agents can be made. Wernicke's encephalopathy is a potential catastrophic consequence of AWS caused by overwhelming metabolic demands on brain cells with depleted intracellular thiamine. Thiamine and B vitamin complex supplementation is an essential component of treatment, reducing mortality and morbidity.[115]

As the underlying pathophysiology of benzodiazepine withdrawal is the same as that in AWS, a similar treatment regimen of a tapering dose of a long-acting benzodiazepine is advised together with supportive therapy. 'Benzodiazepine-sparing' treatment regimens incorporating dexmedetomidine are also recommended.[54] It should be noted that there is an increased risk of mortality for younger patients (<65 years) associated with a dexmedetomidine sedation regimen early during mechanical ventilation,[116] and continuous infusion of dexmedetomidine over several days may result in dependency. Low-dose flumazenil is an approach provided as multiple bolus intravenous doses together with or without benzodiazepine tapering to reduce withdrawal symptoms.[117] Efficacy and safety has largely been tested in ambulatory care settings; guidelines for use during critical illness are not available.

Mild opioid withdrawal may be treated with supportive therapy alone, but moderate-to-severe withdrawal is treated with tapering doses of methadone.[118] More recently, buprenorphine has been found to control withdrawal symptoms better than methadone and may reduce long-term dependence.[119] The first dose of buprenorphine is administered when withdrawal symptoms are moderate, reducing the risk of precipitated withdrawal.[118] Other anxiolytic medications such as clonidine, dexmedetomidine and benzodiazepines may also play a role in reducing somatic withdrawal symptoms.[120]

Nicotine replacement therapy (NRT) has been associated with adverse outcomes, consequently universal use of NRT is not recommended for the critically ill.[121, 122] It should be reserved for patients for whom the risk of not providing NRT (e.g. severe agitation or anxiety attributable to nicotine withdrawal) outweighs potential harms.[123] The usual regimen for NRT comprises transdermal administration of tapering doses of 24-hour-release nicotine-impregnated patches.

Comprehensive guidance for all substance withdrawal syndromes is beyond the scope of this textbook. The reader is advised to consult papers published in journals such as Alcohol and Alcoholism and the Journal of Chemical Dependency and relevant textbooks (Erickson, 2011; Mack, 2016; see Further reading) as well as local practice guidelines.

Practice tip

Next time you care for a patient who has experienced alcohol withdrawal, ask them about the symptoms and strategies other than medications that helped reduce their discomfort.

Pain

Pain is an unobservable, inherently subjective, experience. The nebulous multifaceted nature of pain has led to significant difficulties in not only understanding the mechanisms underlying the experience but also assessing and managing the phenomenon.

Pain is a sensation widely experienced by critical care patients and is one of the stressors most commonly reported by former and current ICU patients.[63,124] In particular, apparently innocuous procedures such as turning or positioning may cause mild or moderate pain while invasive procedures (e.g. chest drain removal) are often severely painful.[125] Arguably, pain management is not always afforded the same emphasis as more 'life-threatening' conditions such as haemodynamic instability. However, its alleviation is an essential element of critical care nursing and should be emphasised in order to reduce potential suffering and the need for sedative medication. Myths such as the possibility that patients may become dependent on analgesics, that the very young and elderly have higher tolerance for pain, and our cultural tendency to reward high pain tolerance may lead to inadequate pain management. In critical care, nurses assume a fairly autonomous role in titrating analgesic medication. With this increased autonomy comes a responsibility to be knowledgeable and aware of effective pain management and assessment of the 'fifth vital sign'.

Pathophysiology of pain

Pain is transmitted to the central nervous system via one of two pathways. The fast pain pathway occurs when the stimuli are carried by small myelinated A-delta fibres, producing a sharp, prickling sensation that is easily localised. The slow pathway acts in response to polymodal nociceptors, is carried by small unmyelinated C fibres and

produces a dull, aching or burning sensation. It is difficult to locate, acts after fast pain, and is considered to be more unpleasant than fast pain.[126]

Perceptions of pain are thought to occur in the thalamus, whereas behavioural and emotional responses occur in the hypothalamus and limbic system.[126] Perceptions of pain are influenced by prior experience, and by cultural and normative practices, which helps to explain individual reactions to pain.[126]

There are negative physiological effects of pain that include a sympathetic response with increased cardiac work, potentially compromising cardiac stability.[127] Respiratory function may be impaired in the critically ill undergoing surgical procedures when deep breathing and coughing is limited by increased pain, reducing airway movement and increasing the retention of secretions and the possibility of nosocomial pneumonia.

Adverse psychological sequelae of poorly treated pain include diminished feelings of control and self-efficacy and increased fear and anxiety. An inability to engage in rehabilitation and health-promoting activities may transpire. The long-term effects of undertreated pain are not clearly understood, but almost certainly impact on recovery and may even lead to worsening chronic pain.[128] When these unwanted outcomes are considered alongside the physiological effects of poorly treated pain, the vital importance of pain management is evident.

Pain assessment

> *Pain is whatever the experiencing person says it is, existing whenever he* [sic] *says it does.*[129]

The nebulous quality and subjective nature of the pain experience lead to considerable problems in its assessment. This is compounded in critically ill patients, who often have insufficient cognitive acumen to articulate their needs and an inability to communicate verbally. A common language and process in which to assess pain is essential in ameliorating some of these challenges. Furthermore, accurate assessment and consistent recording are fundamental aspects of pain management. Without these vital components, it is impossible to evaluate interventions designed to reduce pain. Despite the importance of assessing pain, there is evidence to suggest that timely and rigorous assessment does not occur.[1,130]

Since the pain experience is subjective, all attempts should be made to facilitate patient communication of the nature, intensity, body part affected and characteristics of their pain. The patient's usual communication aids, such as glasses and hearing aid, should be used. Whenever patients cannot verbally communicate, other strategies must be established and used consistently. For example, strategies involving nodding, hand movements, facial expressions, eye blinks, mouthing answers and writing can be highly effective. In cases when there is limited motor function but the patient is cognitively able, the speech pathologist may be able to advise on alternative communication strategies.

When possible, a patient's health history (from the family if the patient is unable), including any existing painful conditions, should be taken. Quite apart from the presenting condition, which may be painful, critical care patients may have significant comorbidities such as rheumatoid/osteoarthritis and chronic back pain. It is imperative that the patient's usual pain management strategies are identified and implemented if possible. For example, factors that relieve the pain or increase its intensity should be recorded, along with its relationship to daily activities such as sleep, appetite and physical ability.

Regardless of the patient's communication capability, strategies to ensure consistent objective assessment and management should be implemented. Laminated cards displaying body diagrams, words to describe pain and pain intensity measures (including visual analogues and numerical scales) are useful instruments in meeting these requirements. Verbal numerical reporting scales and visual analogue scales are commonly used. These are outlined in Table 6.7.[131,132] VAS can be difficult to administer to critically ill patients; however, a combined VAS and numerical reporting scale includes the benefit of a visual cue with the ability to quantify pain intensity.

