



THE UNIVERSITY OF BRITISH COLUMBIA

**Pediatric Critical Care Medicine
Postgraduate Training Program**

Roles and Key Competencies in Pediatric Critical Care Medicine

MEDICAL EXPERT/CLINICAL DECISION MAKER:

- To understand the pathophysiology and management of all aspects of single and multi-organ failure, specifically:

1. *The Patient with Respiratory Dysfunction*

Given a critically ill patient, the Resident must be able to determine the presence or absence of respiratory failure, provide for its emergency support, and have a plan of action to subsequently investigate and manage the problem.

The Resident shall demonstrate knowledge of:

- Normal anatomy of the respiratory system
- The physiology of the gas exchange unit, lung and chest wall mechanics, airway dynamics and the control of respiration
- The pathophysiology of disease states leading to respiratory failure
- The physiology and pathophysiology of respiratory development during growth and development from intrauterine life to adulthood
- The disease processes related to the different stages of development of the pediatric respiratory system
- The principles and theory of mechanical ventilation and other methods of respiratory support
- Familiarity with respiratory problems which may be associated with surgical interventions in children with cardiac disease

2. *The Patient with Cardiovascular Dysfunction*

Given a critically ill patient with cardiac dysfunction, either congenital or acquired, the Resident must be able to recognize the problem, provide emergency life saving support, and embark upon a diagnostic and management program to correct the instability.

The Resident shall demonstrate:

- Knowledge of the methods and application of “Advanced Cardiac Life Support” techniques
- Knowledge of the methods and application of “Pediatric Advanced Life Support” techniques
- Knowledge of principles of invasive and non-invasive hemodynamic monitoring.
- Detailed knowledge of the pathophysiology and treatment of cardiac failure in neonates, infants, children and adolescents, including the pharmacology of drugs used to treat these entities
- An understanding of the basic and complex cardiac arrhythmias, including pharmacological and electrical management
- An understanding of the shock syndromes, with emphasis on the pathophysiological events leading to and resulting from the shock state
- An understanding of heart-lung interactions
- Familiarity with the congenital malformations of the vascular system leading to heart failure and/or hypoxemia

3. *The Patient with Neurological Dysfunction*

Given a patient with CNS crisis and/or an altered level of consciousness, the Resident must be able to recognize the problem, institute immediate life-sustaining measures, carry out appropriate neurological examination, derive a differential diagnosis, and continue with appropriate diagnostic and supportive measures.

The Resident shall demonstrate knowledge of:

- The pathophysiology and importance of coma and raised intracranial pressure, with an understanding of the differences found during the different stages of development.
- The investigation of coma and raised ICP and the monitoring techniques involved.
- The available treatment for intracranial hypertension
- Metabolic, structural and infectious causes of altered consciousness.
- Seizure abnormalities and the systemic metabolic consequences of status epilepticus, with an emphasis on the pharmacological management.
- The clinical diagnosis of brain death, and the confirmatory investigations involved with this diagnosis
- Environmental and drug-related psychopathology associated with pediatric intensive care units (ie., anxiety, sleep disorder, hallucinations and withdrawal)

4. ***The Patient with Neuromuscular Dysfunction***

Given a patient with an acute or chronic neuromuscular disorder, the Resident must be able to recognize the seriousness of the problem, institute life-sustaining measures, and compose a precise program of definitive diagnosis, ongoing support and specific therapy applicable.

The Resident shall demonstrate knowledge of:

- The major focus of care ie., support of vital organs, circulation, respiration, nutrition and bowel, bladder and skin care
- The major pathophysiological entities associated with acute neuromuscular disease, including any specific therapeutic options available (eg, plasmapheresis, immunosuppressants)
- The medical, administrative, and ethical entities associated with the institution and maintenance of long-term mechanical ventilation
- The involvement and importance of supportive services integral to the management of patients with neuromuscular diseases. (eg, physiotherapy, occupational therapy, orthotics, social services).

5. ***The Patient with Renal Dysfunction***

Given a critically ill patient with oliguria, evidence of advancing renal failure, or established renal failure, the Resident must be able to recognize the problem, institute measures to preserve remaining renal function, and provide for precise diagnosis, adequate supportive measures, and appropriate therapy.

