



CoBaTrICE SYLLABUS

(PRESENTED BY DOMAIN)

[VERSION 1.0 (2006)]

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PREFACE

This syllabus is the aggregate of all the knowledge, skills, behaviours and attitudes required for each of the 102 CoBaTrICE competencies. It is divided into 13 sections: 12 domains plus basic sciences. This format inevitably results in repetition with the same topic appearing in more than one domain and linked to multiple competencies. Similarly there is some cross-over between the knowledge and basic sciences, and knowledge and skills lists. An alternative (lengthier) format which displays the syllabus for each competence is available to download from the CoBaTrICE website (www.cobatrice.org/syllabus).

The CoBaTrICE syllabus can be used by trainees and trainers to aid reflective learning, formal teaching and to guide some aspects of assessment. It could also be modified to audit the content of training received in different centres. The syllabus is presented in tables to allow trainees to track the progression of their learning if they wish. It is **not** intended that these tables be used as checklists for the assessment of competence. No trainee can be expected to have a comprehensive knowledge of every single aspect of the syllabus.

Much of this material has been 'gracefully borrowed' from international guidelines and national training documents, and we acknowledge with thanks the prior work done by colleagues in many countries. Additional material also came from the CoBaTrICE Delphi. The sum total of knowledge required to become a specialist intensivist is impressive, and would be even larger if individual elements were presented in greater detail. The breadth of knowledge demonstrates that intensivists have an important role as the general practitioners of acute hospital medicine.

CoBaTrICE DOMAINS

- 1:** Resuscitation and initial management of the acutely ill patient
- 2:** Diagnosis: assessment, investigation, monitoring and data interpretation
- 3:** Disease management
 - ◆ Acute disease
 - ◆ Co-morbid disease
 - ◆ Organ system failure
- 4:** Therapeutic interventions / organ system support in single or multiple organ failure
- 5:** Practical procedures
 - ◆ Respiratory system
 - ◆ Cardiovascular system
 - ◆ Central nervous system
 - ◆ Gastrointestinal system
 - ◆ Renal / Genitourinary system
- 6:** Peri-operative care
- 7:** Comfort and recovery
- 8:** End of life care
- 9:** Paediatric care
- 10:** Transport
- 11:** Patient safety and health systems management
- 12:** Professionalism
 - ◆ Communication skills
 - ◆ Professional relationships with patients and relatives
 - ◆ Professional relationships with colleagues
 - ◆ Self governance

CoBaTrICE COMPETENCIES

DOMAIN	COMPETENCE STATEMENT	
1. RESUSCITATION & INITIAL MANAGEMENT OF THE ACUTELY ILL PATIENT	1.1	Adopts a structured and timely approach to the recognition, assessment and stabilisation of the acutely ill patient with disordered physiology
	1.2	Manages cardiopulmonary resuscitation
	1.3	Manages the patient post-resuscitation
	1.4	Triages and prioritises patients appropriately, including timely admission to ICU
	1.5	Assesses and provides initial management of the trauma patient
	1.6	Assesses and provides initial management of the patient with burns
	1.7	Describes the management of mass casualties
2. DIAGNOSIS: ASSESSMENT, INVESTIGATION, MONITORING AND DATA INTERPRETATION	2.1	Obtains a history and performs an accurate clinical examination
	2.2	Undertakes timely and appropriate investigations
	2.3	Describes indications for echocardiography (transthoracic / transoesophageal)
	2.4	Performs electrocardiography (ECG / EKG) and interprets the results
	2.5	Obtains appropriate microbiological samples and interprets results
	2.6	Obtains and interprets the results from blood gas samples
	2.7	Interprets chest x-rays
	2.8	Liaises with radiologists to organise and interpret clinical imaging
	2.9	Monitors and responds to trends in physiological variables
	2.10	Integrates clinical findings with laboratory investigations to form a differential diagnosis
3. DISEASE MANAGEMENT	ACUTE DISEASE	
	3.1	Manages the care of the critically ill patient with specific acute medical conditions
	CHRONIC DISEASE	
	3.2	Identifies the implications of chronic and co-morbid disease in the acutely ill patient
	ORGAN SYSTEM FAILURE	
	3.3	Recognises and manages the patient with circulatory failure
	3.4	Recognises and manages the patient with, or at risk of, acute renal failure
	3.5	Recognises and manages the patient with, or at risk of, acute liver failure
	3.6	Recognises and manages the patient with neurological impairment
	3.7	Recognises and manages the patient with acute gastrointestinal failure
	3.8	Recognises and manages the patient with acute lung injury syndromes (ALI / ARDS)
	3.9	Recognises and manages the septic patient
	3.10	Recognises and manages the patient following intoxication with drugs or environmental toxins
	3.11	Recognises life-threatening maternal peripartum complications and manages care under supervision
4. THERAPEUTIC INTERVENTIONS / ORGAN SYSTEM SUPPORT IN SINGLE OR MULTIPLE ORGAN FAILURE	4.1	Prescribes drugs and therapies safely
	4.2	Manages antimicrobial drug therapy
	4.3	Administers blood and blood products safely
	4.4	Uses fluids and vasoactive / inotropic drugs to support the circulation
	4.5	Describes the use of mechanical assist devices to support the circulation
	4.6	Initiates, manages, and weans patients from invasive and non-invasive ventilatory support
	4.7	Initiates, manages and weans patients from renal replacement therapy
	4.8	Recognises and manages electrolyte, glucose and acid-base disturbances
	4.9	Co-ordinates and provides nutritional assessment and support

DOMAIN	COMPETENCE STATEMENT	
5. PRACTICAL PROCEDURES	RESPIRATORY SYSTEM	
	5.1	Administers oxygen using a variety of administration devices
	5.2	Performs fiberoptic laryngoscopy under supervision
	5.3	Performs emergency airway management
	5.4	Performs difficult and failed airway management according to local protocols
	5.5	Performs endotracheal suction
	5.6	Performs fiberoptic bronchoscopy and BAL in the intubated patient under supervision
	5.7	Performs percutaneous tracheostomy under supervision
	5.8	Performs thoracocentesis via a chest drain
	CARDIOVASCULAR SYSTEM	
	5.9	Performs peripheral venous catheterisation
	5.10	Performs arterial catheterisation
	5.11	Describes a method for surgical isolation of vein / artery
	5.12	Describes ultrasound techniques for vascular localisation
	5.13	Performs central venous catheterisation
	5.14	Performs defibrillation and cardioversion
	5.15	Performs cardiac pacing (transvenous or transthoracic)
	5.16	Describes how to perform pericardiocentesis
	5.17	Demonstrates a method for measuring cardiac output and derived haemodynamic variables
	CENTRAL NERVOUS SYSTEM	
	5.18	Performs lumbar puncture (intradural / 'spinal') under supervision
	5.19	Manages the administration of analgesia via an epidural catheter
	GASTROINTESTINAL SYSTEM	
	5.20	Performs nasogastric tube placement
	5.21	Performs abdominal paracentesis
	5.22	Describes Sengstaken tube (or equivalent) placement
	5.23	Describes indications for, and safe conduct of gastroscopy
	GENITOURINARY SYSTEM	
	5.24	Performs urinary catheterisation
6. PERI-OPERATIVE CARE	6.1	Manages the pre- and post-operative care of the high risk surgical patient
	6.2	Manages the care of the patient following cardiac surgery under supervision
	6.3	Manages the care of the patient following craniotomy under supervision
	6.4	Manages the care of the patient following solid organ transplantation under supervision
	6.5	Manages the pre- and post-operative care of the trauma patient under supervision
7. COMFORT & RECOVERY	7.1	Identifies and attempts to minimise the physical and psychosocial consequences of critical illness for patients and families
	7.2	Manages the assessment, prevention and treatment of pain and delirium
	7.3	Manages sedation and neuromuscular blockade
	7.4	Communicates the continuing care requirements of patients at ICU discharge to health care professionals, patients and relatives
	7.5	Manages the safe and timely discharge of patients from the ICU
8. END OF LIFE CARE	8.1	Manages the process of withholding or withdrawing treatment with the multidisciplinary team
	8.2	Discusses end of life care with patients and their families / surrogates
	8.3	Manages palliative care of the critically ill patient
	8.4	Performs brain-stem death testing
	8.5	Manages the physiological support of the organ donor

DOMAIN	COMPETENCE STATEMENT	
9. PAEDIATRIC CARE	9.1	Describes the recognition of the acutely ill child and initial management of paediatric emergencies
	9.2	Describes national legislation and guidelines relating to child protection and their relevance to critical care
10. TRANSPORT	10.1	Undertakes transport of the mechanically ventilated critically ill patient outside the ICU
11. PATIENT SAFETY AND HEALTH SYSTEMS MANAGEMENT	11.1	Leads a daily multidisciplinary ward round
	11.2	Complies with local infection control measures
	11.3	Identifies environmental hazards and promotes safety for patients & staff
	11.4	Identifies and minimises risk of critical incidents and adverse events, including complications of critical illness
	11.5	Organises a case conference
	11.6	Critically appraises and applies guidelines, protocols and care bundles
	11.7	Describes commonly used scoring systems for assessment of severity of illness, case mix and workload
	11.8	Demonstrates an understanding of the managerial & administrative responsibilities of the ICM specialist
12. PROFESSIONALISM	COMMUNICATION SKILLS	
	12.1	Communicates effectively with patients and relatives
	12.2	Communicates effectively with members of the health care team
	12.3	Maintains accurate and legible records / documentation
	PROFESSIONAL RELATIONSHIPS WITH PATIENTS AND RELATIVES	
	12.4	Involves patients (or their surrogates if applicable) in decisions about care and treatment
	12.5	Demonstrates respect of cultural and religious beliefs and an awareness of their impact on decision making
	12.6	Respects privacy, dignity, confidentiality and legal constraints on the use of patient data
	PROFESSIONAL RELATIONSHIPS WITH PATIENTS AND RELATIVES	
	12.7	Collaborates and consults; promotes team-working
	12.8	Ensures continuity of care through effective hand-over of clinical information
	12.9	Supports clinical staff outside the ICU to enable the delivery of effective care
	12.10	Appropriately supervises, and delegates to others, the delivery of patient care
	SELF GOVERNANCE	
	12.11	Takes responsibility for safe patient care
	12.12	Formulates clinical decisions with respect for ethical and legal principles
	12.13	Seeks learning opportunities and integrates new knowledge into clinical practice
	12.14	Participates in multidisciplinary teaching
	12.15	Participates in research or audit under supervision

DOMAIN 1: RESUSCITATION & INITIAL MANAGEMENT OF THE ACUTELY ILL PATIENT

KNOWLEDGE

Early warning signs of impending critical illness
 Causes of cardio-respiratory arrest, identification of patients at risk and corrective treatment of reversible causes
 Clinical signs associated with critical illness, their relative importance and interpretation
 Clinical severity of illness and indications when organ dysfunctions or failure are an immediate threat to life
 Recognition of life threatening changes in physiological parameters
 Measures of adequacy of tissue oxygenation
 Causes, recognition and management of:

- Acute chest pain
- Tachypnoea & dyspnoea
- Upper and lower airway obstruction
- Pulmonary oedema
- Pneumothorax (simple & tension)
- Hypoxaemia
- Hypotension
- Shock states
- Anaphylactic and anaphylactoid reactions
- Hypertensive emergencies
- Acute confusional states and altered consciousness
- Acute seizures / convulsions
- Oliguria & anuria
- Acute disturbances in thermoregulation
- Acute abdominal pain

Treatment algorithms for common medical emergencies
 Immediate management of acute coronary syndromes
 Methods for assessing neurological function e.g. Glasgow Coma Scale
 Methods for securing vascular access rapidly
 Surface anatomy: structures in the antecubital fossa; large veins and anterior triangle of the neck; large veins of the leg and femoral triangle
 Intraosseous cannulation
 Techniques for effective fluid resuscitation
 Principles of blood and blood component therapy; principles of massive transfusion
 Treatment strategies for abnormalities of fluid, electrolyte, acid-base and glucose balance
 Cardiopulmonary resuscitation
 The modification of resuscitation techniques in the special circumstances of hypothermia, immersion and submersion, poisoning, pregnancy, electrocution, anaphylaxis, acute severe asthma and trauma
 Risks to the rescuer during resuscitation & methods to minimise these
 Indications for and methods of ventilatory support
 Basic and complex cardiac arrhythmias - recognition and management (pharmacological and electrical)
 Indications, doses and actions of primary drugs used in the management of a cardiac arrest (inc. special precautions and contraindications)
 Tracheal route for drug administration: indications, contraindications, dosage
 Indications, dosages and actions of drugs used in the peri-arrest period
 Cardiac arrhythmias and the principles of their management (treatment algorithm): Peri-arrest arrhythmias (bradycardia, broad complex tachycardia, atrial fibrillation, narrow complex tachycardia) ; ventricular fibrillation (VF) and pulse-less ventricular tachycardia (VT); Non-VF / VT rhythms (asystole / PEA)
 Defibrillation: principles of monophasic & biphasic defibrillators; mechanism, indications, complications, modes and methods (manual and automated external defibrillators (AED))
 Electrical safety: conditions which predispose to the occurrence of macro-shock / micro-shock; physical dangers of electrical currents; relevant standards regarding safe use of electricity in patient care; basic methods to reduce electrical hazards.
 Indications and methods of cardiac pacing in the peri-arrest setting
 Effect of cardio-respiratory arrest on body systems
 Principles and application of therapeutic hypothermia
 Audit of outcome after cardiac arrest
 Indications for not starting resuscitation or ceasing an initiated attempt
 Legal and ethical issues relating to the use of the recently dead for practical skills training, research and organ donation
 Relevance of prior health status in determining risk of critical illness and outcomes
 Triage and management of competing priorities
 Criteria for admission to, and discharge from ICU - factors influencing intensity and site of care (ward, high dependency unit (HDU), intensive care unit (ICU))
 Performance and interpretation of a primary and secondary survey

