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Handbook of Pediatric & Neonatal Emergencies



S Sushamabai

Foreword
MKC Nair

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Chapter 1

Setting Up of Pediatric Intensive Care Unit

Seany T Varghese, S Sushamabai

ABSTRACT

Pediatric intensive care unit (PICU) should be separate from adult and newborn ICU. The bed number should depend upon the patient load and specialties to be cared providing 150–200 sq. ft. for each bed, should have separate isolation room, adequate equipment, electrical facilities, telephone services, and a well-placed central station to observe all patients. The staff pattern should comprise at least one intensivist, adequate number of pediatricians experienced in critical care management and mechanical ventilation round the clock, and enough residents to carry out the orders in time; experienced nurses in 1:1 ratio for unstable/ventilated patients, enough ancillary staff always available; well-equipped laboratory and radiology service close to the unit, good waste disposal system and periodic evaluation by the infection surveillance unit. Adequate equipment, periodically updated medicines and resuscitation equipment and drugs should be properly arranged. Proper register maintenance and reporting should be done by the MO in-charge.

UNIT DESIGN

Pediatric intensive care unit should be separate from neonatal and adult units dedicated solely to infants and children. Six to eight beds are ideal; should be more if the unit cares specialized surgery and trauma victims. Should be designed for future adaptability and be located near the lift, emergency department and operation theater.

Room Layout and Bed Area

- Room layout should allow actual visualization of all patients from central station.
- Patient area in open PICU should be 150–200 sq. ft.
- In a cubicle, the minimum area should be 200 sq. ft. with one wash basin.

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- At least one room should have an isolation capability with an anteroom (separate area of 20 sq. ft. for handwashing, wearing mask and gown) and separate ventilation.
- The area around each bed should have enough space for performing procedures and bedside investigations.
- Easy access to head end of the patient for airway management is a must for all beds.
- Wall and ceilings should have sound absorption capability.
- Wall oxygen outlets (two), air outlet (one), suction outlets (two), and electrical outlets (10) for various equipment per bed are recommended.
- Windows should be provided in rooms to prevent the sense of isolation.
- Adequate lighting, child-friendly wall papering or painting with soothing colors and curtains are desirable.

Power Supply and Temperature Control

- Central air conditioning and central heating are preferable.
- Overhead warmers are a must if no central heating system.
- Uninterrupted power supply by backup power sources should be available.

ICU Beds

- Beds should have facility to elevate head and foot ends.
- Air/water mattresses (at least two) to prevent bedsores, should be available.
- All beds must have railing to prevent accidental fall.
- Emergency alarm button to activate code system (3) for each bed should be provided.
- There should be a cart at each bedside to keep personal belongings.

Crash Cart or Resuscitation Trolley

Resuscitation trolley should be equipped with emergency drugs and portable monitor or defibrillator; should have zones for medication preparation and cabinets for storage of medicines/materials.

Entry Doors

- Entry doors should be two in number—one for patients and another exclusively for the staff, which should be sufficiently away from the first door.
- The patient's door should be monitored by security staff.

Central Station

- Central station should have visibility to all patient areas.
- It should have ample space for necessary staff functions.

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- It should be convenient enough to arrange the patients' records.
- It should provide adequate space for computer, printer, and file works for doctors and nurses.
- Three telephone lines are preferable (one dedicated to incoming calls and two for outgoing communications).
- X-ray viewer (with capacity to view several films at a time) can be placed at the central station or at a distinctive area.

Storage

- Refrigerator and essential drugs and items should be inside the PICU.
- Large patient care equipment and standby items should have a separate storeroom near the PICU; adequate area is needed for stretchers and wheelchairs.

Clean and Dirty Utility Rooms

- Clean utility room for storage of clean linen should be available.
- There must be separate dirty utility room for soiled linen and waste materials along with a separate sink.
- Provision for emptying and cleaning bedpans and urine bottles is necessary.

Waste Disposal

Waste disposal should be as per pollution control guidelines.

Communication Area

Communication area should be close to the PICU with adequate privacy.

LABORATORY SERVICES

Should have 24-hour availability with a reporting time of less than 1 hour; central along with side laboratory services are ideal.