Other physiological and behavioural pain indicators may be used to assess pain in less-responsive or unconscious patients.[133] A large range of instruments have been developed and validated for use in the critically ill adult patient. The Behavioural Pain Scale (BPS) (Fig. 6.4)[131] and the Critical Care Pain Observation Tool (CPOT)[132] (http://ajcc.aacnjournals.org/content/15/4/420/T1.expansion.html) are the most robust scales for assessing pain in critically ill adults.[54] Briefly, scores are assigned to categories such as altered body movements, restlessness and synchronisation with the ventilator, providing a global score for comparison after pain relief interventions. The CPOT offers several benefits over the BPS, including use of an indicator assessing muscle tension where resistance to passive movement is assessed as 0 = relaxed, 1 = tense or rigid, 2 = very tense or rigid, and an alternative indicator to compliance with ventilation that can be used in extubated patients – assessments include whether the patient is talking in normal tone or no sound = 0; sighing, moaning = 1; crying out, sobbing = 2.

Nurses should not rely solely on changes in physiological parameters, including cardiovascular (elevated blood pressure and heart rate) and respiratory recordings to assess pain intensity, as other pathophysiological or treatment-related factors may be responsible.[134,135] Classic reactions to stressors (e.g. pain), such as increased heart rate and blood pressure, do not always occur in critically ill patients and are therefore unreliable pain assessment methods.[134] A potential explanation is that autonomic tone may be dysfunctional in a large proportion of ICU patients.[136] In haemodynamically stable long-term critical patients, vital signs may be useful if used in conjunction with other forms of assessment.[54] Where necessary, for example when the patient is unable to self-report their pain experience, it may be appropriate to involve the family.[54] Although

TABLE 6.7
Pain scales

SCALE	DESCRIPTION	COMMENT
Verbal numeric reporting scale	Self-rating scale. Single-item scale. Scale from 0 (no pain) to 10 (worst pain ever).	Patient must be able to communicate verbally. Needs to understand concept of rating pain. Dependent on prior pain experiences. Simple, easy to use.
Visual analogue scale	Self-rating scale. Single-item. A horizontal line with equal divisions is used for the patient to rate current pain level (no pain is on far left and worst pain is far right).	Patient can communicate by pointing. Needs to understand concept of rating pain. Dependent on patient's prior pain experiences. Simple, easy to use.
Behavioural Pain Scale (see Fig. 6.4)[131]	Based on pain-related behaviours: the sum of three items. Higher scores indicate higher pain intensity (range: 3–12).	Patient does not have to communicate. Simple, easy to use. Includes 'ventilator compliance' (may no longer be relevant for pain assessment when using modern ventilators).
Critical Care Pain Observation Tool (CPOT)[132]	Based on previously developed instruments using pain-related behaviour to assess pain, e.g. BPS 4 items: facial expression, body movements, muscle tension and compliance with ventilator or vocalization. Higher scores indicate more pain (range: 0–8).	Patient does not have to communicate. Simple, easy to use. Includes 'ventilator compliance' (may no longer be relevant for pain assessment when using modern ventilators) or vocalisation in extubated patients

FIGURE 6.4 Behavioural Pain Scale.[131]

Item	Description	Score
Facial expression	Relaxed	1
	Partially tightened (e.g. brow lowering)	2
	Fully tightened (e.g. eyelid closing)	3
	Grimacing	4
Upper limbs	No movement	1
	Partially bent	2
	Fully bent with finger flexion	3
	Permanently retracted	4
Compliance with ventilation	Tolerating movement	1
	Coughing but tolerating ventilation for most of the time	2
	Fighting ventilator	3
	Unable to control ventilation	4

Source: Payen JF, Bru O, Bosson JL, et al. Assessing pain in critically ill sedated patients by using a behavioral pain scale. Crit Care Med 2001;29(12):2258–63.

family reports have been found to be closer to the patients than clinical staff, these reports should not be taken ahead of self-report by the patient.

In addition, it is particularly important to regularly consider and search for potential sources of pain in unresponsive patients and those who are unable to communicate. Nurses should assume pain is present if there is a reason to suspect pain; an analgesic trial may assist in identifying this. As a general rule, analgesia medication should be administered to patients who are heavily sedated or receiving muscle relaxants as a precaution.

Pain management

Although pain management is discussed here independently, in practice it is often combined with sedative administration

to reduce anxiety. However, pain management should always be the first goal for achieving overall patient comfort (the so-called analgosedation approach[137]). Efforts to improve patient comfort for intubated patients often favour the concurrent use of both sedative and analgesic medications.[54] This practice therefore makes it difficult to assess the single effect of each medication on the patient's pain and highlights its multidimensional properties. In addition to pharmacological treatment of pain, non-pharmacological strategies can be effective as an adjunct to drug therapy or as an alternative.

Pain relief may be required for pre-existing injuries or prior to specific procedures to prevent pain. Being turned is often cited as a painful procedure; however, wounds, drain removal, tracheal suction, femoral catheter removal, placement of a central venous catheter and wound dressings and coughing may also cause considerable discomfort.[124] Guidelines and written protocols for procedures such as femoral sheath removal and insertion of a central venous catheter can significantly reduce pain intensity as they often contain reminders to provide analgesia. Some procedures, such as insertion of invasive devices, require additional pain management such as local anaesthetics. This highlights the potential need for additional pain protocols linked to key standard procedures (e.g. patient turning) to reduce patients' pain experience.

Pain-relieving medication can be administered via a number of routes, including oral, enteral feeding tube, intravenous, rectal, topical, subcutaneous, intramuscular, epidural and intrathecal. For all routes of administration, assessment of the patient's suitability and contraindications for use are an essential part of the decision-making process. Patient-controlled analgesia for intravenous and, more recently, epidural analgesia is commonly part of critical care nursing.

Epidural pain management requires additional evaluation, including sensory and functional assessment, because both local anaesthetic and opioid medications are used. Sensory function should be regularly checked using a dermatome chart to gauge segments that are blocked by the local anaesthetic agent. In addition to sensory blockade, regular assessment for lower-limb motor deficit is required to detect changes in motor response, which may impair the ability to mobilise safely. Sudden or subtle changes may also indicate a complication such as epidural haematoma. The Bromage Assessment Scale is often used to assess motor response. The catheter site must be regularly checked to identify complications such as bleeding, haematoma and infection early and to ensure catheter patency. Intrathecal administration of analgesic medications has similar contraindications and complications to epidural analgesia and requires similar precautions. It is important to note that intrathecal (as compared with intravenous) administration does not eliminate all opioid side effects (see Further reading).

Practice tip

Epidural administration of medication does not preclude mobilisation. However, certain safety measures should be taken. Ensure that the epidural catheter is well secured; view the site before mobilising and apply extra tape. Monitor blood pressure and heart rate before and during the initial stages of mobilising. Two healthcare personnel should assist during the first attempt to mobilise.

