CONTENTS

TOPIC OF INTEREST - “CRITICAL CARE - I”

Hemodynamic monitoring in Pediatric Intensive Care 5
- Anil Sachdev, Preeti Anand

Septic shock 16
- Indumathy Santhanam

Intracranial hypertension: Pathophysiology and approach to therapy 23
- Ranjit S

Disease specific mechanical ventilation in pediatrics 33
- Praveen Khilnani, Bhaskar Saikia

Pain and sedation in the PICU 43
- Soonu Udani

DKA - Changing thoughts 49
- Poovazhagi V

Acute liver failure in children 54
- Sharat Varma, Rakesh Lodha

Polytrauma 60
- Anitha VP

Perioperative care in PICU 66
- Santhosh Soans, Samith Alva S, Aswathy R

GENERAL ARTICLE

Antibiotic therapy - Right choice right result 72
- Kinjawadekar US
HEMODYNAMIC MONITORING IN PEDIATRIC INTENSIVE CARE

* Anil Sachdev  
** Preeti Anand

Abstract: Invasive hemodynamic monitoring is an essential monitoring system required to save critically ill children. Different methods are available to assess the cardiac function, state of the peripheral vasculature and tissue perfusion. Few methods are very simple and cheap like hourly urine output while others including pulmonary wedge pressure and continuous mixed venous saturation monitoring involve costly equipments and are highly technical and require skilled expertise. The critical care provider should thoroughly know the advantages and disadvantages of different available methods and their clinical utility.

Keywords: Hemodynamic monitoring, Pediatric intensive care, Invasive monitoring, Invasive pressure, Invasive pressure wave forms.

Points to Remember

• Upstream and downstream monitoring tools reflect the different physiological aspects of cardiovascular system.

• The intensivist should remember the usefulness and pitfalls of all available hemodynamic monitoring tools.

• The different invasive pressure waveforms help in understanding the physiological state of the cardiovascular system.

• The critical care provider should not depend on a single parameter but take all the available hemodynamic variables into consideration and plan intervention.

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* Director, Pediatric Emergency, Critical Care and Pulmonology, Senior Consultant Pediatrician, Intensivist and Pulmonologist.

** Fellow, Pediatric Critical Care Institute of Child Health, Sir Ganga Ram Hospital, Rajinder Nagar, New Delhi.


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SEPTIC SHOCK

* Indumathy Santhanam

Abstract: The first protocol for septic shock published in 2002 by the American College of Critical Care medicine advised pushing up to 60 mL/kg in the initial minutes of resuscitation of shock due to sepsis. Faced with level I evidence that demonstrated increased risk of pulmonary edema in India and increased mortality in Africa these guidelines were modified. “The Surviving Sepsis Campaign guidelines-2012” now states that these recommendations are “appropriate only in resource rich regions with universal access to mechanically ventilated ICU beds”. This review discusses the protocol used for early recognition of septic shock in the out-patient department and a step wise management of shock using clinical therapeutic goals in setting with limited access to mechanical ventilation and invasive monitoring.

Keywords: Septic shock, Pulmonary edema, Acute lung injury, CPAP triggers.

Points to Remember

- The protocol for septic shock can only provide a broad guideline where treatment needs to be individualized for the patient at hand.
- Recognize septic shock by looking for evidence of decreased mental status and peripheral perfusion in any ill looking child with fever.
- Altered level of consciousness in a febrile child could be due to septic shock. Correction of the hypoxia and shock often improves mental status in the ED.
- Resuscitation should be continued till all therapeutic goals of shock and pulmonary edema are resolved.

References


INTRACRANIAL HYPERTENSION:
PATHOPHYSIOLOGY AND APPROACH
TO THERAPY

* Suchitra Ranjit

Abstract: Intracranial hypertension is a medical emergency requiring prompt recognition and management. Etiology, pathophysiology, initial stabilization, specific management, monitoring and escalated therapy for refractory cases are discussed here. When treating ICP, clinicians should ensure an adequate cerebral perfusion pressure by maintaining a high normal mean arterial pressure for age. Cushing’s triad is a late sign of intracranial hypertension. Systematic evaluation of underlying and associated problems is essential. Decision to do lumbar puncture (LP) in a comatose child is dictated by balancing the potential benefits of LP for early diagnosis of infection against the risks of herniation. Therefore if LP is decided, it must be performed with utmost care. One should remember the fact that absence of papilledema or normal CT scan in the acute phase, do not rule out raised ICP.

Keywords: Intra Cranial Pressure, Pathophysiology Approach.

Points to Remember

- Patients presenting with altered mental status and potential raised ICP have many challenging issues.
- A systematic approach to stabilization and diagnosis may be rewarding in a large proportion.
- The family needs to be counseled with honesty and sensitivity, explaining that survival and long term prognosis may be difficult to state with certainty, especially in the initial stages of illness.