The Resident shall demonstrate knowledge of:

- The ability to distinguish between pre-renal, renal and post-renal failure
- The pathophysiology and management, both medical and surgical of the above types of renal failure
- The interaction between drugs, nephrotoxins and the kidney, in both normal and diseased states
- The physiology and management of the patient following renal transplantation, including the pharmacological management, and complications
- The diagnosis and management of fluid or electrolyte deficiencies in disease states
- The pathophysiology, diagnosis and treatment of acid-base disorders

6. ***The Patient with Gastrointestinal Dysfunction***

Given the critically ill patient who presents with gastrointestinal crisis, the Resident must be able to critically evaluate the nature of the illness, institute immediate life-sustaining support, and embark upon a program of precise diagnosis, continuing support and appropriate therapy.

The Resident shall demonstrate knowledge of:

- The causes, diagnostic techniques and management of the acute abdomen
- The diagnostic techniques and management of the child presenting with congenital malformations of the GI system
- The diagnosis and management of upper and lower GI bleeding
- The complications of abdominal surgery and trauma

7. *The Patient with Hepatic Dysfunction*

Given a patient with jaundice and/or manifest hepatic failure, the Resident must be able to recognize the problem, provide for immediate life-sustaining support, and develop an plan for the diagnosis and the treatment of the patient.

The Resident shall demonstrate knowledge of:

The pathophysiology and management of acute and chronic liver disease

- The role of the liver in the reticuloendothelial system, and as a site for the detoxification of endogenous and exogenous substances, and for the production of substance necessary for hemostasis
- The physiology and management of the patient following liver transplantation, including the pharmacological management, and complications (if not available at the site of training, the Resident should have an understanding of the current field)

8. *The Patient with Hematological/Oncologic Disorders*

Given a critically ill patient with a malignancy, a thrombotic or thrombolytic disorder, bleeding, neutropenia, or anemia, the Resident must be able to recognize the problem, provide for any indicated life-sustaining support, and proceed with an orderly course of investigation, management, continued support and treatment.

The Resident shall demonstrate knowledge of:

- The pathogenesis and management of thrombocytopenia, anemia, neutropenia
- The pathogenesis and management of pediatric oncologic diseases and their complications
- The pathogenesis and management of hemolytic and vaso-occlusive diseases
- The coagulation sequence, the fibrinolytic pathway, and disorders of these mechanisms, including recognition and pathophysiology
- Blood component therapy, complications, and alternatives available
- Anticoagulant and fibrinolytic therapies

9. *Nutritional Support*

Given a critically ill patient, the Resident must be able to evaluate the nutritional status of the patient, identify current deficiencies, ongoing losses and extra needs induced by the

illness. The Resident must also be able to devise a management strategy for the provision of either enteral and/or parenteral nutrition to sustain the patient throughout the period of critical illness.

The Resident shall demonstrate knowledge of:

- The difference in fluid compartments and fluid requirements at different stages of child development
- The techniques and laboratory tests used to evaluate nutritional status in children
- Methods of assessing basal energy expenditure and monitoring effectiveness of supporting care
- The indications, limitation, methods and complications of enteral and parenteral nutritional techniques.

10. ***The Patient with Metabolic - Endocrine Disorders***

Given a critically ill patient with metabolic-endocrine abnormalities, the Resident must be able to recognize the nature and severity of the problem, establish a differential diagnosis and, embark on a course of definitive diagnosis, continued monitoring and support.

The Resident shall demonstrate knowledge of:

- The diagnosis and management of fluid or electrolyte deficiencies in disease states
- The pathophysiology, diagnosis and treatment of acid-base disorders
- The pathophysiology, diagnosis and treatment of endocrine disorders in children and adults
- Disorders of temperature regulation and the regulation of normal body temperature, with emphasis on the demands placed on neonates and small children during normal thermoregulation.
- The diagnosis and management of the acute presentation/crises of inborn errors of metabolism

11. ***The Patient with Trauma***

Given a patient who has sustained severe trauma, with or without extensive soft tissue and bony injury, the Resident must be able to manage such a patient in accordance with practices such as those advocated by the Advanced Trauma Life Support course.