Non-pharmacological treatment for pain

Non-pharmacological strategies to reduce pain are linked to some key strategies to reduce stress. Excessive pain may lead to stress as the body attempts to maintain homeostasis and stress may exacerbate pain. Strategies to reduce stress and pain include both comfort measures and diversional interventions, which require the nurse to individualise and adapt strategies to match the patient's needs and preferences. Diversional methods may include distraction strategies, and aim to refocus the patient's thinking away from the pain and on to other more pleasant thoughts or activities. Research has highlighted the importance patients place on the presence of family members in the facilitation of emotional and physical strategies of pain management.[138,139] Some interventions that may be effective are listed in Table 6.8.[140,141]

Non-pharmacological interventions have the benefit of being nurse initiated, non-invasive and able to be personalised. These strategies may not reduce pain intensity significantly on their own but have the capacity to enhance the effects of analgesic medication and humanise the critically ill patient's experience.

Pharmacological treatment for pain

Pharmacological treatment for pain in critically ill patients centres on opioid medications, which act as opioid agonists binding to the mu-receptors in the brain, central nervous system and other tissues.[54] Opioid medications have a rapid action and are readily titrated, and their metabolites, if present, are less likely to accumulate. Morphine sulfate and fentanyl are routinely used in critical care, and their properties, side effects and nursing implications are outlined in Table 6.9.

TABLE 6.8
Non-pharmacological treatment for pain

COMFORT MEASURES	DIVERSIONAL MEASURES
Repositioning[54]	Relaxation
Oral and endotracheal suctioning	Breathing exercises
Mouth, oral and/or wound care	Visual imagery
Reassurance and information	Music therapy[50, 140]
Massage	Family presence[141]
Cold therapy[54]	

TABLE 6.9
Analgesics

DRUG/DRUG DOSE	PROPERTIES	SIDE EFFECTS	NURSING IMPLICATIONS
Morphine sulfate 1–10 mg/h (IV infusion), 1–4 mg (IV bolus).	Water-soluble. Peak effect 30 min. Half-life: 3–7 h. Sedative effect and release of histamines.[54]	Vasodilatory effect. Decreased gastric motility. Respiratory depression. Nausea and vomiting.[126]	Intermittent doses, rather the need for continuous infusions.[54]
Fentanyl 25–200 micrograms/h (IV infusion), 25–100 micrograms (IV bolus).	Lipid-soluble Synthetic opioid 80–100 times more potent than morphine. Peak effect in 4 min. Half-life: 1.5–6 h.[54]	Respiratory depression. Bradycardia. Muscular rigidity.	Useful where: hypotension or tachycardia needs to be avoided; gastric and/or histamine side effects occur with morphine.
Tramadol hydrochloride 100 mg (IV bolus), then 50–100 mg 4–6/24 h. Provide orally/enterally when able.	Centrally acting opioid-like analgesic for moderate to severe pain.	Better side effect profile than opioids; however, nausea, vomiting, dizziness and dry mouth are possible. Headache. Sweating.	Intermittent doses only. Do not administer in combination with MAOIs. Do not administer in the setting of seizures or epilepsy. Adjust dose for the elderly. Monitor hepatic function.
Tapentadol immediate release 50–100 mg/3 or 4/24. Tapentadol sustained release 50–250 mg 2/24 h (do not exceed 500 mg/24 h).	Centrally acting opioid analgesic for moderate or severe pain (immediate release for acute pain and sustained release for chronic pain). First-line analgesic for intolerance to other opioids.	Opioid-related side effects such as respiratory depression, nausea. Considered to have a better opioid side effect profile than other opioids.	Not recommended in the setting of severe renal or hepatic impairment. Monitor renal and liver function. Do not administer in combination with MOAIs.
Paracetamol (acetaminophen) 1 g 4–6/24 h (max 4 g and 3 g/24 h for over 80 years, <50 kg body weight and hepatic impairment) given IV, orally/enterally or per rectum.	Centrally acting analgesic suitable for mild to moderate pain.	Liver impairment.	Monitor hepatic function.
NSAIDs IV, oral/enteral or rectal routes.	Analgesia and antipyretics.	Gastrointestinal. Some have anticoagulant side effects.	Not used routinely but may be used for procedural pain. Renal clearance.
Ketamine 0.5 micrograms/kg IV bolus then 1 micrograms/kg/min infusion.	Analgesic and dissociative anaesthetic for painful procedures. Onset of action 1–2 min. Analgesic/anaesthetic effects last 5–15 min. Half-life 3 h.	Hypertension and respiratory depression (administer slowly). Increased intracranial pressure. Hallucinations.	Use for painful procedures, e.g. wound dressings or as an adjuvant to opioid therapy. Administer 2 mg of midazolam at the start of the procedure or continue midazolam infusion to minimise the dysphoric and hallucinogenic side effects.

The table above contains an overview only. Consult local drug formulary and guidance before prescribing and administering. MOAI = monoamine oxidase inhibitor, NSAIDs = non-steroidal anti-inflammatory drugs.

(For ischaemic chest pain management see Chapter 10.) There is growing evidence of improved effectiveness of pain relief with combination therapy – for example, the addition of paracetamol, ketamine or neuropathic pain medications to opioid therapy.[54]

Although non-steroidal anti-inflammatory drugs (NSAIDs) are not recommended as an adjuvant to opioid therapy, they can be considered as an alternative to opioids to manage pain during specific procedures in critical care.[54] NSAIDs act by inhibition of an enzyme within the inflammatory cascade, and may produce analgesia (especially when combined with opioids) for bone and soft tissue injuries. As with all medication, side effects and contraindications can be serious and, in the case of NSAIDs, include gastrointestinal bleeding, renal insufficiency and exacerbation of asthma.

Pain relief is a primary goal for critical care nursing and requires regular assessment of pain intensity. No single medication is ideal for all patients, and clinicians need to carefully select, monitor and titrate the doses of any agent. In the case of major thoracic or abdominal surgery, patient-controlled analgesia may provide the most effective pain management strategy (see Chapter 12). Non-pharmacological strategies add to the relief of pain and come under the domain of nursing care. Without adequate pain management, patients will be unable to achieve adequate rest and sleep, both essential for healing and well-being.

Sedation

Maintaining appropriate levels of sedation is a core component of care during critical illness, when patients are treated with invasive and difficult-to-tolerate procedures and interventions. Some critically ill patients will require no sedation to be comfortable, while others may require significant amounts to both be comfortable and maintain optimal physiological status. Individualising sedation management is crucial to effective treatment, with accurate assessment a core requirement. Adequate sedation is paramount for those patients receiving muscle relaxants. In association with sedation management, it is essential that adequate pain relief and anxiolysis are provided to all critically ill patients.

