CoBaTrICE SYLLABUS

(Presented by Domain)

[VERSION 1.0 (2006)]

The CoBaTrICE Collaboration: 1st September 2006

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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

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## CoBaTrICE Competencies

<table>
<thead>
<tr>
<th>Domain</th>
<th>Competence Statement</th>
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</thead>
<tbody>
<tr>
<td>1. Resuscitation &amp; Initial Management of the Acutely Ill Patient</td>
<td>1.1 Adopts a structured and timely approach to the recognition, assessment and stabilisation of the acutely ill patient with disordered physiology</td>
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<tr>
<td></td>
<td>1.2 Manages cardiopulmonary resuscitation</td>
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<td>1.3 Manages the patient post-resuscitation</td>
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<td></td>
<td>1.4 Triage and prioritises patients appropriately, including timely admission to ICU</td>
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<td></td>
<td>1.5 Assesses and provides initial management of the trauma patient</td>
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<td>1.6 Assesses and provides initial management of the patient with burns</td>
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<td>1.7 Describes the management of mass casualties</td>
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<tr>
<td>2. Diagnosis: Assessment, Investigation, Monitoring and Data Interpretation</td>
<td>2.1 Obtains a history and performs an accurate clinical examination</td>
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<td>2.2 Undertakes timely and appropriate investigations</td>
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<td>2.3 Describes indications for echocardiography (transthoracic / transoesophageal)</td>
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<td>2.4 Performs electrocardiography (ECG / EKG) and interprets the results</td>
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<td>2.5 Obtains appropriate microbiological samples and interprets results</td>
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<td>2.6 Obtains and interprets the results from blood gas samples</td>
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<td>2.7 Interprets chest x-rays</td>
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<td></td>
<td>2.8 Liaises with radiologists to organise and interpret clinical imaging</td>
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<td>2.9 Monitors and responds to trends in physiological variables</td>
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<td>2.10 Integrates clinical findings with laboratory investigations to form a differential diagnosis</td>
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<tr>
<td>ACUTE DISEASE</td>
<td>3.1 Manages the care of the critically ill patient with specific acute medical conditions</td>
</tr>
<tr>
<td>CHRONIC DISEASE</td>
<td>3.2 Identifies the implications of chronic and co-morbid disease in the acutely ill patient</td>
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<tr>
<td>ORGAN SYSTEM FAILURE</td>
<td>3.3 Recognises and manages the patient with circulatory failure</td>
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<td>3.4 Recognises and manages the patient with, or at risk of, acute renal failure</td>
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<td>3.5 Recognises and manages the patient with, or at risk of, acute liver failure</td>
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<td>3.6 Recognises and manages the patient with neurological impairment</td>
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<td>3.7 Recognises and manages the patient with acute gastrointestinal failure</td>
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<td>3.8 Recognises and manages the patient with acute lung injury syndromes (ALI / ARDS)</td>
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<td>3.9 Recognises and manages the septic patient</td>
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<td>3.10 Recognises and manages the patient following intoxication with drugs or environmental toxins</td>
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<td>3.11 Recognises life-threatening maternal peripartum complications and manages care under supervision</td>
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<tr>
<td>4. Therapeutic Interventions / Organ System Support in Single or Multiple Organ Failure</td>
<td>4.1 Prescribes drugs and therapies safely</td>
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<tr>
