INDIAN ACADEMY OF PEDIATRICS

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PEDIATRIC INTENSIVE CARE

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2 Recognition and Stabilization of the Critically Ill Child

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LEARNING OBJECTIVES

- Proper, systematic, and structured evaluation of a child helps in early recognition of severity of illness, which helps in proper and timely intervention, thus decreasing morbidity and mortality.
- In this chapter, reader will be able to evaluate any child coming to emergency in an organized way thus classifying the severity of illness and hence intervening in timely manner, and saving precious lives.

INTRODUCTION

"Critically ill child" is a child who is in a clinical state which may result in respiratory or cardiac arrest or severe neurological complications if not recognized and promptly treated. Many diseases can lead to this "critically ill state." Whether a child presents with a primary cardiovascular, respiratory, neurological, infectious, or metabolic disorder, the goal of initial evaluation should be early recognition of respiratory and circulatory insufficiency or compromise. Timely intervention in seriously ill or injured children is the key in preventing progression toward cardiac arrest and in saving lives. Early recognition and treatment of a patient with deficiencies in oxygenation, ventilation, or perfusion frequently prevents deterioration to respiratory or cardiac arrest. Outcomes for children who develop cardiopulmonary arrest are poor.

An experienced clinician finds it easy to recognize a critically ill child. It is essential for the clinician to assess and classify the degree of illness. It is also important to identify a child with physiological derangement in its early stages when signs are subtle. The "golden hour" concept applies to all children with illnesses presenting as emergencies. Early recognition of a "critically ill child" requires a systematic, structured approach and rapid clinical assessment, with background knowledge of age appropriate physical signs and level of development. This process of examining a child in short time is known as "rapid cardiopulmonary assessment". With practice, it should take the clinician about 30 seconds to complete this assessment.

For this reason, we would like to endorse and quickly summarize the methodology followed in the Advanced Life Support (ALS) course. Kindly refer to the Indian Academy of Pediatrics (IAP)-ALS provider manual for details.

The management of a critically ill child follows the loop of "Evaluate–Identify–Intervene" (EII).

EVALUATION

The components of evaluation include:
- Initial impression [pediatric assessment triangle (PAT)]
- Primary assessment
- Secondary assessment
- Diagnostic tests.

Initial Impression

Pediatric assessment triangle (PAT) is a rapid assessment which relies primarily on three observations—(i) appearance, (ii) breathing, and (iii) color; in short, "ABC" to quickly identify a child with respiratory or circulatory compromise, and is highly reliable.

In addition to recognizing children who require stabilization with respiratory or cardiovascular interventions, the PAT also identifies most children with serious illnesses who should receive prompt evaluation.

Appearance: Infants and young children in hospital may be agitated or crying because of unfamiliar environment. Such patients must be distinguished from children who are restless or anxious due to hypoxia. The following characteristics of a child's appearance [the tone, interactiveness, consolability, look or gaze, and speech or cry (TICLS) mnemonic] help the clinician identify normal from abnormal appearance.
- *Tone*: Sick children have decreased tone and appear limp whereas normal movements are reassuring.
- *Interactiveness*: If the child is looking around or has appropriate stranger anxiety, then it is not that worrying but if the child is not responding or looking around, that is a serious concern.
- *Consolability*: Can the infant be consoled or distracted by a parent or caregiver? Crying may be a nonspecific symptom but if the child can be consoled or distracted, rather than let it inconsolably cry or just whimpering, that is reassuring.
- *Look/gaze*: Does the infant or child focus on the examiner or objects or has an unfocused gaze? An unresponsive stare suggests an altered mental status.
- *Speech/cry*: Loud and strong crying is normal but if the cry is weak or if the voice is hoarse or muffled that is abnormal.

To summarize, any child who is alert, easily consolable when crying, has good muscle tone, and responding to a caregiver is unlikely to be critically ill. On the other hand, the clinician should be very concerned about an infant who is limp, noninteractive, listless, and has a weak cry.

Work of breathing: Deficiencies in oxygenation and/or ventilation may be indicated by either increased work of breathing or decreased work of breathing or apnea. Assessment of airway sounds, the child's position of comfort, and use of accessory muscles provides information regarding the patient's work of breathing.