There is growing evidence of the detrimental effects of sedation on outcomes in critically ill patients, although the evidence linking level of sedation to outcomes is inconsistent.[142] A light, rather than deep, level of sedation has been associated with shorter duration of mechanical ventilation and hospital length of stay, as well as reduced incidence of ventilator-associated pneumonia in some studies.[142] Strategies to achieve light sedation are now the mainstay of sedation assessment and management for the critically ill. In short-term sedation there is also a growing recognition that the use of benzodiazepines should be minimised.[54]

Assessment of sedation

Assessment of the effect of all sedative treatments is essential. When pharmacological agents are used there is always a risk of over- or undersedation, and both can have significant negative effects on patients.[143] Oversedation may lead to detrimental physiological effects including cardiac, renal and respiratory depression and can result in longer duration of mechanical ventilation, associated complications and recovery. Undersedation has the opposite effect on the cardiac system, with hypertension, tachycardia, arrhythmias, ventilator dyssynchrony, agitation and distress, with the potential for accidental self-harm.

Objective sedation scales provide an effective method of assessing and monitoring consciousness or arousal level, as well as evaluating parameters such as cognition, agitation and patient–ventilator synchrony. Although a number of sedation scales have been developed, only the Richmond Agitation–Sedation Scale (RASS)[144] and the Riker Sedation–Agitation Scale (SAS)[145] have been validated appropriately for use in intensive care (Figs 6.5 and 6.6). Even though clinicians are frequently concerned about the reliability of sedation assessment in patients with neurological compromise, there is evidence that the RASS is reliable.[146]

Bispectral index monitoring provides an objective measurement of sedation level. A self-adhesive electrode pad is secured to the patient's forehead to continuously record cortical activity, which is scored on a scale from 0 (absence of brain activity) to 100 (completely aware). There is not yet consensus on the most appropriate brain activity level for intensive care patients or what role bispectral index monitoring can offer in their care,[147,148] although there is growing belief that it may be helpful in optimising sedation titration. More studies to evaluate the efficacy of bispectral index are required.

Sedation protocols

Patients' sedation needs are complex. There is growing awareness of the need to ensure optimal pain management prior to considering sedation, with the knowledge that sedation will not always be required once adequate pain management has been implemented (see Pain above).

In situations where sedation is required, one of the strategies used is a sedation protocol. The aim of sedation protocols is to improve sedation management by encouraging regular discussion of sedation goals among the healthcare team, while enabling nurses to manage ongoing sedative needs. Not all patients' sedative needs will be met within the sedation protocol; in these instances, specific care should be planned and implemented by the multidisciplinary healthcare team.

Sedation protocols offer a framework, or algorithm, within which clinicians can manage specific patient care with prearranged outcomes. Aspects of sedation management that should be incorporated into sedation protocols include:

- the sedation scale to be used, as well as frequency of assessment
- an algorithm-based process for selecting the most appropriate sedative agent
- the range of sedative agents that might be considered and associated administration guidelines

FIGURE 6.5 Richmond Agitation–Sedation Scale (RASS).[144]

Richmond Agitation Sedation Scale (RASS)

Sore	Term	Description	
+4	Combative	Overtly combative, violent, immediate danger to staff	
+3	Very agitated	Pulls or removes tube(s) or catheter(s); aggressive	
+2	Agitated	Frequent non-purposeful movement, fights ventilator	
+1	Restless	Anxious but movements not aggressive vigorous	
0	Alert and calm		
–1	Drowsy	Not fully alert, but has sustained awakening (eye-opening/eye contact) to *voice* (≥10 seconds)	Verbal Stimulation
–2	Light sedation	Briefly awakens with eye contact to *voice* (<10 seconds)	
–3	Moderate sedation	Movement or eye opening to *voice* (but not eye contact)	
–4	Deep sedation	No response to voice, but movement or eye opening to *physical* stimulation	Physical Stimulation
–5	Unarousable	No response to *voice* or *physical* stimulation	

Procedure for RASS Assessment

1. Observe patient
   a. Patient is alert, restless, or agitated. (score 0 to +4)
2. If not alert, state patient's name and *say* to open eyes and look at speaker.
   b. Patient awakens with sustained eye opening and eye contact. (score –1)
   c. Patient awakens with eye opening and eye contact, but not sustained. (score –2)
   d. Patient has any movement in response to voice but no eye contact. (score –3)
3. When no response to verbal stimulation, physically stimulate patient by shaking shoulder and/or rubbing sternum.
   e. Patient has any movement to physical stimulation. (score –4)
   f. Patient has no response to any stimulation. (score –5)

Source: Reprinted with permission of the American Thoracic Society. Copyright © 2019 American Thoracic Society. Sessler CN, Gosnell M, Grap MJ, et al. The Richmond Agitation–Sedation Scale: validity and reliability in adult intensive care patients. Am J Respir Crit Care Med 2002;166:1338–44. The 'American Journal of Respiratory and Critical Care Medicine' is an official journal of the American Thoracic Society.

FIGURE 6.6 Riker Sedation–Agitation Scale (SAS).[145]

Riker Sedation-Agitation Scale (SAS)

Score	Term	Description
7	Dangerous agitation	Pulling at ET tube, trying to remove catheters, climbing over bedrail, striking at staff, thrashing side-to-side
6	Very agitated	Requiring restraint and frequent verbal reminding of limits, biting ETT
5	Agitated	Anxious or physically agitated, calms to verbal instructions
4	Calm and cooperative	Calm, easily arousable, follows commands
3	Sedated	Difficult to arouse but awakens to verbal stimuli or gentle shaking, follows simple commands but drifts off again
2	Very sedated	Arouses to physical stimuli but does not communicate or follow commands, may move spontaneously
1	Unarousable	Minimal or no response to noxious stimuli, does not communicate or follow commands

Guidelines for SAS Assessment

1. Agitated patients are scored by their most severe degree of agitation as described.
2. If patient is awake or awakens easily to voice ('awaken' means responds with voice or head shaking to a question or follows commands), that's a SAS 4 (same as calm and appropriate – might even be napping).
3. If more stimuli such as shaking is required but patient eventually does awaken, that's SAS 3.
4. If patient arouses to stronger physical stimuli (may be noxious) but never awakens to the point of responding yes/no or following commands, that's a SAS 2.
5. Little or no response to noxious physical stimuli represents a SAS1.

Source: Riker RR, Picard JT, Fraser GL. Prospective evaluation of the Sedation–Agitation Scale for adult critically ill patients. Crit Care Med 1999;27(7):1325–9.

- a target sedation score
- when to commence, increase, decrease or cease sedative agents
- when to seek review by a medical officer.

Sedation protocols usually also incorporate an analgesia component, frequently with an emphasis on pain assessment and management as the first step to achieve patient comfort.

Although sedation protocols have widespread support, there is mixed evidence regarding the benefits of their implementation.[54] It is likely that sedation protocols provide most benefit in settings where ratios of critical care nurses and medical officers to patients are low (that is, are not available or limited in numbers).