OTHER FACILITIES

- Every PICU should have a well-prepared and updated PICU protocol for doctors and nurses.
- Doctor's duty room should be close to the PICU with intercom facility.
- PICU staff duty room with locker cabinets near the unit should be provided.
- Family waiting area for two persons (with bathroom and toilet facilities) is a must near the PICU.

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EQUIPMENT (BOX 1.1)

- Equipment box should be selected on cost–benefit analysis but should be user-friendly.
- It should have proven use on pediatric patients and should be adapted for children.
- It should have warranty and biomedical service support (of the company and hospital).

Box 1.1: Essential pediatric intensive care unit equipment.

- Diagnostic equipment:
  - Otoscope, ophthalmoscope, glucometer
  - ECG, portable X-ray machine, EEG, blood gas analyzer
  - Portable ultrasound and ECHO facilities.
- Monitoring equipment:
  - Oral and rectal thermometers
  - Noninvasive multiparameter monitors
  - Pulse oximeter
  - Transducers
  - Central venous pressure monitors
- Procedural equipment:
  - Emergency cart
  - Butterfly needles (19–24 gauges)
  - Micro infusion pumps
  - Intravenous cannula (14–24 gauges)
  - Portable suction
  - Suction catheters (size 5–14 F)
  - Ambu bags—neonatal (250 mL), pediatric (450 mL), adult (1000 mL)
  - Oxygen masks—rebreather and non-rebreather (neonatal, pediatric, adult)
  - Laryngoscope handles (pediatric, adult) with extra batteries
  - Laryngoscope blades (straight 0–4; curved 2–3)
  - Endotracheal tubes uncuffed (2.5–5.5), cuffed (6.0–8.0)
  - Stylets (pediatric, adult)
  - Laryngeal mask airway
  - Oxygen delivery devices (nasal prongs, hood)
  - Nasogastric tubes (6–14 F)
  - Indwelling catheters
  - Portable oxygen cylinders
  - Blankets
  - Overhead warmer/spotlight
  - Nebulizer
  - Oral airways (size 00–5)
  - Nasal airways (size 12–30 F)
  - Magill forceps (pediatric, adult)
  - Intraosseous needles (16–18 gauges)
  - Procedure light (portable)
  - Ventilators (volume/pressure/PEEP support, low tidal volume capacity of 30–50 mL with nebulizer, humidifier and alarms)
  - Noninvasive ventilator

Contd...

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Contd...

- T piece
- Tongue depressors
- Defibrillator/cardioverter
- Multilumen central catheters (4.5, 5.5, 7 F) 8 cm, 16 cm
- Sterile trays for instrument set
- Sets for cut down, lumbar puncture, thoracocentesis, bone marrow aspiration, chest tubes, and suture removal

• Miscellaneous:
- Weighing machines
- Bedside table
- Overbed table
- Intravenous pole
- Bedside chair
- Procedure stool
- Torchlight with extra batteries
- Breast pump
- Phototherapy unit
- Arm boards
- Adhesive tapes
- Cardiac arrest board/backboard
- Splints
- Sterile dressings
- Stiff neck collars (small, large)
- Television
- Toys
- Clocks

ORGANIZATION AND STAFFING

Doctor-in-charge

- Doctor-in-charge should be a pediatrician—trained and experienced in pediatric critical care and should implement the smooth functioning of PICU with appropriate policies and protocols in consultation with the senior faculty.
- Should maintain the PICU statistics.
- Should be the nodal person for equipment needs (Box 1.1), their updating and maintenance and should observe uninterrupted supply of PICU drugs.
- Should observe quality assurance and improvement in patient care.
- Be a member of the hospital infection control committee.
- Be prompt and responsible in reporting disease outbreaks.
- Must establish teaching and training for medical, nursing, and other staff.

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Medical Staff

- Round the clock postgraduate pediatrician, good in airway skills, and having Pediatric Advanced Life Support (PALS) certification should be available.
- Residents/trainees enough in number should be available on 12-hourly rotation.

Nursing Staff

Nursing staff should be experienced in pediatric intensive care; nurse–patient ratio should be 2:1 for unstable patients; need to be 1:3 for relatively stable and unventilated patients.

Ancillary Staff

Services should be available from physiotherapist, dietician, respiratory technician, laboratory technician, radiographer, biomedical engineer, clerical staff, and social worker.

