High Stakes Pediatrics: Resuscitation and the MISFITS

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KEYWORDS

• Pediatric • Resuscitation • Critical • Sepsis • Seizure

KEY POINTS

- Clinicians can follow a sequential approach to the resuscitation of unstable or critically ill pediatric patients.
- Causes of critical illness in the pediatric population differ from the adult population.
- The use of the mnemonic MISFITS can remind clinicians of the unique causes of illness in neonates and infants.
- Treatment protocols for sepsis and seizure can aid in clinical care.

INTRODUCTION

Every presentation of a pediatric patient is high stakes considering the preciousness of life and the expected long life of the child. The following chapter focuses on initial treatments including the resuscitation of the undifferentiated critically ill pediatric patient followed by brief discussions of disease states in the pediatric population that are unique or differ slightly from adult emergency medicine (EM).

GENERAL APPROACH TO THE CRITICALLY ILL PEDIATRIC PATIENT

Background: To improve outcomes and begin resuscitation early, it is essential that the EM clinicians recognize the features of a critically ill neonate, infant, or child which may differ slightly from adolescents and adults including limited communication from the patient and potentially an incomplete history of events. Clinicians must quickly and accurately interpret visual clues, vital signs (VS), and physical examination findings to start early, aggressive resuscitation in undifferentiated shock without a complete history and before confirmatory testing and imaging.

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Pearls and Pitfalls: The first step in recognizing a potentially critically ill child is a careful examination of the vital signs. Pediatric vital signs vary by age as illustrated in **Table 1**. Even vital signs, however, can be misleading with most pediatric patients having robust cardiovascular reserves allowing them to maintain blood pressure (BP) within normal range while in early shock states, known as compensated shock. Unrecognized and untreated, this will lead to the "crashing patient" with sudden and precipitous drops in BP and cardiovascular collapse. This is known as decompensated shock defined by a low mean arterial pressure (MAP) resulting in global hypoperfusion often first manifested in an alteration in mental status. Goals for MAP will be discussed later and are listed in **Table 2**.

A declining mental status can also be difficult to interpret in patients with limited communication requiring careful history taking and physical examinations. Frequent re-evaluation looking for poor perfusion including skin changes and poor capillary refill as well as monitoring of vital signs, especially the heart and respiratory rate are crucial in the early identification of the critically ill pediatric patient.

The pediatric assessment triangle (PAT)[1] depicted in **Figure 1** is a rapid observational tool using visual clues to predict the etiology and severity of the undifferentiated sick child. It has been taught in the pediatric resuscitation curriculum and assessed in a prospective observational study[2] showing reliable identification of high-acuity patients and their category of illness. The PAT requires no equipment, only evaluation of the child's appearance, work of breathing, and circulation to the skin looking for the following features (**Fig. 1**):

1. *Appearance* – tone, interaction, consolable, look/gaze, speech cry (abbreviated TICLS)
2. Work of Breathing – abnormal sounds, positioning, retractions, nasal flaring, apnea/gasping
3. *Circulation* to skin – pallor, mottling, cyanosis

Using these 3 categories as representations of brain perfusion, respiratory status, and cardiovascular performance, a clinician can accurately predict the etiology of the undifferentiated sick infant. Most times, if all 3 are normal the patient is stable, while abnormal findings in 1, 2, all 3 categories can point toward a cause. Pure respiratory distress will have normal skin and brain perfusion, while respiratory failure will first result in altered mental status (AMS). Similarly, early cardiovascular impairments will lead to skin changes such as mottling, pallor, and poor capillary refill, followed by

Table 1
Normal pediatric vital signs

Age	HR	SBP	DBP	RR
Premature	110–170	55–75/	/35–45	40–70
0–3 mo	110–160	65–85/	/45–55	35–55
3–6 mo	110–160	70–90/	/50–65	30–45
6–12 mo	90–160	80–100/	/55–65	22–38
1–3 y	80–150	90–105/	/55–70	22–30
3–6 y	70–120	95–110/	/60–75	20–24
6–12 y	60–110	100–120/	/60–75	16–22
>12 y	60–100	110–135/	/65–85	12–20

HR, heart rate, SBP, systolic blood pressure, RR, respiratory rate.