Environmental hazards & injuries: hypo- and hyperthermia, near-drowning, electrocution, radiations, chemical injuries, electrical safety/micro shock

Relevance of mechanism of injury to clinical presentation

Effects and acute complications of severe trauma on organs and organ systems:

- Respiratory - thoracic trauma; acute lung injury; tension pneumothorax
- Cardiovascular - hypovolaemic shock; cardiac tamponade
- Renal - acute renal failure; rhabdomyolysis
- Neurological - altered consciousness; traumatic brain injury; post-anoxic brain injury; coup and contra-coup injuries; intracranial haemorrhage and infarction; spinal cord injury
- Gastrointestinal - abdominal trauma; abdominal tamponade; rupture of liver or spleen
- Musculoskeletal system - soft tissue injury; short term complications of fractures; fat embolism; crush injury & compartment syndromes; maxillofacial injuries

Secondary insults that potentiate the primary injury

Immediate specific treatment of life-threatening injury

Management of cervical spine injuries

Principles of management of closed head injury; coup and contra-coup injuries; methods of preventing 'secondary insult' to the brain; recognition and immediate management of raised intracranial pressure

Management of severe acute haemorrhage and blood transfusion; correction of coagulation disorders and haemoglobinopathies

Principles, including indications, limitations and therapeutic modalities of basic radiological methods, CT scanning, MRI, ultrasound, angiography and radio nucleotide studies in the critically ill patient

Indications for and basic interpretation of chest radiographs: range of normal features on a chest x-ray; collapse, consolidation, infiltrates (including ALI/ARDS), pneumothorax, pleural effusion, pericardial effusion, position of cannulae, tubes or foreign bodies, airway compression, cardiac silhouette, mediastinal masses

Principles of outcome prediction / prognostic indicators and treatment intensity scales; limitations of scoring systems in predicting individual patient outcome

Pathophysiology and medical/surgical management of the phases of a burn injury

Calculation of area burned

Principles of calculation of fluid losses & fluid resuscitation in the burned patient

Respiratory complications of burn injuries (smoke inhalation, airway burns) - detection and management

Burn-related compartment syndrome and escharotomy

The environmental control necessary for optimal care of the burned patient

Recognition and management of acute disturbances in thermoregulation

Prevention of infection in the burned patient

Organisational principles for the coordination and management of mass casualties

Characteristics and clinical presentations associated with major incidents caused by natural or civilian disasters, infection epidemics or terrorist attack

Local major incident plan - the role of the ICU in hospital/community disaster plans

Communication tasks and personal role in major incident / accident plan

Principles of internal hospital communication

Management of public relations and information

Alternative forms of external communication

Triage methods in use locally

Decontamination procedures

Principles of crisis management, conflict resolution, negotiation and debriefing

Psychological support for patients and relatives

Principles of oxygen therapy and use of oxygen administration devices (see 5.1)

Principles of emergency airway management (see 5.3)

Management of difficult or failed airway management (see 5.4)

Surgical techniques to obtain vascular access (see 5.11)

SKILLS & BEHAVIOURS

Consider legal and ethical issues: patient autonomy, appropriateness of resuscitation and ICU admission

Conduct a primary survey: obtain relevant information rapidly and accurately

Recognise signs and symptoms of impending cardiac arrest

Assess conscious level, status of airway and cervical spine, and conduct careful systems review

Order and prioritise appropriate investigations

Use emergency monitoring equipment

Monitor vital physiological functions as indicated

Recognise and rapidly respond to adverse trends in monitored parameters
 Check & assemble resuscitation equipment
 Demonstrate advanced life support skills (ALS standard or equivalent)
 Use a defibrillator safely
 Initiate routine investigations during resuscitation to exclude reversible problems (e.g. hyperkalaemia)
 Recognise and manage choking / obstructed airway
 Implement emergency airway management, oxygen therapy and ventilation as indicated
 Demonstrate emergency relief of tension pneumothorax
 Obtain vascular access sufficient to manage acute haemorrhage, rapid fluid infusion and monitor cardiovascular variables
 Initiate emergency cardiac pacing
 Act appropriately as a member or leader of the team (according to skills & experience)
 Respond to an emergency in a positive, organised and effective manner; able to direct the resuscitation team
 Support relatives witnessing an attempted resuscitation
 Participate in timely discussion and regular review of 'do not resuscitate' orders and treatment limitation decisions
 Assess and communicates effectively the risks and benefits of intensive care admission
 Discuss treatment options with a patient or relatives before ICU admission
 Take decisions to admit, discharge or transfer patients
 Consider the need for stabilisation before transfer
 Determine when the patient's needs exceed local resources or specialist expertise (requirement for transfer)
 Explain life-sustaining therapies, in clear language, and describe the expected outcome of such therapies in view of the patient's goals and wishes.
 Professional and reassuring approach - generates confidence and trust in patients and their relatives
 Assess and document Glasgow Coma Scale (GCS)
 Examine and plan care for the confused patient
 Perform a comprehensive secondary survey; integrate history with clinical examination to form a differential diagnosis
 Prioritise the order of investigations and interventions for individual injuries according to their threat to life
 Protect a potentially unstable cervical spine
 Assess, predict and manage circulatory shock
 Assess burn severity and prescribe initial fluid resuscitation
 Estimate burn wound mortality from published data tables
 Describe the endpoints of burn resuscitation and preferred fluids
 Prescribe appropriate analgesia
 Identify or describe risk factors for airway compromise in the burned patient
 Identification and management of carbon monoxide poisoning
 Lead, delegate and supervise others appropriately according to experience and role
 Recognise and manage emergencies; seek assistance appropriately

ATTITUDES

Rapid response to resuscitation
 Appreciates the importance of timely institution of organ-system support
 Recognises the need for supportive care for all organ systems whether failing / injured or not
 Clear in explanations to patient, relatives and staff
 Consult and take into account the views of referring clinicians; promote their participation in decision making where appropriate
 Establishes trusting relationships with and demonstrates compassionate care of patients and their relatives
 Patient safety is paramount
 Determination to provide best and most appropriate care possible regardless of environment
 Appreciate the importance of ensuring physiological safety as a primary aim
 Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

DOMAIN 2: DIAGNOSIS: ASSESSMENT, INVESTIGATION, MONITORING AND DATA INTERPRETATION

KNOWLEDGE

Importance and principles of obtaining an accurate history of the current condition, comorbidities and previous health status using appropriate sources of information

Clinical signs associated with critical illness, their relative importance and interpretation

Sources and methods of obtaining clinical information

Relevance of prior health status in determining risk of critical illness and outcomes

Significance and impact of co-morbid disease on the presentation of acute illness

Impact of drug therapy on organ-system function

Indications for and the selection of suitable methods of monitoring or investigation taking into account their accuracy, convenience, reliability, safety, cost and relevance to the patient's condition.

Sensitivity and specificity of the investigation as related to a specific disease

Appropriate use of laboratory tests to confirm or refute a clinical diagnosis

Methods and routes of obtaining samples - associated indications and complications

Indications, limitations and basic interpretation of laboratory investigations of blood and other body fluids (e.g. urine, CSF, pleural and ascitic fluids):

- Haematology
- Immunology
- Cytology
- Blood grouping and x-matching
- Urea, creatinine, glucose, electrolytes and lactate
- Liver function tests
- Drug levels in blood or plasma
- Tests of endocrine function (diabetes, thyroid disorders, adrenal failure)
- Blood gas samples (arterial, venous and mixed venous)
- Microbiological surveillance and clinical sampling

Types of organisms - emergence of resistant strains, mode of transfer, opportunistic and nosocomial infections; difference between colonisation & infection

Universal precautions and preventative infection control techniques (hand washing, gloves, protective clothing, sharps disposal etc.)

Principles of aseptic technique and aseptic handling of invasive medical devices

Local patterns of bacterial resistance and antibiotic policy; difference between contamination, colonisation and infection

Interpretation of information from monitoring devices, and identification of common causes of error; principles of monitoring trends of change and their significance

Hazards of inappropriate monitoring including misuse of alarms; principles of disconnection monitors

Principles of invasive pressure monitoring devices: components & functions of an electromanometer system (catheter, tubing, transducer, amplifier and display unit); zero and calibration techniques; dynamics of the system - natural frequency and damping

Anatomy and physiology of the heart and cardiovascular system

Principles of haemodynamic monitoring - invasive & non invasive methods, indications & limitations, physiological parameters and waveform interpretation

Recognition of life threatening changes in physiological parameters

Invasive & non-invasive systems available for measuring cardiac output and derived haemodynamic variables, the principles involved and the type and site of placement of the monitoring device

Interpretation of, relationships between, sources of error and limitations of measured and derived cardiovascular variables including pressure, flow, volume and gas transport

Methods for measuring temperature

Principles, indications and limitations of pulse oximetry

Principles of ECG monitoring (heart rate, rhythm, conduction, ST segment change & QT interval) - indications, limitations and techniques. Advantages and disadvantages of different lead configurations

Clinical measurement: pH, pCO₂, pO₂, SaO₂, FiO₂, CO₂ production, oxygen consumption, respiratory quotient

Principles of monitoring ventilation - significance of respiratory rate, tidal volume, minute volume, mean, peak, end expiratory and plateau pressure, intrinsic and extrinsic PEEP, inspired oxygen concentration, arterial blood gas and acid base status; relationship between mode of ventilation and choice of parameters monitored; airflow and airway pressure waveforms

Physical principles, indications and limitations of end tidal CO₂ monitoring, and relationship

between end tidal CO₂ and arterial pCO₂ in various clinical circumstances

Surface anatomy: structures in the antecubital fossa; large veins and anterior triangle of the neck; large veins of the leg and femoral triangle; arteries of the arms and legs

Pre-analytical errors of arterial blood gas sampling (choice of sample site, sampling device, heparin, mixing, storage and transport)

Homeostatic regulation of acid base balance and buffer ions (e.g. Na⁺, K⁺, Ca⁺⁺, Cl⁻, HCO₃⁻, Mg⁺⁺, PO₄⁻)

Respiratory physiology: gas exchange, O₂ and CO₂ transport, hypoxia, hypo- and hypercarbia, functions of haemoglobin in oxygen carriage and acid-base balance

Renal physiology: regulation of fluid and electrolyte balance

Methods for assessing pain and sedation

Methods for assessing neurological function e.g. Glasgow Coma Scale

Systems available for intracranial pressure monitoring - indications, principles, type and site of placement of the monitoring device, data collection and trouble-shooting

Indications and techniques of jugular bulb oximetry

Principles, including indications, limitations and therapeutic modalities of basic radiological methods, CT scanning, MRI, ultrasound, angiography and radio nucleotide studies in the critically ill patient

Risks to patient and staff of radiological procedures and precautions to minimise risk

Indications for and basic interpretation of chest radiographs: range of normal features on a chest x-ray; collapse, consolidation, infiltrates (including ALI/ARDS), pneumothorax, pleural effusion, pericardial effusion, position of cannulae, tubes or foreign bodies, airway compression, cardiac silhouette, mediastinal masses

Effect of projection, position, penetration and other factors on the image quality

Basic interpretation of radiological investigations:

- Neck and thoracic inlet films
- X-rays of abdominal fluid levels / free air
- X-rays of long bone, skull, vertebral and rib fractures
- CT or MRI scans of head demonstrating fractures / haemorrhage
- Ultrasound of the abdomen (liver, spleen, large abdominal vessels, kidney, urinary bladder)
- Echocardiography (ventricular function, filling status, valve abnormality, size of the heart, any akinetic or dyskinetic segments, pericardial effusion with or without evidence of tamponade)

Principles, indications, limitations and basic interpretation of:

- Respiratory function tests	- Intra-abdominal pressure monitoring
- Diagnostic bronchoscopy	- Intrathoracic pressure (oesophageal pressure) measurements
- Diagnostic ECG (EKG)	- Fluid input-output monitoring
- Echocardiography	- Basic principles of ultrasound and the Doppler effect
- Electroencephalogram (EEG) and evoked potentials	

SKILLS & BEHAVIOURS

Examine patients, elicit and interpret clinical signs (or relevant absence of clinical signs) in the ICU environment

Obtain relevant information from the patient, relatives and other secondary sources

Professional and reassuring approach - generates confidence and trust in patients and their relatives

Listen effectively

Integrate history with clinical examination to create a diagnostic and therapeutic plan

Acquire, interpret, synthesize, record, and communicate (written and verbal) clinical information

Develop a working, and limited differential diagnosis based on presenting clinical features

Recognise impending organ system dysfunction

Order and prioritise appropriate investigations

In emergency situations, confirm or refute early diagnoses before data collection / analysis is complete - make contingency plans based on these diagnoses to combat further threats to the patient's life

Integrate clinical findings with results of investigations

Interpret laboratory results in the context of the patient's condition

Evaluate benefits and risks related to specific investigations

Monitor vital physiological functions as indicated

Obtain and accurately record data from monitors

Set monitor alarms appropriately

Differentiate real change from artefact & respond appropriately

Identify deviations from normal range and interpret these in the context of the clinical circumstances

Recognise and rapidly respond to adverse trends in monitored parameters

Recognise patterns in trends - early diagnosis and outcome prediction
 Review the need for continued monitoring regularly Use emergency monitoring equipment
 Obtain and interpret data from:

- Invasive and non-invasive arterial blood pressure measurement
- ECG / EKG (3 and 12 lead)
- Central venous catheters
- Pulmonary artery catheters or oesophageal Doppler
- Pulse oximetry
- FVC, spirometry and peak flow measurement
- Inspired and expired gas monitoring for O₂, CO₂ and NO
- Intracranial pressure monitoring
- Jugular bulb catheters and SjO₂ monitoring

