ED are encouraged to develop an expanded differential diagnosis by using their knowledge of anatomy to aid memory (Table 16.2).

**KEY POINTS**

- Use a systematic approach to evaluate and manage infants and toddlers. Know common milestones and age-specific manifestation of illness, take an “AMPLIFIEDD” history, do a “head-to-toe” physical examination, and use the “head-to-toe” memory tool to generate an expanded differential diagnosis.
- Do not make the diagnosis of infantile colic on first episode of excessive crying. Remember Wessel’s rule of 3.
- When the cause of illness in an infant or toddler is not obvious, the emergency practitioner should maintain a high level of suspicion for abuse, accidental toxin ingestion or exposure, intussusception, infection, and nonconvulsive seizure activity.

**PERSPECTIVE**

More than 20% of emergency department (ED) visits are by pediatric patients, and a large proportion involve children 4 years or younger. Common reasons for ED visits in this age group include traumatic injuries, fever, respiratory complaints, and gastrointestinal problems. Although many of the disease processes are self-limited, it is imperative that the emergency practitioner (EP) identify infants and children at risk for progression to serious illness.

Knowledge of developmental milestones and age-specific manifestations of illness, in addition to taking a thorough history and physical examination, will greatly enhance the clinician’s ability to diagnose and initiate appropriate therapeutic interventions. From early infancy to the toddler stage, remarkable developmental changes occur. Understanding the changes in language, motor, cognitive, and social skills is important to properly assess infants and toddlers (Fig. 16.1). Many of the common illnesses experienced are age related (Table 16.1), and early recognition of the signs and symptoms of the specific diseases that threaten infants and toddlers is an effective strategy. Taking an “AMPLIFIEDD” history (Box 16.1) and performing a “head-to-toe” physical examination allow the clinician to gather the clinical clues needed to generate a comprehensive differential diagnosis. Practitioners in the ED are encouraged to develop an expanded differential diagnosis by using their knowledge of anatomy to aid memory (Table 16.2).

**DOCUMENTATION**

Infant or Toddler in the Emergency Department
Document consideration of life-threatening diagnoses. Create a word picture of the child: minor or serious illness; for example:

- “Child is playful, interactive, and taking bottle or fluids well.”
- “Well hydrated, nontoxic, and no evidence of trauma, sepsis, meningitis, or distress.”
- “Alert, good tone, moving all extremities.”
- “Child appropriately cries but can be consoled by caregivers.”

This chapter demonstrates how to take a systematic approach to the evaluation of infants and toddlers in the ED to develop a comprehensive diagnostic and therapeutic plan by using three examples of different clinical manifestations: a crying infant, an infant or toddler with altered level of consciousness, and a vomiting infant or toddler.

**THE CRYING INFANT**

“Birds fly and babies cry”

—Marc Weissbluth, pediatrician

**PERSPECTIVE**

One of the most challenging aspects of pediatric emergency care is managing an infant with the nonspecific symptom of acute, excessive crying. Infants are not able to vocalize complaints, and crying is the primary mode of communication until language development. According to Brazelton, most babies will cry between 1½ and 3 hours per day in the first 3 months of life, with the peak occurring at approximately 6 weeks. By the time that parents bring their crying infant or
Fig. 16.1 Easy-to-remember developmental milestones for the emergency department practitioner.

**BOX 16.1 The “AMPLIFIEDD” History**

- Allergies: to medications, environmental allergens
- Medications: prescription, over the counter, natural remedies
- Past medical or surgical history:
  - Birth history
  - Congenital anomaly
  - Chronic disease (e.g., inborn error of metabolism, endocrinopathy)
  - Previous infections
  - Surgeries
- Last “feed, pee, poop”: Feeding, stool, and urine pattern; use of formula (dilution?)
- Immediate events (history of present illness and review of systems): OLD CAARS
  - Onset: Rapid or gradual
  - Location: Evidence of localized pain?
  - Duration and progression of symptoms
  - Characterization of symptoms
  - Alleviating factors of symptoms
  - Aggravating factors of symptoms
  - Recurrence of symptoms: ever had similar manifestation?
  - Severity and system review
- Family and social history
  - Inherited disorders
  - Day care: Who cares for child?
- Immunizations up to date?
- Emergency medical service history: Elicit history of potential trauma, ingestion, abuse, or toxin exposure
- Doctor: Name of primary care physician or specialist for additional information and help
- Documents: Obtain previous medical records

toddler to the ED, they are often exhausted from attempts to console the child. In such circumstances, the EP must be able to distinguish between relatively benign conditions, such as colic, and severe, life-threatening illnesses, such as meningitis. An orderly approach to infants with excessive unexplained crying will allow the EP to diagnose the occasional severe illness and provide guidance to the caregivers.

**EPIDEMIOLOGY**

The prevalence of early excessive crying (e.g., >3 hours) in infants younger than 3 months has been estimated at 8% to 29%, but it may persist for months longer in up to 40% of these children. However, there is no accurate estimate of the incidence of excessive crying secondary to illness because almost every disease process can be accompanied by the symptom of crying. As infants grow and expand their repertoire for expressing specific needs, excessive crying is less frequently voiced as a primary complaint by caregivers.