Table 2
Goal systolic blood pressure (SBP) and mean arterial pressure (MAP) for age

Age	Goal SBP > 5th Percentile for Age	Goal SBP > 50th Percentile for Age	Goal MAP at 50th Percentile
Newborn	>60	90	55 mm Hg
1–12 mo	>70	90	55 mm Hg
2 year old	>74	94	58 mm Hg
4 year old	>78	98	61 mm Hg
7 year old	>84	104	65 mm Hg
10 year old	>90	110	70 mm Hg

AMS in shock. A change in "Appearance" without any indication of respiratory or circulatory compromise points toward a metabolic cause such as hypoglycemia or a pure central nervous system (CNS) etiology.

Easy access to printed or digital reminders of pediatric VS and the PAT can be found online and make for great reminders, rather than relying on memory alone. Broselow tape is also a handy estimate of pediatric drug dosing that is often found in emergency departments with corresponding color-coded drawers for common medications.

PEDIATRIC RESUSCITATION

Introduction: Regardless of the cause of cardiopulmonary collapse, the steps in early resuscitation of the neonate, infant, and child are similar in each age group and aimed at restoring airway patency, normal breathing, and adequate circulation. Clinicians should be trained in and follow the protocols of Pediatric Advanced Life Support (PALS) with key elements highlighted here. This is not a substitute for certification in PALS and should be viewed as a summary.

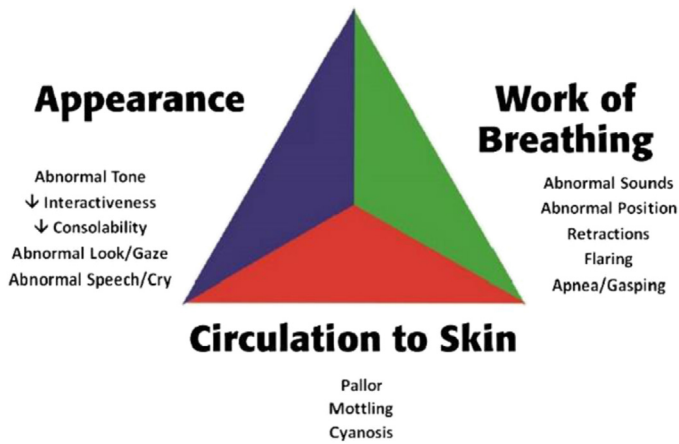

Fig. 1. The Pediatric Assessment Triangle and its components from Horeczko T, Enriquez B, McGrath NE, Gausche-Hill M, Lewis RJ. The pediatric assessment triangle: Accuracy of its application by nurses in the triage of children. Journal of emergency nursing. 2013;39(2):182-189; with permission (see Fig. 1 in original).

Always consider sepsis as a cause of cardiovascular collapse, especially in the neonate under 30 days with a low threshold to give empiric broad-spectrum antibiotics early. Genetic abnormalities often show abnormal physiology in the first month of life and can result in hypoperfusion and shock states. Hypoglycemia is common in sepsis and in-born errors of metabolism.

INITIAL IMPRESSION

1. Using the Pediatric Assessment Triangle,[1] a provider can visually assess the child's appearance, circulation, and work of breathing to formulate a general idea of the cause of illness with visual clues of respiratory causes, CNS or metabolic etiology, cardiovascular collapse (shock), or complete cardiopulmonary failure (arrest).
2. Recognizing the critically ill neonate
   a. Poor perfusion – mottled/gray, delayed cap refill, tachycardic
   b Respiratory distress – grunting is auto-peep (may need positive pressure), tachypnea
   c Altered mental status (AMS) – lethargic, not responding to noxious stimuli
   d Poor tone – floppy baby

Vital signs: Vital signs vary dramatically by age with a quick reference later in discussion in **Table 1**.