Color: Pallor or cyanosis is a worrisome finding that may indicate hypoxemia or inadequate perfusion to the skin.

Monitoring: Children who are critically ill require frequent assessment and continuous monitoring of vital signs, particularly heart rate and pulse oximetry. All patients should be on a

multichannel monitor. This is essential to evaluate the effectiveness of interventions and to identify clinical deterioration.

Physical examination: Following the rapid initial assessment (PAT) and initiation of appropriate supportive care as mentioned in stabilization of a sick child, a thorough physical examination should be performed, which includes the following.

Primary Assessment Using the ABCDE Model

- *Airway*: To check for secretions, any abnormal sound like stridor and impression is made regarding the status of airway like clear or maintainable by simple positioning and suctioning or not maintainable, which needs further assistance like with invasive devices.
- *Breathing*: The respiratory rate and effort should be noted, including any retractions. Auscultation provides essential information regarding air entry, tidal volume, abnormal sounds, i.e., upper versus lower airway sounds, crepitations in case of lung parenchymal disease. Pulse oximetry should be done in all sick children. It should be monitored continuously for measurements at or below 94%. Within the range of partial pressure of oxygen (PaO_2) that represents clinically significant hypoxemia, small changes at the level of saturated hemoglobin reflect much larger decreases in PaO_2. As an example, a normal blood oxygen saturation level (SpO_2) of 98% correlates with a PaO_2 of approximately 100 mm Hg, 95% with 80 mm Hg, and 90% with 60 mm Hg; the latter value is the level that represents clinically significant hypoxia. In addition, low perfusion states, the presence of abnormal hemoglobin (such as carboxyhemoglobin or methemoglobin), and anemia can also result in inaccurate pulse oximetry readings.
- *Circulation*: It includes heart rate and rhythm, peripheral and central pulses, skin color and temperature to touch, capillary refill time, and blood pressure (BP). In addition, abnormal heart sounds (such as a gallop rhythm or a murmur) may indicate a cardiac etiology.
- *Disability*: Pertains to neurologic assessment—consciousness level provides an important indication of brain perfusion. The AVPU scale can be used, where A is alert, V responds to verbal commands, P responds to painful stimuli, and U is unresponsive. Abnormal mental status may result from a non-neurologic cause (such as hypoxia or hypovolemic shock) or from a primary neurologic disorder. Focal findings consistent with a neurologic process include abnormalities in pupillary light response, extraocular movements, or motor activity.
- *Exposure*: Examination of the skin may provide information regarding the patient's circulatory status, as well as clues to a specific underlying condition. For instance, petechiae or purpura indicates an infectious process, such as meningococcemia, while urticaria suggests anaphylaxis. Bleeding, burns, bruises, deformities, etc., need to be observed which could explain the condition of the patient.

This information may identify the underlying condition and guide-specific treatment. In addition, it establishes a baseline from which changes in the child's condition can be recognized and supportive care and specific treatment modified. As an example, the condition of a child who was initially in severe respiratory distress with an anxious appearance and now has decreased work of breathing and lethargy has deteriorated from respiratory distress to respiratory failure. The patient may now require assisted ventilation, as well as supplemental oxygen.

Fig. 1: Broselow tape, length-based dosages of drugs.

Vital signs should be obtained, particularly respiratory rate, heart rate, blood pressure (BP), and pulse oximetry. Weight in kilograms should also be recorded whenever possible.

Estimation of weight: Medications and fluid resuscitation need accurate weight of the child. Healthcare provider weight estimates can be inaccurate. While parent estimation is most accurate (within 10% of actual body weight approximately 80% of the time); parents frequently are not available during pediatric resuscitation.

When parent estimation is not available, length-based measurements using Broselow tape, as shown in Figure 1, can be used. The Broselow pediatric emergency tape is a color-coded length-based tape. It can be used to check a child's height as measured by the tape to his/her weight to provide medical instructions including medication dosages, the size of the equipment that should be used, and the amount of shock when using a defibrillator.

Most resuscitation drugs have a volume of distribution associated with lean weight; length-based methods provide reasonable estimates when weights cannot be measured.