Practice tip

Assessing and managing pain first, prior to providing any sedation, will improve comfort and reduce the need for sedation in many patients.

Nurse-led sedation protocols

Nurse-led sedation protocols are usually ordered by a doctor or advanced practice nurse with prescribing rights, contain guidance regarding sedation management and are usually used by nurses although they may have input from pharmacists or other members of the healthcare team. While some studies show benefits associated with nurse-led sedation protocols, particularly in relation to hospital length of stay, others do not.[149] Until further research is undertaken, sedation protocols should be considered on a local basis where current practice conditions indicate potential benefit from care standardisation. Appropriate evaluation of the impact of protocol implementation should be undertaken.

Practice tip

Patients should be kept 'calm and cooperative' unless there is a reason for deeper sedation. Strategies to minimise sedation include discussion and agreement of a target sedation score, and regular assessment of pain, agitation and delirium.

Sedation minimisation protocols

A range of multidimensional protocols have been developed for use by all the multidisciplinary team for the purpose of minimising the amount of sedation delivered and the patients' sedation level. Some of these have been incorporated into bundles such as the Wake Up and Breathe Program[150] or the expanded ABCDEF bundle.[151] Like nurse-led sedation protocols, benefits have been demonstrated in some settings but not all.[152] Despite these inconsistent results, the lack of adverse effects associated with these multidimensional protocols means implementation of such a protocol should be considered, although any plans to implement such a protocol should take into account local practice and ensure continuous evaluation of the benefits as well as adverse events.

Daily interruption of sedation

A specific form of sedation protocol is the daily interruption of sedation. Although the initial study in this area found benefits in reduced duration of mechanical ventilation and ICU length of stay,[153,154] these benefits have not been demonstrated subsequently. In both a meta-analysis of data from nine studies including 1282 patients and a multicentre study of 423 patients in 16 centres across Canada and the USA, no improvement was seen in duration of mechanical ventilation, ICU or hospital length of stay or rates of delirium.[155,156] Further, in the multicentre study, patients who received daily interruption of sedation required higher daily doses of some sedative and analgesic agents, and greater nurse workload was required for patients in this group.[156] From a practical perspective there are growing reports of clinicians' concerns regarding patient comfort such as agitation and pain, as well as adverse events such as device removal during sedation interruption.[157,158] Given this evidence, daily interruption of sedation cannot be recommended. Instead, the mainstay of achieving good practice in this setting is maintaining appropriate targets for sedation levels that are as light as possible and based on individual patient needs.

Sleep

The function of sleep is not yet fully understood; however, it is considered to be required for many bodily functions.[159] It is vital for well-being, and sleep disruption or deprivation leads to physical illness[160] and premature mortality.[161] Good-quality sleep is associated with better psychological health.[162] Hence sleep is considered to be physically and psychologically restorative and essential for healing and recovery from illness. Arguably, critically ill people are in greater need of undisrupted sleep, given their need for healing and recovery, but are more likely to experience poor-quality sleep.[163]

Sleep in the healthy adult comprises one consolidated period of 6–8 hours (mean 7.5 hours) in each 24-hour period occurring at night according to natural circadian rhythms.[164] There are two main sleep states: rapid eye movement sleep (REM) (approximately 25% of total sleep time (TST)) and non-rapid eye movement sleep (non-REM) (approximately 75% of TST). Non-REM sleep is composed of three stages: stages 1 and 2 or light sleep and stage 3 or slow-wave sleep (SWS), which must be completed in sequence in order to enter REM sleep.

The consolidated sleep period consists of four to six sleep cycles: stages 1–3 followed by REM sleep, which lasts 60–90 minutes.[165] All sleep stages are important to health and, unfortunately, critically ill patients commonly experience little SWS or REM sleep.

Evidence suggests that, although critically ill patients may experience normal sleep quantities, the quality is poor, with very few experiencing SWS or REM sleep.[166] Sleep is highly disrupted and distributed across 24 hours, with roughly equal amounts occurring in the day and at night.[167,168] These findings, obtained using polysomnography (PSG), have been corroborated by patients' self-reports of their sleep in critical care.[169] Patients consistently rate their overall sleep quality as poor and, more specifically, they report light sleep with frequent awakenings.[170] Many factors are thought to affect the patient's ability to sleep, including those intrinsic to the patient such as abnormal temperature and pain, others that are environmental such as noise and light, and those that are treatment related such as medications, tubes and mechanical ventilation.[171,172]

There are changes in sleep architecture over the adult lifespan that require consideration in the context of critical care nursing. TST and the percentage of SWS decline with age (TST by 10 minutes and SWS by 2% per decade) and light sleep increases slightly (by 5% between 20 and 70 years).[173] REM sleep remains fairly constant, with an approximate 0.6% decline per decade until age 70 years, when REM increases with a simultaneous decrease in TST.[174] Time spent awake after sleep onset increases with age by 10 minutes per decade after age 30 years.[173]

Sleep assessment/monitoring

The patient's sleep history should be taken as soon as possible after admission. The person closest to the patient (ideally living in the same home) may be willing to provide a sleep history if the patient is unable to communicate verbally. The requirement for nocturnal non-invasive ventilation or sleep medication should be considered with the multidisciplinary team. Particular attention should be paid to reports of daytime sleepiness, dissatisfaction with sleep and bed partner reports of excessive snoring as these may indicate an undiagnosed sleep disorder. Usual sleep habits such as 'going to bed', 'getting up' and shower times should be accommodated while the patient is treated in critical care whenever possible.

Unfortunately, few objective methods of assessing sleep reliably in critically ill patients are available. PSG, a method of recording electroencephalography, electrooculography and electromyography, is the 'gold standard' for assessing sleep. PSG data are analysed according to Rechtschaffen and Kales' (R & K)[175] criteria to provide TST and sleep stage times. Difficulties in applying standard R & K sleep criteria to critically ill patients' sleep data and the need for a trained operator to undertake analysis preclude its routine clinical use in critical care. Actigraphy is another method of recording sleep that has been attempted in the critically ill. Modern actigraphs are small wristwatch devices (they may also be located on the ankle) containing accelerometers that detect motion in a single axis or multiple axes.[176] Although actigraphy has been shown to be feasible in the critically ill population,[176,177] there is some evidence that actigraphy provides an overestimation of sleep time given that critically ill patients are typically immobile for long periods regardless of sleep state. The other objective method that has been attempted in critical care is bispectral index monitoring.[178] At present, considerable algorithm development using comparisons with PSG data are required before it is a viable option to measure sleep accurately in any setting, although there is some early evidence of feasibility.[179]

The most reliable option for the critical care clinician to assess sleep is a patient self-report (in any case, the patient is best placed to judge the adequacy of their sleep if they are able). Two instruments have been specifically developed for use in critical care: the Richards–Campbell Sleep Questionnaire (RCSQ)[180] and the Sleep in Intensive Care Questionnaire (SICQ) (Table 6.10).[181] The RCSQ comprises five 100-mm VASs: sleep depth, latency, awakenings, time awake and quality of sleep. It was validated in 70 male patients where there was a moderate correlation between total RCSQ score and PSG sleep efficiency index, $r = 0.58$, ($P < 0.001$).[180] The SICQ is better suited for use when assessing a unit/organisation-wide change in practice rather than an individual patient's sleep (see Table 6.10).