Normal Vital Signs:

THE A, B, C, D^2, E^2 METHOD

Primary Assessment: The primary assessment includes the evaluation and management of the airway, breathing, circulation, (A, B, C) as well as a quick neurologic evaluation (disability = D) and exposure (E) of the skin to look for rashes or other clues. After exposure, including the diaper area and back, clinicians should ensure no further heat loss, especially in neonates as well as prevent hyperthermia. Because hypoglycemia can be a cause or a result of critical illnesses, early monitoring, and correction with dextrose (D) is essential, as are extra tests (E) depending on the presentation.

Because infants have low glucose reserves and may have unrecognized metabolic derangement, the early assessment and correction of hypoglycemia are encouraged. This can be expressed as an additional "D" for dextrose in the sequence of evaluation as well as an extra "E" for extra testing that needs to be addressed simultaneously, such as vascular access, abdominal examination, and focused assessment with sonography in trauma (FAST), obtaining urine and blood for cultures and laboratories, and so forth. This can easily be remembered as A, B, C, D^2, and E^2.

AIRWAY

- Assess for patency: start with maneuvers to open the airway (jaw-thrust, head-tilt, shoulder elevation for large occiput) being cautious not to excessively move the cervical spine if suspicious of trauma
- Remove obstructions or potential obstructions manually or with suction (food, foreign body). Upper airway obstructions tend to cause stridor and usually can be removed with McGill forceps if visualized. If there is stridor without visible obstruction, be cautious of epiglottis, larynx, or trachea foreign body or inflammation.
- Administer medications such as racemic epinephrine for croup with stridor. Consider epiglottitis or other dangerous causes of upper airway obstruction that may need controlled intubation.
- Do not delay the administration of intramuscular (IM) epinephrine for anaphylaxis.

BREATHING

- Assess rate and effort of breathing visually and auscultate for wheezing or rales that might be a clue to a diagnosis.
- Pulse oximetry assessment and oxygen intervention as needed. Provide 100% oxygen by nasal cannula if oxygen saturation is less than 94% or according to clinician judgment.
- Proceed to bag valve mask or positive pressure ventilation for continued hypoxia or poor ventilatory effort.
- If in respiratory failure, or concern for impending respiratory arrest, proceed to intubation as indicated. Be cautious in children with rapid respiratory rate due to metabolic acidosis because artificial ventilators may not be able to replicate the rate needed to compensate for acidosis.
- Initiate treatment of any conditions found to compromise respiration or ventilation such as albuterol and epinephrine for asthma.
- Monitor ventilation with end-tidal carbon dioxide if intubated or for the close assessment of potential ventilatory failure on supplemental oxygen that may have a rise in CO2 before a decline in oxygen.

CIRCULATION

- Assess perfusion through skin color, temperature, capillary refill, and strength of peripheral pulses.
- Auscultate heart sounds for clues to etiology.
- Measure blood pressure (BP) frequently.
- Early recognition of shock in pediatric patients is key because a drop in BP is usually a late finding with tachycardia and poor capillary refill seen early. Sepsis or anemia may have very high cardiac output yet produce shock. Low cardiac output will often be compensated early with increased heart rate, venous tone, arterial resistance, and inotropy that can result in a systolic BP (SBP) in the normal range.
- Decompensated shock is defined in PALS as the following, although clinicians should rely on experience and gestalt to start treatment early.
  - Goal systolic blood pressure (SBP) are calculated for <5th percentile = 70 mm Hg + (child's age in years x 2) SBP considered normal at 50th percentile = 90 mm Hg + (age in years x2).
  - It is recommended to maintain MAP between 5th and 50th percentile for age recommended by Surviving Sepsis Campaign[3] with insufficient evidence for a narrower recommendation. Aiming for a mean arterial pressure (MAP) at the 50th percentile may be preferable[4] (calculated as 55 + 1.5 x age in years). These are listed for quick reference in **Table 2**.
- Begin volume expansion as needed
  - Initial fluid bolus IV 10 to 20 mL/kg isotonic fluid
  - Transfuse PRBC 10 mL/kg if indicated
  - Follow massive transfusion protocol for trauma with hemorrhage.