LEVELS OF PICU CARE

Level 3 Care

It has defined admission and discharge policies by a pediatric intensivist heading the unit and should have 1:1 nurse patient ratio for ventilated patients.

Level 2 Care

It is for patients requiring oxygen, nebulization, trauma monitoring, parenteral fluid therapy, and monitoring and those on follow-up care from level 3.

CONCLUSION

Pediatric intensive care unit should be well-designed with adequate and updated equipment and proper trained staff pattern.

FURTHER READING

1. Khilnani P. Indian Society of Critical Care Medicine (Pediatric Section), Indian Academy of Pediatrics (Intensive Care Chapter). Consensus guidelines for pediatric intensive care units in India. Indian Pediatr. 2002;39:43-50.

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Chapter 2

Daily Routine in PICU

Seany T Varghese, S Sushamabai

ABSTRACT

Daily work in pediatric intensive care unit (PICU) if systematically carried out by all doctors and nurses, will improve the patient care and reduce the working time and medicolegal problems. Precautions for infection control, a positive preparedness to receive sick patients at any time, assessing the PICU team of the day, the status of equipment and drugs and proceeding to corrective steps in time, prioritizing the sick patients as per severity, and replacing the documents at proper places are the important points to be observed. A brief discussion of the patient's status and management should be done among the unit members (avoiding controversial points in front of caretakers). Reevaluation of the patient should not be postponed.

INTRODUCTION

Observing certain points methodically in our daily routine will be beneficial to all categories of doctors and nurses; will improve the patient care better and make it easier, and will help the one tide over medicolegal problems.

Points to Consider

- Give priority to the PICU patients for the day's work.
- Have a confident mind and determination for overcoming the problems encountered on the day, whatever be the nature.
- Be clean and modest in your attire.
- Observe precautions for infection control—change your footwear, practice proper handwashing (at least alcohol disinfection) before and after handling each patient, use sterile mask, gown, and gloves when handling highly infective patients.
- Be prepared for receiving critically ill patients at any time.
- Assess the PICU team of the day—ample in number and experienced; if not, make the appropriate arrangements.

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- Evaluate the lifesaving equipment and medicines; consider urgent step for repair or replacement if at fault.
- Prioritize the patients as per disease severity, sick and unstable first and recovering patients subsequently.
- Devote ample time for each patient—do not appear to be hasty, but should not be too lengthy also.
- Decisions regarding treatment, investigations, and consultations should be taken after a brief discussion among the unit members; be careful not to discuss controversial points in front of the caretakers.
- The working diagnosis and management plan should be informed clearly to the caretakers.
- Patient's records and PICU documents should be replaced in proper places.
- Discussion of the illness of older age group children should be avoided in their presence.
- Do not postpone a reevaluation of the patient, if needed.
- Teaching, discussion, literature search, and research activities should go in pace with patient care for quality improvement.

CONCLUSION

Daily work in PICU if carried out systematically will improve patient care and time management.

FURTHER READING

1. Khilnani P. PICU – A working rounds and documentation – IAP PICU Protocols, PEDICON 2011, Jaipur.

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Chapter 3

PICU Rounds and Documentation

Seany T Varghese, S Sushamabai

ABSTRACT

Routine rounds and documentation in pediatric intensive care unit (PICU) should be at least twice daily or more in critically ill patients. The resident is to present the information first which has to be verified by the senior. The format includes verification of the points in history, assessing the vitals, systemic examination by prioritization. Fluid status of the body and investigation reports need to be evaluated and orders be changed accordingly. Inform the family members regarding the condition, taking care to avoid unpleasant facts in front of older children. Order sheet and progress sheet should reveal the name, age, hospital number and time of writing on each page and in-between. Procedure notes should reveal the date, time, name of the procedure and the result obtained, medicines given, consent obtained, name of the performer and the senior consultant available. A failed procedure should be documented as such. Transfer and discharge notes should reveal the date and time, patient's details and further advice. Each documentation has to be signed with the name of the doctor along with date and time.

INTRODUCTION

Working rounds and documentation reflect the quality of care in a PICU and progress of the disease after admission.