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<td>4.2 Manages antimicrobial drug therapy</td>
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<td></td>
<td>4.3 Administers blood and blood products safely</td>
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<td>4.4 Uses fluids and vasoactive / inotropic drugs to support the circulation</td>
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<td>4.5 Describes the use of mechanical assist devices to support the circulation</td>
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<td>4.6 Initiates, manages, and weans patients from invasive and non-invasive ventilatory support</td>
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<td>4.7 Initiates, manages and weans patients from renal replacement therapy</td>
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<td>4.8 Recognises and manages electrolyte, glucose and acid-base disturbances</td>
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<td>4.9 Co-ordinates and provides nutritional assessment and support</td>
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<table>
<thead>
<tr>
<th><strong>DOMAIN</strong></th>
<th><strong>COMPETENCE STATEMENT</strong></th>
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<tbody>
<tr>
<td><strong>RESPIRATORY SYSTEM</strong></td>
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<tr>
<td>5.1</td>
<td>Administers oxygen using a variety of administration devices</td>
</tr>
<tr>
<td>5.2</td>
<td>Performs fiberoptic laryngoscopy under supervision</td>
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<tr>
<td>5.3</td>
<td>Performs emergency airway management</td>
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<tr>
<td>5.4</td>
<td>Performs difficult and failed airway management according to local protocols</td>
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<tr>
<td>5.5</td>
<td>Performs endotracheal suction</td>
</tr>
<tr>
<td>5.6</td>
<td>Performs fiberoptic bronchoscopy and BAL in the intubated patient under supervision</td>
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<tr>
<td>5.7</td>
<td>Performs percutaneous tracheostomy under supervision</td>
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<tr>
<td>5.8</td>
<td>Performs thoracocentesis via a chest drain</td>
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<tr>
<td><strong>CARDIOVASCULAR SYSTEM</strong></td>
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<tr>
<td>5.9</td>
<td>Performs peripheral venous catheterisation</td>
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<tr>
<td>5.10</td>
<td>Performs arterial catheterisation</td>
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<tr>
<td>5.11</td>
<td>Describes a method for surgical isolation of vein / artery</td>
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<tr>
<td>5.12</td>
<td>Describes ultrasound techniques for vascular localisation</td>
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<tr>
<td>5.13</td>
<td>Performs central venous catheterisation</td>
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<tr>
<td>5.14</td>
<td>Performs defibrillation and cardioversion</td>
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<tr>
<td>5.15</td>
<td>Performs cardiac pacing (transvenous or transthoracic)</td>
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<tr>
<td>5.16</td>
<td>Describes how to perform pericardiocentesis</td>
</tr>
<tr>
<td>5.17</td>
<td>Demonstrates a method for measuring cardiac output and derived haemodynamic variables</td>
</tr>
<tr>
<td><strong>CENTRAL NERVOUS SYSTEM</strong></td>
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<tr>
<td>5.18</td>
<td>Performs lumbar puncture (intradural / 'spinal') under supervision</td>
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<tr>
<td>5.19</td>
<td>Manages the administration of analgesia via an epidural catheter</td>
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<tr>
<td><strong>GASTROINTESTINAL SYSTEM</strong></td>
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<tr>
<td>5.20</td>
<td>Performs nasogastric tube placement</td>
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<tr>
<td>5.21</td>
<td>Performs abdominal paracentesis</td>
</tr>
<tr>
<td>5.22</td>
<td>Describes Sengstaken tube (or equivalent) placement</td>
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<tr>
<td>5.23</td>
<td>Describes indications for, and safe conduct of gastroscopy</td>
</tr>
<tr>
<td><strong>GENITOURINARY SYSTEM</strong></td>
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</tr>
<tr>
<td>5.24</td>
<td>Performs urinary catheterisation</td>
</tr>
</tbody>
</table>