If neither parent estimation nor length-based methods are available, age-based methods can be used but will often be inaccurate. Of the age-based formulas, the modified European Paediatric Life Support formula appears to perform best:

- 1–10 years of age: weight (kg) = 2 × (age in years + 4)

Secondary Assessment

After completing the primary assessment and appropriate interventions to stabilize the child, the next priority is a focused history and physical examination.

The SAMPLE mnemonic may be useful:

- S—signs and symptoms
- A—allergies

- M—medications
- P—past medical history
- L—last meal
- E—events

Diagnostic Tests

It consists of ancillary studies to detect and identify the presence and severity of respiratory and circulatory abnormalities.

Investigations like arterial/venous blood gas, blood sugar, hemoglobin concentration, arterial lactate, chest X-ray, electrocardiography (ECG), echocardiogram, etc., would help in assessing the abnormalities. Further investigations would depend on the findings and working diagnosis from the initial assessment. They may entail anything from electrolytes to sophisticated imaging.

Arterial blood gas/venous blood gas: Accurate information regarding a critically ill patient's oxygenation, ventilation, and acid–base status is an essential determinant of optimum management. Sampling of arterial blood should be performed in the following circumstances:

- To assess ventilation when end-tidal carbon dioxide ($ETCO_2$) or total carbon dioxide (TCO_2) measurements are not available
- To correlate with trends in noninvasive monitoring
- To measure PaO_2 and partial pressure of carbon dioxide ($PaCO_2$) when noninvasive measurements may be inaccurate.

An arterial sample that is properly handled provides the most accurate information regarding a patient's oxygenation, ventilation, and acid–base status.

Venous pH generally correlates well with arterial pH. However, the correlation between venous and arterial $PaCO_2$ and PaO_2 is not sufficient to provide an accurate assessment of ventilation and oxygenation in critically ill patients.

Identification: Units should have charts of normal heart rate and BP for ages for ready referral.

INTERPRETING ABNORMAL VITAL SIGNS

Pulse Rate/Heart Rate

In a child with tachycardia, consider the following:

Ask yourself if the heart rate is appropriate to the age, physiological state of the child and explainable by the level of physical activity. Tachycardia is expected due to pain, fever, exercise, anemia, anxiety, crying, thyrotoxicosis, as well as with tachypnea.

Tachycardia in an afebrile child who is sleeping/resting is generally abnormal and may be a subtle sign of myocardial dysfunction, or may indicate nonconvulsive seizures in an unconscious child. Tachycardia is often associated with abnormal pulse volume and other signs of compromised peripheral perfusion.

Look for beat-to-beat variability of heart rate with changing level of activity to distinguish sinus tachycardia from supraventricular tachycardia (SVT).

Rapid changes of heart rate and BP in high and low extremes may suggest autonomic instability.

In a child with bradycardia, consider the following:
Assess if bradycardia is associated with adequate perfusion, or does the patient have symptomatic bradycardia with cardiopulmonary compromise. Individuals into active sports may have a relatively lower heart rate due increased vagal tone. Also differentiate sinus bradycardia from bradyarrhythmia with the help of an ECG. Do not forget the 5 Hs [hypoxia, H ions (acidosis), hypovolemia, hypo/hyperkalemia, head injury] and 5 Ts [trauma, toxins, tension pneumothotax, tamponade (cardiac), thromboembolism] to find the cause of bradycardia.

Respiratory Rate

Check if respiratory rate is appropriate for the age and physiological status. See if tachypnea is occurring alone or accompanied by signs of respiratory distress (nasal flaring, chest wall retractions, grunting, head bobbing, etc.). Reduction in respiratory rate in an alert and playful child is a sign of improvement, while reducing respiratory rate with worsening sensorium and shallow breathing is a sign of respiratory failure.

Look for any abnormal breathing pattern and listen for abnormal respiratory sounds (snoring, stridor, wheeze, expiratory grunt, etc.).

Blood Pressure

Signs of adequate peripheral perfusion are as important as having normal BP. One may not necessarily chase a low BP record if a child is otherwise well with good peripheral perfusion, especially in the context of malnutrition or myocardial dysfunction.

The mean arterial pressure (MAP) is more important than individual systolic and diastolic BP because it is the most important determinant of tissue perfusion.