**PATHOPHYSIOLOGY**

During the first few months of life, infants are expected to have variable periods of prolonged crying, which is normal behavior. However, crying is considered excessive when parents complain about it. Most paroxysmal episodes of crying have a behavioral etiology. In 1954 Wessel published his “rule of 3” for diagnosing colic: when an otherwise healthy infant between the ages of 3 weeks and 3 months cries more than 3 hours per day for more than 3 days per week. However, if organic pathology is to be identified, the EP must recognize
# Table 16.1 Age-Related Differential Diagnosis for Various Chief Complaints (Overlap Can Occur)

<table>
<thead>
<tr>
<th>Complaints</th>
<th>INFANTS</th>
<th>TODDLERS</th>
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</thead>
<tbody>
<tr>
<td><strong>Respiratory Complaints</strong></td>
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<td></td>
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<tr>
<td>Cough</td>
<td>Upper respiratory infection</td>
<td>Upper respiratory infection</td>
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<td></td>
<td>Bronchiolitis</td>
<td>Asthma</td>
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<tr>
<td></td>
<td>Croup</td>
<td>Croup</td>
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<td></td>
<td>Pertussis</td>
<td>Postnasal drip</td>
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<td></td>
<td>Pneumonia (viral or bacterial)</td>
<td>Pneumonia (viral or bacterial)</td>
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<tr>
<td></td>
<td>Tracheoesophageal fistula</td>
<td>Foreign body aspiration</td>
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<tr>
<td></td>
<td>Swallowing incoordination</td>
<td>Allergy, anaphylaxis</td>
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<tr>
<td></td>
<td>Bronchogenic cyst</td>
<td></td>
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<td></td>
<td>Vascular ring</td>
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<tr>
<td></td>
<td>Foreign body aspiration</td>
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<tr>
<td>Wheezing</td>
<td>Bronchiolitis</td>
<td>Asthma</td>
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<tr>
<td></td>
<td>Reactive airways disease</td>
<td>Foreign body aspiration</td>
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<tr>
<td></td>
<td>Foreign body aspiration</td>
<td>Allergic reactions, anaphylaxis</td>
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<tr>
<td></td>
<td>Bronchopulmonary dysplasia</td>
<td>Mediastinal mass (tumor or lymphadenopathy)</td>
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<tr>
<td></td>
<td>Tracheobronchomalacia</td>
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<tr>
<td></td>
<td>Gastroesophageal reflux</td>
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<tr>
<td></td>
<td>Congenital lobar emphysema</td>
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<tr>
<td></td>
<td>Vascular ring</td>
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<td></td>
<td>Pulmonary edema (secondary to congenital heart disorders)</td>
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<tr>
<td><strong>Gastrointestinal Complaints</strong></td>
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<td></td>
</tr>
<tr>
<td>Vomiting</td>
<td>Sepsis</td>
<td>Sepsis</td>
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<tr>
<td></td>
<td>Meningitis, encephalitis</td>
<td>Meningitis, encephalitis</td>
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<tr>
<td></td>
<td>Central nervous system mass</td>
<td>Central nervous system mass</td>
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<tr>
<td></td>
<td>Head injury</td>
<td>Head injury</td>
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<tr>
<td></td>
<td>Hydrocephalus</td>
<td>Hydrocephalus</td>
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<tr>
<td></td>
<td>Posttussive emesis</td>
<td>Appendicitis</td>
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<tr>
<td></td>
<td>Pneumonia</td>
<td>Intussusception</td>
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<tr>
<td></td>
<td>Gastroesophageal reflux disease</td>
<td>Gastroenteritis</td>
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<tr>
<td></td>
<td>Gastroenteritis</td>
<td>Incarcerated hernia</td>
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<td></td>
<td>Pyloric stenosis</td>
<td>Peritonitis</td>
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<td></td>
<td>Intussusception</td>
<td>Diabetic ketoacidosis</td>
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<td></td>
<td>Malrotation with volvulus</td>
<td>Neoplasm (Wilms tumor, neuroblastoma)</td>
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<tr>
<td></td>
<td>Incarcerated hernia</td>
<td>Urinary tract infection</td>
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<tr>
<td></td>
<td>Hirschsprung disease</td>
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<td></td>
<td>Peritonitis</td>
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<td></td>
<td>Congenital adrenal hyperplasia</td>
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<td></td>
<td>Urinary tract infection</td>
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<tr>
<td></td>
<td>Inborn errors of metabolism</td>
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<tr>
<td>Abdominal pain</td>
<td>Trauma (intentional and nonintentional)</td>
<td>Trauma (intentional and nonintentional)</td>
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<tr>
<td></td>
<td>Malrotation with volvulus</td>
<td>Appendicitis</td>
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<tr>
<td></td>
<td>Intussusception</td>
<td>Intussusception</td>
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<tr>
<td></td>
<td>Gastroenteritis</td>
<td>Gastroenteritis</td>
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<tr>
<td></td>
<td>Constipation</td>
<td>Constipation</td>
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<tr>
<td></td>
<td>Incarcerated hernia</td>
<td>Diabetic ketoacidosis</td>
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<tr>
<td></td>
<td>Malabsorptive diseases (celiac disease, lactase deficiency)</td>
<td>Incarcerated hernia</td>
</tr>
<tr>
<td></td>
<td>Hirschsprung disease</td>
<td>Hemolytic-uremic syndrome</td>
</tr>
<tr>
<td></td>
<td>Hemolytic-uremic syndrome</td>
<td>Neoplasm (Wilms tumor, neuroblastoma)</td>
</tr>
<tr>
<td><strong>Neurologic Complaints</strong></td>
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<td></td>
</tr>
<tr>
<td>Seizures</td>
<td>Febrile seizure</td>
<td>Febrile seizure</td>
</tr>
<tr>
<td></td>
<td>Toxic ingestion</td>
<td>Toxic ingestion</td>
</tr>
<tr>
<td></td>
<td>Hypoglycemia</td>
<td>Hypoglycemia</td>
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<tr>
<td></td>
<td>Hyponatremia</td>
<td>Meningitis</td>
</tr>
<tr>
<td></td>
<td>Pyridoxine-dependent seizures</td>
<td>Encephalitis</td>
</tr>
<tr>
<td></td>
<td>Meningitis</td>
<td>Traumatic head injury</td>
</tr>
<tr>
<td></td>
<td>Encephalitis</td>
<td>Lennox-Gastaut syndrome</td>
</tr>
<tr>
<td></td>
<td>Inborn errors of metabolism</td>
<td>Childhood absence epilepsy</td>
</tr>
<tr>
<td></td>
<td>Traumatic head injury</td>
<td>Partial benign epilepsy</td>
</tr>
<tr>
<td></td>
<td>Myoclonic encephalopathy</td>
<td></td>
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<tr>
<td></td>
<td>Early infantile epileptic encephalopathy</td>
<td></td>
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<tr>
<td></td>
<td>Benign infantile seizures</td>
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</tbody>
</table>
that excessive crying has meaning and may be indicative of acute illness. In a study of 56 infants with an episode of excessive, prolonged crying without fever or cause identified by the parents, 61% had a serious final diagnosis.\textsuperscript{10}

