Fever

National Pediatric Nighttime Curriculum

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Case 1

- 4-month-old well-appearing girl admitted for croup and respiratory distress. Develops fever to 39.1.
  - What additional evaluation would you do at this point?

Case 2

- 12-year old boy with AML, in induction, admitted for febrile neutropenia. He had just received his first dose of ceftazidime and vancomycin when he developed another fever to 38.5, chills, and new dizziness shortly after receiving the antibiotics.
  - What would be the next steps in this patient's management?

Objectives

- To determine which patients are at high risk of developing sepsis.
- To assess patient with fever.
- To initiate empiric therapy.

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Which patients are high-risk for sepsis?

- Neonates
- Transplant recipients
  - Bone marrow
  - Solid organ
- Oncology patients
  - Undergoing therapy, mucositis, central line
  - Most chemotherapy: nadir ~ 10 days after rx
- Asplenic patients, including sickle cell

Definition of fever

- 38.0
  - Neonates (< 12 months)
  - Any immunocompromised patient
    - Including transplant patients, patients with immunodeficiencies, oncology patients (sustained ≥38 x 1 hour)
- 38.5
  - All other patients
- These are general guidelines, individual patients/services may have different parameters

What etiologies cause fever?

- Infectious
- Inflammatory
- Oncologic
- Other: CNS dysfunction, drug fever
- Life-threatening conditions

Infectious

- Systemic
  - Bacteremia, sepsis, meningitis, endocarditis
- Respiratory
  - URI, sinusitis, otitis media, pharyngitis, pneumonia, bronchiolitis
- Abdominal
  - Urinary tract infection, abscess (liver, kidney, pelvis)
- Bone/joint infection
- Hardware infection
  - Central line, VP shunt, G-tube

Inflammatory

- Kawasaki disease
- Juvenile inflammatory arthritis
- Lupus
- Inflammatory bowel disease
- Henoch-Schonlein purpura

Others

- CNS dysfunction
- Drug fever

Life-threatening conditions

- Sepsis, febrile neutropenia
  - Vital sign instability, poor-perfusion, may have altered mental status, disseminated intravascular coagulation
- Hemophagocytic lymphohistiocytosis
  - Splenomegaly, bicytopenia, elevated ferritin, elevated triglycerides, low fibrinogen, hemophagocytosis, low/absent NK cell function, elevated soluble IL2 receptor
- Malignant hyperthermia
  - Following administration of inhaled anesthetics or depolarizing neuromuscular blockers (succinylcholine), at-risk patients include those with myopathy
  - Muscle rigidity, rhabdomyolysis, acidosis, tachycardia

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Assessment

- Vital signs
- Repeat physical exam
  - Overall appearance (sick, toxic)
  - Central/peripheral lines
  - Incisions/wounds
  - VP shunt/tracheostomy/gastrostomy tube
  - Oral mucosa/perineal area for neutropenic patients
  - Perfusion
- Call for help if concerning vital signs/exam
  - Fellow or attending
  - Rapid response team (RRT)/PICU

Laboratory evaluation

- What would you do if the patient has hardware (VP shunt, tracheostomy, gastrostomy tube) or central line?
  - CBC with differential
  - Blood culture
  - CSF (tap VP shunt)

Laboratory evaluation

- What would you do if the patient has a high risk for sepsis?
  - Immunocompromised
  - Transplant recipient
  - Oncology patient

  - CBC with differential
  - Blood culture
  - Urinalysis and urine culture

Laboratory evaluation

- What would you do for an infant ≤ 2 months of age?
  - CBC with differential
  - Blood culture
  - Catheterized urinalysis and urine culture
  - Lumbar puncture

Laboratory evaluation

- Who needs a urinalysis and urine culture?
  - Circumcised males < 6 months
  - Uncircumcised males < 1 year
  - Females < 2 years
  - Immunocompromised patients
  - Patients with history of UTI/pyelonephritis

Laboratory evaluation

- Who needs a lumbar puncture?
  - Neonates ≤ 2 months
  - Ill-appearing
  - Altered mental status
- What tests do you send?
  - Gram stain and culture
  - Cell count and differential
  - Protein and glucose
  - Extra tube for additional studies
    - Enteroviral PCR, HSV PCR, CA encephalitis project

Laboratory evaluation

- Consider CRP, ESR
- Consider PT/PTT, fibrinogen
- Consider chest x-ray
- Consider nasopharyngeal DFA
- For immunosuppressed patients consider:
  - Viral PCR studies (ie CMV, EBV, HHV6)
  - Additional imaging (ie ultrasound, CT scan)

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Treatment for non-high risk patients

- May not need empiric antibiotics
- Consider the following issues:
  - Is patient clinically stable?
  - Are the screening laboratory studies suggestive of infection?

Treatment for patients with central lines

- Ceftriaxone
- Vancomycin

Treatment for neonates ≤ 2 months

- If < 28 days old
  - Ampicillin **AND** cefotaxime **OR**
  - Ampicillin **AND** gentamicin
    - Consider acyclovir
- If 29-60 days old
  - Ceftriaxone **±** Ampicillin **OR** Vancomycin
  - Until CSF results are known (cell count, protein, glucose), initiate therapy with meningitic dosing regimen

Treatment for febrile neutropenia

- Broad-spectrum antibiotics with *Pseudomonas coverage*
  - Ex: use ceftazidime or piperacillin-tazobactam
- Consider double coverage for possible resistant *Pseudomonas*
  - Ex: add amikacin or tobramycin
- Consider gram-positive coverage (central line, skin infections)
  - Ex: add vancomycin
- Consider anaerobic coverage (mucositis, typhlitis)
  - Ex: use piperacillin-tazobactam or add clindamycin

Take home points

- Infections are the most common cause of fever in children
- During assessment of a child with fever, pay close attention to vital sign changes, overall appearance, and potential sites of infection
- Closely monitor for clinical decompensation after antibiotic administration, particularly in patients at high-risk of developing sepsis

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