STABILIZATION

Children who have any abnormalities found using the PAT are critically ill and require immediate intervention. A detailed primary assessment from the physical examination and/or ancillary studies may also provide indications for respiratory or circulatory support.

Follow the key elements of effective team dynamics to achieve stabilization in the shortest possible time. These elements include clear roles and responsibilities, clear messages, closed loop communication, constructive intervention, knowing limitations, knowledge sharing, mutual respect, re-evaluation, and summarizing.

After every stage of evaluation, starting from the initial impression, one needs to follow the cycle of EII. Re-assessment is important after every intervention. If a life-threatening condition is identified at any stage of evaluation, urgent lifesaving interventions should be started before proceeding with any further evaluation.

The priorities during stabilization follow the same order as in assessment, i.e., ABC, except during cardiopulmonary resuscitation (CPR), when the sequence is compression, airway, and breathing (CAB).

The following interventions should be done in a patient with any abnormality of appearance, breathing or color on initial impression followed by primary assessment.

For the sake of discussion, we would like to divide the process of stabilization into (i) general measures and (ii) specific measures.

General measures include interventions that are common to most emergency situations, like (i) calling for help as appropriate (activating the emergency response system, code blue team or the rapid response team) depending on the patient's location; (ii) providing oxygen; (iii) achieving vascular access [intravenous (IV)/intraosseous (IO)]; and (iv) connecting the patient to vital signs monitor, including ECG monitoring.

Specific measures entail disease or problem-specific interventions. Details of management of individual illnesses are beyond the scope of this chapter. Depending on the physiologic status of the child, the following stabilization measures can be undertaken.

Airway

Airway can be maintained by simple measures like allowing the child to assume a position of comfort. Avoid unnecessary agitation. Head-tilt/chin-lift maneuver can be used to open the airway unless cervical spine injury is suspected in which case jaw thrust without neck extension should be done.

- *If the airway is open and clear*: No immediate intervention is needed.
- *Maintainable*: Simple measures like head-tilt/chin-lift, jaw thrust (in suspected cervical spine injury), suctioning of secretions, insertion of oropharyngeal or nasopharyngeal airway, nebulization with adrenaline (croup, postextubation stridor).
- *Not maintainable*: Advanced interventions like endotracheal intubation, laryngeal mask airway insertion, cricothyrotomy, tracheostomy, or foreign body airway obstruction relief techniques (in severe choking).

Breathing

Any child who appears seriously ill by the PAT should be put on oxygen. In general, patients with two or more abnormalities in the PAT require oxygen therapy. In addition, most patients with an oxygen saturation ≤94% should receive supplemental oxygen.

One hundred percent humidified oxygen should be provided to any critically ill child irrespective of the physiologic status. Use a high concentration nonrebreathing system if available. Monitor oxygen saturation continuously.

In respiratory distress, the child is kept with the caregiver, is allowed to maintain a position of comfort, and oxygen is provided in a non-threatening manner. Turbulent airflow leads to increased airway resistance; hence, the child should be kept calm.

Anticipate respiratory failure if the following features are found:

- An increased respiratory rate, particularly with signs of distress (e.g., increased respiratory effort including nasal flaring, retractions, seesaw breathing, or grunting)
- An inadequate respiratory rate, effort, or chest excursion (e.g., diminished breath sounds or gasping), especially if mental status is depressed
- Cyanosis with abnormal breathing despite supplementary oxygen.

If the child has *respiratory failure*, the approach is more aggressive. In case of inadequate chest expansion or respiratory arrest, bag and mask ventilation should be given with 100% oxygen. Tracheal intubation may be required.

Tracheostomy or cricothyrotomy may be required in cases of complete upper airway obstruction caused by diphtheria, severe orofacial injuries or laryngeal fractures.

In addition to disease specific interventions, a child may be provided respiratory support by one of the following means, depending upon the extent of respiratory compromise:

If a child has respiratory distress, s/he should be provided supplemental oxygen by an appropriate oxygen delivery device. The basic prerequisites for using an oxygen delivery device are that the child should be breathing spontaneously with an intact airway, conscious enough not to aspirate and not in respiratory fatigue. If these prerequisites are not met in a child with abnormal breathing, s/he needs of an advanced airway with or without positive pressure ventilation.