### PRESENTING SIGNS AND SYMPTOMS

The general appearance of the crying infant immediately helps the EP establish the severity of the illness (sick or not so sick?). A lethargic, ill-appearing, inconsolable infant mandates immediate consideration of sepsis, meningitis, increased intracranial pressure, or some other serious illness. After the primary survey is complete and it is determined that no emergency intervention is indicated, the EP needs to elicit a comprehensive AMPLIFIEDD history (Box 16.2) from the primary caregiver. Clinical findings on the head-to-toe evaluation suggesting a potential cause of the excessive crying may include the following:

- Signs of head trauma, such as scalp contusions, ecchymoses and lacerations, hemotympanum, postauricular hematomas, or peri orbital ecchymoses
- A bulging fontanelle indicative of increased intracranial pressure
- A sunken anterior fontanelle consistent with dehydration
- Fluorescein uptake indicating corneal abrasions
- Retinal hemorrhages raising concern for serious abuse
- An erythematous and bulging tympanic membrane signifying otitis media

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**Table 16.2 The “Head-to-Toe” Memory Tool**

<table>
<thead>
<tr>
<th>&quot;HEAD-TO-TOE&quot; PHYSICAL EXAMINATION</th>
<th>POTENTIAL CLINICAL FINDINGS</th>
<th>GENERATE “HEAD-TO-TOE” DIFFERENTIAL DIAGNOSIS (EXAMPLES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>Bulging fontanelle</td>
<td>Central nervous system infection</td>
</tr>
<tr>
<td></td>
<td>Step-off, laceration, ecchymosis, hematoma</td>
<td>Meningitis, Encephalitis, Intracranial abscess, Closed head injury, Ventriculoperitoneal shunt malfunction, Central nervous system tumor, Cerebrovascular accident: ischemic or hemorrhagic Seizure</td>
</tr>
<tr>
<td>Eyes</td>
<td>Icterus, conjunctival injection, cranial nerve deficit, retinal hemorrhage</td>
<td>Bile obstruction, hemolysis, foreign body or abrasion, shaken baby syndrome</td>
</tr>
<tr>
<td>Nose</td>
<td>Congestion</td>
<td>Upper airway distress (&lt;6 mo)</td>
</tr>
<tr>
<td>Mouth</td>
<td>Poor dentition</td>
<td>Toxin ingestion or exposure, Oral infection</td>
</tr>
<tr>
<td>Neck</td>
<td>Mass</td>
<td>Thyroid or parathyroid disease, Adenitis</td>
</tr>
<tr>
<td>Chest</td>
<td>Chest wall tenderness</td>
<td>Trauma (e.g., child abuse), Croup, tracheitis, pneumonia, bronchiolitis, asthma, Congenital heart disease, myocarditis, supraventricular tachycardia</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>Stridor, rales, rhonchi, wheezing, murmur, dysrhythmia</td>
<td></td>
</tr>
<tr>
<td>Cardiac</td>
<td>Distention, tenderness, peritoneal signs, palpable mass</td>
<td>Gastroesophageal reflux, malrotation, pyloric stenosis, intussusception, hernia, appendicitis, Hirschsprung disease, constipation, Liver: inborn error, Pancreas: hypoglycemia, diabetic ketoacidosis, Urinary tract: electrolyte disorder, infection, torsion, Adrenal: congenital adrenal hyperplasia</td>
</tr>
<tr>
<td>Abdomen</td>
<td>Deformity, tenderness, edema, induration, erythema</td>
<td>Fractures, Nonaccidental trauma, Accidental trauma, Osteomyelitis, septic arthritis, toxic synovitis, Rhabdomyolysis</td>
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<tr>
<td>Gastrointestinal tract</td>
<td></td>
<td></td>
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<tr>
<td>Liver</td>
<td></td>
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<tr>
<td>Pancreas</td>
<td></td>
<td></td>
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<tr>
<td>Kidney and urinary tract</td>
<td></td>
<td></td>
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<tr>
<td>Adrenal glands</td>
<td></td>
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<tr>
<td>Extremities</td>
<td>Rash, petechiae</td>
<td>Abscess, cellulitis, omphalitis, mastitis, burn, anal fissure, sepsis</td>
</tr>
<tr>
<td>Skin</td>
<td>Weakness, decreased reflexes</td>
<td>Guillain-Barré syndrome, botulism</td>
</tr>
<tr>
<td>Neurologic</td>
<td></td>
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</tbody>
</table>
BOX 16.2 The AMPLIFIEDD History for a Crying Infant or Toddler