The Resident shall demonstrate knowledge of:

- The necessity to evaluate and prioritize the unique needs of the traumatized pediatric patient
- The need for continuing care of the traumatized patient with regard to all systems, injured or not

- The secondary insults that enhance the primary pathogenicity of the traumatized organs
- The special needs of the physically and/or sexually abused patient
- The long-term sequelae, physical and emotional requirements of the traumatized child and their family, and the prognosis of traumatized children

12. *Patient with Septic Illness*

Given a patient with catastrophic septic illness, the Resident must be able to recognize the infective nature of the condition, institute immediate life-sustaining measures, establish a differential diagnosis of probably site of origin and etiological pathogens, and embark upon a course of definitive diagnosis, continued life support and appropriate antimicrobial and/or surgical therapy.

The Resident shall demonstrate knowledge of:

- Available techniques for diagnostic procedures
- The epidemiology of age specific infectious disease
- The immuno-compromised host and associated diseases
- Techniques to control and limit nosocomial infection
- The pharmacology, indications, complications, interactions, monitoring and efficacy of usual antimicrobial agents.
- The occult indications of sepsis in children
- Systemic inflammatory response syndrome/multiple organ dysfunction
- Adjunctive therapies for management of sepsis including steroids and Plasmapheresis
- Current literature in sepsis management

13. *The Intoxicated Patient*

Given a patient potentially suffering from the effects of an acute or chronic intoxicant, the Resident must be able to identify this probability, stabilize the life-threatening complications and undertake a sequential plan to support organ function, to prevent further absorption, alter distribution, if possible, and enhance elimination by natural and mechanical means.

The Resident shall demonstrate knowledge of:

- The importance of vital system support, together with any specific antidotes or supportive therapy pertinent to individual intoxicants
- The pharmacology of common intoxicants
- The means to reduce absorption, enhance elimination, and the techniques and indications for hemodialysis and hemoperfusion
- The patient and family's need for emotional and psychiatric support

14. *The Patient with Burns and/or Electrical Injury*

Given a patient who has sustained primary, secondary or tertiary life threatening burns, the Resident must be able to institute immediate life-supportive measures and develop a plan of ongoing support that includes adequate fluid resuscitation, maintenance of vital organ systems' integrity, prevention and management of burn wound sepsis and the minimization of metabolic complications of burns.

The Resident shall demonstrate knowledge of:

- The pathophysiology and medical/surgical management of the phases of the burn injury
- The importance of respiratory complications of burn injuries (eg smoke inhalation, airway burns)
- The importance of environment control for the child with emphasis on thermal regulation and infection control

15. *Pharmacotherapy*

Given the spectrum of ages, diseases, and types of patients requiring medicates during critical illness, the Resident shall have a thorough knowledge of the indications, risks, and side effects of pharmacotherapy

The Resident shall demonstrate knowledge of:

- The pharmacologic and therapeutic applications of drugs with particular emphasis on differences found in different age ranges.
- The side effects and drug interactions associated with commonly used medications
- The indication and management of sedation, analgesia, neuromuscular blockade and anesthesia in all age ranges

16. *Patient Behaviour*

The Resident should acquire a conceptual and informational base for the effective use of psychological and social variables as they relate to the patient and the patient's family when confronted with critical illness, in the short term and long term.

The Resident shall demonstrate knowledge of:

- To understand the impact of critical illness on long term quality of life
- The effect of illness, injury, or death, on the child and the family, with emphasis on the psychodevelopmental stage of the patient
- The support mechanisms available for children and their families at times of crisis

17. *Transportation of the Patient*

The Resident should demonstrate an awareness of the problems peculiar to the transportation of the critically ill infant or child

The Resident shall demonstrate knowledge of:

- Communication, triage and preparation prior to and during transport
- The understanding of altitude physiology for air transport
- The understanding of the unique monitoring and management problems during transport
- The special needs of infants and small children requiring transportation
- The role of paramedical personnel and the evaluation of patients requiring physician accompaniment

18. *Transplantation*

The Resident should demonstrate an awareness of the problems peculiar to transplantation.