DISABILITY

A rapid neurologic evaluation should include pupillary response to light and level of consciousness. The AVPU scale seen in **Table 3** assesses if the child is spontaneously alert, responsive to voice or pain only, or completely unresponsive is a rapid test for level of consciousness.

Table 3
AVPU scale for level of consciousness

A	Awake
V	Responds to verbal stimuli
P	Responds to painful stimuli
U	Unresponsive

The use of the Glasgow Coma Scale (GCS) in pediatric trauma patients $\leq$ 3 years old has not been shown to be very reliable[5] with routine intubation of trauma patients with a GCS of $\leq$ 8 possibly harmful.[6] Other more complex scoring systems such as the revised trauma score[7] (correlates strongly with patient survival and whether the patient should be transferred to a trauma center) or the pediatric age-adjusted shock index[8] can be used to identify severely injured children but are more cumbersome and offer less immediate guidance. These can be calculated in secondary or tertiary surveys.

DEXTROSE

Obtain rapid bedside glucose test and treatment with dextrose. The "Rule of 50" below is recommended by PALS[9] when treating for hypoglycemia to give 50 g of dextrose. Adults are typically given "1 amp" or 50 mL of D50, while infants and children should be given less concentrated solutions to avoid sclerosing the veins. A quick reference is found in **Table 4**.

If D10 W and D25 W are not available, dilution of D50 can easily be made[10] by using 10 mL of D50 with 40 mL of sterile water to create D10 W and 25 mL of D50 with 25 mL of sterile water to create D25 W, both a total volume of 50 mL.

EXPOSURE

All skin areas must be examined for any evidence of bruising, trauma, rashes, or other skin findings. Temperatures obtained with rectal temperatures are most accurate[11] and a reflection of core temperature under 5 years old.[12,13] This is also extremely important in the evaluation of nonaccidental trauma (NAT) discussed later.

EXTRA TESTING

A focused physical examination will include other areas not addressed in the airway, breathing, circulation primary assessment depending on the presentation and differential diagnosis considered. More extensive guidance will be given in the following section on common causes of critically ill pediatric presentations.

SECONDARY AND TERTIARY ASSESSMENT

This includes a focused history with caregivers and patient if possible. Key historical questions pertinent to the pediatric population are included here in **Table 5**.

Table 4
Dextrose dosing in pediatric hypoglycemia

Patient	Dextrose Concentration	Dose	Concentration x Dose = 50
Newborn/infant	D10 W	5 mL/kg	50
Child	D25 W	2 mL/kg	50
Adolescent	D50 W	1 mL/kg	50

Table 5
Helpful historical questions

Question	May Identify
Familial genetic/inherited diseases?	Congenital heart disease, cystic fibrosis, metabolic disorder
Prenatal care?	Genetic disorder (cystic fibrosis, muscular dystrophy, hemophilia A, kidney disease, sickle cell, Tay-Sachs, thalassemia), heart defect on ultrasound screening
Birth outside of hospital?	Lack of screening tests or vitamin K administration at birth
Preterm birth?	Risk factor for pulmonary diseases, serious bacterial infection, necrotizing enterocolitis, jaundice, anemia
Vaccinations since birth?	Risk for influenza, hepatitis B, hemophilus influenza, measles, pneumococcal disease, rotavirus, diphtheria, pertussis, rubella, varicella
Formula fed and how is formula mixed?	Hypotonic hydration, hypoglycemia
Sweating or crying when feeding?	Congenital heart disease
Hungry after feeding and vomiting?	Pyloric stenosis

By this time, a clinician may have a suspicion of etiology, nature, treatment of illness/injury and will order ancillary studies according to clinical suspicion. For the undifferentiated crashing pediatric patient or neonate, consider THE MISFITS[14] which is listed in **Table 6** with a brief description of treatment guidelines.