Set and interpret data from ventilator alarms
 Obtain blood gas samples using aseptic techniques; interpret data from arterial, central venous or mixed venous samples
 Confirm adequate oxygenation and control of PaCO₂ and pH
 Obtain blood cultures using aseptic techniques
 Interpret chest x-rays in a variety of clinical contexts
 Interpret data from scoring or scaling systems to assess pain and sedation
 Assess and document Glasgow Coma Scale (GCS)
 Recognise changes in intracranial and cerebral perfusion pressure which are life threatening
 Identify abnormalities requiring urgent intervention
 Recognise significant changes and the need for repeated testing (i.e. that a single normal result is not as significant as identifying trends of change by repeated testing where indicated)
 Document investigations undertaken, results and action taken
 Assemble clinical and laboratory data, logically compare all potential solutions to the patient's problems, prioritise them and establish a clinical management plan
 Undertake further consultation / investigation when indicated
 Communicate effectively with radiological colleagues to plan, perform and interpret test results
 Communicate and collaborate effectively with all laboratory staff
 Lead, delegate and supervise others appropriately according to experience and role

ATTITUDES

Consults, communicates and collaborates effectively with patients, relatives and the health care team
 Promotes respect for patient privacy, dignity and confidentiality
 Avoids extensive invasive procedures or monitoring which can not be adequately interpreted at the bedside
 Minimises patient discomfort in relation to monitoring devices
 Responds rapidly to acute changes in monitored variables
 Ensures safe and appropriate use of equipment
 Supports other staff in the correct use of devices
 Considers patient comfort during procedures / investigations
 Avoids unnecessary tests
 Demonstrates compassionate care of patients and relatives
 Desire to minimise patient distress
 Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

DOMAIN 3: DISEASE MANAGEMENT

KNOWLEDGE

Pathophysiology, diagnosis and management of commonly encountered acute and chronic medical conditions including:

RESPIRATORY DISORDERS: the unprotected airway; pneumonia, lung or lobar collapse, asthma, chronic obstructive airways disease, pulmonary oedema, acute lung injury (ALI) and acute respiratory distress syndrome (ARDS) and their causative factors; pulmonary haemorrhage, pulmonary embolus, pleural effusion, pneumothorax (simple and tension); upper and lower airway obstruction including epiglottitis, respiratory muscle disorders; pulmonary fibrosis; pulmonary thrombo-embolic disease

CARDIOVASCULAR DISORDERS: shock states (anaphylactic, cardiogenic, hypovolaemic, septic); crescendo / unstable / chronic angina; acute myocardial infarction; left ventricular failure; chronic heart failure; cardiomyopathies; valvular heart disease and prosthetic valves; vaso-occlusive diseases; pulmonary hypertension; right ventricular failure; cor pulmonale; malignant hypertension; cardiac tamponade; common arrhythmias and conduction disturbances, pacing box failure; peripheral vascular disease

NEUROLOGICAL DISORDERS: acute confusional states and coma; post-anoxic brain damage; intracranial haemorrhage and infarction; sub-arachnoid haemorrhage; cerebro-vascular accidents (CVA / stroke); convulsions and status epilepticus; meningitis and encephalitis; medical causes of raised intracranial pressure; acute neuromuscular diseases causing respiratory difficulty (e.g. Guillain-Barre, myasthenia gravis, malignant hyperpyrexia); critical illness polyneuropathy, motor neuropathy and myopathy; cerebro-vascular accidents (CVA / stroke); dementia

RENAL AND GENITO-URINARY DISORDERS: urological sepsis; acute renal failure; chronic renal failure; renal manifestations of systemic disease including vasculitides; nephrotoxic drugs and monitoring; rhabdomyolysis

GASTROINTESTINAL DISORDERS: peptic/stress ulceration; upper GI haemorrhage; diarrhoea and vomiting; pancreatitis; cholecystitis; jaundice; acute and chronic liver failure; fulminant hepatic failure; paracetamol (acetaminophen)-induced liver injury; cirrhosis; inflammatory bowel diseases; peritonitis; ascites; mesenteric infarction; perforated viscus; bowel obstruction & pseudo-obstruction; abdominal trauma; intra-abdominal hypertension & compartment syndrome; short-bowel syndrome; rupture of liver or spleen.

HAEMATOLOGICAL AND ONCOLOGICAL DISORDERS: disseminated intravascular coagulation (DIC) and other coagulation disorders, hemolytic syndromes, acute and chronic anaemia, immune disorders; lymphoproliferative disorders. High risk groups: the immunosuppressed or immunoincompetent patient, chemotherapy, agranulocytosis and bone marrow transplant patients. Massive blood transfusion. Malignancy including complications of chemotherapy and radiotherapy

INFECTIONS: pyrexia and hypothermia; organ-specific signs of infection including haematogenous (venous catheter-related, endocarditis, meningococcal disease), urological, pulmonary, abdominal (peritonitis, diarrhoea), skeletal (septic arthritis) soft tissue and neurological. Pyometra. Septic abortion. Organisms causing specific infections: Gram positive and Gram negative bacteria, fungi, protozoa, viruses; nosocomial infections

METABOLIC DISORDERS: electrolyte disorders; acid-base disorders; fluid-balance disorders; thermoregulation and associated disorders

ENDOCRINE DISORDERS: critical illness-induced hyperglycaemia; diabetes mellitus; over- and under-activity of thyroid; adrenal and pituitary disorders; sepsis-induced relative adrenal insufficiency; endocrine emergencies

Treatment algorithms for common medical emergencies

Diagnosis and management of other acute medical conditions until appropriate specialist assistance is available

Definitive / long term management of commonly encountered acute medical conditions

Investigation of impaired organ function

Range of therapeutic interventions available to support organ function and treat the underlying causes

Multi-system effects of acute medical conditions and implications for clinical management

Indications and contraindications for treatment; circumstances when treatment is unnecessary or futile

Therapies available for the treatment of commonly encountered medical conditions, their efficacy and potential side-effects

Complications of specific therapies, their incidence and management

Concept of risk : benefit ratio and cost effectiveness of therapies

Complications of the disease processes; effects of disease and its treatments on other organ

systems

Effects of concomitant treatment and/or co-morbid conditions on an individual patient's response to treatment

Impact of occupational and environmental exposures, socio-economic factors, and life style factors on critical illness

Principles of outcome prediction / prognostic indicators and treatment intensity scales; limitations of scoring systems in predicting individual patient outcome

Causes and consequences of decompensation in chronic organ failure; diagnosis and management of acute-on-chronic organ failure

Long term effects of acute medical conditions and late complications

Pathogenesis of multiple organ dysfunction (MODS) and the inflammatory response in relation to organ system dysfunction

Risk factors, recognition and assessment of single or multiple organ failure

Cardiopulmonary resuscitation

Techniques for effective fluid resuscitation

Use of fluids and vasoactive / inotropic / anti-arrhythmic drugs to support the circulation (see 4.4)

Use of mechanical assist devices to support the circulation (see 4.4)

Indications, complications, interactions, selection, monitoring, and efficacy of common antimicrobial drugs (antibacterial, antifungal, antiviral, antiprotozoal, antihelmintics)

Local patterns of bacterial resistance and antibiotic policy; difference between contamination, colonisation and infection

Safe use of therapies which modify the inflammatory response

Principles of management of closed head injury

Coup and contra-coup injuries

Methods of preventing the 'second insult' to the brain

Methods for assessing neurological function e.g. Glasgow Coma Scale

Principles of cerebral perfusion pressure, cerebral oxygenation and the methods by which they may be optimised

Factors and therapies which may influence intracranial and cerebral perfusion pressure

Application of techniques to treat or induce hypo/hyperthermia

Systems available for intracranial pressure monitoring - indications, principles, type and site of placement of the monitoring device, data collection and trouble-shooting

Cerebral spinal fluid (CSF) drainage for raised ICP

Indications, contraindications and complications of lumbar puncture (see 5.18)

Management of vasospasm

Principles of measurement of jugular venous saturation, cerebral Doppler velocities and cerebral blood flow.

Principles, indications and limitations of electroencephalogram (EEG) and evoked potentials

Indications for urgent imaging of the brain and neurosurgical consultation

Functions of the liver - biosynthetic, immunologic, and detoxification

Signs and symptoms of acute liver failure and assessment of severity

Causes and complications of acute and acute-on-chronic liver failure, their prevention and management

Supportive therapy for the failing liver including extracorporeal liver support and indications for emergency liver transplantation

Principles and techniques for insertion of gastro-oesophageal balloon tamponade tube (e.g. Sengstaken-Blakemore)

Etiology and management of raised intracranial pressure (ICP)

Hepatotoxic drugs and adjustment of drug doses in hepatic impairment / failure

Indications for transcutaneous & transjugular liver biopsies and transjugular intrahepatic portosystemic shunt (TIPSS)

Principles of blood glucose control: indications, methods, monitoring of safety & efficacy

Causes and complications of renal failure - methods to prevent or treat these

Signs, symptoms and causes of renal failure (acute / chronic / acute on chronic) and indications for intervention

Distinguishing features of acute versus chronic renal failure and implications for management

Investigation of impaired renal function

Indications, complications and selection of renal replacement therapies (continuous and intermittent)

Nephrotoxic drugs and adjustment of drug doses in renal impairment/failure

Urinary catheterisation techniques: transurethral and suprapubic

Factors and therapies which may influence intra-abdominal pressure; etiology and management of raised intra-abdominal pressure

Principles of nutritional assessment and support (see 4.9)

Signs and symptoms of acute airway insufficiency and acute respiratory failure, and indications for intervention

Causes of respiratory failure, their prevention and management

Indications for and methods of invasive and non-invasive mechanical ventilation Modes of mechanical ventilation - indications, contraindications & expected results of each mode (CMV, IRV, PRVC, HFOV, SIMV, PS, CPAP, BiPAP, NIV) Initial set-up and modification of ventilator settings according to the condition or response of the patient
 Lung protective ventilation for acute lung injury (ALI)
 Pharmacological and non-pharmacological adjunct therapies for ALI
 Detection and management of haemo/pneumothorax (simple and tension)
 Principles of weaning from mechanical ventilation and factors which may inhibit weaning
 Potential adverse effects and complications of respiratory support and methods to minimise these
 Indications for and basic interpretation of chest radiographs: range of normal features on a chest x-ray; collapse, consolidation, infiltrates (including ALI/ARDS), pneumothorax, pleural effusion, pericardial effusion, position of cannulae, tubes or foreign bodies, airway compression, cardiac silhouette, mediastinal masses
 Ventilator associated pneumonia: definition, pathogenesis and prevention
 Principles of extra-corporeal membrane oxygenation (ECMO)
 Pathogenesis, definitions and diagnostic criteria of sepsis, severe sepsis, septic shock and systemic inflammatory response syndrome (SIRS)
 Occult indicators of sepsis
 Causes, recognition and management of sepsis-induced organ dysfunction; multi-system effects of sepsis and their impact on clinical management
 Prognostic implications of multiple systems dysfunction or failure
 Evidence based guidelines: sepsis care bundles - rationale and indications; principles of early goal-directed therapy
 Signs and symptoms of acute intoxication associated with common intoxicants
 Multi-system effects of acute intoxication and implications for clinical management
 General supportive therapy and specific antidotes pertinent to individual intoxicants
 Specific management of poisoning with aspirin, paracetamol/acetaminophen, paraquat, carbon monoxide, alcohol, ecstasy, tricyclic and quadricyclic antidepressants
 Strategies to reduce absorption and enhance elimination (haemodialysis, haemoperfusion, gastric lavage and charcoal therapy)
 Pharmacology of common intoxicants
 Indications for and basic interpretation of drug levels in blood or plasma
 Indications and complications of hyperbaric oxygenation
 Services available to patients and families to provide emotional or psychiatric support
 Physiological changes associated with a normal pregnancy and delivery
 Pathophysiology, identification and management of peripartum complications: pre-eclampsia and eclampsia; HELLP syndrome; amniotic fluid embolism; ante-partum and post-partum haemorrhage; ectopic pregnancy; septic abortion
 Risks and avoidance of pulmonary aspiration in pregnant patients
 Methods of avoiding aorto-caval compression
 Cardiopulmonary resuscitation of the pregnant patient
 Identification of unexpected concurrent pregnancy in a critically ill woman
 Awareness of the psychological impact of separation on the family

SKILLS & BEHAVIOURS

Recognise and diagnose commonly encountered acute medical conditions (according to national case mix)
 Acquire, interpret, synthesise, record, and communicate (written and verbal) clinical information
 Develop a working, and limited differential diagnosis based on presenting clinical features
 Recognise impending organ system dysfunction
 Order and prioritise appropriate investigations
 Establish a management plan based on clinical and laboratory information
 Critically appraise the evidence for and against specific therapeutic interventions or treatments
 Prioritise therapy according to the patient's needs
 Consider potential interactions when prescribing drugs & therapies
 Identify and manage chronic co-morbid disease
 Identify and evaluate requirements for continuation of chronic treatments during and after the acute illness
 Take chronic health factors into account when determining suitability for intensive care
 Evaluate the impact of chronic disease and prior health on outcomes
 Define targets of therapy and review efficacy at regular intervals
 Consider modifying diagnosis and/or therapy if goals are not achieved
 Optimise myocardial function
 Use fluids and vasoactive / inotropic drugs to support the circulation (see 4.4)