Oxygen delivery devices are broadly classified as low-flow systems (nasal prongs, simple face mask) and high-flow systems (venturi mask, oxygen hood, partial rebreathing, and nonrebreathing mask). The concentration of oxygen delivered is unpredictable through a low-flow system and more reliable through a high-flow system. The concentration of oxygen delivered to the patient can be increased by (i) use of a high flow system; (ii) preventing rebreathing of exhaled air by increasing the oxygen flow rate beyond patient's own minute ventilation and use of an assembly with an inbuilt expiratory valve; (iii) use of an oxygen reservoir; and (iv) ensuring a tight seal between the face and the mask to prevent mixing of room air.

The choice of oxygen delivery device depends on (i) the age and acceptance of the child and (ii) the severity of respiratory distress/hypoxia, and hence the need for supplemental oxygen. At times, one may have to settle for free flow oxygen provided by the parents through simple oxygen tubing in an anxious and agitated infant or toddler, provided the distress is mild without significant hypoxia.

Recent years have witnessed an increasing utilization of noninvasive ventilation (NIV) and high flow nasal cannula (HFNC) with rewarding results. Many children with moderate-to-severe respiratory distress who would have received invasive ventilation in the past are being successfully managed with early and judicious use of these modalities.

Circulation

Patients with inadequate perfusion as indicated by decreased mental status, poor skin perfusion, and/or abnormal vital signs are in shock. Vascular access should be established, and they should receive fluid resuscitation. Vascular access and the initial management of shock are discussed elsewhere.

The focus of brief discussion under this heading would be some basic aspects of management of a child in shock. The first step in the management of a child in shock is to administer 100% oxygen through a nonrebreathing mask, or a higher level of breathing support if needed. The second objective is to achieve a reliable vascular access (IV or IO, if IV access not possible) to begin with and a central venous access (femoral, internal jugular, or subclavian) in many situation where shock is refractory to initial management.

The subsequent management depends on the type and severity of shock. Hence, it is very important to identify the type of shock correctly. The treatment includes crystalloid (occasionally colloid) boluses, inotropes, vasopressors, inodilators, either alone or in combination. The treatment is guided by ongoing multimodal hemodynamic monitoring, including clinical assessment, intra-arterial BP, functional echocardiography, and noninvasive cardiac output monitoring as per the availability of equipment. The quantity and rapidity of fluid boluses also depend on the type of shock. Boluses are large volume and rapid in hypovolemic and septic shock, and much more restricted in cardiogenic shock.

A stable, normotensive child should be allowed to remain with the caregiver while an unstable child should be put in the Trendelenburg position.

High-flow oxygen is indicated in all children with shock.

Once airway and breathing have been stabilized, vascular access is to be secured. IO route may be used in case of collapsed veins. *No child should die due to a lack of vascular access*. Any drug can be infused using this route provided it is followed by a flush of fluid to get the drug in the central circulation.

Fluid resuscitation should be given. Isotonic crystalloids like normal saline or ringer lactate is preferred over colloids. Administer fluids as a 20 mL/kg bolus over 5–20 min. The child needs to be monitored after administration of each fluid bolus. The rate of administration and the number of boluses depend on the type of shock. Repeat boluses should be given till the BP and tissue perfusion is restored. Blood products should be administered only when specifically indicated for replacement of blood loss or for correction of coagulopathies.

The SpO_2, heart rate, BP, pulse pressure, mental status, temperature, and urine output should be monitored frequently to evaluate trends and determine response to therapy.

Conduct ancillary laboratory and nonlaboratory studies to help in identification of the etiology and severity of shock, evaluation for organ dysfunction, identification of metabolic derangements, and evaluation of the response to therapeutic interventions.

When the circulation does not improve with fluid boluses alone, inotropes, phosphodiesterase inhibitors, vasodilators, and vasopressors are used.

The goal of therapy is to improve the perfusion and correct the hypotension.

Arrhythmias if present need to be corrected.

