

The Pediatric Assessment Triangle

A Novel Approach for the Rapid Evaluation of Children

Ronald A. Dieckmann, MD, MPH, FACEP, FAAP,* Dena Brownstein, MD,†
and Marianne Gausche-Hill, MD, FACEP, FAAP‡§

Abstract: The Pediatric Assessment Triangle (PAT) has become the cornerstone for the Pediatric Education for Prehospital Professionals course, sponsored by the American Academy of Pediatrics. This concept for emergency assessment of children has been taught to more than 170,000 health care providers worldwide. It has been incorporated into most standardized American life support courses, including the Pediatric Advanced Life Support course, Advanced Pediatric Life Support course, and the Emergency Nursing Pediatric Course. The PAT is a rapid and simple observational tool suitable for emergency pediatric assessment regardless of presenting complaint or underlying diagnosis. This article describes the PAT and its role in emergency pediatric assessment.

Key Words: prehospital, assessment, paramedics

(*Pediatr Emer Care* 2010;26: 312–315)

Emergency assessment of a critically ill or injured infant or young child is often difficult, even for the experienced clinician. History, when available, is usually provided by the child's caregiver. The child may be too young, too frightened, or too disabled to respond to questions. Physical examination may be compromised by a child too distressed to cooperate with a hands-on evaluation, and standard assessments tools such as auscultation and abdominal palpation may miss serious disease or injury. Vital signs—the cornerstones of adult assessment—may be difficult to interpret because of age-based variation. Finally, most clinicians outside pediatric emergency departments (EDs) and pediatric critical care units have relatively infrequent encounters with critically ill or injured children, which limits opportunities to reinforce both cognitive and psychomotor skills.¹

Clinical decision making is most challenging, and error is most common when a clinician is faced with a novel and uncommon situation, such as the assessment and management of a critically ill or injured child. Complex information must be cognitively integrated to generate a differential diagnosis, assess likelihood, and determine diagnostic and treatment priorities, all in a compressed time frame. As in any medical emergency, an algorithmic approach to initial assessment and management enhances reliability. Standardization of assessment provides a framework for common expectations and improved communications among members of the health care team and mitigates the risk that important information will be missed or misinterpreted in high-stress situations.

A number of pediatric-specific scales and scoring systems have been advanced to promote an objective approach to the

assessment of acuity and to help predict illness or injury outcomes in children. The Yale Observation Scale, the Pediatric Glasgow Coma Scale, the Pediatric Trauma Score, the PRISM score (Pediatric Risk of Mortality score), and a host of pain scales and respiratory scoring systems are examples of important attempts to promote standardization and a common vocabulary in assessing severity of illness and prognosis in children.^{2–6} Implementation of these tools has been variable: lack of validation has been an issue for some, whereas complexity of the scoring system and difficulties with retention and accurate application of the system during critical clinical events have limited the applicability of others.^{7–11}

The Pediatric Assessment Triangle (PAT) was developed as a tool to standardize the initial assessment of infants and children for all levels of health care providers.¹² Intended for use in “rapid assessment,” the PAT uses only visual and auditory clues, requires no equipment, and takes seconds to perform. It allows the emergency clinician to establish the severity of the child's condition, determine the urgency of interventions, recognize the general category of pathophysiology, and formally articulate a general impression of the child to other team members. This article describes the PAT and its role in emergency pediatric assessment.

Pediatric Emergency Assessment

For children of all ages, emergency assessment includes 3 distinct, sequential steps: (1) the general observational assessment—the PAT, (2) the “primary” hands-on physiological assessment with the ABCDEs, and (3) the “secondary” anatomical assessment. The pediatric primary and secondary assessments (sometimes called the “initial” and “additional” assessments) have well-defined components that mirror the tools used in adult practice. These 2 steps will not be described further. Implicit in an emergency assessment of a patient of any age is the mandate to treat life-threatening problems at the time that they are identified in the sequence, before moving on to the next step in the algorithm.

