Streptococcal Pharyngitis:
Controversies in Diagnosis and Treatment

Etiology in children: 20% to 50% idiopathic; 17% to <50% viral; 30% to 40% bacterial (almost all group A β-hemolytic Streptococcus [GABHS]); idiopathic almost always viral

Distinguishing GABHS from non-GABHS pharyngitis: clinical syndromes often used, but usually inappropriately; palatal petechiae — Forchheimer response; also seen in rubella, idiopathic thrombocytopenic purpura, and infectious mononucleosis; incidence similar in GABHS pharyngitis (37%) and non-GABHS pharyngitis (39%); other — pharyngeal erythema, uvular petechiae, tonsillar erythema, and tonsillar exudate seen more frequently in GABHS, but also seen in 37% to 80% of non-GABHS pharyngitis; “doughnut” petechiae — pathognomonic of GABHS; papules with white center; conclusion — GABHS should not be diagnosed clinically

Diagnostic tests: latex agglutination test, enzyme-linked immunosorbent assay, and chemiluminescent DNA probe test effective; throat cultured with 2 swabs (right tonsil, left tonsil, and posterior pharynx); one swab taken for rapid test [if positive, confirm with culture]; rapid antigen detection tests (RADTs) — have 28% false-negative rate; per Red Book Committee and Centers for Disease Control and Prevention recommendations, culture unnecessary if data from one’s practice show high yield (90%) of positives from RADTs; unless sensitivity of test validated, confirmatory culture required; throat culture — gold standard; false-negative results common if only one side swabbed; planted on bacitracin disc (GABHS susceptible; groups B, C, and G not susceptible) and diagnosis obtained in 24 to 48 hr; touching any other area dilutes results; sequential cultures may yield different results; ≥20% positive results expected

Other causes of febrile exudative pharyngitis: viruses (particularly adenoviruses), 42%; pharyngitis not common in children <3 yr of age: pus in tonsils not diagnostic of Streptococcus; presence of any signs or symptoms of common cold with sore throat characteristic of viral infection, and culture not indicated

Exoenzyme antibody tests: true GABHS infection defined by recovery of organism plus subsequent rise in titer of antistreptococcal antibodies; usually confirmed with anti-DNAaseB; treatment with penicillin (PCN) in first 2 to 3 days blunts antibody response

Carriers of GABHS: ≈10% rate in general population of children; 50% of children who have had infection still harbor organism at 4 mo (persists ≤1 yr in some); GABHS persists ≤8 mo in carriers who acquire it through contact without becoming sick; organism harbored in biofilm adherent to pharyngeal mucosa and tonsils, and intracellularly; in carriers, GABHS does not cause disease or lead to serious consequences, nor become transmitted to other individuals; however, carrier state confounds diagnosis in children who actually have viral pharyngitis

Treatment: who — any symptomatic individual with GABHS in pharynx; why — prevent rheumatic fever; single paper in 1950s showed that those treated had lower incidence of nephritis, compared to those not treated; reduce spread of infection; prevent suppurative complications; shorten duration of illness

Antibiotic therapy: clinical and bacteriologic cure rates better with cephalosporins than with PCN V; clinical and bacteriologic cure rates with amoxicillin almost twice as good as with PCN; azithromycin and cefadroxil once-daily dosing approved by Food and Drug Administration (FDA); amoxicillin once-daily dosing not approved by FDA, but recommended by American Academy of Pediatrics Committee on Infectious Diseases at dose of 50 mg/kg to 1 g; once-daily dosing of PCN VK ineffective; effective 5-day short-course therapies — azithromycin; cefpodoxime and cefdinir not FDA-approved for short-course therapy, but accepted by Committee as potential treatment; steroids — 3 trials showed decreased time to relief and resolution of throat pain with dexamethasone, but neither clinically significant; use not recommended

Clinical failure: causes include bacteriologic failure or coexistent viral infection; possible causes of bacteriologic failure — poor compliance; carrier state; reinfection; antibiotic tolerance or resistance (never seen with PCN); copathogenicity (β-lactamase-positive flora surrounding GABHS); coaggregation (attachment to β-lactamase-positive flora); coexistent viral infection — more common cause; study found that, of cases of exudative pharyngitis and fever unresponsive to antibiotic therapy, 41% due to Epstein-Barr virus; adenovirus also seen

Recent streptococcal pharyngitis: 63% failure rate seen with benzathine PCN; amoxicillin-clavulanate and clindamycin (β-lactamase resistant antibiotics) recommended; recurrent tonsillitis — has genetic basis; prevention of recurrence — daily amoxicillin; tonsilectomy (rarely)