The Resident shall demonstrate knowledge of:

- Organ donation and donor management
- Ethical and medico-legal issues of brain death
- Immunosuppression and rejection
- Infections including opportunistic and nosocomial infectious risks

19. *Research and epidemiology*

The Resident should demonstrate an awareness of the basic principles of clinical and laboratory research. The Resident should demonstrate knowledge of:

- a scientific approach to analyse and solve problems encountered
- the general and specific tests to solve a problem
- common statistical principles and tests and their usefulness
- the importance of good record keeping in research
- the ethical considerations in research involving humans and animal subjects
- the steps required to prepare a protocol involved in hypothesis and observational research
- the process of organizing a laboratory research project
- the principles of evidence based medicine techniques

The opportunity to perform clinical or animal research should be made available in each resident in the program.

20. *Legal, Moral and Ethical Issues*

The Resident should acquire a conceptual information and understanding of the importance of medico-legal issues of the critically ill and their families, as well as moral and ethical considerations associated with patients, their families and the health care team

The Resident should demonstrate knowledge of :

- The importance of effective communication with patients, their families and staff
- Ethical and Moral considerations fundamental to making decisions regarding the appropriateness of care of the critically ill patients
- The medico-legal considerations in caring for the critically ill patient
- The importance of a compassionate approach to the patient that is deteriorating and dying
- The case at risk for medico-legal intervention and the mechanisms of reducing the likelihood of litigation
- The sequence of events that must take place once one is threatened with litigation
- The identification of forensic issues

21. Environmental Hazards

The Resident should demonstrate awareness of the potential for environmental hazards within the ICU as they apply to the patients and to the staff in the ICU

22. Technical Skill Development

- Airway management (intubate, care and management of acute and chronic tracheostomies)
- Central venous access
- Mechanical ventilation using a variety of ventilators
- Setting up a ventilator circuit
- Diagnostic and therapeutic bronchoscopy, including brushing, bronchial and broncho-alveolar washing techniques
- Thoracentesis and pericardiocentesis
- Invasive and non-invasive hemodynamic monitoring
- Use of cardiac pacemakers
- Perform a 12 lead ECG / interpret ECG's
- Use of defibrillators / external pacemakers
- Knowledge and management of extracorporeal life support
- Management of external ventricular drains and intracranial pressure monitors
- Jugular venous bulb catheter insertion and monitoring of oxygen extraction across the brain
- Diagnosis of brain death
- Support of an organ donor
- Insertion of peritoneal dialysis catheter
- Management of peritoneal dialysis
- Insertion of hemodialysis catheters
- Management of all forms of renal replacement therapy
- Blind insertion of nasojejunal tubes
- Safe transport of children

- Interpretation of routine radiology; chest, abdominal and neuro CT; cardiac MRI

These skills will be taught by:

- clinical exposure during PICU clinical rotations
- attendance at academic half days / hospital based rounds
- formal process of graded responsibility
- bedside and simulation teaching of procedural skills
- learning about evidence based medicine through library facilities and academic sessions
- Defined lectures of epidemiology and principles of evidence based medicine at academic half days
- Journal clubs

These skills will be evaluated by:

- monitoring of performance at daily ward rounds
- performance of research projects
- presentation of research projects at the annual Winnipeg Resident Research Competition
- in-training evaluations and meeting of expectations
- annually partaking the SITE written examination
- twice yearly oral examinations
- quarterly review of performance by Program Director and other members of the Division of Critical Care Medicine

COMMUNICATOR:

Recognizes the need for effective communication with patients and their families

- Recognizes the need for effective communication with medical and nonmedical colleagues
- To act as a consultant and co-ordinate management involving a number of consultants
- Be able to refer problem issues or problem cases appropriately

These skills will be taught and assessed by:

- daily observation of trainee performance by clinical supervisors with regular feedback
- observation of Resident – staff interaction during rotations
- a review of the written record by the attending physicians with ongoing feedback

COLLABORATOR:

- Must be able to work effectively as part of multi-disciplinary team
- Be able to act as a leader of a multidisciplinary team
- Contribute to the education of medical, nursing and paramedical staff

These skills will be taught by:

- observation of daily practice patterns with regular feedback
- attendance at interdisciplinary rounds

