Curriculum

PDCC Pediatric Critical Care (1-year course)

Department of Pediatrics

All India Institute of Medical Sciences Kalyani

Faculty:

Associate Professor	Dr Niladri Sekhar Bhunia
Assistant Professor	Dr. Rohit Bhowmick

Infrastructure:

AIIMS Kalyani has dedicated Pediatrics department which caters good numbers of Pediatric critical care cases from all over the State and even outside. The department of Pediatrics is currently running with two bedded PICU services.

The following Pediatric ICU equipment will be used for training:

- High End Ventilators
- HHHFNC
- POC Ultrasonography
- Pediatric Spirometry
- FOT (coming)
- CRRT with RO system (coming)
- Hemodialysis (coming)
- CAPD (coming)

Entry requirements: -

- MD or DNB in Pediatrics from an Institute or Medical College recognized by National Medical Commission (NMC) or Medical Council of India (MCI).

Mode of Selection:-

- The candidates will be selected on basis of Academic Profile and Interview by the Selection Board.

Duration: - 1 year

Seats: - 2 per year

Stipend: - Under head of senior resident (out of total designated posts of senior resident for department of Pediatrics, two posts will be diverted for PDCC Pediatric Critical Care)

Tuition fees:- *As per Institutional Norms*

ASSESSMENT OF TRAINING: -

As per the institutional guidelines.

Exit Examination- at the end of the training program.

1. Introduction

Preamble

Training program for PDCC in Pediatric Critical Care Medicine aims to produce students who after undergoing complete training are competent to manage a critically sick child. The postgraduate students must gain sufficient knowledge and experience in the diagnosis, treatment and counseling of pediatric patients with acute, serious, and life- threatening medical and surgical conditions. The student should also acquire skills in supervision of paramedical staff and be able to work as a team member of the health care providers.

New Competency based training curriculum shall primarily focus on training Pediatricians with MD/equivalent qualification. The program is designed for wholesome development of the trainee which includes developing his/her scientific knowledge, clinical and research skills. The trainee is also expected to acquire optimum teaching and communication abilities. The core components of clinical services of the specialty of Pediatric Critical Care Medicine revolves around providing life-support therapies under one roof to critically sick pediatric patients (medical, surgical and trauma etc.) who are admitted in the pediatric emergency and Pediatric Intensive **Care Unit (PICU).** They should also have the expertise to coordinate care of any critically sick pediatric patient admitted in any other ward,before being transferred to PICU.

Need and situation Analysis:

The body of basic and applied knowledge encompassed by the field of critical care medicine has grown remarkable in the last two decades. The need for separation of critically ill patients from others was recognized as early as 1854. The ICUs began with the need to provide ventilation to victims of poliomyelitis epidemic in 1958. The anesthetists usually cared for these patients and continuation of this had made anesthetists responsible for ICUs in many countries. Nevertheless,

many medical specialties became involved in treating wide range of diseases making critical care medicine a multidisciplinary, multi professional endeavor. Intensive care in Pediatrics has made a significant difference to the mortality especially in conditions like sepsis with complications, pneumonia, meningitis, poisonings and several others.

Even though critical care medicine conditions are included in all medical schools, it has been shown that students (both undergraduate and postgraduate) lack the most basic critical care medicine skills and are poorly equipped to even make appropriate referral to the ICU. Training in Critical Care medicine as a part of the training programme for M.D. (Pediatrics) exist in a few medical colleges, as most of them lack basic facilities to conduct such training. The deficiencies in the training programme get further compounded by the non-availability of trained teachers.

In past decade Pediatric Critical Care has rapidly grown in India but still remains a developing branch as far as Indian scenario is concerned and there are not many places in India where satisfactory critical care is being delivered to the needy children. As an effort to promote this field of pediatric critical care in India, with primary mission to train the next generation of pediatricians, who will care for children with the most complex and critical conditions.

2. Programme Outcomes

Upon completion of the PDCC Pediatric Critical Care program, the trainee shall be able to acquire certain subject specific competencies in the acquired knowledge (cognitive), professionalism (affective domain) and skills (psychomotor domain)

I. SPECIFIC CREDENTIALS

Each trainee should achieve provider and/or instructor status in one or more of the following:

1. Advanced Cardiac Life Support
2. Advanced Trauma Life Support
3. Pediatric Advanced Life Support
4. Fundamentals of Critical Care Support

II. COGNITIVE SKILLS

Acquisition of the following cognitive skills by trainees could be ensured by the training director through the use of any of a number of techniques, including didactic lectures, journal club sessions,

and illustrative case reports.