Pediatric Assessment Triangle

Emergency assessment of patients of all ages begins with a general observational assessment. In children, this requires a developmentally appropriate approach that emphasizes the visual and auditory “first look” at the child to quickly decide: “sick or not sick?” The PAT (Fig. 1) is a tool for the rapid, initial assessment of any child to identify physiological instability and to institute critical treatment. Using the PAT at the point of first contact with the patient helps establish a level of severity, determine urgency for treatment, and identify the general type of physiological problem. Serial applications of the PAT provide a way to track response to therapy and determine the timing of subsequent interventions. The PAT promotes consistent communication among medical professionals about the child's physiological status and goals for therapy.

The 3 components of the PAT are appearance (Table 1), work of breathing (Table 2), and circulation to the skin (Table 3).

From the *University of California, San Francisco, CA; †University of Washington, Division of Emergency Medicine, Seattle Children's Hospital, Seattle, WA; ‡David Geffen School of Medicine at UCLA, Los Angeles; and §Department of Emergency Medicine, Harbor-UCLA Medical Center, Torrance, CA.

Reprints: Marianne Gausche-Hill, MD, FACEP, FAAP, Harbor-UCLA Medical Center, 1000 W Carson, Torrance, CA 90502
(e-mail: mkausche@emeharbor.ucla.edu).

Copyright © 2010 by Lippincott Williams & Wilkins
ISSN: 0749-5161

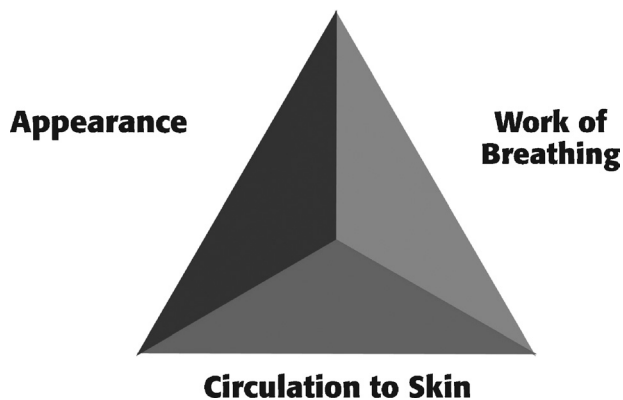


FIGURE 1. The pediatric assessment triangle (PAT).

Together, these patient characteristics provide an initial picture of the child’s cardiopulmonary status and cerebral and metabolic function. Each component of the PAT is evaluated separately, using specific predefined physical, visual, or auditory findings (Tables 1–3). If the clinician detects an abnormal finding, the corresponding component is, by definition, abnormal. The PAT is not intended to generate a specific diagnosis—rather, it is designed to identify the type and severity of the physiological problem and to prioritize initial treatment.

Combining the 3 PAT components forms a general impression. The general impression is the clinician’s overall evaluation of the child’s physiological state. This general impression in its simplest form first distinguishes severity: stable versus unstable or “sick” versus “not sick.” Second, the PAT helps identify the primary type of underlying physiological abnormality (respiratory, perfusion, metabolic, or central nervous system [CNS]). Further refinements in the general impression are based on the PAT’s tandem evaluation of severity and pathophysiology. These may be divided into 6 major assessment categories: respiratory distress or respiratory failure, compensated or decompensated (hypotensive) shock, CNS dysfunction/metabolic dysfunction, and cardiopulmonary failure. The relationship of the PAT components to these physiological categories are described in Table 4. Hence, the PAT defines the urgency of treatment based on

TABLE 1. Characteristics of Appearance: The “Tickles” (TICLS) Mnemonic

Characteristic	Normal Features
Tone	Moves spontaneously Resists examination Sits or stands (age appropriate)
Interactiveness	Appears alert and engaged with clinician or caregiver Interacts with people, environment Reaches for toys, objects (eg, penlight)
Consolability	Stops crying with holding and comforting by caregiver Has differential response to caregiver versus examiner
Look/gaze	Makes eye contact with clinician Tracks visually
Speech/cry	Has strong cry Uses age-appropriate speech

Adapted from American Academy of Pediatrics.¹⁵

TABLE 2. Characteristics of Work of Breathing

Characteristic	Abnormal Features
Abnormal airway sounds	Snoring, muffled or hoarse speech, stridor, grunting, wheezing
Abnormal positioning	Sniffing position, tripodding, preference for seated posture
Retractions	Supraclavicular, intercostal, or substernal retractions, head bobbing (infants)
Flaring	Flaring of the nares on inspiration

Adapted from American Academy of Pediatrics.¹⁵

the assessment category and drives lifesaving management, including the delivery of oxygen, support of ventilation, establishment of intravenous access and fluid resuscitation, emergency drug delivery, and the initiation of chest compressions (Table 5).