Conclusions: because accurate clinical differentiation of viral and bacterial pharyngitis difficult, Red Book 2012 recommends laboratory confirmation of GABHS pharyngitis for children, except in children with obvious viral symptoms; scheduled dosing with analgesic prevents pain and fever

Educational Objectives
The goals of this program are to improve the diagnosis and management of pharyngitis and the management of infectious disease emergencies in children. After hearing and assimilating this program, the clinician will be better able to:

1. Diagnose group A β-hemolytic streptococcal (GABHS) pharyngitis.
2. Recommend appropriate antibiotic therapy to treat GABHS pharyngitis.
3. Determine when an infectious disease emergency requires immediate surgery.
4. Prescribe the antibiotics of choice for infectious disease emergencies.
5. Identify the common causative organisms of infectious disease emergencies.

Faculty Disclosure
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, Dr. Marcy and the planning committee reported nothing to disclose. In his lecture, Dr. Marcy presents information that is related to the off-label or investigational use of a therapy, product, or device.
Infectious Disease Emergencies in Children

Case 1: infant girl, 15 days of age, presents with redness and swelling of left breast; has no history of illness or trauma; feeding and acting normally; afebrile; physical examination (PE) — breast enlarged, erythematous, firm, and tender; infant otherwise vigorous; differential diagnosis — friction trauma; cellulitis; abscess; white blood cell (WBC) count elevated, with bands slightly above normal; ultrasonography (US) showed abscess in breast

Neonatal breast abscess: usually occurs in first 6 wk of life (85% in first 3 wk); patient rarely ill or febrile (infection highly localized); methicillin-resistant *Staphylococcus aureus* (MRSA) as cause increasing, particularly if mother has breast abscess or positive anal or vaginal culture for *S aureus*; less common causes — gram-negative bacteria, *Escherichia coli*, *Proteus*, *Pseudomonas*, *Salmonella*, and anaerobes; when due to *S aureus*, skin pustules common; caused by ascending infection in ducts of breast; repeated milking of breast predisposing factor; rare in premature infants (have less developed breast tissue); treatment — US-guided needle drainage and/or incision and drainage; do not incise across ducts; treat emergently; the longer infection persists, the more nonfunctional and hypoplastic breast tissue becomes; may cause localized asymmetry of breast; US useful in distinguishing between cellulitis and abscess; antibiotics can be given adjunctively (eg, clindamycin with or without cefazolin); intravenous [IV] vancomycin used if clindamycin resistance in community; adjust on basis of culture and susceptibility study); if caused by *S aureus*, warn family of possibility of contagion; also warn parents that damage to breast occurs in one-third of cases

Case 2: boy, 9 mo of age, brought in after 3 bowel movements over 1 hr described as “more blood than stool”; no fever, vomiting, travel history, or ill contacts; on iron-containing formula; rectal exam finding — mahogany red stool; examination otherwise normal; differential diagnosis — milk allergy; intussusception; Meckel diverticulum; polyph; anal fissure; WBC count, polymorphonuclear leukocytes, and platelet count normal; fecal occult blood negative

Cefdinir (Omnicef) stool: red color caused by nonabsorbable complex between cefdinir and iron in gastrointestinal tract; reported shortly after widespread use began; many patients also on iron-containing supplements; resolves when antibiotic discontinued

Case 3: boy, 14 yr of age, presents for frontal headache persisting for 9 days; swelling of forehead and eyes noted on presentation to emergency department (ED); had cold and stuffy nose for 1.5 to 2 wk and low-grade fever for ≤1 day; review of systems revealed hay fever in spring, otherwise normal; temperature 102°F; PE — tender and fluctuant swelling of mid- and left forehead with edema of upper eyelid; purulent discharge in nose; eyes and extraocular movement normal; no proptosis; left forehead with edema of upper eyelid; purulent discharge; temperature 102°F; pulse of 101 bpm; child “whiny” and appeared sick; treatment — vancomycin with or without cefazolin; intravenous [IV] vancomycin used if caused by *S aureus*; warn family of possibility of contagion; also warn parents that damage to breast occurs in one-third of cases

Case 4: girl, 5 yr of age, bitten on upper arm by cousin 3 days ago; presented with painful inflamed wound draining serosanguinous fluid; had no previous history of bite; temperature 102°F; pulse of 101 bpm; child “whiny” and appeared sick; PE — right upper arm discolored, swollen, and indurated, with bullae and redness; exquisitely tender; differential diagnosis — cellulitis; in humans, bite wound infection due to *Pasteurella multocida* (Eikenella corrodens) with dogs or cats; *S aureus* and GABHS also important; necrotizing fasciitis (NF); WBC and band count elevated; Gram stain of discharge showed gram-positive cocci in chains; culture showed GABHS; magnetic resonance imaging (MRI) showed cellulitis, with signs suggestive of NF