Up to 50% of patients treated in critical care may be unable to complete a sleep self-assessment, in which case the only remaining option is nurse assessment. The Nurses' Observation Checklist (NOC)[182] can be used to obtain the bedside nurses' assessments of the patient's sleep quantity. It is a relatively simple instrument to use. However, evidence from many studies suggests that nurses tend to overestimate sleep time, so sleep time derived from the NOC may be better used as a trend rather than a definitive report for an individual night's sleep.[183,184]

Sleep promotion and maintenance

There is a growing, although still small and often low-quality, body of evidence of interventions that are effective in promoting sleep for patients in ICU. These interventions include optimising patient comfort and adapting the environment to be more conducive to normal sleep routines. Multidimensional interventions that incorporate a number of strategies have been found to be beneficial.[51] Individualised approaches to all aspects of care are best and this is particularly important when promoting and maintaining sleep in the critically ill. The following information, based on research and expert opinion, provides some general advice that may promote and maintain sleep and, at the very least, create conditions conducive to rest.

TABLE 6.10
Sleep assessment instruments

INSTRUMENT	DESCRIPTION	COMMENTS
Richards–Campbell Sleep Questionnaire[180]	Five VAS (0–100 mm). Total score derived from average of the five scales (high scores indicate good sleep).	Patient does not need to be able to write (nurse can mark the line as instructed by patient). Patient requires sufficient level of cognitive function to use it.
Sleep in Intensive Care Questionnaire[181]	Seven questions (some have more than one item). Likert scales 1–10. No global score. Good for organisational changes in practice.	Patient does not need to be able to write (nurse can circle the response as instructed by patient). Patient requires sufficient level of cognitive function to use it. Not yet validated.
Nurses' observation checklist[182]	Tick box table. Assignment of a category: 'awake', 'asleep', 'could not tell' and 'no time to observe' every 15 min.	No training required. Typically, nurses tend to overestimate sleep. Better for trend over several nights.

Comfort measures

- Ensure pain relief is offered and administered if pain is suspected.
- Reduce anxiety by providing information and the opportunity to have questions answered. Anxiolytics such as low-dose benzodiazepines may also be required (recognising that these may adversely affect sleep quality).
- Avoid night-time sedation (unless the patient took this prior to hospitalisation). Sedatives and hypnotics rarely improve the quality and quantity of sleep and when prescribed in hospital are likely to continue beyond hospital,[185] predisposing the patient to the risk of dependency and long-term sleep difficulties (and fall injuries particularly in the elderly[186]).
- Consider providing a light massage or music therapy unless contraindicated to encourage relaxation.[187]
- Provide an extra cover for warmth (metabolic rate typically drops during sleep).
- Request the patient's family to provide some of the patient's own personal belongings such as pillows and toiletries.
- Ear plugs and eye covers may assist some patients,[150,187] and have been shown to reduce the risk of delirium, although patients provided with ear plugs and eye covers should have the ability to remove them without assistance if they wish.

Care activities

- Attend to nursing care at the beginning of the night to reduce the likelihood of disturbing sleep during the night, for example:
  - redress wounds and empty drainage bags
  - wash, clean teeth and change gown and sheets
  - reposition with suitable pressure support measures
  - level the transducer at the phlebostatic axis to ensure accurate haemodynamic monitoring so you do not need to disturb the patient again later
  - ensure intravenous lines and drains are accessible.
- Plan care activities to allow the patient 1.5–2-hour periods of undisturbed time during the night. Negotiate with other healthcare personnel to allow these uninterrupted periods at night and during daytime rest times. 'Cluster care', for example, time medication administration, planned ETT suctioning and pressure area care to coincide.
- Provide the daily bath to suit patient needs rather than organisational needs (either before settling for the night or during normal waking hours).

Practice tip

Enabling the patient to experience good quality and quantities of sleep should be a major priority for critical care nursing. Demonstrate your commitment to improving rest and sleep for intensive care patients by incorporating sleep into the treatment reminder system used in the unit you work in (e.g. FASTHUG becomes FASSTHUG).

Environmental

- Reduce sound levels especially during rest times and at night, which may require a unit-wide change in practice as several critical care studies highlight

the association between noise levels and sleep disruption.[188,189] Sound levels in adult critical care areas consistently exceed hospital standards; for example, the World Health Organization guidelines that recommend sound levels during the night inside a hospital should not exceed 40 dB, with particular attention given to sound levels in the ICU.[190]

- Ensure that lights are sufficiently dimmed and window blinds drawn during rest times and at night and that lighting is bright and blinds opened at all other times. It is known that critically ill patients' melatonin metabolism is often non-circadian so it is particularly important to attempt to use lighting that encourages normal circadian rhythm.[191,192] Generally, critical care areas contain fluorescent lights that may emit up to 600 lux. It is well known that artificial lights emit light with sufficient short-wave content to affect melatonin secretion, but research indicates that it is contemporary practice to provide sufficiently low light levels at night although daytime light may be inadequate to entrain circadian rhythms.[193,194]

Practice tip

Ask your patient (or their relatives) about their usual night-time 'settling routine' for sleep. Try to emulate the routine as closely as possible. Then check whether this improved their sleep.

Treatments

- Discuss the need for alternative mechanical ventilation settings at night with the medical team. Hyperventilation caused by inappropriately high inspiratory pressure can cause hypocapnia, which may lead to central apnoeas and sleep disturbance.[195]
- Many medications administered in critical care affect sleep architecture. Even vasoactive medications such as adrenaline have the capacity to affect the quality of sleep. Sedatives, especially benzodiazepines and opioids, reduce time in stage 3 and REM, so reduce the quantity and quality of sleep.[196–198] Pain relief and anxiolysis may be essential for sleep to occur, but an awareness of potential adverse medication reactions is important in the prevention of escalating sleep disturbances.
- Administration of specific medications to promote sleep are not recommended in hospital and ICU.[54,199,200]

Practice tip

Next time you are at work in the ICU, take the time to consider the sound level. At an appropriate time and position in the ICU, close your eyes for 1 minute and consider whether you would be able to rest. In addition, find a patient who is well enough to be discharged to the hospital ward and ask them about the factors that they found most disruptive to rest and sleep while they were being treated in ICU.

Practice tip

If after interviewing the patient or their family about their usual sleep and assessing their sleep in ICU you suspect they might have an existing untreated sleep disorder, request the treating medical team to make a sleep medicine referral. Untreated sleep problems long term may be associated with increased risk of cardiovascular disease and cancer.