Allergies

Medication (by mom or infant): Prescription, over the counter, natural remedies

Past medical history
- Birth history: Prenatal-maternal illness or infections, illicit drug use
- Perinatal: Gestational age, complications, birth weight, infections in infant or mom
- Outpatient treatment or hospitalizations for illness or surgery
- Developmental milestones
- Appropriate weight gain
- Newborn screen: Identify abnormalities

Last feed, pee, poop, sleep
- Feed: Diet, amount and frequency, correct formula preparation, recent changes, breast milk (maternal medications or drugs)
- Adequacy of urine output and characterization of stooling pattern
- Abnormal sleep pattern: Too much or too little

Immediate events (history of present illness and review of systems): OLD CAARS
- Onset of crying (when did the crying begin?)
- Location: As the child develops a more expanded repertoire for communication and caretakers are able to intuit the child’s behavior, localization of pain is possible
- Duration of crying
- Characterization of crying: What does the cry sound like? Is it a cry of hunger, pain, or expression of a desire to be changed or cuddled?
- Aggravating factors: What factors exacerbate the crying (e.g., holding the child, manipulating an extremity)?
- Alleviating factors: What factors alleviate the crying (e.g., feeding, caretaker contact)?
- Recurring factors: Is this episode acute and prolonged or a recurring event? If recurrent, establish the frequency and relationship to feeding and sleeping and ask about previous evaluations
- Review of Systems: Fever, trauma, rhinorrhea, cough, difficulty breathing, vomiting (bilious, projectile, feculent, bloody, or stomach contents only), diarrhea, blood in stool, rash, abnormal movement or spell-like behavior

Family and social history
- Inherited disorders: Sickle cell disease, cystic fibrosis, immunodeficiency disorder, hemophilia, asthma
- Characterization of parental-infant interactions: Identify parental styles and management practices (include perceptions of extended family members)
- Birth order of child may influence parental interpretation of the meaning of crying
- Day care
- Smoking, use of illicit drugs, or excessive alcohol consumption in the household
- Exposure to other ill children or adults

Immunizations: Nonstop crying episodes for longer than 3 hours can rarely occur with recent pertussis vaccination

Emergency medical service history: Elicit history of potential trauma, abuse, or toxin exposure

Doctor: Name of primary care physician or specialist for additional information and help

Documents: Obtain previous medical records


- Obstruction of the nares secondary to a foreign body
- Oral thrush or mucosal ulcers in the oropharynx often seen with stomatitis
- Exudative pharyngitis and fullness of the posterior pharynx suggesting peritonsillar or retropharyngeal abscesses
- Wheezing, rales, or rhonchi indicating a respiratory infection
- Palpation of a mass during the abdominal examination, which can be associated with pyloric stenosis, intussuscep-
tion, or a tumor
- Diaper rash, anal fissure, or impacted stool on rectal examination
- Scrotal swelling consistent with an incarcerated hernia or testicular torsion
- Extremity tenderness, edema, or bruising concerning for a possible fracture
- Erythema, induration, and tenderness suggesting a soft tissue infection (cellulitis or abscess)
- Hair tourniquet on a toe or finger
- Rashes with potentially life-threatening causes (e.g., petechiae, purpura)

DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING

A comprehensive history and systematic head-to-toe physical examination along with a period of ED observation are usually sufficient to differentiate acute illness or injury from a recurrent benign crying syndrome. It is important to remember that excessive crying may be the only behavioral change that the caregiver recognizes as an indicator of illness. Detection of subtle signs and symptoms will help identify high-acuity, low-frequency events. The practitioner should pay close attention to red flags in a young infant such as fever, failure to thrive, paradoxical irritability (crying with movement), vomiting, bloody stools, abnormal neurologic findings, and unexplained abnormal vital signs. A comprehensive differential diagnosis can be generated by using the head-to-toe memory tool (Fig. 16.2 and Box 16.3).

Allow the history, physical examination, and observed behavior of the infant to guide a stepwise approach to
**Fig. 16.2** Head-to-toe differential diagnosis.