- Identify and avoid factors contributing to impaired renal function
- Identify patients at risk of developing renal failure
- Initiate, manage and wean patients from renal replacement therapy (see 4.7)
- Perform aseptic urinary catheterisation: male and female (see 5.24)
- Identify patients at risk of acute liver failure
- Interpret laboratory tests of liver function
- Prevent, identify and manage hyper / hypoglycaemia
- Identify and manage coagulopathies
- Examine and plan care for the confused patient
- Assess and document Glasgow Coma Scale (GCS)
- Recognise changes in intracranial and cerebral perfusion pressure which are life threatening
- Take prompt action to reduce acutely elevated intracranial pressure
- Undertake or assist in the insertion and maintenance of an intracranial pressure monitor
- Obtain and interpret data from intracranial pressure monitoring
- Manage cardiorespiratory physiology to minimise rises in intracranial pressure
- Prevent, identify and treat hyponatraemia
- Implement emergency airway management, oxygen therapy and ventilation as indicated
- Demonstrate emergency relief of tension pneumothorax
- Perform thoracocentesis and manage intercostal drains (see 5.8)
- Select the appropriate type and mode of ventilation for an individual patient
- Plan, implement, review and adapt lung protective approach during mechanical ventilation
- Plan, perform and review lung recruitment manoeuvres
- Assess, predict and manage circulatory shock
- Measure and interpret haemodynamic variables (including derived variables)
- Resuscitate a patient with septic shock using appropriate monitoring, fluid therapy and vasoactive agents
- Manage antimicrobial drug therapy (see 4.2)
- Obtain and interpret results of microbiological tests (see 2.5)
- Perform a lumbar puncture under supervision (see 5.18)
- Perform abdominal paracentesis (see 5.21)
- Liaise with obstetric and midwifery services
- Manage pregnancy induced hypertension
- Determine when the patient's needs exceed local resources or specialist expertise (requirement for transfer)
- Lead, delegate and supervise others appropriately according to experience and role
- Recognise and manage emergencies; seek assistance appropriately

ATTITUDES

- Demonstrates compassionate care of patients and relatives
- Appreciates the importance of timely institution of organ-system support
- Appreciates the differences between organ system support and specific treatment
- Enquiring mind, undertakes critical analysis of published literature
- Adopts a problem solving approach
- Desire to minimise patient distress
- Consults, communicates and collaborates effectively with patients, relatives and the health care team
- Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

DOMAIN 4: THERAPEUTIC INTERVENTIONS / ORGAN SYSTEM SUPPORT IN SINGLE OR MULTIPLE ORGAN FAILURE

KNOWLEDGE

Mode of action of drugs (see basic sciences)

Pharmacokinetics & pharmacodynamics (see basic sciences)

SYSTEMIC PHARMACOLOGY:

Indications, contraindications, effects and interactions of commonly used drugs including:

- hypnotics, sedatives and intravenous anaesthetic agents
- simple & opioid analgesics; opioid antagonists
- non-steroidal anti-inflammatory agents
- neuromuscular blocking agents (depolarising & non-depolarising) & anti-cholinesterases
- drugs acting on the autonomic nervous system (inotropes, vasodilators, vasoconstrictors, antiarrhythmics)
- respiratory stimulants and bronchodilators
- anti-hypertensives
- anti-convulsants
- anti-diabetic agents
- diuretics
- antibiotics (antibacterial, antifungal, antiviral, antiprotozoal, antihelmintics)
- corticosteroids and hormone preparations
- drugs influencing gastric secretion & motility; antiemetic agents
- local anaesthetic agents
- immunosuppressants
- antihistamines
- antidepressants
- anticoagulants
- plasma volume expanders

Adverse effects and interactions of drugs and their management

Recognition and management of serious adverse reactions and anaphylaxis

Local policies and procedures governing the prescription of drugs and therapies

Indications for and basic interpretation of drug levels in blood or plasma

Impact of drug therapy on organ-system function

Effects of concomitant treatment and/or co-morbid conditions on an individual patient's response to treatment

Prophylactic therapies and indications for their use

Concept of risk : benefit ratio and cost effectiveness of therapies

Complications of specific therapies, their incidence and management

Circumstances when treatment is unnecessary

Principles of prevention of multiple organ failure

Epidemiology and prevention of infection in the ICU

Types of organisms - emergence of resistant strains, mode of transfer, opportunistic and nosocomial infections; difference between contamination, colonisation & infection

Risk factors for nosocomial infection and infection control measures to limit its occurrence

Local patterns of bacterial resistance and antibiotic policy

Indications, complications, interactions, selection, monitoring, and efficacy of common antimicrobial drugs (antibacterial, antifungal, antiviral, antiprotozoal, antihelmintics)

Requirements for microbiological surveillance and clinical sampling

Safe use of therapies which modify the inflammatory response

Interpret data from an arterial blood gas sample

Effect of critical illness upon homeostatic mechanisms and causes of homeostatic disturbances

Physiology of fluid, electrolyte, acid-base and glucose control

Methods to assess and monitor intravascular volume and state of hydration using clinical signs and modern technology

Pathophysiological consequences, signs and symptoms of disordered fluid, electrolyte, acid-base and glucose balance

Treatment strategies for abnormalities of fluid, electrolyte, acid-base and glucose balance

Fluid therapies: components, physical properties, distribution and clearance of commonly used fluids; indications, contraindications and complications of their administration

Indications for and interpretation of fluid balance charts

Theoretical advantages and disadvantages of crystalloid and colloid solutions

Indications for and basic interpretation of haematological tests (including coagulation and sickle tests)

Indications for and basic interpretation of blood grouping and x-matching

The pathogenesis and management of anaemia, thrombocytopenia, neutropenia and pancytopenia
 Indications for, contraindication, risks and alternatives to blood transfusion
 Local protocols which govern the ordering, storage & verification procedures, monitoring during administration of blood products and reporting of adverse incidents
 Principles of blood and blood component therapy; principles of massive transfusion
 Infections from contaminated blood / body fluids; strategy if contaminated (e.g. needle stick injury)
 Coagulation and fibrinolytic pathways, and their associated disorders; clinical and laboratory evaluation of haemostasis
 Principles of plasma exchange
 Pathophysiology, detection and management of shock states according to aetiology and in response to physiological data
 Principles of haemodynamic monitoring - invasive & non invasive methods, indications & limitations, physiological parameters and waveform interpretation
 Invasive & non-invasive systems available for measuring cardiac output and derived haemodynamic variables, the principles involved and the type and site of placement of the monitoring device
 Indications, limitations and complications of techniques of measurement of cardiac output (e.g. pulmonary artery catheters, oesophageal Doppler, PiCCO, LiDCO) and action to prevent them
 Integration of data from clinical examination and haemodynamic monitoring to characterise haemodynamic derangements
 Receptor-specific effects of inotropic and vasopressor agents; effects of critical illness and concomitant therapies on receptor function (e.g. down-regulation)
 Indications and contraindications, limitations and complications of inotropic / vasoactive drug therapy
 Interactions between inotropic agents and concomitant therapies and/or co-morbid diseases (e.g. ischaemic heart disease)
 Pathophysiology and treatment of cardiac failure
 Principles of right and left ventricular assist devices
 Principles and techniques of cardiac pacing
 Indications, contraindications, complications and basic principles of intra-aortic counter pulsation balloon pump
 Risk of bleeding: indications, contraindications, monitoring and complications of therapeutic anticoagulants, thrombolytic and anti-thrombolytic agents
 Causes of respiratory failure, their prevention and management
 Principles of oxygen therapy and use of oxygen administration devices (see 5.1)
 Signs and symptoms of acute airway insufficiency and acute respiratory failure, and indications for intervention
 Distinguishing features of acute versus chronic respiratory failure and implications for management
 Principles of emergency airway management (see 5.3)
 Indications for and methods of invasive and non-invasive mechanical ventilation
 Principles of continuous positive airways pressure (CPAP) and positive end-expiratory pressure (PEEP) and CPAP & PEEP delivery systems
 Modes of mechanical ventilation - indications, contraindications & expected results of each mode (CMV, IRV, PRVC, HFOV, SIMV, PS, CPAP, BiPAP, NIV)
 Operation of at least one positive pressure ventilator, one non-invasive ventilator, and a constant positive airway pressure (CPAP) device
 A systematic approach to checking ventilator, breathing circuit and monitoring devices
 Initial set-up and modification of ventilator settings according to the condition or response of the patient
 Principles of monitoring ventilation - significance of respiratory rate, tidal volume, minute volume, mean, peak, end expiratory and plateau pressure, intrinsic and extrinsic PEEP, inspired oxygen concentration, arterial blood gas and acid base status; relationship between mode of ventilation and choice of parameters monitored; airflow and airway pressure waveforms
 Measures of adequacy of tissue oxygenation
 Measurement and interpretation of pulmonary mechanics during mechanical ventilation
 Potential adverse effects and complications of respiratory support and methods to minimise these
 Ventilator associated pneumonia: definition, pathogenesis and prevention
 Safe prescribing of oxygen; manifestations of pulmonary oxygen toxicity
 Causes of lung injury in ventilated patients; effects and clinical manifestations of pulmonary barotrauma
 Effect of ventilation upon cardiovascular and oxygen delivery parameters, other organ function and how these effects can be monitored (heart-lung interactions)
 Principles of physiotherapy in the ICU
 Principles of weaning from mechanical ventilation and factors which may inhibit weaning
 Indications and contraindications to tracheostomy (percutaneous and surgical) and minitracheostomy

Management of and complications associated with tracheostomy tubes Principles of extra-corporeal membrane oxygenation (ECMO)

Signs, symptoms and causes of renal failure (acute / chronic / acute on chronic) and indications for intervention

Investigation of impaired renal function

Distinguishing features of acute versus chronic renal failure and implications for management

Indications, complications and selection of renal replacement therapies (continuous and intermittent)

Placement & management of invasive devices necessary for renal replacement therapy (e.g. temporary haemodialysis catheter)

Principles of haemofiltration, haemodialysis, peritoneal dialysis, haemoperfusion and plasmapheresis

Function and operation of continuous haemodiafiltration devices (key components & troubleshooting)

Effect of renal failure and its treatment on other organ systems

Nephrotoxic drugs and adjustment of drug doses in renal impairment/failure

Patterns of nutritional impairment; consequences of starvation and malnutrition

Methods to assess nutritional status and basal energy expenditure

Fluid & caloric requirements in the critically ill patient including electrolytes, vitamins, trace elements and principles of immunonutrition

Indications, limitations, methods, and complications of enteral and parenteral nutritional techniques

Nutritional formulations: indications, complications and their management

Principles of nasogastric cannulation in the intubated and non-intubated patient

Alternative routes for enteral feeding: indications, contraindications and complications of post-pyloric and percutaneous feeding tube placement

Prevention of stress ulceration

Gut motility: effects of drugs, therapy and disease

Causes of regurgitation and vomiting; prevention and management of pulmonary aspiration

Prevention and management of constipation and diarrhoea

Techniques for preventing gastrointestinal microbial translocation

Principles of blood glucose control: indications, methods, monitoring of safety & efficacy

SKILLS & BEHAVIOURS

Prioritise therapy according to the patient's needs

Establish a management plan based on clinical and laboratory information

Consider potential interactions when prescribing drugs & therapies

Consider risk-benefit and cost-benefit of alternative drugs & therapies

Obtain informed consent/assent from the patient where appropriate

Critically appraise the evidence for and against specific therapeutic interventions or treatments

Set realistic goals for therapy (independently or in collaboration with other teams)

Define targets of therapy and review efficacy at regular intervals

Consider modifying diagnosis and/or therapy if goals are not achieved

Recognise when treatment is unnecessary or futile

Administer intravenous drugs (prepare, select route and mode of administration and document)

Use infusion pumps to administer drugs and fluids

Prescribe appropriate antimicrobial therapy based on history, examination and preliminary investigations

Collaborate with microbiologists / infectious diseases clinicians to link clinical, laboratory and local (hospital / regional / national) microbiological data

Choose appropriate fluid, volume, rate and method of administration

Administer and monitor response to repeated fluid challenges

Consider and exclude unknown pathology if goals of fluid therapy are not achieved (e.g. continued bleeding)

Select an appropriate inotrope / vasopressor - dose, physiological endpoint, rate and route of administration

Order, check, verify and administer blood products according to local protocols

Identify and correct haemostatic and coagulation disorders

Resuscitate a patient with septic shock using appropriate monitoring, fluid therapy and vasoactive agents

Measure and interpret haemodynamic variables (including derived variables)

Identify and treat underlying causes for a metabolic acidosis

Select the appropriate type and mode of ventilation for an individual patient

Identify and correct ventilator misassembly and disconnections

Stabilise a patient on a constant positive airway pressure (CPAP) device

- Stabilise a patient on a non-invasive ventilator (NIV)
- Stabilise a patient on a positive pressure ventilator
- Confirm adequate oxygenation and control of PaCO₂ and pH
- Set and interpret data from ventilator alarms
- Construct, monitor and review a weaning plan
- Identify and avoid factors contributing to impaired renal function
- Supervise the provision of continuous renal replacement therapy
- Set appropriate exchange and fluid balances for renal replacement therapies
- Modify fluid and electrolyte therapy according to clinical features and fluid balance charts
- Prescribe and manage anticoagulation therapy
- Correct electrolyte disorders (e.g. hyperkalaemia, hyponatraemia)
- Prevent hypokalaemia
- Institute and manage a regimen to control blood glucose within safe limits
- Prescribe an appropriate standard enteral feeding regimen
- Identify surgical and other contraindications to enteral feeding
- Prescribe and supervise safe administration of a standard / customized parenteral (TPN) preparation
- Collaborate with nursing staff / clinical dietician in monitoring safe delivery of enteral and parenteral nutrition
- Liaise with clinical dieticians / medical team to plan feeding regimens after discharge from the ICU
- Recognise and manage emergencies; seek assistance appropriately

ATTITUDES

- Appreciates the importance of timely institution of organ-system support
- Appreciates the differences between organ system support and specific treatment
- Recognises the need for supportive care for all organ systems whether failing / injured or not
- Responds rapidly to acute changes in monitored variables
- Consults, communicates and collaborates effectively with patients, relatives and the health care team
- Demonstrates compassionate care of patients and relatives
- Desire to minimise patient distress
- Respects the ideas and beliefs of the patient and their family and their impact on decision making (does not impose own views)
- Respects the expressed wishes of competent patients
- Lead, delegate and supervise others appropriately according to experience and role
- Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

DOMAIN 5: PRACTICAL PROCEDURES

KNOWLEDGE

GENERIC

Patient selection - indications, contraindications and potential complications of the procedure / intervention
Universal precautions and preventative infection control techniques (hand washing, gloves, protective clothing, sharps disposal etc.)
Principles of aseptic technique and aseptic handling of invasive medical devices
Methods and routes of insertion - associated indications and complications
Appropriate use of drugs to facilitate the procedure
Detection of potential physiological alterations during the procedure
Indications for specific monitoring to ensure patient safety during an intervention / procedure
Complications of the technique, how to prevent/recognise them and initiate appropriate treatment
Methods of sterilisation and cleaning or disposal of equipment
Management and use of the device once in situ necessary to minimise the risks of complications
Indications and technique for removal