Melatonin

This naturally occurring hormone is both sleep promoting and sleep maintaining. Melatonin is used for the short-term alleviation of secondary sleep disorders (e.g. insomnia and shift-work-induced circadian disruption).[201] There is some evidence to suggest it is useful for improving self-reported sleep quality for people with chronic diseases.[202] Several small-scale studies have been undertaken to examine whether melatonin improves either sleep or delirium in the critically ill, and, although there are some promising signs, evidence remains limited, conflicting and inconclusive.[203] Difficulties occur in emulating the typical endogenous pulsatile secretion of the hormone and, together with its short half-life, these probably explain why the evidence is inconclusive. The high doses required to achieve an adequate plasma level overnight when administered once at the beginning of the night are likely to persist in the body and may disrupt circadian rhythm. The typical dose is 3–5 mg once or twice a day.

The current advice of the authors based on evidence available to date is that conditions that encourage the normal circadian secretion of endogenous melatonin (i.e. provide lighting and activity levels appropriate for the time of day) may be more effective than administering exogenous melatonin. However, the risk profile of exogenous melatonin is low so it may considered as a useful adjunct to improve sleep.

Summary

Meeting the psychological needs of patients is essential in the care of critically ill patients. In this chapter the various methods that are available to assess and then effectively manage aspects of patient care related to anxiety, delirium, pain, sedation and sleep are outlined. Assessment of these aspects of the patient's condition require thorough clinical assessment, with a range of validated instruments available to help improve consistency over time and between clinicians, as well as to inform decisions regarding the most appropriate interventions. Although these aspects of care have been reviewed sequentially in this chapter, in reality they are closely interrelated and should be considered concurrently.

Case study

A 44-year-old man, Ian, was brought to hospital with 'difficulty breathing' by ambulance after a 5-day history of a flu-like illness. Ian had a positive polymerase chain reaction (PCR) COVID-19 test 2 days previously. On arrival in the emergency department, Ian was hypoxic and hypercapnic, his respiratory rate was 40 per minute and his Glasgow Coma Scale score was 7. He was transferred to the ICU for emergency intubation in the negative pressure room.

Ian was reported by his wife, Maddy, via video conference to be healthy with no underlying physical health conditions and rarely saw his GP. She also added that Ian worked long hours in information technology and was occasionally stressed and 'down in the dumps' but rarely complained of sleeping badly. Ian was a non-smoker and rarely drank alcohol but occasionally ate marijuana cookies with some old school friends. He weighed 85 kg and was 185 cm tall (BMI: normal). The couple had two sons: an 8-year-old and a teenager. At the time of Ian's admission Maddy reported than none of the family were vaccinated against COVID-19. Ian was admitted to hospital during a COVID-19 pandemic wave.

Ian was mechanically ventilated on pressure control and required FiO_2 1.00 to maintain his oxygenation. High doses of steroids and immunomodulating therapy were given. He was placed in a prone position for the first five consecutive nights of his stay in ICU. High doses of fentanyl and midazolam were used and cisatracurium was used at night. Cisatracurium was withheld during the day. Target sedation level on the Richmond Agitation–Sedation Scale (RASS) was −5 (during muscle relaxant hold). Despite all efforts, Ian remained difficult to oxygenate and ventilate. By day 7 his lung compliance was so poor his tidal volumes were <40 mL. Therefore, extracorporeal membrane oxygenation (ECMO) was started and continued until his lung function improved sufficiently 14 days later. When the ECMO was removed (day 21 ICU) the cisatracurium infusion was stopped and the sedative medication infusion rates were reduced.

On day 22 Ian was stable enough to be transferred to a room with windows facing outside the building. His lung function remained poor; he required FiO_2 0.5 and high inspiratory pressures to ventilate him and maintain normocapnia. Quantitative PCR testing revealed that his viral load was still high. He was physically weak and delirious.

By ICU day 24, Ian had sufficient strength to move his head vigorously from side to side greatly jeopardising his airway and frequently causing the ventilator tubing to disconnect from his endotracheal tube. Given his obvious discomfort and the anticipated protracted nature of his lung disease he was tracheostomised on ICU day 27. Despite this he remained agitated and required large doses of sedatives to maintain his safety. Infection prevention and control for the COVID-19 infection required healthcare workers to use full PPE, to minimise time in the room and to keep the room door closed. In addition, demands on the nursing workforce, including a high number of patients and high acuity patients and a limited number of nurses with sufficient expertise, lead to difficulties maintaining continuity of care. Ian was delirious (Confusion Assessment Method-ICU positive), appeared fearful and withdrawn most of the time. He was awake all night and seemed unable to stay awake during the day.

TREATMENT

From ICU day 28 an ICU nurse practitioner case managed Ian's early recovery with input from the entire multidisciplinary team including physiotherapy, dietitian, social work and speech pathology. A daily routine was developed with input from Maddy (Ian was still too delirious to provide input), which included set 'wake up' and 'lights out' times. In-depth information about Ian's personality, his interests and likes and dislikes were obtained and documented in a care plan. Instructions about the daily routine were placed in prominent

places in Ian's room. A low-dose dexmedetomidine infusion was administered at night if Ian was delirious and he was ventilated using pressure control at night and pressure support during the day. The speech pathologist helped find strategies to improve communication. Regular video conferences were scheduled for Maddy and Ian and their sons to see each other (until visiting restrictions were reduced and Ian had two negative PCR tests towards the end of his ICU stay).

When Ian was no longer delirious, he was asked about his goals for the future. He simply wanted to 'breathe without the ventilator' and 'go home'. Therefore, rehabilitation started with an emphasis on developing respiratory function to address these goals. At times he was despondent and discouraged by the lack of progress, especially in relation to his respiratory function.

- Ian was encouraged to express his feelings using the communication strategies available (at first picture boards containing faces of different emotions were used and Ian was asked to point at these).
- Ian's lists of interests were consulted by nurses and other healthcare professionals before they entered the room and used as 'conversation starters' and he was encouraged to watch his favourite TV programs.
- Within the constraints of the COVID-19 infection prevention and control, non-pharmacological interventions were used to manage delirium as much as possible with the addition of nocturnal dexmedetomidine.
- Nurses were encouraged to ensure the room was well lit during the day to ensure circadian entrainment.
- When COVID-19 infection prevention and control visiting restrictions were relaxed, Ian was visited each day by Maddy.
- Maddy was provided with support and advice about carer support.
- A summary of his day's achievements, however small, were written on a whiteboard in the room.

Ian was treated in ICU for 6 weeks and was discharged to an inpatient rehabilitation facility 2 weeks later. His frailty and impaired respiratory function were the main reasons for his continued need for inpatient treatment.