References


* Chief Pediatric Intensivist,
Apollo Childrens Hospital,
Chennai.
DISEASE SPECIFIC MECHANICAL VENTILATION IN PEDIATRICS

* Praveen Khilnani
** Bhaskar Saikia

Abstract: Mechanical ventilation is a complex technique utilizing sophisticated and sometimes complex equipment. It can keep the most severely ill patients alive but simultaneously it can damage the lung and generate other unwanted complications. Mechanical ventilation can be seen as highly efficient technology but with a narrow therapeutic window. Although the technique has been available for children for last several decades, there are many gaps in knowledge of how best to apply the technique in specific situations. There is lack of data on mechanical ventilation in the pediatric population on how to ventilate children. Much of the knowledge applied to children in this area is handed down from adult intensive care research. The key to improving our application of mechanical ventilation is age and disease specific research and an increased understanding of safe ventilation practices leading to least disturbance in physiology and minimizing lung injury.

Keywords: Mechanical Ventilation, Pediatrics, Disease Specific, ARDS, PEEP.

Points to Remember

- Volume control may be required if there is severe ARDS. Use 7-9 ml/kg tidal volume (6-8ml expired tidal volume)
- Patients with asthma may be ventilated with pressure control with pressure support and low PEEP.
- Patients with neuromuscular weakness (GBS) and raised ICP will require minimal settings to maintain normal ABGs and maintain pCO₂ 30-35mmHg.
- Permissive hypercapnea and permissive hypoxemia are practiced to minimize lung injury caused by mechanical ventilation.

References


PAIN AND SEDATION IN THE PICU

* Soonu Udani

Abstract: All children who undergo pain and or anxiety in the course of treatment require adequate attention to alleviate their discomfort. There is a large number of sedatives and analgesics that can be used singly or in combination. In critically ill children, as opposed to stable children undergoing painful procedures, the issue is complicated by factors affecting organ failure, pharmacokinetics and tolerance as these agents need to be given, often in combinations, for prolonged periods. The possible combinations and their various uses in different situations in critical ill children in a Pediatric Intensive Care Unit (PICU) will be discussed here.

Keywords: Sedation, Analgesia, PICU.

Points to Remember

• Provide analgesia first with fentanyl, morphine, or possibly dexmedetomidine. Monitor analgesia adequacy if possible.
• Avoid the adverse effects commonly associated with standard sedative medications.
• Avoid midazolam accumulation by limiting the duration of use; practice at least daily interruption of drug or awakening the patient and targeting the lightest level of sedation possible.
• Use drugs that you are familiar with and can control and titrate well
• If propofol is used, avoid prolonged use
• Monitor all patients for delirium, even those who are calm and not agitated.
• Before hospital discharge, assess cognitive function in patients and consider neuropsychiatric follow-up for anyone who needs it.

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DKA - CHANGING THOUGHTS

* Poovazhagi V

Abstract: Changing thoughts pertaining to the diagnosis, monitoring, intravenous fluids and insulin therapy in Diabetic Keto Acidosis (DKA) are discussed in this article. Capillary blood ketone measurement using ketone meters is very useful in the diagnosis of DKA. Weight based intravenous fluid rates can be used from the precalculated fluid charts in DKA. Normal saline as the maintenance fluid is to be continued for at least 4-6 hours of initial therapy. Delay insulin infusion until 1-2 hours of fluid therapy. Oral rehydration fluids are advised if intravenous fluid therapy is not feasible. Subcutaneous rapid acting insulin analogs can be given 1-2 hourly in DKA. Children on glargine insulin can continue the same along with intravenous insulin. Bed side capillary blood ketone measurements help to estimate recovery from ketoacidosis. Anticoagulant prophylaxis is advised in young children, especially with femoral lines. Hypertonic saline can be used as an alternative for treatment of cerebral edema in DKA.

Keywords: DKA, Pediatric, Cerebral edema, Insulin therapy.

Points to Remember

- Bedside blood ketone measurement is useful in diagnosis and monitoring of children with DKA.
- Fluid therapy in DKA should always precede insulin infusion in DKA.
- Ensure normal serum potassium before starting insulin infusion.
- Restricted fluid therapy as per protocol is essential in management of DKA.
- Rapid analogs of insulin can be used 1-2 hourly if insulin infusion is not feasible.
- Children on long acting insulin can continue the therapy during treatment of DKA.
- Both new onset DKA and recurrent DKA are preventable in children with diabetes.

