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PEDIATRICS: ANTIBIOTICS/NONTRAUMATIC ABDOMINAL EMERGENCIES

Pediatric Antibiotics Update

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Introduction: pediatric infectious diseases (ID) common in emergency department (ED); national initiative to decrease prescription of antibiotics in children and adults; infectious agents and patterns of infections change constantly and have substantially changed treatment and management (especially over past 10 yr)

Expert recommendations for antibiotic use: antibiotics not indicated for viral infections; clinician in ED must have awareness of resistance patterns (ie, antibiotic) in local pediatric hospitals because patterns differ between children and adults; patterns of resistance help determine most effective antibiotic for infection (eg, depending on geographic region, methicillin-resistant Staphylococcus aureus [MRSA] skin infections may have resistance to clindamycin ≤50%)

Judicious use of antibiotics: increased advocacy by Choosing Wisely campaign, Centers for Disease Control and Prevention (CDC), and American Association of Pediatrics (AAP); principles of Judicious Antibiotic Prescribing to prevent unnecessary use of antibiotics; brochure from CDC — addresses commonly asked questions regarding protection of children from antibiotic-resistant bacteria, whether mucus color dictates need for antibiotics, and why antibiotics not used for all infections; antibiotics for sore throat and upper respiratory infections (URIs) — according to AAP, antibiotics not optimal for symptomatic management of pharyngitis caused by S aureus, but short-course antibiotic therapy may reduce symptoms more effectively than long-course therapy; future studies may support reduced dose, frequency, and/or duration of antibiotic therapy for URI; 2014 article on principles of judicious use of antibiotics for URIs — encourages clinicians to first determine likelihood of bacterial infection by performing rapid tests to measure bacteria and assessing symptoms (eg, fever, tonsillar exudate and swelling, swollen anterior cervical nodes); then to assess benefits vs harms of antibiotics (amoxicillin recommended for all bacterial URIs); and finally to implement judicious prescribing strategies

Clinical practice guidelines for pneumonia (2011): published by Pediatric Infectious Diseases Society and Infectious Diseases Society of America; bacterial and viral presentation similar in young child; difficult to determine etiology in children, but studies indicate S aureus most common cause of bacterial pneumonia; guidelines for use of antibiotic in outpatients of preschool age — antibiotics not routinely required, because majority of cases caused by virus; amoxicillin first-line therapy for mild to moderate bacterial cases; for Mycoplasma and other pathogens, clinician should perform laboratory tests before administration of macrolides or azithromycin, but often impractical in ED; guidelines for antibiotic use in pediatric inpatients — ampicillin first-line therapy if infant fully immunized and no evidence of Pneumococcus with high resistance to penicillin in area; ceftriaxone first-line therapy if infant not immunized or high resistance pattern suspected; overall recommendations — use narrow-spectrum antibiotics for minimum time needed

2011 clinical practice guidelines for urinary tract infections (UTIs): risk factors in children ≤24 mo — higher risk for UTI in girls <12 mo, if patient has fever for >2 days, and no other source of infection evident; girls have much higher overall risk than boys; uncircumcised boys ≤20 times more likely to have UTI than circumcised boys; primary guidelines for monitoring — according to speaker, fever without source requires catheterized specimen in addition to urinalysis; definition of true diagnosis — includes pyuria and/or bacteria in urinalysis and ≥50,000 colony-forming units (CFU)/mL; explain to family of patient that true diagnosis dependent on results of final culture

Prescribing antibiotics for children in ED: verify contact information; determine appropriate funding source for antibiotics; determine whether patient should take tablet or liquid; administer initial dose in ED if evening, weekend, or holiday; if unsure about appropriate antibiotic, use resources or applications; if infection or situation atypical, discuss with local consultant for pediatric ID or patient’s primary care physician; list phone number of ED on prescription because pharmacists often verify prescriptions for pediatric antibiotics

Antibiotic dosing for pediatric patients: weight-based dosing may be inappropriate if patient obese (may calculate dose greater than maximum adult dose); order extra doses of antibiotic to account for vomiting or spitting up medicine; clinician should not rely exclusively on electronic medical record to verify dose and formulation; if patient critically ill and no IV available, administer first dose intramuscularly; indications for more aggressive treatment — patient not fully immunized; born prematurely; age <2 mo; has chronic illness, immunodeficiency,