Disability

The most common neurological problems encountered in an emergency setting are altered level of consciousness, seizures, and raised intracranial pressure (ICP), irrespective of the basic disease process. The emergency treatment begins with the maintenance of ABCs. Any unconscious child should be actively monitored for signs of raised ICP and managed accordingly, until proved otherwise. Details of management are discussed elsewhere.

DO'S AND DONT'S OF EMERGENCY MANAGEMENT

Airway and breathing: Do not interfere with the child's own spontaneous efforts to maintain his airway in suspected upper airway obstruction as long as the child is alert and not in respiratory fatigue. Let the child remain with his caregivers and administer oxygen in a nonthreatening manner by an age appropriate device. Agitation worsens upper airway obstruction.

Never use respiratory depressants.

Use standardized scoring systems available for respiratory illnesses (e.g., asthma, croup) to make assessment more objective and decision making streamlined.

Do not sedate an agitated or crying child without knowing the cause. Try to identify and treat the cause of agitation (e.g., hypoxia, raised intracranial pressure, intussuception, etc.)

Recognition, categorization, and initial stabilization based on PAT are shown in Table 1.

Initial recognition and management as per physiological status can be documented in triage form in the emergency [used in the Postgraduate Institute (PGI) and Dayanand Medical College (DMC)], as shown below.

Table 1: Categorization and initial stabilization based on PAT.

Appearance	*Breathing*	*Circulation*	*Interpretation*	*Initial stabilization*
Normal	Normal	Normal	Stable	None
Normal	Abnormal	Normal	Respiratory distress	Allow position of comfort (mother's lap) Oxygen in a nonthreatening manner
Abnormal	Abnormal	Normal	Respiratory failure	Stabilize airway Start on 100% oxygen Provide bag and mask ventilation if required
Normal	Normal	Abnormal	Compensated shock	Start on 100% oxygen Establish vascular access Connect to cardiac monitor Check glucose values
Abnormal	Normal	Abnormal	Decompensated shock	Start on 100% oxygen Establish vascular/intraosseous access Connect to cardiac monitor Check glucose values
Abnormal	Normal	Normal	Primary brain dysfunction/systemic dysfunction	Start on 100% oxygen Establish vascular access Connect to cardiac monitor Check glucose values
Abnormal	Abnormal	Abnormal	Cardiorespiratory failure/cardiac arrest	CPR if HR <60/min despite adequate ventilation or absent central pulses

Adapted from AHA-PALS provider manual 2015.

PEDIATRIC EMERGENCY ROOM

Date ..... Time .....AM/PM

Weight.... ... kg Ht: ..... Informant.....

Chief complaints:

Name
Age
Gender

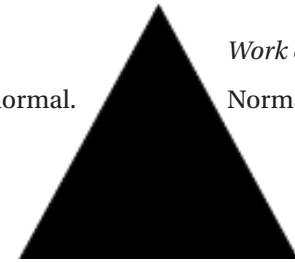
Pediatric assessment triangle (PAT)

Appearance

Normal/Abnormal.

Work of Breathing

Normal/Abnormal



Color Normal/Abnormal

Detailed clinical assessment (ABCDE)

AIRWAY	BREATHING *RR;…… /min*	CIRCULATION HR……./min
• Open and stable • Open but unstable • Obstruction	*Efforts: Normal poor increased acidotic* *Air Entry: Normal poor differential* *Auscultation: None stidor wheeze crackles* *SpO_2 (room air)……..…..……* *SpO_2 (on oxygen)……*	Central pulse: Good/Poor Peripheral pulse: Good/Poor CFT ……BP…….. *Skin Temp* Warm Cool *ECG*: Rhythm…….. T-wave…..…Others…….

DISABILITY A V P U GCS E V M	EXPOSURE *Temp…….°F*
Pupil size……Reaction…….. *Motor activity Normal and symmetrical* *Asymmetrical seizures* *Posturing flaccidity* *Extrapyramidal movements* *Blood sugar..…… mg/dL*	*Color: Normal pallor cyanosis Ashen gray skin* *Surface findings: Rash abscess pustules* *Cellulitis Patechie Purpura ecchymosis* *Hemorrhagic nodules Mucosal ulcers* *Dermatosis Desquamation edema* *Trauma/others (specify……..*