RESPIRATORY SYSTEM

Anatomy and bronchoscopic appearance of the upper and lower airways
Signs, symptoms and causes of acute airway insufficiency and indications for intervention
Methods of maintaining a clear airway
Indications, selection and insertion of oral (guedel) airways, nasopharyngeal airways and laryngeal mask airways (LMA)
Tracheal intubation: selection of tube type, diameter & length; indications and techniques; methods to confirm correct placement of a tracheal tube
Appropriate use of drugs to facilitate airway control
Monitoring during sedation/induction of anaesthesia for endotracheal intubation
Airway management in special circumstances, (head injury, full stomach, upper airway obstruction, shock, cervical spine injury)
Causes of regurgitation and vomiting; prevention and management of pulmonary aspiration
Cricoid pressure: indications and safe provision
Management of difficult intubation and failed intubation (local algorithm or protocol)
Indications for and principles of fiberoptic intubation; use of fiberoptic intubation with airway adjuncts
Indications and methods of securing an emergency surgical airway
Anatomical landmarks for cricothyroidotomy/tracheostomy/mini-tracheotomy
Indications and techniques for needle and surgical cricothyroidotomy
Indications and contraindications to tracheostomy (percutaneous and surgical) and mini-tracheostomy
Techniques for percutaneous and surgical tracheotomy
Manage anaesthesia and control the airway during initial tracheostomy tube insertion in the intensive care unit (ICU)
Management of and complications associated with tracheostomy tubes
Principles of endotracheal suctioning
Consequences of the procedure during ventilation
Indications, contraindications and complications of oxygen therapy
Environmental hazards associated with storage and use of oxygen; strategies to promote safety
Use of pipeline gas and suction systems
Storage and use of oxygen, nitric oxide (NO), compressed air and helium, including use of gas cylinders
Principles of pressure regulators, flow meters, vaporizers and breathing systems
Indications for and operation of fixed and variable performance oxygen therapy equipment, humidification and nebulising devices
Respiratory physiology: gaseous exchange; pulmonary ventilation: volumes, flows, dead space; mechanics of ventilation: ventilation/perfusion abnormalities; control of breathing, acute and chronic ventilatory failure, effect of oxygen therapy
Indications for different modes of ventilation and operation of at least one positive pressure ventilator, one non-invasive ventilator, and a constant positive airway pressure (CPAP) device
Indications and complications of hyperbaric oxygenation
Methods of bronchoscopy via an endotracheal tube
Methods of bronchoscopic broncho-alveolar lavage (BAL) in an intubated patient
Safety and maintenance of flexible fiberoptic endoscopes

Detection and management of haemo/pneumothorax (simple and tension)
Anatomical landmarks for intrapleural drains
Insertion and management of chest drains and air exclusion devices
Patient groups at risk who may require chest drain placement under ultrasound or CT guidance

CARDIOVASCULAR SYSTEM

Surface anatomy: structures in the antecubital fossa; large veins and anterior triangle of the neck; large veins of the leg and femoral triangle; arteries of the arms and legs
Methods for securing vascular access rapidly
Principles, routes and techniques of peripheral and central venous cannulation
Principles and techniques for surgical isolation of a vein or artery
Methods for insertion of a tunnelled central venous catheter (e.g. for parenteral nutrition)
Indications, contraindications, and complications of peripheral intravenous infusion / injection and central venous infusion / injection
Principles of arterial catheterisation
Allens test - application & limitations
Recognition and management of inadvertent intra-arterial injection of harmful substances
Principles of haemodynamic monitoring - invasive & non invasive methods, indications & limitations, physiological parameters and waveform interpretation
Zero and calibration techniques for invasive pressure monitoring
Invasive & non-invasive systems available for measuring cardiac output and derived haemodynamic variables, the principles involved and the type and site of placement of the monitoring device
Interpretation of, relationships between, sources of error and limitations of measured and derived cardiovascular variables including pressure, flow, volume and gas transport
Indications, limitations and complications of techniques of measurement of cardiac output (e.g. pulmonary artery catheters, oesophageal Doppler, PiCCO, LiDCO) and action to prevent them
Principles of ECG monitoring (heart rate, rhythm, conduction, ST segment change & QT interval) - indications, limitations and techniques. Advantages and disadvantages of different lead configurations
Basic and complex cardiac arrhythmias - recognition and management (pharmacological and electrical)
Principles and techniques of cardiac pacing
Treatment (algorithm) of patients in ventricular fibrillation (VF) and pulseless ventricular tachycardia (VT)
Defibrillation: principles of monophasic & biphasic defibrillators; mechanism, indications, complications, modes and methods (manual and automated external defibrillators (AED))
Electrical safety: conditions which predispose to the occurrence of macro-shock / micro-shock; physical dangers of electrical currents; relevant standards regarding safe use of electricity in patient care; basic methods to reduce electrical hazards.
Basic principles of ultrasound and the Doppler effect
Principles and basic interpretation of echocardiography (see 2.3)
Detection and acute management of cardiac tamponade
Anatomical landmarks and technique for percutaneous pericardial aspiration

CENTRAL NERVOUS SYSTEM

Physiological effects of pain and anxiety
Recognition and methods of assessment of pain
Pharmacokinetics, pharmacodynamics, indications and complications of opiates and local anaesthetic agents
Indications, contraindications, methods and complications of epidural catheterisation
Indications, contraindications and complications of epidural infusion / injection; principles of safe epidural drug administration
Contraindications, methods and complications of epidural catheter removal
Indications for lumbar puncture and CSF sampling; laboratory analysis of CSF samples

GASTROINTESTINAL SYSTEM

Principles of nasogastric cannulation in the intubated and non-intubated patient
Principles and techniques for insertion of gastro-oesophageal balloon tamponade tube (e.g. Sengstaken-Blakemore)
Anatomy of the abdominal wall; landmarks for abdominal paracentesis and abdominal drainage catheters
Principles of peritoneal lavage
Indications, contraindications, complications and technique of abdominal paracentesis
Alternative routes for enteral feeding: indications, contraindications and complications of post-pyloric and percutaneous feeding tube placement

GENITOURINARY SYSTEM

Anatomy of the genitourinary system and anatomical landmarks for suprapubic catheterisation
Urinary catheterisation techniques: transurethral and suprapubic
Urinary catheterisation in pelvic trauma: indications, contraindications and techniques

SKILLS & BEHAVIOURS**GENERIC**

Prioritise tasks and procedures
Select appropriate equipment or device & use resources efficiently
Prepare equipment, patient and staff prior to undertaking the procedure
Obtain informed consent/assent from the patient where appropriate
Use drugs as indicated to facilitate the procedure
Choose an appropriate route / method of insertion and position the patient accordingly
Identify relevant anatomical landmarks
Use protective clothing (gloves / mask / gown / drapes) as indicated
Perform the procedure in a manner which minimises the risks of complications
Undertake appropriate investigation to confirm correct placement of device or exclude complications
Sterilise, clean or dispose of equipment appropriately
Recognise and manage emergencies; seek assistance appropriately

RESPIRATORY SYSTEM

Accurately assess the airway for potential difficulties with airway management
Choose a safe environment to undertake airway management (or optimise environment as circumstances allow)
Optimise the patient's position for airway management
Maintain a clear airway using oral / nasal airways
Support ventilation using bag and mask
Insert and check correct placement of laryngeal mask airway
Select appropriate tracheal tube type, size and length
Perform intubation and verify correct placement of tube
Manage and minimise cardiovascular and respiratory changes during and after intubation
Apply an end-tidal CO₂ detector post-intubation and interpret a capnograph trace
Demonstrate rapid sequence induction of anaesthesia / cricoid pressure
Change an orotracheal tube
Perform extubation
Prepare equipment for difficult or failed intubation
Demonstrate failed intubation drill (according to local algorithm or protocol)
Demonstrate minitracheotomy or needle cricothyroidotomy
Change a tracheostomy tube electively
Identify patients requiring tracheostomy; discuss indications and contraindications for percutaneous tracheostomy
Perform endotracheal suction (via oral / nasal / tracheostomy tube)
Check pipelines; check and change portable cylinders
Undertake bronchoscopy to assess tube position
Undertake bronchoscopy to perform bronchoalveolar lavage
Demonstrate aseptic insertion of an intrapleural chest drain and connection to a one-way seal device
Demonstrate emergency relief of tension pneumothorax

CARDIOVASCULAR SYSTEM

Insert peripheral cannulae via different routes
Establish peripheral venous access appropriate for resuscitation in major haemorrhage
Chest x-ray interpretation (see 2.7)
Insert central venous catheters by different routes
Describe a method for tunnelled intravenous catheterisation
Minimise blood loss related to clinical investigations and procedures
Insert arterial catheters by different routes
Distinguish between arterial and venous blood samples
Prepare equipment for intravascular pressure monitoring
Measure and interpret haemodynamic variables (including derived variables)
Obtain and interpret data from central venous catheters
Obtain and interpret data from a pulmonary artery catheter, oesophageal Doppler or alternative cardiac output measurement technique
Obtain and interpret data from ECG (3- and 12-lead)

Insert a temporary pacing wire
Demonstrate emergency percutaneous pericardial aspiration
Establish & review pacing box settings
Use manual external defibrillators
Use automated external defibrillators (AED)

CENTRAL NERVOUS SYSTEM

Select an appropriate epidural infusion regimen and titrate safely
Select & determine adequacy and route of administration of analgesia
Manage an established epidural infusion
Administer bolus analgesia via an epidural catheter
Minimise complications associated with opioid and non-opioid analgesics

GASTROINTESTINAL SYSTEM

Insert a nasogastric tube in an intubated and non-intubated patient
Insert an abdominal drain

GENITOURINARY SYSTEM

Perform aseptic urinary catheterisation: male and female

ATTITUDES

Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)
Considers patient comfort during procedures / investigations
Desire to minimise patient distress
Accepts personal responsibility for the prevention of cross infection and self infection
Lead, delegate and supervise others appropriately according to experience and role
Supports other staff in the correct use of devices
Promotes respect for patient privacy, dignity and confidentiality

DOMAIN 6: PERIOPERATIVE CARE

KNOWLEDGE

Factors determining perioperative risk
Methods of optimising high risk surgical patients
Importance of preoperative health status on postoperative outcomes
Indications for, and interpretation of pre-operative investigations
Dangers of emergency anaesthesia & surgery
Effect of gastric contents and dehydration on perioperative risk
Anaesthetic risk factors complicating recovery: suxamethonium apnoea, anaphylaxis, malignant hyperpyrexia, difficult airway
Criteria for admission to, and discharge from ICU - factors influencing intensity and site of care (ward, high dependency unit (HDU), intensive care unit (ICU))
Perioperative implications of current drug therapy
Consent and assent in the competent and non-competent patient
Implications for postoperative care of common acute and chronic medical conditions (see 3.1 & 3.2)
Implications of type of anaesthesia (general/regional/local) for perioperative care
Implications of type / site of surgery for postoperative management and potential complications within the first 24 hours of surgery
Assessment and management of commonly encountered perioperative conditions & complications including:
RESPIRATORY: Interpretation of symptoms and signs of respiratory insufficiency in the surgical patient; the unprotected airway; upper and lower airway obstruction including laryngeal trauma & oedema; pneumonia, collapse or consolidation, pulmonary infiltrates including acute lung injury (ALI) and the acute respiratory distress syndrome (ARDS) and their causative factors; pulmonary oedema; pleural effusion, haemo/pneumothorax (simple and tension); use of chest drains; factors affecting patients following thoracotomy, lung resection, oesophagectomy, cardiac surgery and thymectomy.
CARDIOVASCULAR: Interpretation of symptoms and signs of cardiovascular insufficiency in the surgical patient; recognition of bleeding; management of hypo/hypertension; operative risk factors in patients with ischaemic heart disease; pulmonary embolus; cardiac tamponade; surgery for acquired and congenital cardiac disease; management of patients following cardiac surgery (coronary grafting, valve replacement) and aortic surgery (arch, thoracic, abdominal); heart and heart-lung transplantation
RENAL: Causes of perioperative oliguria and anuria; prevention and management of acute renal failure; rhabdomyolysis; consequences of nephrectomy, ileal conduits; management post-renal transplantation
NEUROLOGICAL: causes of post-operative confusion, stroke (CVA), coma and raised intracranial pressure; determinants of cerebral perfusion and oxygenation; prevention of secondary brain injury; perioperative management of patients with neuropathies and myopathies; intracranial pressure monitoring; intracerebral haemorrhage; spinal cord injury & ischaemia; brachial plexus injury; complications of neuromuscular blockade
GASTROINTESTINAL: Interpretation of abdominal pain and distension; peptic ulceration and upper GI haemorrhage; diarrhoea, vomiting and ileus; peritonitis; intestinal ischaemia; perforation; abdominal hypertension; pancreatitis; jaundice; cholecystitis; management of the pre- and post-liver transplant patient; perioperative nutrition; post operative nausea & vomiting
HAEMATOLOGY AND ONCOLOGY: Care of the immunosuppressed or immunoincompetent patient; complications of chemotherapy; management of severe acute haemorrhage and blood transfusion; correction of coagulation disorders and haemoglobinopathies.
METABOLIC AND HORMONAL: Perioperative management of patients with diabetes; blood glucose control; hypo- and hyper adrenalism, surgery to thyroid, adrenal and pituitary glands; perioperative management of electrolyte disorders.
SEPSIS AND INFECTION: fever and hypothermia; postoperative hypoperfusion and impaired oxygen delivery; wound infection; opportunistic and nosocomial infection; perioperative infection risk and prophylactic antibiotics; necrotising fasciitis; peritonitis; intestinal ischaemia; antibiotic selection and prescribing
MUSCULO-SKELETAL: principles and management of external fixators and casts; perioperative positioning; pressure area care; compartment syndromes; paralysed patients; principles of salvage surgery
Recognition, assessment and management of acute pain
Indications and choice of agent for antibiotic prophylaxis
Indications for and methods of perioperative anti-thrombotic treatment
Surgical interventions in patients with cardiac disease, perioperative management of the

cardiovascular surgery patient and potential complications occurring within 24 hours of cardiac surgery
 Major neurosurgical procedures, peri-operative management of the patient undergoing major neurosurgery, and potential complications occurring within 24 hours of surgery
 Solid organ-specific transplantation (heart-lung, liver, renal): peri-operative considerations, pharmacological management, post operative care and potential complications
 Immunosuppression and rejection