- Assess each patient completely at least twice a day and more often if unstable.
- Master a uniform system of condensing the clinical notes; this will aid in better patient assessment, plan of action, and communication between different teams (doctors and nurses) inside the PICU.

Note: Information should be presented by the resident first.

- Get the detailed history, compiling the points obtained from the caretaker, reference letters, and others.
- Verify the patient's chart to assess the progress of the disease.
- Abridge the relevant points.

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SYSTEMATIC APPROACH FOR EXAMINATION

- Appearance of the child—critical/improved?
- Verify the vital signs and note the abnormalities.
- Prioritize the systems to be evaluated; and proceed.
- Respiratory: Oxygen saturation, lung examination, arterial blood gas (ABG), chest skiagram, and ventilator settings.
- Cardiovascular: Capillary refill time, peripheral pulse volume, warmth of the extremities, IV line sites for infection, mean arterial pressure/systolic blood pressure (MAP/SBP), central venous pressure, cardiomegaly, heart sounds, murmurs, and vasopressors in use.
- *F*luids, *E*lectrolytes, *N*utrition (*FEN*): Intake (oral + parenteral including the quantity infused with medicines), output (urine as mL/kg/hr especially in last hours, stools, vomitus, aspirates), electrolyte changes, nutrition (calories, proteins, vitamins), and renal indices.
- Nervous system: Consciousness level (AVPU/GCS/FOUR score), pupils, seizures—controlled?Anticonvulsants—appropriate?
- Neurologic deficits and reflexes.
- CT/MRI, electroencephalography reports, cerebrospinal fluid studies.
- Gastrointestinal tract and abdomen: Oral ulcers, thrush, abdominal distension (girth) tenderness, mass, bowel sounds, perineum (edema, hernia, skin changes), and perianal excoriation or ulcers.
- Infectious diseases: Body temperature, status of the initial septic focus, hospital-acquired illness, white blood counts, culture reports, day of antibiotics, and review for antibiotic change as per sensitivity.
- Hematology: Anemia, bleeding from puncture sites, skin or mucosal bleeds, platelet count, and coagulation status.
- Limbs: Perfusion, color, swellings, tenderness or compartmental syndrome, and pulsations of the arteries.
- Invasive lines, catheters: Consider the need for central lines, Foley's catheter or peripheral lines.
- Hepatic: Fetor hepaticus, flapping tremor, palmar erythema, liver span (increasing /rapidly decreasing).
- Laboratory results: Review all.
- Prescription charts: Review drugs and dosages, assess nurse's chart for proper timing of drug administration.
- Plan or alter the therapy based on these assessments.
- Discuss clearly the plan among the unit members.
- Specialist's opinion if needed should be obtained.
- Communicate to the family members clearly about the probable diagnosis, treatment adopted, expected course of the illness, and probable outcome.

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DOCUMENTATION

Writing good notes is an art; complete and accurate documentation ensures continuity of care and will be a defense to the doctor in an hour of crisis.

POINTS TO REMEMBER

- Be truthful, never add to or delete an old controversial chart or note.
- Make a new corrected entry for deleted orders.
- Document what you tell to the family.

GENERAL GUIDELINES

- Note heading, date, and time.
- Be legible, no erasers—strike through mistakes and rewrite.
- Sign and write name with designation—for multipage notes sign, rewrite date and time.
- Following documentations should be clear and concise:
  - Admission notes
  - Progress report
  - Prescription
  - Procedure details
  - Transfer notes
  - Discharge summaries.

ADMISSION NOTES

- Be concise, clear, and complete; diagrammatic representation is better.
- For documenting physical examination, diagrams are better explanatory.
- Evaluate the investigations ordered and the results.
- Proceed to assessment; write diagnosis if sure only; otherwise, consider possible differential diagnosis.
- Plan the investigations and time of starting medicines.

PROGRESS NOTES

- Title, date, and time.
- Follow the SOAP format (**S**ubjective—what the patient says, **O**bjective—examination findings, **A**ssessment, **P**lan); vital signs are mandatory.
- Signature, name, and designation.