Table 6
Differential diagnosis of the undifferentiated neonate in distress

Trauma	A Wide Range of Presentation Should Be Treated according to ATLS Guidelines with Head Trauma a Leading Cause of Death
Hypovolemia and Heart disease	Volume expansion and Cardiovascular and arrhythmia management according to PALS guidelines
Endocrine	Consider congenital adrenal hypoplasia in fluid refractory shock, correct electrolyte and glucose abnormalities as needed
Metabolic	Check and correct glucose early, manage electrolyte and acid/base derangement
Inborn errors of metabolism	Rare, most diagnosed at birth, hypoglycemia is common, fluid resuscitation may be needed
Sepsis	Leading cause of neonatal mortality that requires rapid resuscitation and treatment
Intestinal catastrophes	Sometimes surgical emergencies that are unique to the pediatric population
Toxins	Consult Poison Control early, obtain ECG, glucose, and electrolytes early, extremely wide range of management
Seizures	Often simple self-resolving febrile seizure. Status epilepticus requires prompt management.

From the preceding list, several categories have highly specified treatments for the many different congenital abnormalities and pathologic states. Because sepsis is the leading cause of childhood death,[15] it will be discussed in detail later in discussion, along with the actively seizing pediatric patient.

SEPSIS

Pediatric Sepsis Protocol: The development of a pediatric sepsis protocol has been shown to improve outcomes even in hospitals with limited resources;[16] however, single screening tools and universal resuscitation bundles, especially in pediatric sepsis, remain controversial with weak evidence to support a single approach.[17] Despite this, the following are key points from the Surviving Sepsis Campaign[18] and Society of Critical Care Medicine.[19]

A 2-step process of first-contact triage nurse or provider screening with a system alert for a clinician evaluation.[17] The use of qSOFA is not recommended[18] with authors recommending the combination of triage evaluation, pediatric SIRS[20] and/or PEWS[21] score, in addition to risk factor screening.[17]

1) Initial laboratories and work-up may be dependent on the patient's age with most children who meet the definition of sepsis receiving the full work-up if no obvious source.
2) Obtain blood cultures before antibiotics unless it will delay antimicrobial therapy.
3) Empiric broad-spectrum antibiotics to cover all likely pathogens recommended within 60 minutes
   a) Previously healthy, immunocompetent children: Ceftriaxone (or Cefotaxime if under 1 month) AND Vancomycin.
   b) Immunocompromised or hospitalized patients should have antipseudomonal coverage (third or higher-generation cephalosporin ie, cefepime) AND a broad-spectrum carbapenem (meropenem, imipenem/cilastatin) OR extended range penicillin/beta-lactamase inhibitor (piperacillin/tazobactam)
   c) Neonates: consider ampicillin for listeria and acyclovir for HSV
4) Respiratory support:
   a) Treat hypoxia without respiratory distress with oxygen by face mask or high-flow nasal cannula
   b) Nasal CPAP can be considered in respiratory distress with hypoxia.
   c) For respiratory failure despite initial oxygenation or respiratory impending failure, intubate. RSI can cause significant hypotension so fluid resuscitation prior when able is best.
   d) Noninvasive ventilation can be considered in patients responding to therapy.
5) Airway management
   a) Trial of noninvasive ventilation is reasonable before RSI.
   b) Optimize RSI with adequate fluid resuscitation prior.
   c) Sedation – ketamine or fentanyl, avoid etomidate
   d) Succinylcholine or rocuronium
6) Fluid resuscitation should start within 30 minutes ideally.
   a) A bolus of 20 mL/kg IV crystalloid is the minimum starting dose.
   b) Start with 40 mL/kg especially for age over 2 years as this has been shown to decrease mortality.[22]
   c) Adult studies[23,24] favor balanced crystalloids (lactated ringers, Plasma-Lyte) over normal saline which can produce a metabolic acidosis in large volumes with clinical trials in pediatrics ongoing.[25]
7) Blood transfusion if hemoglobin of less than 7 g/dL. No clear guidelines above 7.