**BOX 16.3 Differential Diagnosis of Crying (Head-to-Toe Memory Tool)**

**Head, Eyes, Ears, Nose, and Mouth**
- **Head**: Meningitis, encephalitis, ventriculoperitoneal shunt malfunction or infection, closed head injury (skull fracture; epidural, subdural hematoma), cerebrovascular accident, tumor
- **Eye**: Foreign body, corneal abrasion, glaucoma
- **Ear**: Otitis media
- **Nose**: Nasal congestion (distress in those <6 mo)
- **Mouth**: Ingestion (drug toxicity such as carbon monoxide, methemoglobinemia), thrush, stomatitis

**Neck**
- Mass, adenitis, torticollis, hyperthyroidism, hypothyroidism

**Chest**
- **Chest wall**: Trauma
- **Airway, lungs**: Pneumonia, bronchiolitis, hypoxia, hypercapnia, croup, tracheitis
- **Cardiac**: Congenital heart disease, congestive heart failure, myocarditis, anomalous origin of the right coronary artery, supraventricular tachycardia

**Abdomen**
- **Gastrointestinal tract**: Gastroesophageal reflux, aerophagia, pyloric stenosis, intussusception, malrotation with volvulus, inguinal hernia, gastroenteritis with dehydration, appendicitis, Hirschsprung disease, constipation, peritonitis
- **Liver**: Inborn errors of metabolism
- **Pancreas**: Hypoglycemia, diabetic ketoacidosis
- **Kidney and urinary tract**: Electrolyte disorders, urinary tract obstruction, urinary tract infection, torsion of the testes or ovaries, hair tourniquet of the penis
- **Adrenal**: Congenital adrenal hyperplasia

**Musculoskeletal**
- Fracture or dislocation, osteomyelitis, septic arthritis, toxic synovitis, pain at injection site, pertussis vaccine reaction, hair tourniquet of a digit

**Skin**
- Mastitis, omphalitis, burn, cellulitis, anal fissure, rash, insect or spider bite

**Neurologic**
- Seizure activity, botulism

**Systemic**
- Sepsis
addition, minimize the risk for abuse by confirming that admission of the infant may provide a needed respite. In capacity to continue caring for the infant while recognizing potential musculoskeletal pathologies.

A normal level of consciousness requires proper function and communication of the cerebral cortex and reticular activating system. Normal neuronal activity involves a multifaceted balance of water, electrolytes, metabolic substrates, and neurotransmitter concentrations within a tightly controlled environment of temperature, pH, and osmolality. Any alteration in this environment resulting from insufficient blood flow, electrolyte imbalance, lack of substrate, presence of toxins, abnormal concentration of metabolic waste products, or loss of temperature results in the final common pathway of CNS dysfunction and an altered level of consciousness.

**ALtered Level of Consciousness**

**Perspective**

An infant or toddler with an altered level of consciousness may have a life-threatening illness that requires immediate recognition and treatment to prevent permanent central nervous system (CNS) dysfunction or death.

**Epidemiology**

An altered level of consciousness in this age group is caused by nonstructural causes (e.g., infection, metabolic abnormalities, toxin ingestion) or primary structural disease of the CNS (e.g., hemorrhage, tumors). Physical abuse is the leading cause of serious head injury in young children. Shaken baby syndrome most often involves children younger than 2 years and can easily be misdiagnosed.

**Pathophysiology**

A healthy-appearing infant who ceases crying before or soon after arrival at the ED rarely has a serious cause. An infant who continues to cry will require diagnostic testing directed by careful consideration of the potential differential diagnosis (Box 16.4). For example, suspicion of child abuse should prompt a funduscopic examination and consideration of radiographic studies, including a skeletal survey, computed tomography (CT) of the head, and CT of the abdomen and pelvis. Evaluate cardiac problems with continuous cardiac monitoring, a 12-lead electrocardiogram, and an echocardiogram as indicated. Confirm gastrointestinal pathology with selective radiographic studies such as screening supine and upright abdominal radiographs, ultrasound, upper gastrointestinal series, or judicious use of CT scanning. Evaluate for infectious causes with a chest radiograph, cerebrospinal fluid analysis, and urinalysis. Serum electrolytes, ammonia level, serum pH, and lactate levels are useful to screen for an inborn error of metabolism. Use C-reactive protein, the erythrocyte sedimentation rate, bone scanning, and magnetic resonance imaging to evaluate potential musculoskeletal pathologies.

**Treatment and Disposition**

The treatment plan and consultative services for excessive crying are determined by the underlying cause. An infant who ceases to cry and otherwise demonstrates no evidence of systemic illness may be discharged home with close follow-up. However, before discharge, carefully assess the caregiver’s capacity to continue caring for the infant while recognizing that admission of the infant may provide a needed respite. In addition, minimize the risk for abuse by confirming that an adequate support system is available. If discharged home, provide clear instructions to return with any progression of symptoms.
**SECTION II  SPECIAL CONSIDERATIONS IN THE PEDIATRIC PATIENT**