Necrotizing fasciitis: exquisite tenderness significant in early stages; involves superficial fascia, subcutaneous fat, nerves, vessels, and deep fascia, often with myonecrosis; stimulatory (hyperesthesia) seen in early inflammatory stage, followed by hypoesthesia; type 1 — mixed anaerobic, aerobic, and facultative bacteria; type 2 — predominantly group A *Streptococcus* and/or *S aureus*; signs and symptoms — systemic toxicity, severe tenderness, crepitus, presence of bullae, and patchy hypoesthesia; C-reactive protein (CRP) and creatine phosphokinase (CPK) elevated (somewhat helpful in distinguishing from cellulitis); diagnosis — clinical or frozen biopsy; percutaneous needle aspiration for Gram stain and culture; treatment — delay of hours seriously affects salvage of involved area and risks mortality; requires immediate surgical debridement; warn parents that 24-hr surgical “look back” possibly indicated; give vancomycin with cefotaxime and metronidazole, vancomycin with meropenem, or vancomycin with piperacillin and tazobactam; watch for impaired renal function, disseminated intravascular coagulation (DIC), and hypocalcemia

Case 5: boy, 2 yr of age, presents with increasing “puffing out under jaw” for 1 day; complained vaguely of pain in mouth for 3 or 4 days; has low-grade tactile fever, snorting respirations, and drooling; “milk bottle” caries present; temperature 100.8°F; pulse of 110 bpm, respiratory rate (RR) of 45 breaths/min, and O₂ saturation of 92%; child sick-looking, with fetid breath; nonpitting, taut mass noted under jaw; tongue elevated; temperature 100.8°F, pulse of 110 bpm, respiratory rate (RR) of 45 breaths/min, and O₂ saturation of 92%; child sick-looking, with fetid breath; nonpitting, taut mass noted under jaw; tongue elevated; had difficulty breathing; differential diagnosis — clinical or frozen biopsy; percutaneous needle aspiration for Gram stain and culture; treatment — delay of hours seriously affects salvage of involved area and risks mortality; requires immediate surgical debridement; warn parents that 24-hr surgical “look back” possibly indicated; give vancomycin with cefotaxime and metronidazole, vancomycin with meropenem, or vancomycin with piperacillin and tazobactam; watch for impaired renal function, disseminated intravascular coagulation (DIC), and hypocalcemia

Case 6: boy, 16 yr of age, presents with low-grade fever for several days; awakened with fever of 104°F; flushed face, chills, headache, one episode of vomiting, and slightly delirious 1 hr before; otherwise well, except for aching knee since tripping and falling 1 wk before; all immunizations up to date, including 2 meningococcal vaccines; PE — temperature 102°F; pulse 132 bpm; respirations 34 breaths/min; blood pressure (BP) normal; O₂ saturation decreased; patient septic-looking, for an aerobes; ceftriaxone for *H influenzae* and gram-negative organisms; culture and susceptibility studies useful (Gram stain and anaerobic culture recommended); observe closely for increased intracranial pressure and seizures; observation in intensive care unit for 24 hr or until stability achieved recommended

Ludwig’s angina: potentially life-threatening; bilateral submaxillary and/or sublingual infection beginning in floor of mouth; usually indurated nonpitting cellulitis, but may form abscesses; location is any dental abscess; bacteriology reflects mouth flora; ≥35% of blood cultures positive; treatment — airway management (fiberoptic nasotracheal intubation; tracheostomy, if necessary); dexamethasone for 2 days to reduce swelling; ampicillin with sulbactam or clindamycin treatment of choice; addition of cefotaxime or gentamicin recommended to cover gram-negative *E coli*, culture and susceptibility studies beneficial if access obtained; need for dental extraction determined by oral surgeon; consult with US to check for development of abscess (occurs in ≤567% of cases)