Application of the PAT

How might this tool be used in the acute care or emergency setting?

Case 1

A 3-year-old boy is brought to the ED with complaints of trouble breathing. The PAT reveals an alert and interactive toddler who cries vigorously when his mother puts him on the examination table and actively resists examination. He has subcostal and intercostal retractions and stridor when agitated, and his skin is pink. Based on the PAT normal appearance and circulation to the skin and abnormal work of breathing, he is in respiratory distress. Severity and urgency of intervention are only moderate, so immediate management includes allowing the child to remain in a position of comfort and continuing the assessment process (ABCDEs and vital signs). Based on his assessment category, further therapy should also be promptly initiated: supplemental oxygen for low arterial oxygen saturation, corticosteroids to reduce inflammation, and nebulized epinephrine for stridor.

Case 2

The nurse calls you to the ED examination room of a 4-month-old girl. The infant is limp and unresponsive and has gasping respiratory effort and pale skin. The PAT abnormal appearance, abnormal work of breathing, and abnormal circulation to the skin confirm that this infant is in respiratory failure or cardiopulmonary failure. The severity and urgency for intervention is high. Before undertaking additional assessment or placement of electronic monitors, you immediately position her head, open the airway, and begin assisted ventilation with 100% oxygen via a bag-mask device. You feel for a pulse and

TABLE 3. Characteristics of Circulation to the Skin

Characteristic	Abnormal Features
Pallor	White or pale skin or mucous membrane coloration
Mottling	Patchy skin discoloration due to varying degrees of vasoconstriction
Cyanosis	Bluish discoloration of skin and mucous membranes

Adapted from American Academy of Pediatrics.¹⁵

TABLE 4. Relationship of the PAT Components to Physiological Categories

Component	Stable	Respiratory Distress	Respiratory Failure	Compensated Shock	Decompensated (Hypotensive) Shock	CNS/Metabolic Dysfunction	Cardiopulmonary Failure
Appearance	Normal	Normal	Abnormal	Normal	Abnormal	Abnormal	Abnormal
Work of breathing	Normal	Abnormal	Abnormal	Normal	Normal/Abnormal	Normal	Abnormal
Circulation to the skin	Normal	Normal	Normal/Abnormal	Abnormal	Abnormal	Normal	Abnormal

assess the need for chest compressions, while establishing vascular access for fluid and drug administration.

The PAT provides a hands-off, across-the-room assessment that can be completed in less than 30 seconds. The PAT codifies the “gut instinct” of an experienced clinician and precedes the hands-on ABCDEs familiar to all emergency providers. It allows for the judicious timing of treatment and rapid initiation of lifesaving therapy without delay when indicated.

History of the PAT and National Consensus Adoption—The 2005 Emergency Medical Services for Children (EMSC) Consensus Conference

In 2000, the American Academy of Pediatrics (AAP) and Jones and Bartlett Publishers published the first national pedi-

atric educational program for prehospital providers. This educational program, entitled *Pediatric Education for Prehospital Professionals* (PEPP), culminated from more than 10 years of work by many experts in the field of pediatric emergency medicine and emergency medical services. The AAP established a PEPP Steering Committee in 1998, which was composed of members from national organizations concerned with the emergency care of children and emergency medical services. The curriculum that emerged from this collaborative process promoted the use of a new rapid assessment tool, the PAT.^{12–14}

In 2005, an Emergency Medical Services for Children (EMSC) task force was convened to review definitions and assessment approaches for national-level pediatric life support programs and courses. Representatives from the AAP, American College of Emergency Physicians, American Heart Association,

TABLE 5. Management Priorities by General Impression (PAT)