RECOVERY

Ian's physical recovery was uneventful; however, he continued to experience severe low mood. While treated in the inpatient rehabilitation facility he saw a psychologist as he was experiencing the symptoms of post-traumatic stress disorder (PTSD). He saw his GP after returning home in the community, who prescribed a mood stabiliser and antidepressant. Three months after he returned home, he visited the ICU and expressed his gratitude for his treatment. He reported that he had experienced repeated flashbacks about not being able to breathe and that this contributed to his low mood.

DISCUSSION

Ian's recovery was complicated by significant challenges associated with delirium and frailty. It is possible, given his history of low moods, that he had experienced depression prior to this hospitalisation and this contributed to the challenges he faced. His 'unproblematic' use of marijuana may have been a method of self-treatment. Many patients have unrecognised mental health disorders which may manifest more strongly during recovery from critical illness. For the large proportion of his ICU stay, Ian's psychological care needs were greater than his physical needs. The situation was compounded by the pandemic-related restrictions on visiting, continuity of care and usual care provided for delirium. However, technology (video conferencing), expert nursing (nurse practitioner) and his main supporter and advocate, Maddy, resulted in a good outcome.

CASE STUDY QUESTIONS

1. List Ian's risk factors for delirium (other than sedative medications) and the non-pharmacological nursing interventions that were used in caring for him, as well as any additional strategies that might have been used.
2. One of the interventions used to assist Ian's to sleep was to ensure the room was brightly lit during the day. Explain the underlying rationale for this intervention.

RESEARCH VIGNETTE

Kusi-Appiah E, Karanikola M, Pant U, et al. Tools for assessment of acute psychological distress in critical illness: a scoping review. Aust Crit Care 2021;34(5):460-72.

Abstract

Objectives: Patients' experience of psychological distress in the ICU is associated with adverse effects, reduced satisfaction and delayed physical and psychological recovery. There are no specific guidelines for the assessment and management of acute psychological distress during hospitalisation in the ICU. We reviewed existing tools for the assessment of acute psychological distress in ICU patients, examined evidence on their metric properties and identified potential gaps and methodological considerations.

Method: A scoping review based on literature searches (Cumulative Index to Nursing and Allied Health Literature, Medical Literature Analysis and Retrieval System Online, Excerpta Medica Database, PsycINFO, Scopus, Health and Psychosocial Instruments, Dissertations and Theses Global, and Google Scholar) and predefined eligibility criteria was conducted as per current scoping review guidelines.

Findings: Overall, 14 assessment tools were identified having been developed in diverse ICU settings. The identified tools assess mainly anxiety and depressive symptoms and ICU stressors, and investigators have reported various validity and reliability metrics. It was unclear whether available tools can be used in specific groups, such as non-communicative patients and patients with delirium, brain trauma, stroke, sedation and cognitive impairments.

Conclusion: Available tools have methodological limitations worth considering in future investigations. Given the high prevalence of psychiatric morbidity in ICU survivors, rigorously exploring the metric integrity of available tools used for anxiety, depressive and psychological distress symptom assessment in the vulnerable ICU population is a practice and research priority.

Relevance to clinical practice: These results have implications for the selection and implementation of psychological distress assessment methods as a means for promoting meaningful patient-centred clinical outcomes and humanising ICU care experiences.

Critique

The importance of assessing psychological distress in critically ill patients is increasingly recognised. Use of valid and reliable instruments is essential to optimise the value of the information gained in such assessments. The search in this scoping review was extensive and covered relevant databases with no date or language limits applied at the time of the search, although non-English papers were subsequently excluded.

Fourteen tools for assessing psychological distress were identified, with initial development work conducted in a range of countries including the USA ($n = 6$), the UK ($n = 2$), Australia ($n = 2$), China ($n = 2$) and 1 in each of Brazil, India and Iran (total = 15 as 1 development study was conducted across 2 countries). Some instruments were designed to assess anxiety alone or in combination with depression, or alternatively a broader construct of psychological distress; there was a mix of instruments designed for self-assessment by the patient or use by clinical/research staff to assess the patient.

The number of items on each instrument range from 1 to 61, with half having 35 items or more. The length of the instruments was identified by the review authors as a feasibility consideration, with 20 items or more considered to create significant test burden, fatigue and frustration for the patients.

Development of the psychological distress instruments rarely involved adequate blinding and the new instruments were frequently not compared with a 'gold standard'. Despite the limitations of the development, adequate validity and reliability measurements were reported on the parameters that have been assessed for many of these instruments. A number of the instruments have also been tested by other author groups to determine applicability in additional settings.

Given the growing recognition of the importance of assessment within critical care, and the challenges involved in assessing psychological constructs such as anxiety, distress and depression in patients who are not completely alert, it is essential that further development work is undertaken to establish reliability and validity in larger sample sizes and multiple settings. Interventions to reduce psychological distress are relevant for all patients, but specific targeting towards patients with greater levels of distress will probably promote improved outcomes.

Despite the limited rigour in the development of these assessment instruments to date, this review offers the best summary of instruments available and provides some guidelines for those in clinical areas redesigning care protocols to incorporate assessment of psychological distress.

Learning activities

1 The assessment of anxiety and pain is integral to critical care nursing:
   - **a** Discuss the assessment strategies you would use to differentiate between anxiety and pain.
   - **b** List any special considerations associated with your choices.

2 Outline some non-pharmacological strategies that could be employed to reduce pain.

3 Discuss how family could help with the management of the patient's anxiety.

4 Critically ill patients who experience delirium require highly skilled and informed nursing. The following exercises may enhance your ability to manage patients with delirium:
   - **a** Identify risk factors for the patient and think of ways to ameliorate them (in practice always discuss with the multidisciplinary team).
   - **b** Highlight nursing interventions that may reduce the potential for delirium. Describe the rationale for your selection of nursing interventions using current research.

5 Outline the differences between delirium and dementia.

6 Effective treatment for alcohol and substance withdrawal is dependent on identifying symptoms early. Outline the strategies to identify patients at risk of alcohol withdrawal in critical care.

7 Why is thiamine and complex B vitamin supplementation considered a vital component of treatment for alcohol dependence?

8 Compare and contrast the various pain assessment instruments and discuss the relative merits and disadvantages of using each of these instruments. Now repeat the exercise for each of the instruments for sedation assessment and for delirium assessment.

9 Using the references provided in this chapter:
   - **a** Highlight the importance of good quality sleep in health and illness.
   - **b** Identify theories that explain the function of sleep.

10 Think about the last time you experienced fragmented sleep or insufficient sleep and describe how you felt in terms of your:
   - **a** mood
   - **b** cognitive function
   - **c** physical function
   - **d** appetite
   - **e** motivation.

Online resources

Australasian Sleep Association, www.sleep.org.au

Healthtalk.org (Former patients talk about their experience), http://www.healthtalk.org/peoples-experiences/intensive-care/intensive-care-patients-experiences/topics.

ICU Delirium and Cognitive Impairment Study Group, www.icudelirium.org

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