Pott puffy tumor: extension of frontal sinuses into subperiosteal and/or epidural and/or subdural spaces; unusual before pneumatization of frontal sinuses at 10 to 11 yr; mainly due to typical organisms in sinus (ie, pneumococci, nontypable *Haemophilus influenzae*, *Moraxella catarrhalis*, *Streptococcus viridans*, *S aureus*, and anaerobes); *S aureus* rare in prepubertal children (consider after puberty, particularly if osteomyelitis present); epileptogenic condition; treatment — potential surgical emergency, particularly with intracranial extension; consult with otolaryngology and neurology (for drainage); vancomycin for *S aureus*, pneumococci, and *S viridans*; metronidazole
with flushed, red, and sweaty face; midsystolic hemic murmurs; right knee mildly swollen; otherwise normal, with scattered small petechiae, ecchymosis, urticaria, or involvement of mucous membranes; test results — WBC count low, with 28% bands; toxic granulations noted; hemoglobin 15.3 mg/dL; platelet count decreased; erythrocyte sedimentation rate 85 mm/hr; CRP 57 mg/L; urinalysis showed 10 red blood cells/high-power field; creatinine and blood urea nitrogen elevated; serum sodium decreased; alanine aminotransferase and aspartate aminotransferase increased; serum albumin decreased; bilateral nodular densities seen on chest x-ray; knee x-ray showed small joint effusion, with no evidence of osteomyelitis; arthrocentesis of knee showed gram-positive cocci in clusters; culture ultimately showed MRSA; diagnosis — sepsis

Systemic inflammatory response syndrome (SIRS): criteria — high or low temperature; tachycardia; increase in RR or partial pressure of CO₂; WBC count of >12,000 or <4000, or >10% bands; if ≥2 of criteria met and infection suspected, diagnosis sepsis; if sepsis and evidence of organ hypoperfusion present, diagnosis severe sepsis; patient met criteria for SIRS and severe sepsis; infectious causes — Neisseria meningitidis; in patient’s age group, up to one-third of cases due to group B meningococci (not covered by quadrivalent vaccine)

Severe staphylococcal sepsis in adolescent: 90% have infection of bone or joint; 90% have septic emboli in lung; 30% have venous thrombophlebitis; 50% have renal failure; DIC common; variety of skin lesions seen; treatment — support fluids, BP, O₂, DIC, and kidneys; vancomycin plus ceftriaxone, with or without gentamicin; IV immunoglobulin anecdotally beneficial if patient nonresponsive or in toxic shock; clinical course — prolonged bacteremia; prolonged fever (mean of 13 days; ≤35 days); prolonged course of antibiotics; mortality 20%

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Suggested Reading

1. Which of the following findings is pathognomonic of group A β-hemolytic streptococcal (GABHS) pharyngitis?
   (A) Cervical lymphadenopathy  
   (B) Pharyngeal erythema  
   (C) “Doughnut” petechiae on soft palate  
   (D) Tonsillar swelling

2. Which of the following is the correct technique for obtaining samples for throat culture?
   (A) Swab one tonsil  
   (B) Swab both tonsils  
   (C) Swab one tonsil and the posterior pharynx  
   (D) Swab both tonsils and the posterior pharynx

3. Which of the following is the gold standard for diagnosis of GABHS pharyngitis?
   (A) Clinical syndromes  
   (B) Antigen detection test  
   (C) Exoenzyme antibody rise  
   (D) Throat culture

4. Once-daily dosing of the following antibiotics is effective, except:
   (A) Amoxicillin  
   (B) Penicillin VK  
   (C) Azithromycin  
   (D) Cefadroxil

5. The use of steroids is recommended for the treatment of GABHS pharyngitis.
   (A) True  
   (B) False

6. All the following statements about neonatal breast abscess are true, except:
   (A) Usually occurs in first 6 wk of life  
   (B) Requires emergent treatment  
   (C) Repeated “milking” of breast is recommended  
   (D) Rarely occurs in premature infants

7. Pott puffy tumor is unusual before significant pneumatization of the frontal sinuses, which occurs at age:
   (A) 4 to 5 yr  
   (B) 7 to 8 yr  
   (C) 10 to 11 yr  
   (D) 15 to 16 yr

8. Exquisite tenderness is significant in the _______ stage of necrotizing fasciitis.
   (A) Early  
   (B) Late

9. Which of the following are indicated in the management of Ludwig’s angina?
   1. Airway management  
   2. Antibiotics  
   3. Dexamethasone  
   4. Follow-up with ultrasonography
      (A) 1,3  
      (B) 2,4  
      (C) 1,2,3  
      (D) 1,2,3,4

10. Which of the following are seen in 90% of cases of severe staphylococcal sepsis in the adolescent?
    1. Infection of bone or joint  
    2. Venous thrombophlebitis  
    3. Septic emboli in lung  
    4. Renal failure
       (A) 1,3  
       (B) 2,4  
       (C) 1,2,3  
       (D) 2,3,4

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