Final physiological impression	*Triangle classification*
• Stable • Respiratory distress • Respiratory failure • Compensated shock • Hypotensive shock • Cardiopulmonary failure • Primary brain/metabolic dysfunction	• Level 1 (Resuscitation) • Level 2 (Emergent) • Level 3 (Urgent) • Level 4 (Less urgent) • Level 5 (Nonurgent)

Any other important gross clinical finding:

EXAMINATION

Pallor icterus cyanosis clubbing Edema neck veins lymphadenopathy

Head and neck

Cardiovascular system (CVS)

Chest

Abdomen

Central nervous system (CNS)

Extremities

PROVISIONAL DIAGNOSIS:

Investigations sent	Emergency treatment administered
Plan	

Staff nurse Junior resident

Reviewed by senior resident/consultant

Emergency room outcome *Transfer*: PICU/ward/ nursery/Pvt room no-/OT/other….

Discharge Death DAMA

Pediatric emergency triage classification system should be employed and used in every first encounter area, be it the emergency room or a clinic. This could be the five-level or color-coded system that the unit chooses.

Level 1 (resuscitation): Patients requiring continuous assessment and intervention to maintain physiological stability; e.g.,

- Severe respiratory distress
- Respiratory failure
- Shock
- Cardiopulmonary arrest
- Seizures
- Unconsciousness
- Coma
- Major bums
- Significant bleeding
- Severe trauma.

Level 2 (emergent): Any physiologically unstable patient and those who requires comprehensive assessment and multiple interventions to prevent further deterioration like

- Moderate respiratory distress
- Altered consciousness [Glasgow Coma Scale (GCS) <13]
- Severe dehydration
- Fever (age <3 months and temperature >102°F),
- Sepsis
- Toxic ingestion/overdose
- Severe asthma
- Seizure (postictal)
- Diabetic ketoacidosis (DKA)
- Child abuse with ongoing risk
- Purpuric rash
- Violent patients
- Severe testicular pain
- Lacerations
- Open fractures
- Other orthopedic injuries with neurovascular compromise or dental injury with an avulsed permanent tooth.
- Dehydration may be difficult to accurately assess.
- Any suspicion (or evidence) should cause concern.

  Temperature is may not always be a reliable indicator of the severity of illness.

  Younger patients can have significant infections and serious problems even though the signs and symptoms may be subtle.

Level 3 (urgent): Patient who is alert, oriented, well hydrated, but minor alterations in vital signs, Level 3 patients need carefully planned reassessment while awaiting care since critical illness in children may present with common symptoms and evolve rapidly, e.g.,

- Fever (age >3 months and temperature >101°F)
- Mild respiration distress

IAP Specialty Series on

PEDIATRIC INTENSIVE CARE

This edition of the book in the specialty series of the Academy on Pediatric Intensive Care is designed to bring an overview of the most important aspects of critical care and its practice to the readers. It does not attempt to be a complete textbook on the subject. Each chapter is written for clarity and conciseness. Clear concepts of pathophysiology and management are laid out for the comfort of even a first-time reader. For the students, the book can be a handy mix of manual and textbook and a good introduction to the subject before venturing onto a weightier tome. For the practitioners, there are management practices that are easy to follow and remember. Many chapters have been written by authorities in that area and all by intensivists experienced in teaching and practice, bringing an ideal blend of theory and practice for easy applicability.

This is a must-have book for every aspiring intensivist and for all who will take care of critically ill children.

Soonu Udani is the Medical Director and Head, Department of Critical Care and Emergency Services, SRCC Children's Hospital (Managed by Narayana Health), Mumbai, Maharashtra, India. She is well known as a Pioneer in Pediatric Critical Care in India, with over 30 years of experience in the field. She has been the Chairperson of the Intensive Care Chapter of the Indian Academy of Pediatrics (IAP), Chancellor of the College of Pediatric Critical Care where she has been at the forefront of education in this area since 2001. She is a DNB teacher, and a Fellow of the Indian College of Critical Medicine of the Indian Society of Critical Care Medicine. She is the Editor of all three editions of the *Pediatric Intensive Care* Book of the Subspecialty Series of the IAP, among others. She serves on the ethics and review Boards of academic institutions. She has contributed chapters, articles and lectures to several publications and conferences.

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