8) Maintain MAP between 5th and 50th percentile for age recommended by Surviving Sepsis Campaign[3] with insufficient evidence for a narrower recommendation. Aiming for a mean arterial pressure (MAP) at the 50th percentile may be preferable[4] (calculated as 55 + 1.5 x age in years). This goal at the 50th percentile is calculated later in discussion in **Table 7**.
9) Perfusion goals should include capillary refill of less than 2 seconds, normal pulses, warm extremities, urine output >1 mL/kg/h, normal glucose and ionized calcium, and normal mental status.
10) Central or peripheral inotropes should be started within 60 minutes, ideally as soon as refractory shock is recognized with the ability to titrate medications down if needed.
11) Inotropic support (pressors) include:
    a) Peripheral epinephrine at 0.05–0.3 μg/kg/min initially and can be given centrally if needed for "cold shock" with mottled, cool, vasoconstricted extremities
    b) Norepinephrine starting at 0.05 μg/kg can be used if "warm shock" seen in a vasodilated patient.
    c) Central dopamine titrated to a max of 10 μg/kg/min if unable to use epinephrine or norepinephrine.
12) Add IV hydrocortisone 2 mg/kg initially for fluid and vasopressor resistant hypotension[26] or known adrenal insufficiency which can be 2–3 mg/kg starting up to a maximum of 100 mg.
13) Monitor and support blood glucose greater than 50 and less than 180, and follow serial lactate and anion gap measures at least every hour. Continuous pulse oximetry, ECG and telemetry monitoring, core temperature, and urine output are all strongly recommended.

PEDIATRIC SEIZURE

Treatment: Management of acutely seizing child in the ED consists of the following:

1. Support brain oxygenation and cardiorespiratory function according to PALS guidelines including supplemental oxygen and airway management with positioning and intervention with RSI if needed for severe hypoxia or status epilepticus.[27]
2. Terminate seizure activity usually with benzodiazepine (lorazepam or diazepam) and a loading dose of phenytoin.[27]
3. Correct potential nonepileptic cause: hypoglycemia, infection, electrolyte imbalance, fever, or other causes.
4. Prevent and treat status epilepticus usually with barbiturate coma using thiopental.[27]

Table 7
Quick reference for goal MAP at 50th percentile of child of average height

Age	Calculation	Goal MAP
Newborn	55 + 1.5 x age in years	55 mm Hg
2 year old	55 + 1.5 x age in years	58 mm Hg
4 year old	55 + 1.5 x age in years	61 mm Hg
7 year old	55 + 1.5 x age in years	65 mm Hg
10 year old	55 + 1.5 x age in years	70 mm Hg

Table 8
Antiseizure medications

Medication	Route	Dose	Max
Lorazepam	IV	0.1 mg/kg	4 mg
Diazepam	IV/IO	0.15–0.2 mg/kg	10 mg
	Rectal	0.2–0.5 mg/kg	20 mg
	Buccal	0.5 mg/kg	10 mg
Midazolam	IM	0.2 mg/kg	10 mg
	Intranasal	0.2 mg/kg	10 mg
Valproic acid	IV/IO	20 mg/kg	3000 mg
Fosphenytoin	IV	20 PE*/kg	1500 PE[a]
Phenobarbital	IV	15–20 mg/kg	20 mg/kg
Levetiracetam	IV	30–60 mg/kg	4500 mg

[a] PE = phenytoin equivalents.

Treatment with antiepileptic drugs (AED) after a first seizure has not been shown to improve prognosis.[28] Treatment with AED after the first seizure may be considered in circumstances whereby the benefits of reducing the risk of a second seizure outweigh the risks of pharmacologic and psychosocial side effects which must be understood by the prescriber. There is a paucity of evidence to suggest the use of IV lorazepam over diazepam and if no IV access is available, buccal midazolam or rectal diazepam are acceptable.

STATUS EPILEPTICUS

Clinical practice: For seizures that persist despite treatment with benzodiazepine, and phenytoin and/or phenobarbitone, consider status epilepticus and treatment with thiopental (barbiturate coma) or continuous benzodiazepine drip. ED providers may be more comfortable with benzodiazepines such as diazepam at a starting dose of 0.01 mg/kg/min or midazolam infusion starting with 2 μg/kg/min up to 12 μg/kg/min.[28] Intravenous Valproate 30 mg/kg diluted 1:1 in normal saline over 2 to 5 min is an alternative to benzodiazepine drip. If still unsuccessful, Levetiracetam 40 mg/kg at 5 mg/kg/min can be infused after valproate before initiating thiopental coma.[27] Ketamine, lidocaine, and propofol are all alternative options with ketamine probably the most comfortable option for ED providers.