Educational Objectives

The goals of this program are to promote appropriate use of antibiotics for pediatric infectious diseases in the emergency department and to improve management of nontraumatic abdominal emergencies in pediatric patients. After listening to and assimilating this program, the clinician will be better able to:

1. Decide on the appropriateness of antibiotic use in pediatric patients with infectious disease based on local patterns of resistance and results of laboratory testing.
2. Utilize resources and applications to determine the appropriate antibiotic to use in pediatric patients based on patient’s immunization status, age, and previous health history.
3. Identify the incidence of nontraumatic abdominal emergencies in pediatric patients.
4. Differentiate between nontraumatic abdominal emergencies in pediatric patients based on pain characteristics, vomiting, and findings on ultrasonography.
5. Determine the necessity and urgency of surgery for pediatric patients with abdominal emergencies based on assessment of risk factors and results of ultrasonography.

Faculty Disclosures

In adherence to ACCME Standards for Commercial Support, Audio Digest requires all faculty and members of the planning committee to disclose relevant financial relationships within the past 12 months that might create any personal conflicts of interest. Any identified conflicts were resolved to ensure that this educational activity promotes quality in health care and not a proprietary business or commercial interest. For this program, members of the faculty and planning committee reported nothing to disclose.
Nontraumatic Abdominal Emergencies in Children

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Appendicitis

Incidence: most common abdominal condition requiring surgery; 6% of population develop appendicitis during lifetime; men affected twice as often as women; highest incidence in individuals 10 to 20 yr of age; mortality higher in younger age groups, possibly because diagnosis delayed (signs and symptoms less obvious)

Diagnosis: clinician must differentiate from other inflammatory, infectious, vascular conditions of abdomen, and congenital abnormalities and conditions related to ovarian problems in adolescent girls; anatomic differences of abdomen in children vs adults — in child, different shape of appendix and lack of lymphatic tissue; pathophysiology relates to obstruction in abdomen (eg, fecolith or lymphatic tissue) that causes secretions and engorgement of appendix, leading to venous obstruction, inflammation, and then perforation

Presentation: vague abdominal pain that starts at midline and progresses to lower right side of abdomen; perforation may lead to temporary relief of pain; peritonitis from perforation may lead to abscess; omentum less developed in young child, so perforation may lead to more severe peritonitis than in adult; appendicitis typically characterized by progression of symptoms; migration of pain from umbilicus to lower right quadrant of abdomen best historical feature; if present, vomiting usually follows onset of pain; diarrhea or constipation common in children with appendicitis; no data to support benefit of rectal examination in diagnosis of appendicitis; if no fecality of pain on right side, patient likely does not have appendicitis; combination of symptoms and laboratory findings used to diagnose appendicitis

Physical examination: tenderness on right lower quadrant of abdomen; according to speaker, “jump test” (ie, assessing whether jumping too painful for patient) good indicator of pain severity, but can be difficult to convince children to perform test; Alvarado and pediatric appendicitis scores — used for adults and children, respectively, to assess likelihood of appendicitis; pediatric score gives lower numerical value for white blood count and elevation of white blood count; “jump test” has higher value than rebound pain in adult score

Imaging: plain x-ray films — not usually helpful for diagnosing appendicitis but may show free air, fluid, or fecalith; computed tomography (CT) — usually shows small fecalith, but findings sometimes mistaken for kidney stones in older children; surgery recommended if CT scan shows increase in size of appendix; ultrasonography — often difficult to visualize appendix; 2012 single-institution study of 181 patients — low-dose CT as effective as regular-dose CT for imaging appendix to diagnose appendicitis; advantages of CT — sensitivity and accuracy high and comparable to other imaging modalities; easy to acquire images; relatively noninvasive and can identify possible diagnoses other than appendicitis; primary disadvantage of CT — radiation exposure; recommended only if no other options for diagnosis; sensitivity and specificity of ultrasonography lower than CT in adults; not useful for ruling out appendicitis, but easier to perform in children than adults because children have less abdominal musculature and fat; 2012 study of 1800 children with suspected appendicitis — found increased chance of identifying appendicitis on ultrasonography with longer duration or higher index of pain; lower proportion of equivocal CT with longer duration of pain