**BOX 16.5 The AMPLIFIEDD History for an Infant or Toddler with Altered Level of Consciousness**

- **Allergies to medications, environmental allergens**
- **Medications:** prescriptions, over the counter, natural remedies
- **Past medical history:** Birth history, congenital anomalies, chronic disease (e.g., inborn error of metabolism, endocrinopathy), infections, seizures
- **Last feed, pee, poop:** Feeding, stool and urine pattern, use of formula (dilution?)
- **Immediate events (history of present illness and review of systems):** OLD CAARS
  - Onset: Rapid or gradual
  - Location: Evidence of localized pain?
  - Duration and progression of symptoms
  - Characterization of change in level of consciousness: Lethargy, irritability, excessive crying
  - Alleviating factors: Can the child be consoled?
  - Aggravating factors: Does movement of the child cause apparent discomfort (e.g., menigitis, peritonitis, injury)?
  - Recurrence of symptoms: Ever had similar findings?
  - System review: Trauma, seizure activity, fever, vomiting, diarrhea, recent infection, shortness of breath, change in behavior (e.g., colicky pain, paroxysmal crying), rash, irritability
- **Family and social history:** Inherited disorders, day care, who cares for the child
- **Immunizations up to date?**
- **Emergency medical system history:** Elicit history of potential trauma, ingestion, abuse, or toxin exposure
- **Doctor:** Name of primary care physician or specialist for additional information and help
- **Documents:** Obtain previous medical records

**PRESENTING SIGNS AND SYMPTOMS**

Always direct the initial evaluation toward identifying potential life-threatening conditions such as hypoxia, hypotension, extremes of temperature, hypoglycemia, seizure activity, and increased intracranial pressure, which require immediate intervention. Once these issues have been excluded, the EP should perform an AMPLIFIEDD history (Box 16.5). Investigate the risk for accidental or nonaccidental trauma, infection, ingestion, or toxin exposure while identifying signs or symptoms suggestive of systemic disease. Interview all available caretakers and emergency medical service personnel.

Following the primary survey, a head-to-toe evaluation should be performed. The EP should:

- Pay close attention to the pupillary response, which generally remain intact with metabolic insults but may be absent with structural lesions, toxin exposure, or severe asphyxia.
- Note the eye position (e.g., deviation of conjugate gaze away from brainstem lesions and toward cerebral lesions).

- Identify abnormalities in the respiratory pattern that may reflect CNS insults or metabolic conditions such as metabolic acidosis.
- Evaluate motor strength, tone, and reflexes, and characterize activity that may be consistent with seizures or abnormal posturing.
- Look for signs of trauma, such as scalp contusions and lacerations, hemotympanum, postauricular or periorbital hematomas, retinal hemorrhages, cerebrospinal fluid otorrhea, and a bulging anterior fontanelle suggestive of increased intracranial pressure.
- Note odors suggesting inborn errors of metabolism or other metabolic disorders (e.g., the smell of acetone in a child with diabetic ketoacidosis).
- Identify physical findings that indicate systemic infections involving the CNS (e.g., vesicular or purpuric rashes).
- Identify signs of other systemic disorders that have a negative impact on mental status, such as intussusception (e.g., abdominal mass, blood in the stool), hepatic disorders (e.g., jaundice, icterus), or cardiopulmonary disease (e.g., hypoxia, rales, hepatomegaly).

**DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING**

A comprehensive differential diagnosis for alterations in consciousness in infants and toddlers can be generated with the head-to-toe memory tool (Box 16.6). Possible causes involve essentially every organ system. When the underlying cause of altered mental status is not obvious, a high level of suspicion should be maintained for abuse, accidental toxin ingestion or exposure, intussusception, infection, or nonconvulsive seizure activity.

Assess the ABCs of resuscitation—airway, breathing, and circulation—rapidly, initiate cardiorespiratory monitoring and pulse oximetry, and institute any necessary interventions immediately. Perform rapid bedside glucose testing as part of the primary survey. Consider antidotes for toxin exposure or poisoning (e.g., naloxone for opioid ingestion), and administer broad-spectrum antibiotics early if indicated.

Perform laboratory and radiographic testing via a systematic, comprehensive approach (Box 16.7). In a critically ill infant or toddler without a definitive diagnosis, routine testing for sepsis, trauma, and metabolic derangements should be supplemented with selective tests as dictated by progression of the clinical course, by the response to initial interventions, and by the history and physical findings.

**TREATMENT AND DISPOSITION**

If a definitive diagnosis is not rapidly apparent in a child with an altered level of consciousness, institute supportive care to assist ventilation and maintain adequate circulation, and treat potentially life-threatening conditions such as sepsis or electrolyte abnormalities. When a cause is diagnosed, appropriate treatment should follow. Unless an easily recognizable and reversible abnormality is found, all children with an altered level of consciousness should be admitted to a pediatric intensive care unit.
VOMITING

**PERSPECTIVE**

Vomiting in children is usually caused by a self-limited condition but may result from a severe, life-threatening illness. A systematic approach based on age-specific considerations is critical for making the appropriate diagnosis and treating infants and toddlers with vomiting. The EP should consider...
**BOX 16.8 The AMPLIFIEDD History for an Infant or Toddler with Vomiting**