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PRESCRIPTIONS

- Each sheet should reveal patient's name, age, hospital number, provisional diagnosis, and weight of the child.
- Enter the date and time.
- Write the orders legibly.
- Drug strength should be in standard units (as mg/g, not as mL/tab).
- Dosing intervals should be in hours (q 8 hr or q 12 hr).
- To correct an order, strike through and rewrite.
- To discontinue (DC) an order, write a dated and timed DC order.
- Verbal or phone orders have to be signed within 24 hours.
- Discuss with the nurse the orders which are written not during routine rounds time.

A time tested prescription writing in priority order is shown below:

- *Monitoring*: T, P, R, BP, I/O chart, daily weight, etc. according to the provisional diagnosis.
- *Lifesaving medicines* as oxygen, nebulization, etc.
- *Specific drug* for specific etiology, e.g. antibiotics.
- *Supportive therapy* like intravenous fluids.
- *Symptomatic therapy* like paracetamol, saline nasal drops, etc. which provide subjective well-being, but will not alter the outcome of the illness.

PROCEDURE NOTES

Procedure notes always should be written with date and time:

- Name of the procedure, indications, whether written consent obtained, site, date and time, duration, sedation, analgesia given, actual procedure including equipment used, condition after the procedure, performer, and senior expert present.
- If unsuccessful, it has to be noted.

TRANSFER NOTES

Transfer can be made from PICU to ward or to another hospital as follows:

- Transfer to ward—enter the progress notes, rewrite orders, indicate pending laboratory reports, and inform the parents regarding ward shift.
- When transferred to another hospital, document the reason for transfer in the hospital record. Brief summary revealing the diagnosis, investigation reports, medicines given, course in the hospital, reason for transfer and the mode of transport, and condition at the time of transfer—all should be documented in the reference letter.

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Handbook of Pediatric & Neonatal Emergencies

Salient Features

- The book provides a perspective of pediatric and neonatal emergencies based on latest evidence-based guidelines for the residents and postgraduates in pediatrics, practicing pediatricians, general practitioners, and the faculty in pediatrics
- It will be extremely useful to the nurses working in emergency care areas as a bedside reckoner for pediatric care
- Almost all pediatric emergencies encountered in Asian countries are included
- Salient points for clinical diagnosis and to exclude the differential diagnosis are projected
- Illustrative diagrams, tables, algorithms, and flowcharts are provided for more clarity
- Brief pathophysiology is explained wherever needed
- Chapters are presented as point projected format that is easy to read and follow
- The initial chapters highlight directions on setting up of a pediatric intensive care unit and its functioning, which will be helpful for those intending to start such units
- Appropriate preparation and administration of emergency medicines are included in concerned chapters; a drug formulary is added as the end chapter
- The book is handy, attractive, and easy-to-read; abstract is added to most of the chapters.

S Sushamabai MD DCH FIMSA FIAP is currently working as Professor and Head of Pediatrics, Pushpagiri Medical College, Pushpagiri Institute of Medical Sciences and Research Center, Thiruvalla, Kerala, India. She has served as Professor and Head of Pediatrics, Government Medical College, Kottayam, Kerala earlier. She had completed her MBBS and MD (Pediatrics) from the prestigious Government Medical College, Thiruvananthapuram, Kerala. She has been serving as Faculty in Pediatrics from 1972 onwards, and had served in Government Medical Colleges of Thiruvananthapuram, Kottayam, Kozhikode and Pushpagiri Medical College, Thiruvalla, Kerala in different cadres. As an astute clinician and an elegant academician, she was internal and external examiner in MBBS, DCH, and MD (Pediatrics) in all Universities of Kerala and several Universities in South India.

She has presented many scientific lectures at State, National, and International conferences; and has more than 150 research papers to her credit in State, National, and International journals. She has contributed several chapters for many books and authored the textbook "Clinical Evaluation of Newborns, Infants and Children" published by Jaypee Brothers Medical Publishers (P) Ltd and approved by the Kerala University of Health Sciences (KUHS) for undergraduate and postgraduate studies in Pediatrics is an eye opener in pediatric clinical skill acquisition for all students of Medicine.

She is an active participant of various organizations in medical fraternity, having life membership of IMA, IAP, IMA-AMS, and many subspecialties of IAP. She was Kerala State IAP President in 2003 and Kerala State NNF President in 2005; was the Member of the Faculty of Medicine, MG University and Member of the MBBS Curriculum Committee, Kerala University of Health Sciences.

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