Studies of diagnosis and management: clinical pathway for diagnosis — prospective study of 200 children with suspected appendicitis showed 31 of 33 patients with high pediatric appendicitis score (8-10) had appendicitis; none of 44 with low score (<3) had appendicitis; 107 of 119 with moderate score (4-7) received ultrasonography (14 of these patients had abnormal findings); none of 73 patients with normal ultrasonography had appendicitis or received CT; concluded that using ultrasonography may help confirm equivocal cases without use of CT; necessity of appendectomies — in study of 423 children, final diagnosis showed normal appendix in ~7%; ~24% had perforated appendix; initial evaluation at community hospital associated with 4 times greater odds of receiving CT before operation; emergent (≤8 hr after presentation) vs urgent (>8 hr after presentation) appendectomies in children — study showed no difference in postoperative outcomes; performing urgent appendectomy at time convenient to surgeon considered standard of care; early (≤24 hr after presentation) vs interval appendectomy (ie, several weeks or months following presentation) — no difference in outcomes; treating some patients with antibiotics before appendectomy possibly effective; rate of misdiagnosis — in children, one-third of appendicitis cases initially missed diagnosed; rate of misdiagnosis inversely related to age of patient; gastroenteritis most common misdiagnosis; delayed diagnosis and rate of perforation — if symptoms present for <18 hr, incidence of perforation <10%; presence of symptoms for >36 hr associated with higher rate of perforation; duration between hospital admission and surgery — study of adults and children with appendicitis showed 80% had surgery on day of admission, 18% 2 days to 4 days after admission, and others >4 days after admission

Intussusception

Incidence: 90% occur in children <2 yr; cases peak in spring and autumn; most pediatric cases idiopathic (vs secondary)

Presentation: symptoms — episodic abdominal pain; abdominal mass; vomiting; lethargy and altered mental status, particularly in younger children (sometimes mistaken for meningitis); classic presentation — review of 219 patients showed majority of patients male; median age 7 mo; patients <1 yr often present with emesis, irritability, and bloody stools; patients >1 yr present with abdominal pain; lead point — usually proximal to ileocecal valve; causes venous obstruction and engorgement, which leads to edema and bleeding, and to strangulation and bowel necrosis if untreated

Diagnosis: x-ray films — not helpful for diagnosis; usually used to rule out other conditions; ultrasonography — high specificity and sensitivity; shows target lesions or “doughnut” sign; visualizes pathologic lead point; identifies alternate diagnoses; helps predict chance of successful reduction

Treatment: stabilize patient with IV fluids and notify surgeon; radiologists often perform air enema to reduce risk for perforation and irritation; use of antibiotics — 2013 study of 118 patients showed patients with antibiotics had similar rates of complications and fever after reduction as those without antibiotics; surgery — indicated when manual reduction unsuccessful or if signs of bowel perforation or necrosis

Pyloric stenosis

Incidence: dynamic condition present in 1 of 4000 infants; more frequent in whites, boys, and infants <3 wk

Diagnosis: presentation — hunger after vomiting; vomit nonbilious and projectile; physical examination — may palpate olive-like mass near lateral margin of right rectus muscle below edge of liver; easiest to palpate after vomiting or placement of
nasogastric (NG) tube; blood tests — hypochloremic alkalosis pathognomonic for pyloric stenosis; abdominal x-rays — may show large bubble in stomach; ultrasonography — optimal to detect pyloric stenosis

**Treatment:** includes rehydration, placement of NG tube, and surgical repair

**Volvulus**

**Definition:** medical emergency characterized by malrotation of intestine; associated with interruption of embryologic sequence of development; rotated intestine prone to torsion; usually occurs in infants <1 mo

**Presentation:** consistent pain; acute abdomen; sudden onset of bilious vomiting; patients with chronic or intermittent problems with feeding or failure to thrive may have malrotation of intestine and at high risk of developing volvulus; may present with shock, distention of abdomen, diffuse tenderness, dilated loops of bowel, and bloody stools; x-rays — sometimes normal; upper gastrointestinal (GI) examination — has highest sensitivity and specificity for detecting volvulus; early recognition of volvulus and stabilization of patient critical to favorable outcome