These skills will be evaluated by:

- direct observation
- feedback through in-training evaluation

MANAGER:

- knows the duties of an intensive care specialist and director of the department
- understands the principles of administration and management
- understands the principles of departmental budgeting, financial management
- to learn how to utilize resources to effectively balance patient care and health care economics
- work to develop effective and efficient patient management strategies by:
 - avoiding duplication of services
 - involving other caregivers
 - appropriate use of information technology
- knows the physical requirements of intensive care unit design
- understands the factors that determine optimum staff establishment for specialist and junior medical; staff, nurses, paramedical and secretarial staff
- understands the process of selecting, ordering and maintaining equipment
- contributes to unit activities and encourages others to do so by instilling enthusiasm amongst colleagues in the work place
- recognizes impaired performance in self and in professional colleagues
- contributes to professional meetings and understands their rules, structure and etiquette
- understands the issues in organizing a scientific meeting
- understands the ethical and legal implications of intensive care practice
- creates a congenial and stimulating work environment
- to learn how to delegate responsibilities in a fair and non-threatening manner
- to be able to recognize and manage problems with junior staff in a non-threatening and constructive manner
- Understands the need and can undertake clinical audit
- Understands the different types of clinical audit in the intensive care unit
- Recognizes the need for clinical audit and quality improvement activities not to be threatening or punitive to individuals
- Encourages others to participate in clinical audit and QA activities
- Current and future trends in developments in biomedical technology, computers and instrumentation within the ICU
- The ICU role in Hospital or regional disaster planning
- The organization and audit of specialized resuscitation teams within and outside the hospitals and the role of the ICU as contributor to these teams

These skills will be taught in the following manner:

- attendance at monthly PBCU management meetings
- assignment of annual QA projects
- learning computer skills

These skills will be evaluated by:

- observation of trainees by rotation supervisors and attending physicians with feedback on a regular basis and through ITER's
- attendance at academic half days

HEALTH ADVOCATE:

- To be able to recognize the risk factors for a variety of common critical illnesses and counsel families and colleagues in ways to minimize the acquisition risk
- Develop the ethic that the patient's welfare always takes precedence in the event of medical, political or ethical conflicts
- Appreciates the difficult and stressful situations associated with the environment of pediatric critical care
- Learns to identify and minimize the stresses placed upon the patients, their relatives, and hospital staff

These skills will be taught by:

- observation of practices of attending physicians and other members of the interdisciplinary team
- site-wide series of ethical sessions organized by UBC
- annual series of ethical seminars the C&W ethics committee
- ethical case discussions at morning clinical ward rounds and academic half days
- series of clinical practical discussion seminars on the principles of medical ethics by local experts in medical ethics
- regular QA teaching program jointly organized with the adult critical care program

These skills will be evaluated by:

- provision of feedback through ITER's
- presentation of a QA project performed under the supervision of a member of the Division of Critical Care

SCHOLAR:

- Accumulates the necessary knowledge to be a competent pediatric critical care physician

- Learns how to apply basic and clinical science to patient care
- To establish a comprehensive self-directed learning and educational strategy
- To be able to impart a similar enthusiasm to their colleagues
- To develop an appreciation of the role of critical analysis in the assessment of current scientific developments
- To develop an understanding of evidence based medicine
- Participate in processes of clinical audit and quality improvement activities
- Maintains competence in pediatric critical care
- To be committed to forever pushing the boundaries of excellence in caring for critically ill children

These skills will be taught by:

- provision of appropriate teaching courses at academic half days

These skills will be evaluated and monitored by:

- monitoring of attendance at academic half days
- regular formal and informal feedback
- formal feedback through ITER's
- written examination

PROFESSIONAL:

- Develop an ethical framework for the delivery of the highest quality care
- Understand professional obligations to patients and colleagues
- Exhibit appropriate personal and interpersonal professional behaviors
- Act with integrity, honesty and compassion in the delivery of the highest quality health care

These skills will be taught by:

- lectures at academic half days
- observation of the daily practice patterns of attending physicians and other health care workers

These skills will be evaluated by:

- daily observation of trainees by attending physicians
- formal evaluations through ITER's
- annual meetings with the Program Director