References


ACUTE LIVER FAILURE IN CHILDREN

* Sharat Varma  
** Rakesh Lodha

**Abstract:** Acute liver failure is a devastating clinical situation of rapidly deteriorating liver function which was normal before. The outcome of this catastrophic situation is greatly improved in the recent past owing to an early diagnosis, recognition of poor prognostic markers and a multi-disciplinary protocol based management. The imperative aspects being the early consultation of a pediatric hepatologist, appropriate and justified measures to manage the coagulopathy, encephalopathy and counseling for the possible need of a liver transplant.

**Key words:** Pediatric, Acute liver failure, Management, Hepatic encephalopathy and Liver transplantation.

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**Points to Remember**

- Acute liver failure is a life threatening condition. Appropriate management needs a multi-disciplinary approach.
- Correct coagulopathy when indicated, not all deranged INR and thrombocytopenia need correction.
- Hypertonic saline and not mannitol is better prophylactic agent for prevention of cerebral edema
- Avoid sedation, if needed propofol is preferred.
- Early consultation with a liver transplant team is beneficial
- King’s College criteria should be used in predicting prognosis and need for liver transplantation

**References**


* Senior Research Officer,  
** Additional Professor,  
Department of Pediatrics,  
All India Institute of Medical Sciences,  
Ansari Nagar, New Delhi.


**POLYTRAUMA**

*Anitha VP*

**Abstract:** Major polytrauma in children results in higher mortality compared to adults. The mechanism of injury defines the associated injuries. Prompt resuscitation, which begins within the “platinum half-hour” and continued in dedicated PICUs will improve outcomes. Primary survey should include cervical spine stabilization and hemorrhage control with routine ABCDE. Emphasis on airway management with alternative plan in case of difficult airway has been defined. Focus has also shifted to damage control resuscitation including permissive hypotension and damage control surgery. CT scan can be the “tunnel of death” for unstable patients. FAST has replaced it as the bedside diagnostic of choice.

**Key words:** Pediatric polytrauma, Damage control, Resuscitation.

**Points to Remember**

- Secure airway early in unstable patients.
- Adhere to damage control resuscitation.
- Prefer E-FAST to identify thoracoabdominal pathology in unstable children.
- CT scans should be performed only after stabilization.

**References**

PERIOPERATIVE CARE IN PICU

* Santosh Soans
** Samith Alva
*** Aswathy R

Abstract: The perioperative period is laden with rapid and dynamic changes in physiologic condition. Anticipation of hemodynamic events and good care are the key to success. Postoperative mortality continues to be high in high-risk population when they undergo surgical procedures. Additionally, patients who undergo high risk corrective procedures or complex palliative surgeries may experience considerable morbidity that further challenges the intensive care physician to improve care and outcome.

Key words: Perioperative care, PICU, Critical care.

Points to Remember

- There are crucial physiologic, diagnostic, medical and surgical priorities and differences between caring for infants and children compared to adults. Unique nature of each surgical condition mandates both specific expertise and careful titration of care at the bedside.

- Post-surgery airway maintenance and ventilation must be monitored continuously as pulmonary gas exchange deteriorates during general anesthesia resulting in airway closure.

- Post anesthesia complications like disorientation, hyperactivity, excitability, and hallucinatory visual disturbances should be completely resolved before discharge from the PICU.

- Postoperative fever has several possible causes can be remembered as the 4 Ws: wind (atelectasis), wound (infection), water (urinary tract infection), and walker (deep vein thrombosis).

- All pediatric patients experience pain if untreated.

- Total parenteral nutrition can provide adequate nutrition in the early hyper catabolic phases of the early post-operative period.

- Cardiac rhythm disturbances and blood pressure fluctuations tend to be less problematic in infants and children recovering from anesthesia post-surgery, than in adults.

- Multiple organ failure (MOF) occurs most frequently in the perioperative setting secondary to prolonged shock or ongoing ischemia, DIC, primary organ failure, a persistent nidus of inflammation/infection, trauma, toxin or drug toxicity.

References


ANTIBIOTIC THERAPY: RIGHT CHOICE  
RIGHT RESULT

* Kinjawadekar US

Abstract: Though awareness of bacterial infections is increasing and better diagnostic techniques such as culture, rapid diagnostic tests (RDTs) and molecular tests help to make a correct diagnosis, rampant antibiotic use to treat any fever and even cough, cold and diarrhea has not reduced. Today, we are facing a dual problem of limited antibiotics in our armamentarium and increasing antibiotic resistance which is affecting the entire globe. A scientific knowledge of antibiotics like when, why, which to use and even knowing their pharmacodynamics is of prime importance for successful therapy of bacterial infections.

Keywords: Bacterial infections, Antibiotics use, Pharmacodynamics.

Points to Remember

• Identify potential or presumed pathogens causing the infection and consider the relative merits of antimicrobial agents for specific pathogens and circumstances.