A. Cardiovascular Physiology, Pathology, Pathophysiology, and Therapy

1. Shock (hypovolemic, neurogenic, septic, cardiogenic) and its complications
2. Cardiac rhythm and conduction Disturbances
3. Pulmonary edema—cardiogenic, noncardiogenic
4. Cardiac tamponade and other acute pericardial diseases
5. Acute and chronic life-threatening valvular disorders
6. Acute complications of cardiomyopathies and myocarditis
7. Vasoactive and inotropic therapy
8. Pulmonary hypertension and cor pulmonale
9. Principles of oxygen transport and utilization
10. Hemodynamic effects caused by ventilatory assist devices
11. Perioperative management of patient undergoing cardiovascular surgery
12. Recognition, evaluation, and management of hypertensive emergencies and urgencies
13. Congenital heart disease and the physiologic alterations with surgical repair
14. Noninvasive methods of cardiac output assessment (i.e., aortic Doppler, indicator dilution techniques, etc.)

B. Respiratory Physiology, Pathology, Pathophysiology, and Therapy

1. Acute respiratory failure
    a. Hypoxemic respiratory failure including acute respiratory distress syndrome
    b. Hypercapnic respiratory failure
    c. Acute on chronic respiratory failure
2. Status asthmaticus
3. Aspiration
4. Chest trauma (e.g., flail chest, pulmonary contusion, rib fractures)
5. Bronchopulmonary infections including bronchiolitis
6. Upper airway obstruction
7. Near drowning
8. Pulmonary mechanics and gas exchange
9. Oxygen therapy
10. Mechanical ventilation

a. Pressure and volume modes of mechanical ventilators
b. Positive end-expiratory pressure, intermittent mandatory ventilation, continuous positive airway pressure, high frequency ventilation, inverse ratio ventilation, pressure support ventilation, volume support (airway pressure release
c. ventilation, pressure regulated volume control ventilation), negative pressure ventilation, differential lung ventilation, pressure control and noninvasive ventilation, spilt lung ventilation, one lung ventilation
d. Indications for and hazards of mechanical ventilation
e. Barotrauma and volutrauma
f. Criteria for extubation and weaning techniques
g. Permissive hypercapnia
h. Pulmonary surfactant therapy
i. High-frequency oscillatory ventilation

11. Airway maintenance
    a. Emergency airway management
    b. Endotracheal intubation
    c. Tracheostomy, open and percutaneous
    d. Long-term intubation vs. tracheostomy
12. Ventilatory muscle physiology, pathophysiology, and therapy, including polyneuropathy of the critically ill and prolonged effect of neuromuscular blockers
13. Pleural diseases
    a. Empyema
    b. Pleural effusion
    c. Pneumothorax
    d. Hemothorax
14. Pulmonary chylothorax, hemorrhage, and hemoptysis
15. Nitric oxide and prostaglandin therapies
16. Noninvasive ventilation
17. Positional therapy (i.e., prone position, rotational therapy)

C. Renal Physiology, Pathology, Pathophysiology, and Therapy

1. Renal regulation of fluid balance and electrolytes
2. Renal failure: Prerenal, renal, and postrenal
3. Derangements secondary to alterations in osmolality and electrolytes
4. Acid-base disorders and their management

5. Principles of renal replacement therapy and associated methodologies (hemodialysis, peritoneal dialysis,
6. ultrafiltration, continuous arteriovenous hemofiltration, and continuous veno-venous hemofiltration)
7. Interpretation of urine electrolytes
8. Evaluation of oliguria
9. Drug dosing in renal failure
10. Rhabdomyolysis
11. Systemic diseases that involve the kidney (hemolytic uremic syndrome)

D. Central Nervous System Physiology, Pathology, Pathophysiology, and Therapy

1. Coma
    a. Metabolic
    b. Traumatic
    c. Infectious
    d. Mass lesions
    e. Vascular-anoxic or ischemic
    f. Drug induced
    g. Assessment and prognosis
2. Hydrocephalus and shunt function and dysfunction
3. Psychiatric emergencies
4. Perioperative management of patient undergoing neurologic surgery
5. Brain death evaluation and certification
6. Diagnosis and management of persistent vegetative states
7. Management of increased intracranial pressure, including intracranial pressure monitors
8. Status epilepticus
9. Neuromuscular disease causing respiratory failure
    a. Guillain-Barré
    b. Myasthenia gravis
    c. Myopathies (Duchenne’s, etc.)
    d. Neuropathy of critical illness
10. Traumatic and nontraumatic intracranial bleed
    a. Subarachnoid
    b. Intracerebral
    c. Epidural

d. Others (subdurals)
e. Traumatic brain injury
f. Axonal shear injury

11. Conscious and deep sedation
12. Pain management: Intravenous, oral, transdermal, and regional and axial
13. Neuromuscular blockade: Use, monitoring, and complications