| **5. PRACTICAL PROCEDURES** | |
| 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 |

| **6. PERI-OPERATIVE CARE** | |
| 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 delerium |
| 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 |

| **7. COMFORT & RECOVERY** | |
| 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 |

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| 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 | 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  
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  
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  
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 |

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## 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

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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)

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

**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

<table>
<thead>
<tr>
<th>KNOWLEDGE</th>
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<tbody>
<tr>
<td><strong>Pathophysiology</strong>, diagnosis and management of commonly encountered acute and chronic medical conditions including:</td>
</tr>
<tr>
<td><strong>Respiratory Disorders</strong>: 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</td>
</tr>
<tr>
<td><strong>Cardiovascular Disorders</strong>: 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</td>
</tr>
<tr>
<td><strong>Neurological Disorders</strong>: 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</td>
</tr>
<tr>
<td><strong>Renal and Genito-urinary Disorders</strong>: urological sepsis; acute renal failure; chronic renal failure; renal manifestations of systemic disease including vasculitides; nephrotoxic drugs and monitoring; rhabdomyolysis</td>
</tr>
<tr>
<td><strong>Gastrointestinal Disorders</strong>: 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 &amp; pseudo-obstruction; abdominal trauma; intra-abdominal hypertension &amp; compartment syndrome; short-bowel syndrome; rupture of liver or spleen.</td>
</tr>
<tr>
<td><strong>Haematological and Oncological Disorders</strong>: disseminated intravascular coagulation (DIC) and other coagulation disorders, haemolytic 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</td>
</tr>
<tr>
<td><strong>Infections</strong>: 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</td>
</tr>
<tr>
<td><strong>Metabolic Disorders</strong>: electrolyte disorders; acid-base disorders; fluid-balance disorders; thermoregulation and associated disorders</td>
</tr>
<tr>
<td><strong>Endocrine Disorders</strong>: critical illness-induced hyperglycaemia; diabetes mellitus; over- and under-activity of thyroid; adrenal and pituitary disorders; sepsis-induced relative adrenal insufficiency; endocrine emergencies</td>
</tr>
</tbody>
</table>

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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

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**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, 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

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)

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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

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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

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Management of and complications associated with tracheostomy tubes
Principles of extracorporeal 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 postpyloric 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

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| 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)

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## 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 fibreoptic intubation; use of fibreoptic 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 fibreoptic endoscopes

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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 tunneled 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
Allen 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

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**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)

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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

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## KNOWLEDGE

<table>
<thead>
<tr>
<th>Factors determining perioperative risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods of optimising high risk surgical patients</td>
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<tr>
<td>Importance of preoperative health status on postoperative outcomes</td>
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<tr>
<td>Indications for, and interpretation of pre-operative investigations</td>
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<tr>
<td>Dangers of emergency anaesthesia &amp; surgery</td>
</tr>
<tr>
<td>Effect of gastric contents and dehydration on perioperative risk</td>
</tr>
<tr>
<td>Anaesthetic risk factors complicating recovery: suxamethonium apnoea, anaphylaxis, malignant hyperpyrexia, difficult airway</td>
</tr>
<tr>
<td>Criteria for admission to, and discharge from ICU - factors influencing intensity and site of care (ward, high dependency unit (HDU), intensive care unit (ICU))</td>
</tr>
<tr>
<td>Perioperative implications of current drug therapy</td>
</tr>
<tr>
<td>Consent and assent in the competent and non-competent patient</td>
</tr>
<tr>
<td>Implications for postoperative care of common acute and chronic medical conditions (see 3.1 &amp; 3.2)</td>
</tr>
<tr>
<td>Implications of type of anaesthesia (general/regional/local) for perioperative care</td>
</tr>
<tr>
<td>Implications of type / site of surgery for postoperative management and potential complications within the first 24 hours of surgery</td>
</tr>
<tr>
<td>Assessment and management of commonly encountered perioperative conditions &amp; complications including:</td>
</tr>
<tr>
<td>RESPIRATORY: Interpretation of symptoms and signs of respiratory insufficiency in the surgical patient; the unprotected airway; upper and lower airway obstruction including laryngeal trauma &amp; 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.</td>
</tr>
<tr>
<td>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</td>
</tr>
<tr>
<td>RENAL: Causes of perioperative oliguria and anuria; prevention and management of acute renal failure; rhabdomyolysis; consequences of nephrectomy, ileal conduits; management post-renal transplantation</td>
</tr>
<tr>
<td>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 &amp; ischaemia; brachial plexus injury; complications of neuromuscular blockade</td>
</tr>
<tr>
<td>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 &amp; vomiting</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>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</td>
</tr>
<tr>
<td>MUSCULO–SKELETAL: principles and management of external fixators and casts; perioperative positioning; pressure area care; compartment syndromes; paralysed patients; principles of salvage surgery</td>
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<tr>
<td>Recognition, assessment and management of acute pain</td>
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<tr>
<td>Indications and choice of agent for antibiotic prophylaxis</td>
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<tr>
<td>Indications for and methods of perioperative anti-thrombotic treatment</td>
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<tr>
<td>Surgical interventions in patients with cardiac disease, perioperative management of the...</td>
</tr>
<tr>
<td>cardiovascular surgery patient and potential complications occurring within 24 hours of cardiac surgery</td>
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<tr>
<td>Major neurosurgical procedures, peri-operative management of the patient undergoing major neurosurgery, and potential complications occurring within 24 hours of surgery</td>
</tr>
<tr>
<td>Solid organ-specific transplantation (heart-lung, liver, renal): peri-operative considerations, pharmacological management, post operative care and potential complications</td>
</tr>
<tr>
<td>Immunosuppression and rejection</td>
</tr>
</tbody>
</table>