General Impression	Management Priorities
Stable	Specific therapy based on possible etiologies
Respiratory distress	Position of comfort Supplemental oxygen/suction as needed Specific therapy based on possible etiologies (eg, albuterol, diphenhydramine, epinephrine)
Respiratory failure	Laboratory and radiographic evaluation as indicated Position the head and open the airway Provide 100% oxygen Initiate bag-mask ventilation as needed Initiate foreign body removal as needed Advanced airway as needed Laboratory and radiographic evaluation as indicated
Shock (compensated)	Provide oxygen as needed Obtain vascular access Begin fluid resuscitation Specific therapy based on possible etiologies (eg, antibiotics, surgical evaluation for trauma, antidysrhythmics)
Shock (decompensated/hypotensive)	Laboratory and radiographic left evaluation as indicated Provide oxygen Obtain vascular access Begin fluid resuscitation Specific therapy based on possible etiologies (eg, antibiotics, vasopressors, blood products, surgical evaluation for trauma, antidysrhythmics, cardioversion)
CNS/metabolic dysfunction	Laboratory and radiographic evaluation as indicated Place pulse oximetry and provide oxygen as needed Obtain rapid glucose Consider other etiologies
Cardiopulmonary failure/arrest	Laboratory and radiographic evaluation as indicated Position the head and open the airway Initiate bag-mask ventilation with 100% oxygen Begin chest compressions as needed Specific therapy based on possible etiologies (eg, defibrillation, epinephrine, amiodarone) Laboratory and radiographic evaluation as indicated

Emergency Nurses Association, National Association of EMTs, the Children's National Medical Center, and the New York Center for Pediatric Emergency Medicine met to adopt consensus definitions and approaches to pediatric emergency care.

The task force was charged to standardize terminology, assessment, and treatment algorithms for clinical practice in pediatric emergency, trauma, and critical care for all provider groups, in all care settings. The group concluded that a standard algorithm for pediatric emergency assessment should start with the PAT. The tool was subsequently incorporated into life support courses, including the Advanced Pediatric Life Support, Emergency Nursing Pediatric Course, Pediatric Advanced Life Support, PEPP, Special Children's Outreach and Prehospital Education, and Teaching Resource for Instructors in Prehospital Pediatrics.¹⁵⁻²⁴ Since its inception, the PAT has been taught to hundreds of thousands of medical providers in the United States and internationally.

Validation of PAT

The PAT is still empiric. Although premised on well-established principles in pediatric emergency care, the paradigm has not yet been validated. Before further extension of the PAT to medical schools, nursing schools, and other training environments, a validation study is imperative. The components of each arm of the triangle must be evaluated to determine inter-observer variability and the sensitivity and specificity of the PAT in driving general assessment and initial management decisions. Several studies are under way in Los Angeles, Calif, to evaluate the PAT in the ED and prehospital settings.

CONCLUSIONS

The PAT is now a widely accepted tool in pediatric life support courses in the United States for initiating emergency assessment of infants and children. It has 3 components—appearance, work of breathing, and circulation to the skin—derived from scientific literature and expert opinion. The PAT codifies the expert “gut feeling” of a seasoned clinician. It is intended to initiate the assessment sequence, not replace the ABCDEs. The PAT is the first step in answering 3 critical questions: (1) How severe is the child's illness or injury? (2) What is the most likely physiological abnormality? (3) What is the urgency for treatment? The PAT also provides a common vernacular for emergency clinicians and drives initial resuscitation and stabilization efforts. Although not yet scientifically validated, it is undergoing rigorous review by several investigators that may promote its adoption in other training and educational settings.

ACKNOWLEDGMENTS

The authors thank the AAP and Jones and Bartlett Publishers for their support of the PEPP course and for fostering the development and dissemination of the PAT concept.