E. Metabolic and Endocrine Effects of Critical Illness

1. Colloid osmotic pressure
2. Nutritional support
   a. Enteral and parenteral
   b. Evaluation of nutritional needs including indirect calorimetry
   c. Immunonutrition and specialty formulas
3. Endocrine
   a. Adrenal crisis and insufficiency (primary and secondary)
   b. Disorders of antidiuretic hormone metabolism
   c. Diabetes mellitus
      i. Ketotic and nonketotic hyperosmolar coma
      ii. Hypoglycemia
   d. Pheochromocytoma
   e. Insulinoma
   f. Disorders of calcium, magnesium, and phosphate balance
   g. Inborn errors of metabolism
4. Electrolyte disorders including Na, K, Mg, Ca, PO4.
5. Glucose management

F. Infectious Disease Physiology, Pathology, Pathophysiology, and Therapy

1. Antibiotics
   a. Antibacterial agents including aminoglycosides, penicillins, cephalosporins, quinolones, and newer emerging classes of antibiotics
   b. Antifungal agents
   c. Ant tuberculosis agents
   d. Antiviral agents
   e. Agents for parasitic infections
2. Infection control for special care units
   a. Development of antibiotic resistance

   b. Universal precautions
   c. Isolation and reverse isolation
3. Anaerobic infections
4. Sepsis definitions (sepsis, severe sepsis, septic shock)
5. Systemic inflammatory response syndrome
6. Tetanus
7. Hospital-acquired and opportunistic infections in the critically ill
8. Adverse reactions to antimicrobial agents
9. ICU support of the immunosuppressed patient
   a. Acquired immunodeficiency syndrome
   b. Transplant
   c. Oncologic
10. Infectious risks to healthcare workers
11. Evaluation of fever in the ICU patient
12. Biological modifiers (activated protein C, tissue factor, etc.)
13. Mechanisms of antibiotic resistance

G. Physiology, Pathology, Pathophysiology, and Therapy of Acute Hematologic and Oncologic Disorders

1. Acute defects in hemostasis
   a. Thrombocytopenia/thrombocytopathy
   b. Disseminated intravascular coagulation
2. Anticoagulation; fibrinolytic therapy
3. Principles of blood component therapy
   a. Packed red blood cell transfusions
   b. Fresh frozen plasma transfusions
   c. Platelet transfusions
   d. Cryoprecipitate transfusions
   e. Specific coagulation factor concentrates
   f. Albumin, plasma protein fraction
   g. Pharmacologic agents that modify the need for transfusion (i.e., aminocaproic acid, aprotinin)
   h. Erythropoietin
4. Acute hemolytic disorders including thrombotic microangiopathies
5. Acute syndromes associated with neoplastic disease and antineoplastic therapy

6. Sickle cell crisis and acute chest syndrome
7. Plasmapheresis
8. ICU-acquired anemia

H. Physiology, Pathology, Pathophysiology, and Therapy of Acute Gastrointestinal, Genitourinary Disorders

1. Upper gastrointestinal bleeding, including variceal bleeding
2. Lower gastrointestinal bleeding
3. Acute and fulminant hepatic failure
4. Acute perforations of the gastrointestinal tract
5. Perioperative management of surgical patients
6. Stress ulcer prophylaxis
7. Drug dosing in hepatic failure
8. Postoperative complications including fistulas, wound infection, and evisceration

I. Environmental Hazards

1. Drug overdose and withdrawal
    a. Barbiturates
    b. Narcotics
    c. Salicylates
    d. Alcohols
    e. Cocaine
    f. Tricyclic antidepressants
    g. Acetaminophen
    h. Others
2. Temperature-Related Injuries
    a. Hyperthermia, heat shock
    b. Hypothermia, frostbite
3. Envenomation
    a. Snake envenomation
    b. Scorpion sting
4. Altitude sickness
5. Decompression sickness
6. Skin and wound care
7. Biological and chemical terrorism
8. Radiation exposure

J. Immunology and Transplantation

1. Principles of transplantation (organ donation, procurement, preservation, transportation, allocation, implantation,
2. maintenance of organ donors, national organization of transplantation activities)
3. Immunosuppression
4. Organ transplantation: Indications preoperative and postoperative care
5. Transplant-related infectious disease