| **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 |

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# Domain 7: Comfort & Recovery

## Knowledge

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

## Skills & Behaviours

<table>
<thead>
<tr>
<th>Skill/Behaviour</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify complications associated with critical illness</td>
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<tr>
<td>Work with colleagues and relatives to minimise patient distress</td>
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<tr>
<td>Anticipate the development of pain and/or anxiety and adopt strategies for its prevention or minimisation</td>
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<tr>
<td>Interpret data from scoring or scaling systems to assess pain and sedation</td>
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<tr>
<td>Use analgesic, hypnotic and neuromuscular blocking drugs appropriately and safely</td>
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<tr>
<td>Select &amp; determine adequacy and route of administration of analgesia</td>
<td></td>
</tr>
<tr>
<td>Minimise complications associated with opioid and non-opioid analgesics</td>
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</tbody>
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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
- Withholding 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 families

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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

<table>
<thead>
<tr>
<th>ATITUDES</th>
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</thead>
<tbody>
<tr>
<td>Values clear decision-making and communication</td>
</tr>
<tr>
<td>Acknowledges the consequences of the language used to impart information</td>
</tr>
<tr>
<td>Willingness to communicate with and support families / significant others</td>
</tr>
<tr>
<td>Respects the ideas and beliefs of the patient and their family and their impact on decision making (does not impose own views)</td>
</tr>
<tr>
<td>Respects the expressed wishes of competent patients</td>
</tr>
<tr>
<td>Respects the religious beliefs of the patient and is willing to liaise with a religious representative if requested by patient or family</td>
</tr>
<tr>
<td>Offers psychological, social and spiritual support to patients, their relatives or colleagues as required</td>
</tr>
<tr>
<td>Desire to support patient, family, and other staff members appropriately during treatment withdrawal</td>
</tr>
<tr>
<td>Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)</td>
</tr>
</tbody>
</table>
## 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 lifestyle 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)