SKILLS & BEHAVIOURS

Optimise high-risk surgical patients before surgery: consider site of care and management plan
 Communicate the risk of surgery to patients and family
 Consider the impact of long-term and chronic treatment on acute surgical care
 Accurately assess the airway for potential difficulties with airway management
 Ensure the necessary resources are available for safe post-operative care
 Identify pre-operative health status and intercurrent disease, medications, allergies and their interaction with the nature of anaesthetic and surgery
 Obtain relevant information from the patient, relatives and other secondary sources
 Interpret pre-operative investigations, intra-operative findings and events/complications, and respond to them appropriately
 Assess conscious level and conduct a careful systems review
 Select & determine adequacy and route of administration of analgesia
 Document, monitor and manage fluid balance, circulating volume, drains, systemic oxygen supply
 Establish a plan for postoperative management
 Recognise and manage perioperative emergencies and seek assistance appropriately
 Identify life-threatening cardiorespiratory complications; manage hypovolaemia and impaired oxygen delivery
 Manage post-operative hypo and hypertension
 Differentiate and manage tension pneumothorax, cardiac tamponade & pulmonary embolus
 Manage post-operative stridor
 Review and monitor perioperative immunosuppressive therapy
 Monitor and manipulate cerebral perfusion pressure (CPP)
 Describe the risk period for use of depolarizing neuromuscular blocking agents in patients undergoing repeated surgical procedures
 Lead, delegate and supervise others appropriately according to experience and role

ATTITUDES

Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)
 Consults, communicates and collaborates effectively with anaesthesiologist, surgeon, nursing staff, other professionals, patients and relatives where appropriate
 Desire to minimise patient distress
 Attention to and control of pain

DOMAIN 7: COMFORT & RECOVERY

KNOWLEDGE

Common symptomatology following critical illness
The role of patient's relatives and their contribution to care
Causes and methods of minimising distress in patients
Physiological effects of pain and anxiety
Stress responses
Recognition and methods of assessment of pain
Recognition and assessment of anxiety
Pharmacokinetics, pharmacodynamics, indications and complications of commonly used analgesic, hypnotic, and neuromuscular blocking drugs in patients with normal and abnormal organ system function
Principles of acute pain management
Patient-controlled analgesia
Indications, contra-indications, methods and complications of regional analgesia in critical illness
Methods of measuring depth of sedation; effects of over-sedation and strategies to avoid this
Environmental and drug-related psychopathology associated with critical illness (e.g. anxiety, sleep disorders, hallucinations, drug withdrawal)
Sensory deprivation / sensory overload
Sleep deprivation and its consequences
Consequences of immobilisation and mobilisation techniques (including disuse atrophy, foot-drop, ectopic calcification)
Causes, prevention and management of critical illness polyneuropathy, motor neuropathy, and myopathy
Fluid & caloric requirements in the critically ill patient including electrolytes, vitamins, trace elements and principles of immunonutrition
Methods to assess nutritional status and basal energy expenditure
Prevention & management of pressure sores
Relevance and methods to care for skin, mouth, eyes and bowels, and to maintain mobility and muscle strength in critically ill patients
Causes and management of acute confusional states
Methods of communicating with patients who are unable to speak
Principles of rehabilitation: physical and psychological
Supportive services integral to the long term rehabilitation of critically ill patients (physiotherapy, occupational therapy, orthotics, social services).
Resources available to patients and relatives for education and support (e.g. societies, local groups, publications, referral to allied health care professionals)
Criteria for admission to, and discharge from ICU - factors influencing intensity and site of care (ward, high dependency unit (HDU), intensive care unit (ICU))
Potential psychological impact of inter-hospital transfer and family dislocation
Common risk factors for post-ICU mortality or re-admission and their minimisation
Methods to minimise potential psychological trauma to the patient and their family of transfer from the ICU (especially with regard to long term ICU patients)
Post-traumatic stress disorders
Impact of staff-patient contact and environmental factors on patient stress
The implications for relatives of adopting a role as a carer at home
Methods for assessing or measuring quality of life
Impact of chronic illness post-ICU on socialisation and employment
Management of tracheostomy care and avoidance of complications outside the ICU
Long-term ventilation outside the ICU environment (e.g. home ventilation)
Persistent vegetative state

SKILLS & BEHAVIOURS

Identify complications associated with critical illness
Work with colleagues and relatives to minimise patient distress
Anticipate the development of pain and/or anxiety and adopt strategies for its prevention or minimisation
Interpret data from scoring or scaling systems to assess pain and sedation
Use analgesic, hypnotic and neuromuscular blocking drugs appropriately and safely
Select & determine adequacy and route of administration of analgesia
Minimise complications associated with opioid and non-opioid analgesics

- Obtain and interpret data from a nerve stimulator to monitor the degree of neuromuscular blockade
- Propose and implement a plan to provide adequate sleep and rest in ICU patients
- Communicate effectively with families who may be anxious, angry, confused, or litigious
- Participate in the education of patients/families
- Appropriate and timely referral to specialists / allied health professionals
- Identify discharge criteria for individual patients
- Ensure effective information exchange before patient discharge from ICU
- Take decisions to admit, discharge or transfer patients
- Liaise with medical and nursing staff in other departments to ensure optimal communication and continuing care after ICU discharge
- Change a tracheostomy tube electively
- Follow-up patients after discharge to the ward
- Participate in follow-up clinics / services where available
- Lead, delegate and supervise others appropriately according to experience and role

ATTITUDES

- Appreciates that physical and psychological consequences of critical illness can have a significant and long lasting effect for both patients and their relatives
- Desire to minimise patient distress
- Establishes trusting relationships with and demonstrates compassionate care of patients and their relatives
- Seeks to modify the stresses which the intensive care environment places upon patients, their relatives and members of staff
- Acknowledges the consequences of the language used to impart information
- Regards each patient as an individual
- Respects the religious beliefs of the patient and is willing to liaise with a religious representative if requested by patient or family
- Willingness to communicate with and support families / significant others
- Early planning for rehabilitation
- Recognises that intensive care is a continuum throughout the 'patient journey'
- Promotes appropriate and timely discharge from ICU
- Fosters effective communication and relationships with medical and nursing staff in other wards / departments
- Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

DOMAIN 8: END OF LIFE CARE

KNOWLEDGE

Basic ethical principles: autonomy, beneficence, non-maleficence, justice
Ethical and legal issues in decision-making for the incompetent patient
Difference between euthanasia and allowing death to occur: doctrine of double effect
With-holding and withdrawing treatment: omission and commission
The limitations of intensive care medicine - expectations of what can and cannot be achieved
Decision-making processes for withholding and withdrawing life sustaining therapies including documentation and iterative review
Principles of delivering bad news to patients and families
Local resources available to support dying patients and their families, and how to access them
Bereavement: anticipating and responding to grief
Cultural and religious practices of relevance when caring for dying patients and their families
Principles of pain and symptom management
Procedure for withdrawing treatment and support
Causes and prognosis of vegetative states
Causes of brain stem death
Applied anatomy and physiology of the brain and nervous system including cerebral blood supply, base of skull, autonomic nervous system and cranial nerves
Physiological changes associated with brain stem death
Preconditions and exclusions for the diagnosis of brain stem death
Clinical, imaging and electrophysiologic tests to diagnose brain death
Legal aspects of brain stem death diagnosis
Cultural and religious factors which may influence attitude to brain stem death and organ donation
Principles of management of the organ donor (according to national / local policy)
Common investigations and procedures undertaken in the ICU prior to organ harvesting
Role of national organ/tissue procurement authority and procedures for referral
Responsibilities and activities of transplant co-ordinators
Responsibilities in relation to legal authorities for certifying death (e.g. coroner, procurator fiscal or equivalent), and reasons for referral
The value of autopsy (post-mortem) examination.
Procedure for completion of death certification

SKILLS & BEHAVIOURS

Recognise when treatment is unnecessary or futile
Discuss end of life decisions with members of the health care team
Willing and able to communicate and discuss issues pertaining to end of life with patients and relatives
Differentiate competent from incompetent statements by patients
Discuss treatment options with a patient or relatives before ICU admission
Participate in timely discussion and regular review of 'do not resuscitate' orders and treatment limitation decisions
Participate in discussions with relatives about treatment limitation or withdrawal
Communicate effectively with relatives who may be anxious, angry, confused, or litigious
Lead a discussion about end of life goals, preferences and decisions with a patient and/or their relatives
Explain the concept of brain stem death and organ donation clearly
Obtain consent/assent for treatment, research, autopsy or organ donation
Withdraw life sustaining treatment or organ support
Relieve distress in the dying patient
Document pre-conditions and exclusions to brain stem death testing
Perform and document tests of brain stem function
Consult and confirm findings of brain stem function tests with colleagues as required by local / national policy or as indicated
Liaise with transplant co-ordinators (local organ donation authority) to plan management of the organ donor
Monitor vital physiological functions as indicated
Recognise and rapidly respond to adverse trends in monitored parameters
Aware of the emotional needs of self and others; seeks and offers support appropriately
Establishes trusting relationships with and demonstrates compassionate care of patients and

their relatives

Integrity, honesty & respect for the truth underpin relationships with patients, relatives and colleagues

Appreciates that the decision to withhold or withdraw treatment does not imply the termination of care

Consult and take into account the views of referring clinicians; promote their participation in decision making where appropriate

ATTITUDES

Values clear decision-making and communication

Acknowledges the consequences of the language used to impart information

Willingness to communicate with and support families / significant others

Respects the ideas and beliefs of the patient and their family and their impact on decision making (does not impose own views)

Respects the expressed wishes of competent patients

Respects the religious beliefs of the patient and is willing to liaise with a religious representative if requested by patient or family

Offers psychological, social and spiritual support to patients, their relatives or colleagues as required

Desire to support patient, family, and other staff members appropriately during treatment withdrawal

Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

DOMAIN 9: PAEDIATRIC CARE

KNOWLEDGE

Key stages of physical and psychological development
Major anatomical and physiological differences between adults and children
Pathophysiology and principles of management of disorders which are life-threatening to paediatric patients (determined by national case mix, but may include: acute respiratory failure, cardiac failure, trauma, severe infections including meningitis and epiglottitis, intoxications, metabolic disorders, seizures, croup, diarrhoea)
Paediatric management of conditions common to both children and adults (e.g. acute severe asthma, renal failure, trauma)
Paediatric resuscitation and the differences between adult and paediatric resuscitation
Principles of paediatric airway management: methods & techniques; calculation of tube sizes; selection of masks and airways
Principles of mechanical ventilation in a child
Preparation for and methods of securing venous access
Intraosseous cannulation
Estimation of blood volume, replacement of fluid loss
Paediatric dosing of common emergency drugs
General principles for stabilising the critically ill or injured child until senior or more experienced help arrives
Operation of local paediatric referral /retrieval services
Principles of communication (verbal and non verbal) with children of different ages; awareness of the consequences of the language used to impart information
Legal and ethical aspects of caring for children
Issues of consent in children
National child protection guidelines
Impact of occupational and environmental exposures, socio-economic factors, and life style factors on critical illness

SKILLS & BEHAVIOURS *(if paediatric patients are routinely managed in the adult ICU setting)*

Paediatric resuscitation at advanced life support level (APLS, PALS or equivalent)
Prepare equipment & drugs for paediatric intubation
Demonstrate paediatric tracheal intubation
Secure venous access (including local anaesthesia pre-medication)
Manage mechanical ventilation in a critically ill child
Communicate effectively with, and attempt to reassure the child and parents
Recognise and manage paediatric emergencies until senior or more experienced help arrives
Manage and stabilise the injured child until senior or more experienced help arrives

ATTITUDES

Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

DOMAIN 10: TRANSPORT

KNOWLEDGE

Indications, risks and benefits of patient transfer (intra / inter hospital)
Criteria for admission to, and discharge from ICU - factors influencing intensity and site of care (ward, high dependency unit (HDU), intensive care unit (ICU))
Principles of safe patient transfer (before, during and after)
Strategies to manage the unique problems associated with patient transfer - limitations of space, personnel, monitoring & equipment
Advantages and disadvantages of road ambulance, fixed and rotary wing aircraft including problems associated with altitude, noise, lighting conditions, vibration, acceleration and deceleration
Selection of mode of transport based upon clinical requirements, distance, vehicle availability and environmental conditions
Determination of required number of physicians / nurses / others during transfer and the role of paramedical personnel
Selection and operation of transport equipment: size, weight, portability, power supply/battery life, oxygen availability, durability and performance under conditions of transport
Principles of monitoring under transport conditions
Physiology associated with air transport
Homeostatic interaction between patient and environment (e.g. thermoregulation, posture / positioning)
Communication prior to and during transport
Operation of locally available retrieval services
Potential psychological impact of inter-hospital transfer and family dislocation