- **Allergies:** To medications or foods (protein intolerance to cow milk, soy, gluten)
- **Medication:** Prescription, over the counter, natural remedies
- **Past medical history**
  - Chronic or previous illness: Metabolic or endocrinopathy, recent unresolved illness
  - Previous surgery suggesting abdominal adhesions, shunt infection, or obstruction
  - Newborn screening: Identify abnormalities
  - Appropriate developmental milestones?
- **Last feed, pee, poop, sleep**
  - Feed: Diet, amount and frequency, correct formula preparation, recent changes, types of solids
  - Pee and poop: Urine output and characterization of stooling pattern (diarrhea, blood, mucus)
  - Sleep pattern: Waking with intermittent episodes of pain (intussusception)
- **Immediate events (history of present illness and review of systems): OLD CAARS**
  - Onset of vomiting
  - Location of pain (e.g., abdomen, head)
  - Duration and frequency of vomiting: Estimate ongoing volume loss by quantifying number and quantity of vomiting or diarrheal episodes
  - Characterization of the emesis
    - Contents: Undigested gastric contents (reflux, bilious (postampullary obstruction), feculent (colonic obstruction), blood or coffee-ground (gastritis, ulcer, Mallory-Weiss tear)
    - Force of vomiting: Projectile (pyloric stenosis), non-projectile (reflux, postfeeding regurgitation)
    - Aggravating factors: What factors exacerbate the vomiting (early morning: central nervous system mass; feeding: food allergen, after ingestion of toxin)?
    - Alleviating factors: What factors relieve the vomiting (keeping the child in an upright position: reflux)?
    - Recurrent: Similar episodes suggestive of recurring disorders (pyloric stenosis, cyclic vomiting, inborn error of metabolism, malrotation with intermittent volvulus)
    - Systems review: Inquire about fever, trauma, neurologic symptoms (headache, vertigo, visual symptoms), diarrheal (infectious gastroenteritis), ingestion of toxins
- **Family and social history**
  - Infectious contacts, travel
  - Characterization of caretaker-infant interactions: Identify risk for child abuse
- **Immunizations up to date?**
- **Emergency medical service history:** Elicit history of potential trauma, ingestion, abuse, or toxin exposure
- **Doctor:** Name of primary care physician or specialist for additional information and help
- **Documents:** Obtain previous medical records

**BOX 16.9 Key Objective Findings on Physical Examination for Assessing Dehydration**

- The presence of two findings indicates greater than 5% dehydration; the presence of three or more findings indicates greater than 10% dehydration:
  - Capillary refill > 2 seconds
  - Dry mucous membranes
  - Absent tears
  - Abnormally lethargic or listless appearance


The AMPLIFIEDD History for an Infant or Toddler with Vomiting

**EPIDEMIOLOGY**

Episodes of acute gastroenteritis in children younger than 5 years lead to 2 to 3 million physician visits annually. The majority of these children have uneventful clinical courses.

**PATHOPHYSIOLOGY**

Vomiting is coordinated by the vomiting center in the reticular formation of the medulla. This vomiting center integrates and responds to afferent pathways from higher cortical centers in the brain and to visceral afferents from receptors in the gastrointestinal tract and other organs. Specifically, the chemoreceptor trigger zone in the floor of the fourth ventricle monitors chemical abnormalities in the blood and cerebrospinal fluid. A basic understanding of these major pathways is essential for developing diagnostic and therapeutic strategies for infants and toddlers with vomiting.

**PRESENTING SIGNS AND SYMPTOMS**

A review of the expansive list of potential causes of vomiting emphasizes the importance of developing an organized approach to achieve an accurate diagnosis. The EP should first elicit an AMPLIFIEDD history (Box 16.8) and perform a thorough head-to-toe physical examination focusing on the age of the infant or toddler. Evidence of bowel obstruction, peritonitis, and signs or symptoms suggestive of extraintestinal disease should be sought. Hydration status (Box 16.9) should be assessed. At the onset of the clinical encounter, the EP should clarify whether the child has had bilious or nonbilious vomiting because bilious emesis in infants implies intestinal obstruction until proved otherwise and requires immediate surgical consultation.

Appearance and age-appropriate behavior should be assessed because a decrease in activity or level of consciousness may indicate serious illness. A bulging fontanelle suggests increased intracranial pressure from potential causes.
such as meningitis, trauma, an intracranial mass, or intracranial bleeding. Retinal hemorrhages indicate nonaccidental trauma, and scleral icterus suggests hepatobiliary disease. An unusual odor may be the first clue to an inborn error of metabolism. Marked abdominal distention, peristaltic waves, increased bowel sounds, palpatable masses, bloody stools, and guarding all point to an intraabdominal disorder. A thorough examination necessitates evaluation for torsion of the testes and the ambiguous genitalia associated with congenital adrenal hyperplasia. The skin should be examined for rashes indicative of an infectious cause. Unusual contusions or musculoskeletal injury may indicate nonaccidental trauma.

**DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING**

The list of potential causes of vomiting in infants is extensive but can be conveniently organized according to age-related categories (Table 16.3). Many serious medical conditions may be initially manifested as vomiting, such as sepsis, meningitis, urinary tract infection, and hepatitis. These conditions must be differentiated from emergency surgical conditions such as an incarcerated hernia, intussusception, and malrotation with volvulus. Intussusception is the most common cause of intestinal obstruction in children 3 months to 5 years of age, whereas appendicitis is the most common condition requiring surgical intervention.\(^\text{15,16}\)

The large number of potential causes of vomiting makes routine laboratory and radiographic evaluation impractical. The history and physical findings should direct the choice of testing for each patient. For most common conditions, laboratory testing is not indicated. A bedside blood glucose measurement should be performed in any child with altered mental status. Serum electrolytes should be measured in children with dehydration requiring intravenous rehydration. A serum bicarbonate level lower than 17 mEq/L appears to be the most useful laboratory value for predicting the likelihood of 5% dehydration.\(^\text{17,18}\) Cerebrospinal fluid analysis should be performed if meningitis or encephalitis is suspected. Drug screening may be necessary to confirm an ingestion. Urinalysis, liver function tests, serum lipase, and ammonia measurements should be considered when the differential diagnosis is broadened.