L. Monitoring, Bioengineering, Biostatistics

1. Prognostic indexes, severity, and therapeutic intervention scores
2. Principles of electrocardiographic monitoring, measurement of skin temperature and resistance, transcutaneous measurements
3. Invasive hemodynamic monitoring
    a. Principles of strain gauge transducers
    b. Signal conditioners, calibration, gain, adjustment
    c. Display techniques
    d. Principles of arterial, central venous, and pulmonary artery pressure catheterization and monitoring
    e. Assessment of cardiac function and derived hemodynamic variables
4. Noninvasive hemodynamic monitoring
5. Electrical safety
6. Thermoregulation
7. Central nervous system brain monitoring (intracranial pressure, cerebral blood flow, cerebral metabolic rate, electroencephalogram, jugular venous bulb oxygenation, transcranial Doppler)
8. Respiratory monitoring (airway pressure, intrathoracic pressure, tidal volume, pulse oximetry, dead space/tidal volume ratio, compliance, resistance, capnography, pneumotachography)
9. Metabolic monitoring (oxygen consumption, carbon dioxide production, respiratory quotient, indirect calorimetry)
10. Use of computers in critical care units

M. Ethics

1. Consent
2. Study enrollment
3. End-of-life decision making and care

4. Organ procurement
5. Outcome and futility
6. Quality of end of life

N. Administration

1. Team building
2. Contracting care
3. Patient triage
4. Physician, nurse, and ancillary staff staffing models
5. Documentation compliance and billing
6. Patient safety

O. Genetic

1. Congenital disease (trisomy, etc.)
2. Storage diseases
3. Polymorphisms

P. Pharmacology

1. Pharmacokinetics
2. Pharmacodynamics
3. Safe medication practice
4. Drug dosing adjustments in hepatic disease
5. Drug dosing adjustments in renal disease

III. CORE PROCEDURAL SKILLS FOR RESIDENTS

In addition to practical training in the following procedural skills, the resident must have an understanding of the indications, contraindications, complications, and pitfalls of these interventions.

A. Airway Management

1. Maintenance of an open airway in the nonintubated patient
2. Ventilation by bag-mask
3. Tracheal intubation
4. Management of pneumothorax

B. Circulation

1. Arterial puncture and cannulation
2. Insertion of central venous catheters
3. Pericardiocentesis in acute tamponade
4. Dynamic electrocardiogram interpretation

5. Cardioversion and defibrillation
6. Electrocardiographic monitoring

C. Additional Procedures

1. Thoracentesis
2. Paracentesis
3. Bronchoscopy

9 ACADEMIC ACTIVITY:

Academic Activity	Frequency
Journal Club	1 hour duration - Paper presentation/discussion -once in 2 weeks.
Seminar	One seminar every week of one hour duration
Lecture/discussion	Lectures on newer topics in place of seminaras per need.
Case presentation	In the ICU daily. Post graduate students will present a clinical case for discussion before a faculty and discussion made pertaining to its management and decision to be recorded in case files
Clinical Meet (Departmental)	Once in 2 weeks
Combined Round/Grand Round	➢ A clinical grand round, involving presentation of unusual and difficult cases will be done by a post graduate student, once a week, in the presence of all the clinical staff belonging to PICU and pediatrics. The exercise is to develop the clinical acumen of the trainee

Joint inter-departmental academic meets with pediatric surgery, nephrology, radiology, etc.	Once a month
Audit presentation(Sepsis data, Critical Incident data)	Once a month
Mortality Meet	Once a month
Institutional level CME	As per the institute's schedule
Research Project Progress Report	Once in 6 months

Note:

A. Bedside clinical training for patient care management. Daily for half to one hour during ward round with faculty and 1-2 hours in the evening by post graduate students /faculty on emergency duty, bed side patient care discussions are to be made.

B. Trainee shall be required to participate in the teaching and training program of undergraduate students and interns.

ADMINISTRATION:-

Research and audit:-

The fellow will have to:

- Undertake a project and have at least one publication.
- Present at one regional and one national conference.
- Participate in the daily teaching sessions within the department, and make regular presentations.
- Take part in Inter-departmental meetings relevant to the area posted.

To sum up:

The goal of the PDCC in Pediatric Critical Care training is to familiarize the trainee with

A) Identifying and management of sick cases and plan treatment as per standard protocols.

B) Diagnosis and work up of all patients admitted to PICU

C) Assist and perform interventions when needed.

D) The Fellow is expected to complete a project by 6 months and at least one publication during the training.

RECOMMENDED BOOKS

1. Rogers textbook of Pediatric Intensive Care – Fifth edition
2. Pediatric Critical care - Bradley P. Fuhrman, Jerry J. Zimmerman – Fourth edition
3. Pediatric critical care medicine. Basic science and clinical evidence –Derek.S.Wheeler, Hector.R.Wong, Thomas P Shanley
4. Respiratory Physiology: The essential – John B West
5. Pulmonary Pathophysiology: The essentials-– John B West
6. Clinical Blood gases: Assessment and management – William Murray
7. Drug Doses- Frank Shann
8. PICU Hand Book- Frank Shann
9. Applied Cardiovascular Physiology – Michael Pinsky