REFERENCES

- Gausche-Hill M, Schmitz C, Lewis RJ. Pediatric preparedness of emergency departments: a 2003 survey of the United States. *Pediatrics*. 2007;120:1229-1237.
- McCarthy PL, Lembo RM, Baron MA, et al. Predictive value of abnormal physical examination findings in ill-appearing and well-appearing febrile children. *Pediatrics*. 1985;76:167-171.
- Pollack MM, Ruttiman UE, Getson PR. The Pediatric Risk of Mortality (PRISM) score. *Crit Care Med*. 1988;16:1110-1116.
- Tepas JJ 3rd, Mollitt DL, Talbert JL, et al. The pediatric trauma score as a predictor of injury severity in the injured child. *J Pediatr Surg*. 1987;22:14-18.
- Teasdale G, Jennett B. Assessment of coma and impaired consciousness: a practical scale. *Lancet*. 1974;2:81-84.
- Bauman BH, McManus JG Jr. Pediatric pain in the emergency department. *Emerg Clin North Am*. 2005;23:393-414.
- Nasr A, Mikrogianskis A, McDowell D, et al. External validation and modification of a pediatric trauma triage tool. *J Trauma*. 2007;62:606-609.
- Raimondi AJ, Hirschauer J. Head injury in the infant and toddler. Coma scoring and outcome scale. *Childs Brain*. 1984;11:12-35.
- Baker D, Avner JR, Bell LM. Failure of infant observation scales in detecting serious illness in febrile, 4- to 8-week-old infants. *Pediatrics*. 1990;85:1040-1043.
- Teach SJ, Fleisher GR. Efficacy of an observation scale in detecting bacteremia in febrile children three to thirty-six months of age, treated as outpatients. Occult Bacteremia Study Group. *J Pediatr*. 1995;126(6):877-881.
- Matis G, Birbilis T. The Glasgow Coma Scale—a brief review. Past, present, future. *Acta Neurol Belg*. 2008;108:75-89.
- Dieckmann RA, Brownstein D, Gausche-Hill M, eds. *Pediatric Education for Prehospital Professionals: PEPP Textbook*. Sudbury, MA: Jones & Bartlett Publishers; 2000.
- Gausche-Hill M, Dieckmann RA, Brownstein D, eds. *Pediatric Education for Prehospital Professionals: PEPP Resource Manual*. Sudbury, MA: Jones & Bartlett Publishers; 2000.
- Dieckmann RD, Brownstein DR, Gausche-Hill M, eds. *Pediatric Education for Prehospital Professionals Instructor Toolkit*. Sudbury, MA: American Academy of Pediatrics and Jones & Bartlett Publishers; 2000.
- American Academy of Pediatrics. *Pediatric Education for Prehospital Professionals: PEPP Textbook*. 2nd ed. Sudbury, MA: Jones & Bartlett Publishers; 2006.
- American Academy of Pediatrics, Dieckmann RD, Brownstein DR, Gausche-Hill M, et al, eds. *Pediatric Education for Prehospital Professionals Instructor Toolkit*. Sudbury, MA: Jones & Bartlett Publishers; 2005.
- Gausche-Hill M, Fuchs S, Yamamoto L, eds. *Advanced Pediatric Life Support: The Pediatric Emergency Medicine Resource, American Academy of Pediatrics*. Sudbury MA: American College of Emergency Physicians and Jones & Bartlett Publishers; 2003.
- Teaching Resource for Instructors in Prehospital Pediatrics*. Available at: <http://cpem.med.nyu.edu/teaching-materials>. Accessed May 30, 2009.
- Pediatric Reference Card. Available at: <http://www.health.state.ny.us/nysdoh/ems/pdf/pediatricreferencecard-04.pdf>. Accessed May 30, 2009.
- Emergency Nurses Association. ENPC—Emergency Nursing Pediatric Course. Available at: www.ena.org/catn_enpc_tncnclenpl. Accessed May 30, 2009.
- Hohenhaus S. Someone watching over me: observations in pediatric triage. *J Emerg Nurs*. 2006;32:398-403.
- Adirim T, Smith E, eds. *Special Children's Outreach and Prehospital Education (SCOPE)*. Sudbury, MA: Jones & Bartlett Publishers; 2006.
- 2005 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Part 12: Pediatric Advanced Life Support. *Circulation*. 2005;112(24 suppl):IV167-IV187.
- Ralston M, Hazinski MF, Zaritsky AL, et al, eds. *PALS Course Guide and PALS Provider Manual*. Dallas, TX: American Heart Association; 2007.