Diagnostic imaging is also dictated by clinical findings. CT of the head should be performed for suspected closed-head injury, intracranial tumor, or hydrocephalus. Plain radiographs may be used to assess for bowel obstruction. An upper

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**Table 16.3 Differential Diagnosis of Vomiting in Infants and Children Using the Head-to-Toe Memory Tool**

<table>
<thead>
<tr>
<th>INFANTS</th>
<th>TODDLERS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Head</strong></td>
<td>Meningitis, encephalitis</td>
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<tr>
<td></td>
<td>Central nervous system mass</td>
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<td></td>
<td>Head injury</td>
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<td></td>
<td>Hydrocephalus (e.g., shunt malfunction)</td>
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<td></td>
<td>Otitis media</td>
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<td></td>
<td>Spitting up</td>
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<tr>
<td><strong>Chest</strong></td>
<td>Posttussive emesis secondary to reactive airways</td>
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<td></td>
<td>Respiratory infection (pneumonia)</td>
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<td><strong>Abdomen</strong></td>
<td>Gastroesophageal reflux disease</td>
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<tr>
<td>Gastrointestinal tract</td>
<td>Gastroenteritis</td>
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<tr>
<td></td>
<td>Nutrient intolerance</td>
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<td></td>
<td>Rummation</td>
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<td></td>
<td>Obstruction:</td>
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<tr>
<td></td>
<td>Pyloric stenosis</td>
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<tr>
<td></td>
<td>Intussusception</td>
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<tr>
<td></td>
<td>Malrotation</td>
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<tr>
<td></td>
<td>Incarcerated hernia</td>
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<tr>
<td></td>
<td>Hirschsprung disease</td>
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<td></td>
<td>Peritonitis</td>
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<tr>
<td><strong>Adrenals</strong></td>
<td>Congenital adrenal hyperplasia</td>
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<tr>
<td><strong>Renal</strong></td>
<td>Uremia</td>
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<tr>
<td></td>
<td>Obstruction</td>
</tr>
<tr>
<td></td>
<td>Urinary tract infection or pyelonephritis</td>
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<tr>
<td></td>
<td>Renal insufficiency</td>
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<tr>
<td><strong>Liver</strong></td>
<td>Hepatitis</td>
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<td></td>
<td>Inborn errors of metabolism</td>
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<tr>
<td><strong>Pancreas</strong></td>
<td>Diabetic ketoacidosis</td>
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<tr>
<td></td>
<td>Pancreatitis</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>Sepsis</td>
</tr>
</tbody>
</table>
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gastrointestinal series is the preferred radiographic modality for diagnosing malrotation with volvulus. Diagnostic ultrasonography is the modality of choice for diagnosing intussusception. Ultrasonography and abdominal CT are used to investigate potential appendicitis when the diagnosis is in question. In children with equivocal findings for appendicitis, ultrasonography using the graded-compression technique should be performed, followed by focused abdominal CT if the ultrasonographic findings are normal. Similarly, implement protocols for appropriate use of ultrasonography and CT for evaluation of intraabdominal pathology such as trauma, an intraabdominal mass, or nephrolithiasis.

treatment

initial management of a vomiting infant or toddler should focus on hemodynamic stabilization. Persistent vomiting, severe dehydration, and electrolyte abnormalities necessitate treatment in parallel with other diagnostic testing. Rehydration is accomplished with 20-mL/kg intravenous boluses of isotonic saline, repeated as necessary. Additional treatment should be directed toward the underlying cause.

immediately consult a surgeon for infants with bilious vomiting. Malrotation with volvulus is a surgical emergency requiring rapid response to prevent infarction of the bowel. Timely surgical consultation is also the standard of care for other conditions such as peritonitis and incarcerated hernia. In some cases the radiologist may successfully reduce the intussuspected bowel with an air or contrast enema, although surgical backup is required for potential complications or treatment failure. Decompression with nasogastric suctioning is indicated for children with ileus or bowel obstruction.

administration of an antiemetic may serve as a successful adjunct to suppress vomiting and allow oral rehydration. Intravenous and oral ondansetron (a selective serotonin [5-htr] receptor antagonist) has been used successfully in the ed for infants and children with vomiting secondary to gastroenteritis.

oral rehydration therapy should be administered to children with mild to moderate dehydration as a result of gastroenteritis (box 16.10). a metaanalysis of randomized control trials involving 1545 children younger than 15 years concluded that rehydration by the oral or nasogastric route is as effective if not better than intravenous rehydration.

disposition

an infant or toddler with a self-limited condition and no evidence of systemic illness or dehydration can be discharged. provide clear plans for follow-up and instructions for outpatient oral rehydration to the parents or caregiver. always confirm that the caretaker understands the need to return to the ed if the illness progresses.

infants or children with persistent vomiting, abnormal electrolyte values, or a more complex diagnosis requiring further medical or surgical management should be admitted to the hospital.

suggested readings

steiner m, dewalt d, byerley j. is this child dehydrated? jama 2004;291:2746-54.
wessel m, cobb j, jackson e, et al. paroxysmal fussing in infancy, sometimes called colic. pediatrics 1954;14:421-35.

references

references can be found on expert consult @ www.expertconsult.com.
REFERENCES