To simplify the approach, authors have suggested a sequential approach to the pediatric patient in status epilepticus like other "code" situations with algorithms like ACLS.[29] By drawing on other literature and evidence, a "seizure code" could simplify the approach with regard to variations in presentation and medication dosing. A summary of this plan adopted from the Neurocritical Care Society and American Epilepsy Society by Stredny and colleagues[29] is included here for quick reference.

1) Initial medication – IV lorazepam or diazepam. If IV access not available, rectal diazepam or intranasal or buccal midazolam.
2) Repeat benzodiazepine if seizure persists at 5 minutes.
3) At 10 minutes consider status epilepticus and add a second agent. Medications options include fosphenytoin, valproic acid, levetiracetam, or phenobarbital.
4) Consult pediatric neurology.
5) At 15 minutes, continuous seizure may be treated with a repeat dose of the second agent chosen, switch to a different agent above, or start continuous infusion. **Table 8** shows the initial and maximum dosing of common seizure medications by the route.

SUMMARY

The crashing pediatric patient, including neonates, requires immediate action to correct pathologic states leading to airway, breathing, and cardiovascular compromise. The most common cause of mortality in infants and children remains sepsis which should be promptly considered and treated. Pediatric seizures present in a much different fashion but can be equally anxiety provoking. A systemic approach to both can aid providers in performing excellent pediatric resuscitation.

CLINICS CARE POINTS

- Care of the critically ill pediatric patient can be anxiety provoking, and clinicians can benefit from a simplified approach focusing on the core principles of resuscitation.
  - Pitfall: Avoid becoming preoccupied with recognition and treatments for rare pediatric illnesses while forgetting to address the basics of emergency medicine
- The first step is the recognition of compensated and decompensated shock states requiring early intervention.
  - Pitfall: Do not rely on BP and MAP alone to recognize shock as children usually have robust cardiovascular reserves that maintain BP until a precipitous crash.
- The Pediatric Assessment Triangle is a validated, rapid observational tool to quickly delineate a potential cause of undifferentiated shock.
  - Pitfall: Trying to memorize normal vital signs can be difficult and delay rapid evaluation and intervention.
- The A, B, C, D2, and E2 sequence in neonatal and pediatric resuscitation is a memory aid for airway, breathing, circulation, disability, dextrose, exposure, and extra tests.
  - Pitfall: Neonates can exhaust glucose reserves and lose body heat rapidly, thus correcting hypoglycemia and preventing hypothermia should be part of resuscitation.
- For the undifferentiated crashing pediatric patient or neonate, consider THE MISFITS: Trauma, Hypovolemia and Heart disease, Endocrine diseases, Metabolic derangements, Inborn errors of metabolism, Sepsis, Intestinal catastrophes, Toxin exposure, and Seizures. Of these, sepsis is the leading cause of pediatric death.
  - Pitfall: Do not delay early broad-spectrum antibiotics and lab tests and cultures necessary for the diagnosis and treatment of sepsis while waiting for confirmatory testing.
- Perfusion goals in septic shock include a MAP between the 5th and 50th percentile, capillary refill of less than 2 seconds, normal pulses, warm extremities, urine output >1 mL/kg/h, normal glucose and ionized calcium, and normal mental status.
  - Pitfall: Do not delay early, aggressive IV fluid resuscitation starting at 20 mL/kg with 40 mL/kg recommended over the age of 2.
- Inotropic support in septic shock should be started within 60 minutes or whenever a refractory shock is recognized.
  - Pitfall: Adrenal insufficiency can be a missed cause of fluid and vasopressor-resistant hypotension.
- A sequential approach to actively seizing pediatric patient, much like other algorithms such as ACLS, can result in better outcomes.
  - Pitfall: Do not delay the administration of benzodiazepines in seizing children with buccal midazolam and rectal diazepam available.

DISCLOSURE

The authors have nothing to disclose.

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