• Certain bacteria can be predicted from certain infections. eg S aureus and S pyogenes for cellulitis, osteomyelitis and septic arthritis and similarly some can be dismissed from certain infections like S aureus/S pneumonia from UTI.

• Age of the child is important parameter for predicting the organism even without bacteriological diagnosis. eg Gram neg organisms are most important cause of pneumonia in neonatal age whereas S pneumoniae and H influenza are commoner after age of 3 months.

• Though culture and susceptibility tests are of great value in diagnosing bacterial infection and choosing the right antibiotic, the results need to be interpreted with caution keeping the entire clinical picture in mind. e.g. asymptomatic bacteriuria.

• A very sick child may demand a broad spectrum antibiotic as empiric therapy to begin with, treatment can be deescalated if organism with narrow spectrum antibiotic susceptibility can be identified. In a less sicker child a more cautious approach in choosing antibacterial therapy and even delay (if acceptable) is worthwhile.

References


* Consultant Pediatrician, Kamlesh Mother & Child Hospital, Navi Mumbai.


ANTI HYPERTENSIVES

* Jeeson C Unni

Abstract: Hypertension in children and adolescents is increasing and its rational management is more intensely researched now than ever before. Remediable causes of hypertension needs to be identified and appropriate remedial measures (surgery for coarctation of aorta, renal artery stenosis, pheochromocytoma) undertaken. Pharmacotherapy is reserved for control of hypertension before such intervention and for essential hypertension and for conditions where such interventions are either not fully curative or not producing expected results. An attempt is made to detail antihypertensives licensed for use in children and adolescents.

Keywords: Antihypertensives, Angiotensin converting enzyme inhibitors, Angiotensin receptor blockers, Calcium channel blockers, Beta-blockers, Central alpha agonist, Peripheral alpha antagonist, Diuretics, Alpha adrenergic blockers, Essential hypertension, Chronic kidney disease, Renovascular hypertension, Pheochromocytoma, Hypertensive emergencies

Points to Remember

• Screening and early diagnosis and identification of cause, if any, of hypertension in childhood is emphasized
• ACEI or CCB may be used to initiate therapy in essential hypertension
• ACEI is preferred for initial therapy of hypertension associated with CKD since these agents also reduce proteinuria and retard progression of renal damage
• Initiate with CCB or beta-blocker in renovascular hypertension prior to surgery and avoid ACEI in bilateral disease
• Treatment for hypertensive emergencies should be initiated with intravenous drugs (controlled reduction of blood pressure is achieved by intravenous administration of labetalol or sodium nitroprusside); once blood pressure is controlled, oral therapy can be started.
• Surgery for pheochromocytoma should not take place until there is adequate blockade of both α- and β- adrenoceptors.

References


HENOCHE-SCHONLEIN PURPURA - REVISITED

* Anandan V

Abstract: Henoch-Schonlein purpura (HSP) is the commonest childhood vasculitis with male preponderance (2:1) and winter predilection with a peak incidence between 4-6 years, first reported in 1801 by William Heberdon, clinically presenting as palpable red spots, joint pains, abdominal pain, with or without blood in the urine and stools frequently preceded by fever and malaise. Renal damage by an immune complex glomerulonephritis is a serious long term complication which warrants early diagnosis, appropriate management and a vigilant watch to avoid long term morbidity.

Key words: Palpable purpura, Arthritis, Arthralgia, Hematuria.

Points to Remember

- Henoch-Schonlein purpura [HSP] is the commonest childhood leucocytoclastic vasculitis self resolving.
- Steroids reduce the morbidity.
- Renal involvement should be ruled out and should be followed up.
- High index of suspicion and a thorough knowledge is essential to rule out the differentials.

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CONGENITAL LUNG CYSTS:
AN OVER VIEW

*Senthil Nathan R
**Sundar M

Abstract: As lung cysts are space occupying lesions, familiarity with normal variations and potential pathologic abnormalities in lung is necessary during evaluation of infective chest conditions that produce respiratory distress and airway problems. Background knowledge of this pathology, facilitates expeditious work up of the case, paving way for precise treatment.

Keywords: Congenital pulmonary airway malformation, Congenital lobar emphysema, Bronchogenic cyst, Bronchopulmonary sequestration.

Points to Remember

- Lung cysts are classified as congenital and acquired.
- Congenital lung cysts are congenital pulmonary airway malformation, congenital lobar emphysema, bronchopulmonary sequestration and bronchogenic cysts
- For congenital pulmonary airway malformation commonly described as “congenital cystic adenomatoid malformation”, surgery is indicated even in an asymptomatic child.
- For congenital lobar emphysema, after a trial of medical management, surgical resection of the affected lobe is undertaken.
- For bronchopulmonary sequestration surgical resection is indicated.
- For bronchogenic cysts over all good lung function and physical growth occur in children after pulmonary lobe resection.

References