SKILLS & BEHAVIOURS

Determine when the patient's needs exceed local resources or specialist expertise (requirement for transfer)
Take decisions to admit, discharge or transfer patients
Communicate with referring and receiving institutions and teams
Check transfer equipment and plan transfers with personnel prior to departure
Select appropriate staff based upon patient need
Prepare patients prior to transfer; anticipate and prevent complications during transfer - maintain patient safety at all times
Adapt and apply general retrieval principles where appropriate to pre-, intra-, and inter-hospital transportation.
Consider the need for stabilisation before transfer
Undertake intra-hospital transfer of ventilated patients to theatre or for diagnostic procedures (e.g. CT)
Undertake inter-hospital transfers of patients with single or multiple organ failure
Maintain comprehensive documentation of the patient's clinical condition before, during and after transport including relevant medical conditions, therapy delivered, environmental factors and logistical difficulties encountered
Lead, delegate and supervise others appropriately according to experience and role

ATTITUDES

Appreciates the importance of communication between referring, transporting and receiving staff
Anticipates and prevents problems during transfer
Desire to minimise patient distress
Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

DOMAIN 11: PATIENT SAFETY AND HEALTH SYSTEMS MANAGEMENT

KNOWLEDGE

Principles of local / national health care provision; strategic planning of the ICU service (structure, function, financing) within the wider health care environment

The non-clinical role of the ICU specialist and how these activities contribute to the efficacy of the ICU, the profile of the ICU within the hospital and the quality of patient management

Principles of administration and management

Physical requirements of ICU design

Principles of resource management; ethics of resource allocation in the face of competing claims to care

Concept of risk : benefit ratio and cost effectiveness of therapies

Difference between absolute requirement and possible benefit when applying expensive technology to critically ill patients

Equipment requirements and selection: clinical need & priority; accuracy, reliability, safety and practical issues (ease of use, acceptance by staff)

Local process for ordering consumables and maintaining equipment

Principles of health economics, departmental budgeting, financial management and preparation of a business plan

Factors that determine the optimum staff establishment for specialist and junior medical staff, nurses and allied professional and non-clinical ICU staff

Principles of workforce planning

Practical application of equal opportunities legislation

Principles of national / local health care legislation applicable to ICM practice

Methods of effective communication of information (written; verbal etc)

Triage and management of competing priorities

Principles of crisis management, conflict resolution, negotiation and debriefing

Roles of different members of the multidisciplinary team and local referral practices

Purpose and process of quality improvement activities such as evidence based practice, best practice guidelines & benchmarking and change management

Purpose and methods of clinical audit (e.g. mortality reviews, complication rates)

Recent advances in medical research relevant to intensive care

Principles of appraisal of evidence: levels of evidence; interventions; diagnostic tests; prognosis; integrative literature (meta-analyses, practice guidelines, decision & economic analyses)

Electronic methods of accessing medical literature

Identification and critical appraisal of literature; integration of findings into local clinical practice

Research methods (see basic sciences)

Statistical concepts (see basic sciences)

Principles of applied research and epidemiology necessary to evaluate new guidelines / forms of therapy

Local policies and procedures relevant to practice

Treatment algorithms for common medical emergencies

Published standards of care at local, national and international level (including consensus statements and care bundles)

Principles of risk prevention

Common sources of error and factors which contribute to critical incidents / adverse events (ICU environment, personnel, equipment, therapy and patient factors)

Critical incident or error monitoring

Recognition of patient groups at high risk for developing complications

Pathogenesis, risk factors, prevention, diagnosis and treatment of complications of ICU management including: nosocomial infection ventilator associated pneumonia (VAP) ventilator associated lung injury - pulmonary barotrauma pulmonary oxygen toxicity thromboembolism (venous, arterial, pulmonary, intracardiac) stress ulceration pain malnutrition critical illness poly-neuropathy, motor-neuropathy & myopathy

Risk of bleeding: indications, contraindications, monitoring and complications of therapeutic anticoagulants, thrombolytic and anti-thrombolytic agents

Modification of treatment or therapy to minimise the risk of complications and appropriate monitoring to allow early detection of complications

Epidemiology and prevention of infection in the ICU

Types of organisms - emergence of resistant strains, mode of transfer, opportunistic and nosocomial infections; difference between contamination, colonisation & infection

Risk of colonisation with potentially pathogenic micro-organisms and the factors associated with patient, staff, equipment and environmental colonisation

Autogenous infection: routes and methods of prevention
 Cross infection: modes of transfer and common agents
 Universal precautions and preventative infection control techniques (hand washing, gloves, protective clothing, sharps disposal etc.)
 Requirements for microbiological surveillance and clinical sampling
 Local patterns of bacterial resistance and antibiotic policy
 Benefits and risks of different prophylactic antibiotic regimens
 Principles of aseptic technique and aseptic handling of invasive medical devices
 Methods of sterilisation and cleaning or disposal of equipment
 Infections from contaminated blood / body fluids; strategy if contaminated (e.g. needle stick injury)
 Staff safety: susceptibility to harmful physical, chemical and infectious hazards in the ICU
 Environmental control of temperature, humidity, air changes and scavenging systems for waste gases and vapours
 Measurement of gas and vapour concentrations, (oxygen, carbon dioxide, nitrous oxide, and volatile anaesthetic agents) - environmental safety
 Hazards associated with ionising radiation and methods to limit these in the ICU
 Electrical safety: conditions which predispose to the occurrence of macro-shock / micro-shock; physical dangers of electrical currents; relevant standards regarding safe use of electricity in patient care; basic methods to reduce electrical hazards.
 Confidentiality and data protection - legal and ethical issues
 Professional responsibility and duty of care to patients placed at risk by the actions of fellow clinicians
 Plan of action / local procedures to be followed when a health care worker is noticed to be in distress, whether or not patients are considered to be at risk
 Principles of outcome prediction / prognostic indicators and treatment intensity scales; limitations of scoring systems in predicting individual patient outcome
 Process and outcome measurement
 Principles of general and organ-specific scoring systems and their usefulness in assessing likely outcome of an illness (e.g. Glasgow Coma Scale, APACHE II and III, PRISM, organ system failure scores, injury severity scores)
 Influence of injury or illness being considered on the validity of a scoring system as a predictor of likely outcome (e.g. Glasgow Coma Score (GCS) in head injury versus drug overdose)
 One general method for measuring severity of illness (severity scoring systems)
 Principles of case-mix adjustment

SKILLS & BEHAVIOURS

Lead, delegate and supervise others appropriately according to experience and role
 Respect, acknowledge & encourage the work of others
 Listen effectively
 Collaborate with other team members to achieve common goals
 Manage inter-personal conflicts which arise between different sectors of the organisation, professionals, patients or relatives
 Demonstrate initiative in problem solving
 Propose realistic initiatives / projects to promote improvement
 Contribute to departmental / ICU activities
 Acquire, interpret, synthesize, record, and communicate (written and verbal) clinical information
 Assemble clinical and laboratory data, logically compare all potential solutions to the patient's problems, prioritise them and establish a clinical management plan
 Confirm accuracy of clinical information provided by members of the health care team
 Consider risk-benefit and cost-benefit of alternative drugs & therapies
 Consider potential interactions when prescribing drugs & therapies
 Establish a management plan based on clinical and laboratory information
 Aware of relevant guidelines and consensus statements and apply these effectively in every day practice under local conditions
 Implement and evaluate protocols and guidelines
 Use a systematic approach to locate, appraise, and assimilate evidence from scientific studies relevant to a patient's health problem
 Use electronic retrieval tools (e.g. PubMed) to access information from the medical & scientific literature
 Recognise the need for clinical audit and quality improvement activities to be non-threatening and non-punitive to individuals
 Participate in the processes of clinical audit, peer review and continuing medical education
 Manage resistance to change in the ICU / hospital environment in order to optimize the outcome of a task
 Record relevant clinical information accurately

Professional and reassuring approach - generates confidence and trust in patients and their relatives

Organise multidisciplinary care for groups of patients in the ICU

Plan long-term multidisciplinary care for patients in the ICU

Identify members of the health care team which require representation at a case conference

Timely organisation - liaise with members of the health care team to identify a suitable time and place for a case conference to maximise attendance

Identify necessary notes / investigations to support discussion during a case conference

Summarise a case history

Accept personal responsibility for the prevention of cross infection and self infection

Demonstrate routine application of infection control practices to all patients, particularly hand washing between patient contacts

Use protective clothing (gloves / mask / gown / drapes) as indicated

Apply methods to prevent autogenous infection (e.g. posture, mouth hygiene)

Implement prophylactic regimens appropriately

Maximise safety in everyday practice

Prescribe antibiotics safely and appropriately

Demonstrate an interest in quality control, audit and reflective practice

Seek expert help to ensure all equipment in the ICU conforms with and is maintained to the relevant safety standard

Monitor complications of critical illness

Document adverse incidents in a timely, detailed and appropriate manner

Inform colleagues, patients and relatives as applicable, of medical errors or adverse events in an honest and appropriate manner

ATTITUDES

Accepts responsibility for patient care and staff supervision

Recognises impaired performance (limitations) in self and colleagues and takes appropriate action

Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

Consults, communicates and collaborates effectively with patients, relatives and the health care team

Desire to minimise patient distress

Seeks to modify the stresses which the intensive care environment places upon patients, their relatives and members of staff

Establishes collaborative relations with other health care providers to promote continuity of patient care as appropriate

Consult and take into account the views of referring clinicians; promote their participation in decision making where appropriate

Ensures effective information transfer

Adopts a problem solving approach

Enquiring mind, undertakes critical analysis of published literature

DOMAIN 12: PROFESSIONALISM

KNOWLEDGE

Basic ethical principles: autonomy, beneficence, non-maleficence, justice
Consent and assent in the competent and non-competent patient
Ethical and legal issues in decision-making for the incompetent patient
Confidentiality and data protection - legal and ethical issues
Methods of effective communication of information (written; verbal etc)
Management of information
Principles of crisis management, conflict resolution, negotiation and debriefing
Principles of delivering bad news to patients and families
Sources of information about different cultural and religious attitudes and beliefs to life threatening illness and death available to health care professionals.
Impact of occupational and environmental exposures, socio-economic factors, and life style factors on critical illness
Strategies to communicate to the general population critical care issues and their impact on the maintenance and improvement of health care.
Principles of adult education and factors that promote learning
Principles of professional appraisal and constructive feedback
Purpose and process of quality improvement activities such as evidence based practice, best practice guidelines & benchmarking and change management
Methods of audit and translating findings into sustained change in practice
Use of information technology to optimize patient care and life-long learning
Electronic methods of accessing medical literature
Identification and critical appraisal of literature; integration of findings into clinical practice
Principles of appraisal of evidence: levels of evidence; interventions; diagnostic tests; prognosis; integrative literature (meta-analyses, practice guidelines)
Principles of applied research and epidemiology necessary to evaluate new guidelines/therapies
Principles of medical research: research questions; protocol design; power analysis, data collection, data analysis and interpretation of results; manuscript preparation and publication
Ethical principles involved in conducting research (including subject protection, consent, confidentiality and competing interests) and national ethical approval processes
Ethical management of relationships with industry
Requirements of ICM training at local and national level

SKILLS & BEHAVIOURS

Communicate with patients and relatives - give accurate information and re-iterate to ensure comprehension; clarify ambiguities
Discuss treatment options with a patient or relatives before ICU admission
Differentiate competent from incompetent statements by patients
Communicate effectively with relatives who may be anxious, angry, confused, or litigious
Obtain consent/assent for treatment, research, autopsy or organ donation
Use non-verbal communication appropriately
Use available opportunities and resources to assist in the development of personal communication skills
Manage inter-personal conflicts which arise between different sectors of the organisation, professionals, patients or relatives
Acquire, interpret, synthesize, record, and communicate (written and verbal) clinical information
Listen effectively
Involve patients in decisions about their care and treatment
Professional and reassuring approach - generates confidence and trust in patients and their relatives
Act appropriately as a member or leader of the team (according to skills & experience)
Lead, delegate and supervise others appropriately according to experience and role
Communicate effectively with professional colleagues to obtain accurate information and plan care
Collaborate with other team members to achieve common goals
Consult and take into account the views of referring clinicians; promote their participation in decision making where appropriate
Liaise with medical and nursing staff in other departments to ensure optimal communication and continuing care after ICU discharge
Participate appropriately in educational activities and teaching medical and non-medical members of the health care team

Contribute to professional meetings - understand their rules, structure and etiquette
 Respect, acknowledge & encourage the work of others
 Take decisions at a level commensurate with experience; accept the consequences of these decisions
 Attentive to detail, punctual, reliable, polite and helpful
 Contribute to departmental / ICU activities
 Participate in the processes of clinical audit, peer review and continuing medical education
 Propose realistic initiatives / projects to promote improvement
 Utilise personal resources effectively to balance patient care, learning needs, and outside activities.
 Develop, implement and monitor a personal continuing education plan including maintenance of a professional portfolio
 Use learning aids and resources to undertake self directed learning
 Use electronic retrieval tools to access information from the medical & scientific literature
 Use a systematic approach to locate, appraise, and assimilate evidence from scientific studies relevant to a patient's health problem
 Demonstrate initiative in problem solving
 Maximise safety in everyday practice

ATTITUDES

Well-being of the patient takes precedence over the needs of society or research
 Desire to contribute to the development of new knowledge
 Seeks to recognise those changes in the specialty, medicine or society, which should modify their practice and adapt their skills accordingly
 Integrity, honesty & respect for the truth underpin relationships with patients, relatives and colleagues
 Establishes trusting relationships with and demonstrates compassionate care of patients and their relatives
 Consults, communicates and collaborates effectively with patients, relatives and the health care team
 Sensitive to the reactions and emotional needs of others
 Approachable and accessible when on duty
 Regards each patient as an individual
 Willingness to communicate with and support families / significant others
 Promotes respect for patient privacy, dignity and confidentiality
 Acknowledges the consequences of the language used to impart information
 Recognises that communication is a two-way process
 Assesses, communicates with, and supports patients and families confronted with critical illness
 Sensitive to patients' expectations and responses; considers their perspective in order to understand their conduct and attitudes
 Respects the cultural and religious beliefs of the patient; demonstrate an awareness of their impact on decision making
 Respects the expressed wishes of competent patients
 Desire to minimise patient distress
 Seeks to modify the stresses which the intensive care environment places upon patients, their relatives and members of staff
 Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)
 Recognises impaired performance (limitations) in self and colleagues and takes appropriate action
 Recognises personal strengths and limitations as a consultant to other specialists
 Adopts a problem solving approach
 Fosters effective communication and relationships with medical and nursing staff in other wards / departments
 Accepts responsibility for patient care and staff supervision
 Generates enthusiasm amongst others
 Desire and willingness to share knowledge
 Contributes effectively to interdisciplinary team activities.
 Participates in, and promotes continuing education of members of the health care team.
 Takes responsibility for his/her personal physical and mental health, especially where impairment may affect patient care and professional conduct
 Enquiring mind, undertakes critical analysis of published literature
 Recognises and uses teaching and learning opportunities arising from clinical experiences, including errors
 Recognises and manages circumstances where personal prejudices or biases may affect behaviour, including cultural, financial and academic aspects