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## DOMAIN 11: PATIENT SAFETY AND HEALTH SYSTEMS MANAGEMENT

### KNOWLEDGE

<table>
<thead>
<tr>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principles of local / national health care provision; strategic planning of the ICU service (structure, function, financing) within the wider health care environment</td>
</tr>
<tr>
<td>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</td>
</tr>
<tr>
<td>Principles of administration and management</td>
</tr>
<tr>
<td>Physical requirements of ICU design</td>
</tr>
<tr>
<td>Principles of resource management; ethics of resource allocation in the face of competing claims to care</td>
</tr>
<tr>
<td>Concept of risk : benefit ratio and cost effectiveness of therapies</td>
</tr>
<tr>
<td>Difference between absolute requirement and possible benefit when applying expensive technology to critically ill patients</td>
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<tr>
<td>Equipment requirements and selection: clinical need &amp; priority; accuracy, reliability, safety and practical issues (ease of use, acceptance by staff)</td>
</tr>
<tr>
<td>Local process for ordering consumables and maintaining equipment</td>
</tr>
<tr>
<td>Principles of health economics, departmental budgeting, financial management and preparation of a business plan</td>
</tr>
<tr>
<td>Factors that determine the optimum staff establishment for specialist and junior medical staff, nurses and allied professional and non-clinical ICU staff</td>
</tr>
<tr>
<td>Principles of workforce planning</td>
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<tr>
<td>Practical application of equal opportunities legislation</td>
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<tr>
<td>Principles of national / local health care legislation applicable to ICM practice</td>
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<tr>
<td>Methods of effective communication of information (written; verbal etc)</td>
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<tr>
<td>Triage and management of competing priorities</td>
</tr>
<tr>
<td>Principles of crisis management, conflict resolution, negotiation and debriefing</td>
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<tr>
<td>Roles of different members of the multidisciplinary team and local referral practices</td>
</tr>
<tr>
<td>Purpose and process of quality improvement activities such as evidence based practice, best practice guidelines &amp; benchmarking and change management</td>
</tr>
<tr>
<td>Purpose and methods of clinical audit (e.g. mortality reviews, complication rates)</td>
</tr>
<tr>
<td>Recent advances in medical research relevant to intensive care</td>
</tr>
<tr>
<td>Principles of appraisal of evidence: levels of evidence; interventions; diagnostic tests; prognosis; integrative literature (meta-analyses, practice guidelines, decision &amp; economic analyses)</td>
</tr>
<tr>
<td>Electronic methods of accessing medical literature</td>
</tr>
<tr>
<td>Identification and critical appraisal of literature; integration of findings into local clinical practice</td>
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<tr>
<td>Research methods (see basic sciences)</td>
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<tr>
<td>Statistical concepts (see basic sciences)</td>
</tr>
<tr>
<td>Principles of applied research and epidemiology necessary to evaluate new guidelines / forms of therapy</td>
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<tr>
<td>Local policies and procedures relevant to practice</td>
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<tr>
<td>Treatment algorithms for common medical emergencies</td>
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<tr>
<td>Published standards of care at local, national and international level (including consensus statements and care bundles)</td>
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<tr>
<td>Principles of risk prevention</td>
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<tr>
<td>Common sources of error and factors which contribute to critical incidents / adverse events (ICU environment, personnel, equipment, therapy and patient factors)</td>
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<tr>
<td>Critical incident or error monitoring</td>
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<tr>
<td>Recognition of patient groups at high risk for developing complications</td>
</tr>
<tr>
<td>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 &amp; myopathy</td>
</tr>
<tr>
<td>Risk of bleeding: indications, contraindications, monitoring and complications of therapeutic anticoagulants, thrombolytic and anti-thrombolytic agents</td>
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<tr>
<td>Modification of treatment or therapy to minimise the risk of complications and appropriate monitoring to allow early detection of complications</td>
</tr>
<tr>
<td>Epidemiology and prevention of infection in the ICU</td>
</tr>
<tr>
<td>Types of organisms - emergence of resistant strains, mode of transfer, opportunistic and nosocomial infections; difference between contamination, colonisation &amp; infection</td>
</tr>
<tr>
<td>Risk of colonisation with potentially pathogenic micro-organisms and the factors associated with patient, staff, equipment and environmental colonisation</td>
</tr>
</tbody>
</table>

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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

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| 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 |

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### 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

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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

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

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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⁻, HCO₃⁻, Mg++, PO₄-
- 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: O₂ and CO₂ 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, neumodulatory 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

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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

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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 & INFERENTIAL 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

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