**Hernia**

**Description:** direct vs indirect hernia — differentiated by involvement of inguinal ring; direct hernia presents as bulge in inguinal crease; presentation — important for clinician to ensure no scrotal involvement or testicular occlusion of blood flow and to distinguish whether hernia incarcerated or strangulated; surgery — required in most cases; mild cases possibly treatable with manual reduction when patient sedated; umbilical hernias — common but often safe to follow; can perform surgical repair electively if not resolved over time; incarcerated hernia — characterized by intermittent mass, vomiting, abdominal pain, and irritability; diagnosed by physical examination

**Rectal bleeding**

**Description:** most cases benign, especially if blood bright red; neonates — rectal bleeding often due to anal fissures, enteritis, intussusception, volvulus, or necrotizing enterocolitis; older children — anal fissures (most common), Meckel diverticulum, upper GI hemorrhages, intussusceptions, inflammatory bowel disease, vascular malformations, or polyps

**Suggested Readings**


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**Suggested Readings**


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1. All of the following statements regarding patterns of resistance to antibiotics are true, except:
   (A) Patterns are typically quite similar between children and adults within a given locality
   (B) Local resistance patterns can help predict whether an antibiotic will be effective
   (C) The same type of infection can have a widely variable resistance to a given antibiotic depending on geographic area
   (D) Patterns of resistance to antibiotics have changed management practices substantially over the past 10 yr

2. According to recent recommendations, in pediatric patients, antibiotics should be used for upper respiratory infections in the emergency department:
   (A) Before testing the infectious agent to minimize delay in treatment
   (B) Based on assessment of symptoms and clinical presentation alone
   (C) After testing for the presence of bacteria, assessing symptoms, and analyzing benefits vs harms of antibiotic use

3. Clinical practice guidelines (2011) for administration of antibiotics for children with pneumonia indicate:
   1. Antibiotics are not routinely required for outpatients of preschool age with pneumonia
   2. Broad-spectrum antibiotics are preferred to narrow-spectrum antibiotics for typical cases of bacterial pneumonia
   3. Ceftriaxone is recommended as first-line therapy for hospitalized infants with bacterial pneumonia who are not fully immunized
   4. Amoxicillin is recommended as first-line therapy for mild to moderate outpatient bacterial cases
      (A) 1,2
      (B) 1,3,4
      (C) 2,3,4
      (D) 2,4

4. The best historical feature for diagnosing appendicitis is:
   (A) Migration of pain from the umbilicus to the lower right quadrant of the abdomen
   (B) Vomiting before onset of abdominal pain
   (C) Unwillingness to perform the “jump test”
   (D) None of the above

5. For a pediatric patient with suspected appendicitis, studies show that ultrasonography:
   (A) Has a higher sensitivity and specificity for diagnosis than CT
   (B) May aid in diagnosis of equivocal cases
   (C) Is more difficult to perform in a child than in an adult
   (D) Is less likely to identify appendicitis if the patient has had pain for a long period of time

6. Studies of the diagnosis and management of appendicitis in children indicate:
   1. A patient with pediatric appendicitis score <3 is unlikely to have appendicitis
   2. Patients who underwent evaluation at a community hospital were less likely to receive preoperative computed tomography (CT)
   3. Duration of symptoms was not associated with risk of perforation
   4. Postoperative outcomes were similar between those who received emergent (≤8 hr after presentation) vs urgent (>8 hr after presentation) appendectomies
      (A) 1,2
      (B) 1,3
      (C) 1,4
      (D) 2,4

7. Which of the following imaging modalities should a clinician use to predict whether intussusception can successfully be reduced in a pediatric patient?
   (A) Ultrasonography
   (B) X-ray film
   (C) CT
   (D) None of the above

8. The main feature that is pathognomonic for pyloric stenosis is:
   (A) Bulge in inguinal crease
   (B) Bilious vomiting
   (C) Hypochloremic alkalosis
   (D) “Doughnut” sign on ultrasonography

9. Which of the following diagnostic tools has the highest sensitivity and specificity for detecting volvulus?
   (A) Abdominal x-rays
   (B) Ultrasonography
   (C) Upper gastrointestinal examination
   (D) CT

10. What is the most common cause of rectal bleeding in older children?
    (A) GI hemorrhage
    (B) Meckel diverticulum
    (C) Enteritis
    (D) Anal fissures

Answers to Audio Digest Emergency Medicine Volume 32, Issue 04: 1-B, 2-C, 3-B, 4-A, 5-C, 6-B, 7-C, 8-D, 9-A, 10-A