BASIC SCIENCES

ANATOMY

RESPIRATORY SYSTEM:

Mouth, nose, pharynx, larynx, trachea, main bronchi, segmental bronchi, structure of bronchial tree: differences in the child

Airway and respiratory tract, blood supply, innervation and lymphatic drainage

Pleura, mediastinum and its contents

Lungs, lobes, microstructure of lungs

Diaphragm, other muscles of respiration, innervation

The thoracic inlet and 1st rib

Interpretation of a chest x-ray

CARDIOVASCULAR SYSTEM:

Heart, chambers, conducting system, blood and nerve supply

Congenital deviations from normal anatomy

Pericardium

Great vessels, main peripheral arteries and veins

Foetal and materno-foetal circulation

NERVOUS SYSTEM:

Brain and its subdivisions

Spinal cord, structure of spinal cord, major ascending and descending pathways

Spinal meninges, subarachnoid and extradural space, contents of extradural space. Cerebral blood supply CSF and its circulation

Spinal nerves, dermatomes

Brachial plexus, nerves of arm

Intercostal nerves

Nerves of abdominal wall

Nerves of leg and foot

Autonomic nervous system

Sympathetic innervation, sympathetic chain, ganglia and plexuses

Parasympathetic innervation.

Stellate ganglion

Cranial nerves: base of skull: trigeminal ganglion

Innervation of the larynx

Eye and orbit

VERTEBRAL COLUMN:

Cervical, thoracic, and lumbar vertebrae

Interpretation of cervical spinal imaging in trauma

Sacrum, sacral hiatus

Ligaments of vertebral column

Surface anatomy of vertebral spaces, length of cord in child and adult

SURFACE ANATOMY:

Structures in antecubital fossa

Structures in axilla: identifying the brachial plexus

Large veins and anterior triangle of neck

Large veins of leg and femoral triangle

Arteries of arm and leg

Landmarks for tracheostomy, cricothyrotomy

Abdominal wall (including the inguinal region): landmarks for suprapubic urinary and peritoneal lavage catheters

Landmarks for intrapleural drains and emergency pleurocentesis

Landmarks for pericardiocentesis

ABDOMEN:

Gross anatomy of intra-abdominal organs

Blood supply to abdominal organs and lower body

PHYSIOLOGY & BIOCHEMISTRY

GENERAL:

Organisation of the human body and homeostasis

Variations with age

Function of cells; genes and their expression

Mechanisms of cellular and humoral defence

Cell membrane characteristics; receptors

Protective mechanisms of the body

Genetics & disease processes

BIOCHEMISTRY:

Acid base balance and buffers Ions e.g. Na^+ , K^+ , Ca^{++} , Cl^- , HCO_3^- , Mg^{++} , PO_4^- Cellular and intermediary metabolism; variations between organs

Enzymes

BODY FLUIDS:

Capillary dynamics and interstitial fluid

Oncotic pressure

Osmolarity: osmolality, partition of fluids across membranes

Lymphatic system

Special fluids: cerebrospinal, pleural, pericardial and peritoneal fluids

HAEMATOLOGY & IMMUNOLOGY:

Red blood cells: haemoglobin and its variants

Blood groups

Haemostasis and coagulation; pathological variations

White blood cells

Inflammation and its disorders

Immunity and allergy

MUSCLE:

Action potential generation and its transmission

Neuromuscular junction and transmission

Muscle types

Skeletal muscle contraction

Motor unit

Muscle wasting

Smooth muscle contraction: sphincters

HEART & CIRCULATION:

Cardiac muscle contraction

The cardiac cycle: pressure and volume relationships

Rhythmicity of the heart

Regulation of cardiac function; general and cellular

Control of cardiac output (including the Starling relationship)

Fluid challenge and heart failure

Electrocardiogram and arrhythmias

Neurological and humoral control of systemic blood pressures, blood volume and blood flow (at rest and during physiological disturbances e.g. exercise, haemorrhage and Valsalva manoeuvre)

Peripheral circulation: capillaries, vascular endothelium and arteriolar smooth muscle

Autoregulation and the effects of sepsis and the inflammatory response on the peripheral vasculature

Characteristics of special circulations including: pulmonary, coronary, cerebral, renal, portal and foetal

RENAL TRACT:

Blood flow, glomerular filtration and plasma clearance

Tubular function and urine formation

Endocrine functions of kidney

Assessment of renal function

Regulation of fluid and electrolyte balance

Regulation of acid-base balance

Micturition

Pathophysiology of acute renal failure

RESPIRATION:

Gaseous exchange: O_2 and CO_2 transport, hypoxia and hyper- and hypocapnia, hyper- and hypobaric pressures

Functions of haemoglobin in oxygen carriage and acid-base equilibrium

Pulmonary ventilation: volumes, flows, dead space.

Effect of IPPV and PEEP on lungs and circulation

Mechanics of ventilation: ventilation/perfusion abnormalities

Control of breathing, acute and chronic ventilatory failure, effect of oxygen therapy Non-respiratory functions of the lungs

Cardio-respiratory interactions in health & disease

NERVOUS SYSTEM:

Functions of nerve cells: action potentials, conduction, synaptic mechanisms and transmitters

The brain: functional divisions

Intracranial pressure: cerebrospinal fluid, blood flow

Maintenance of posture
Autonomic nervous system: functions
Neurological reflexes Motor function: spinal and peripheral
Senses: receptors, nociception, special senses
Pain: afferent nociceptive pathways, dorsal horn, peripheral and central mechanisms, neuromodulatory systems, supraspinal mechanisms, visceral pain, neuropathic pain, influence of therapy on nociceptive mechanisms
Spinal cord: anatomy and blood supply, effects of spinal cord section
LIVER:
Functional anatomy and blood supply
Metabolic functions
Tests of function
GASTROINTESTINAL:
Gastric function; secretions, nausea and vomiting
Gut motility, sphincters and reflex control
Digestive functions and enzymes
Nutrition: calories, nutritional fuels and sources, trace elements, growth factors
METABOLISM AND NUTRITION:
Nutrients: carbohydrates, fats, proteins, vitamins, minerals and trace elements Metabolic pathways, energy production and enzymes; metabolic rate
Hormonal control of metabolism: regulation of plasma glucose, response to trauma Physiological alterations in starvation, obesity, exercise and the stress response
Body temperature and its regulation
ENDOCRINOLOGY:
Mechanisms of hormonal control: feedback mechanisms, effect on membrane and intracellular receptors
Central neuro-endocrine interactions
Adrenocortical hormones
Adrenal medulla: adrenaline (epinephrine) and noradrenaline (norepinephrine) Pancreas: insulin, glucagon and exocrine function
Thyroid and parathyroid hormones and calcium homeostasis
PREGNANCY:
Physiological changes associated with a normal pregnancy and delivery
Materno-foetal, foetal and neonatal circulation
Functions of the placenta: placental transfer
Foetus: changes at birth

PHARMACOLOGY

PRINCIPLES OF PHARMACOLOGY:
Dynamics of drug-receptor interaction
Agonists, antagonists, partial agonists, inverse agonists
Efficacy and potency
Tolerance
Receptor function and regulation
Metabolic pathways; enzymes; drug: enzyme interactions; Michaelis-Menten equation
Enzyme inducers and inhibitors.
Mechanisms of drug action Ion channels: types: relation to receptors.
Gating mechanisms.
Signal transduction: cell membrane/receptors/ion channels to intracellular molecular targets, second messengers
Action of gases and vapours
Osmotic effects
pH effects
Adsorption and chelation
Mechanisms of drug interactions:
Inhibition and promotion of drug uptake.
Competitive protein binding.
Receptor inter-actions.
Effects of metabolites and other degradation products.
PHARMACOKINETICS & PHARMACODYNAMICS
Drug uptake from: gastrointestinal tract, lungs, nasal, transdermal, subcutaneous, IM, IV, epidural and intrathecal routes
Bioavailability
Factors determining the distribution of drugs: perfusion, molecular size, solubility, protein binding.
The influence of drug formulation on disposition

Distribution of drugs to organs and tissues:
 Body compartments Influence of specialised membranes: tissue binding and solubility
 Materno-foetal distribution
 Distribution in CSF and extradural space

Modes of drug elimination:
 Direct excretion
 Metabolism in organs of excretion: phase I & II mechanisms
 Renal excretion and urinary pH
 Non-organ breakdown of drugs

Pharmacokinetic analysis:
 Concept of a pharmacokinetic compartment
 Apparent volume of distribution
 Orders of kinetics
 Clearance concepts applied to whole body and individual organs

Simple 1 and 2 compartmental models:
 Concepts of wash-in and washout curves
 Physiological models based on perfusion and partition coefficients
 Effect of organ blood flow: Fick principle

Pharmacokinetic variation: influence of body size, sex, age, disease, pregnancy, anaesthesia, trauma, surgery, smoking, alcohol and other drugs
 Effects of acute organ failure (liver, kidney) on drug elimination Influence of renal replacement therapies on clearance of commonly used drugs

Pharmacodynamics: concentration-effect relationships: hysteresis
 Pharmacogenetics: familial variation in drug response
 Adverse reactions to drugs: hypersensitivity, allergy, anaphylaxis, anaphylactoid reactions

SYSTEMIC PHARMACOLOGY
 Hypnotics, sedatives and intravenous anaesthetic agents
 Simple analgesics
 Opioids and other analgesics; Opioid antagonists
 Non-steroidal anti-inflammatory drugs
 Neuromuscular blocking agents (depolarising and non-depolarising) and anti-cholinesterases
 Drugs acting on the autonomic nervous system (including inotropes, vasodilators, vasoconstrictors, antiarrhythmics, diuretics)
 Drugs acting on the respiratory system (including respiratory stimulants and bronchodilators)
 Antihypertensives
 Anticonvulsants
 Anti-diabetic agents
 Diuretics
 Antibiotics
 Corticosteroids and other hormone preparations
 Antacids. Drugs influencing gastric secretion and motility
 Antiemetic agents
 Local anaesthetic agents
 Immunosuppressants
 Principles of therapy based on modulation of inflammatory mediators indications, actions and limitations
 Plasma volume expanders
 Antihistamines
 Antidepressants
 Anticoagulants
 Vitamins A-E, folate, B12

PHYSICS & CLINICAL MEASUREMENT

MATHEMATICAL CONCEPTS:

Relationships and graphs
 Concepts of exponential functions and logarithms: wash-in and washout
 Basic measurement concepts: linearity, drift, hysteresis, signal: noise ratio, static and dynamic response
 SI units: fundamental and derived units
 Other systems of units where relevant to ICM (e.g. mmHg, bar, atmospheres)
 Simple mechanics: Mass, Force, Work and Power

GASES & VAPOURS:

Absolute and relative pressure.
 The gas laws; triple point; critical temperature and pressure
 Density and viscosity of gases.
 Laminar and turbulent flow; Poiseuille's equation, the Bernoulli principle

Vapour pressure: saturated vapour pressure
Measurement of volume and flow in gases and liquids.
The pneumotachograph and other respirometers.
Principles of surface tension

ELECTRICITY & MAGNETISM:

Basic concepts of electricity and magnetism.
Capacitance, inductance and impedance
Amplifiers: bandwidth, filters
Amplification of biological potentials: ECG, EMG, EEG.
Sources of electrical interference
Processing, storage and display of physiological measurements
Bridge circuits

ELECTRICAL SAFETY:

Principles of cardiac pacemakers and defibrillators
Electrical hazards: causes and prevention.
Electrocution, fires and explosions.
Diathermy and its safe use
Basic principles and safety of lasers
Basic principles of ultrasound and the Doppler effect

PRESSURE & FLOW MONITORING:

Principles of pressure transducers
Resonance and damping, frequency response
Measurement and units of pressure.
Direct and indirect methods of blood pressure measurement; arterial curve analysis
Principles of pulmonary artery and wedge pressure measurement
Cardiac output: Fick principle, thermodilution

CLINICAL MEASUREMENT:

Measurement of gas and vapour concentrations, (oxygen, carbon dioxide, nitrous oxide, and volatile anaesthetic agents) using infrared, paramagnetic, fuel cell, oxygen electrode and mass spectrometry methods
Measurement of H⁺, pH, pCO₂, pO₂
Measurement CO₂ production/ oxygen consumption/ respiratory quotient
Colligative properties: osmometry
Simple tests of pulmonary function e.g. peak flow measurement, spirometry.
Capnography
Pulse oximetry
Measurement of neuromuscular blockade
Measurement of pain

RESEARCH METHODS

DATA COLLECTION:

Simple aspects of study design (research question, selection of the method of investigation, population, intervention, outcome measures)
Power analysis
Defining the outcome measures and the uncertainty of measuring them
The basic concept of meta-analysis and evidence based medicine

DESCRIPTIVE STATISTICS:

Types of data and their representation
The normal distribution as an example of parametric distribution
Indices of central tendency and variability

DEDUCTIVE & INFERENCE STATISTICS:

Simple probability theory and the relation to confidence intervals
The null hypothesis.
Choice of simple statistical tests for different data types
Type I and type II errors
Inappropriate use of statistics