

Title of case: 27 day old female with fever
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Date case created: 03/28/2022

Learning Objectives: KAS 8-14

HPI: A 27 day old F, born via normal spontaneous vaginal delivery at 39 weeks and 3 days, is brought to the clinic for decreased oral intake. The infant normally has been taking in 1.5 ounces every 2-3 hours, but for the past 24 hours has been less interested and fussier. Parents also feel that the baby feels warmer than usual. There has been 4 wet diapers and 3 stools in the past day. Parents deny any cough, congestion, rhinorrhea, vomiting, diarrhea, or otherwise foul smelling diapers. Parents deny any sick contacts and are in good health. On examination he is comfortably asleep without any signs of distress.

Pertinent ROS:

- Decreased oral intake
- No cough, congestion, or rhinorrhea
- No vomiting, diarrhea or otherwise foul smelling diapers
- Hyperpigmented patches to shoulder and sacrum since birth

Birth hx: ex 39 weeks and 3 days, NSVD, uncomplicated nursery course, GBS positive with penicillin prophylaxis 2 hours prior to delivery, rupture of membranes at home with clear fluids and total duration for 21 hours

No PMH, PSH, Meds, or allergies

Imm: received HBV vaccine at birth

Dev: normal for age

Social hx: lives with mom, dad, maternal grandmother, and maternal grandfather

Family hx: maternal grandmother with glaucoma, maternal grandfather with atrial fibrillation, hypertension, and diabetes

Vitals: 39.2 °C (rectal), heart rate 170, 81/55, RR 40, satting at 98%

PE:

GENERAL APPEARANCE: well-nourished, well developed

HEAD: anterior fontanelle open, soft, & flat, no cranial hematomas

EYES: conjunctiva, sclera, & pupils normal; red reflexes present bilaterally

EARS: normal position & rotation; canals present

NOSE: passages patent

MOUTH: palate intact; no deformities noted

NECK: supple, no masses palpated, clavicles intact

HEART: RRR, normal S1 & S2, no m/r/g

PULSES: 2+ brachial & femoral pulses bilaterally
LUNGS: CTA bilaterally, no tachypnea/retractions
ABDOMEN: soft, non-tender, non-distended; no masses, no hepatosplenomegaly; umbilicus clean and without erythema or induration
GU FEMALE: normal appearance; no GU rashes
HIPS: negative Barlow & Ortolani
EXTREMITIES: no deformities, full range of motion
SKIN: no significant lesions, no nevus simplex, dermal melanocytosis to shoulder and sacrum
BACK: no midline defects
NEURO: cries but consolable; good Moro, suck, & grasp reflexes; normal tone & strength

Question 1. Based on the patient's history and physical, which of the following sets of diagnostic labs would it be most appropriate to obtain?

- Blood culture and CBC
- Urinalysis, urine culture, blood culture, and CBC
- Urinalysis, urine culture, blood culture, CBC, CRP, and procalcitonin**
- Urinalysis, urine culture, blood culture, CBC, CRP, procalcitonin, and CSF studies

Explanation: The risk of bacteremia and bacterial meningitis is lower in infants 22-28 days of age compared to infants 8-21 days of age, but still greater than infants 29-60 days of age. This middle group's risk for bacterial meningitis may thus be evaluated with inflammatory markers which include temperature $>38.5^{\circ}\text{C}$, procalcitonin $>0.5\text{ ng/mL}$, CRP $>20\text{ mg/dL}$, and ANC $>4000\text{-}5200/\text{mm}^3$. Most clinics will not have the capability to perform these labs with a quick turnaround, so it would be appropriate to refer the patient to the ED for these labs and further possible workup and treatment.

Learning Goal: KAS 8-10

Question 2. The urinalysis comes back with positive leukocytes, negative nitrites and 5-10 WBC/hpf. WBC is 18.5 K/mm^3 , absolute neutrophil count is $10,000/\text{mm}^3$, CRP is 35 mg/L and procalcitonin is 2 ng/mL . On reexamination the baby had just fed 2 ounces and appears comfortable. Which of the following is the most accurate statement regarding obtaining cerebrospinal fluid studies in this patient?

- CSF studies should be obtained**
- CSF studies should be obtained only if observation is to happen at home
- CSF studies may be obtained (provider discretion)
- CSF studies should not be obtained

Explanation: If any inflammatory markers are positive, CSF studies should be obtained to rule out bacterial meningitis. Inflammatory markers include and are considered abnormal at the following levels: (1) temperature $>38.5^{\circ}\text{C}$, (2) procalcitonin $>0.5\text{ ng/mL}$, (3) CRP $>20\text{ mg/L}$, and (4) absolute neutrophil count $4,000\text{-}5,200/\text{mm}^3$. A lumbar puncture may still be considered if all

inflammatory markers and urine tests are normal as the results are helpful in determining disposition for admission versus close observation at home. CSF studies should be obtained before administration of antimicrobial agents because interpreting CSF after the administration of antimicrobial agents is difficult.

Learning Goal: KAS 11-12

Question 3. CSF studies are obtained and the patient is started on empiric antimicrobials. Initial CSF findings include WBC 1,200 polymorphonuclear cells/hpf, glucose 15 mg/dL, and protein 120 mg/dL. A CSF gram stain identifies gram positive cocci. Which of the following microbes is the most likely to be identified in the CSF culture?

- a. Escherichia coli
- b. Listeria monocytogenes
- c. Streptococcus agalactiae**
- d. Streptococcus pyogenes

Explanation: Streptococcus agalactiae (also known as Group B Streptococcus, or GBS) is the leading cause of neonatal bacterial meningitis. Gram positive cocci include Staphylococcus and Streptococcus genera. Bacterial meningitis in neonates is most commonly caused by GBS, Escherichia coli, and Listeria monocytogenes. Since the 1980s, the epidemiology of bacterial infections in neonates and infants has changed as a result of many factors, including prenatal GBS screening and incorporation of immunization against Streptococcus pneumoniae. Furthermore, improvements in food safety may have resulted in a decrease in the incidence of disease caused by Listeria monocytogenes in this age group. Escherichia coli, a gram negative rod, is now the leading cause of neonatal bacteremia, and the second most common cause of neonatal bacterial meningitis. GBS remains the leading cause of neonatal bacterial meningitis. Overall, gram negative organisms are now responsible for 60% - 80% of neonatal bacterial infections

Learning Goal: Changing bacteriology of neonatal bacteremia and meningitis

Case resolution: The infant is diagnosed with bacterial meningitis due to Streptococcus agalactiae. The patient defervesced after 36 hours of parenteral antibiotics. The microbe culture comes back susceptible to ampicillin and the antimicrobial coverage is narrowed accordingly. A hearing screen is obtained prior to discharge and is notable for moderate sensorineural hearing loss. The patient is eventually discharged after a 21 day course of ampicillin with close outpatient follow up arranged.

Citations:

Pantell R H, Roberts K B, Adams W G, et al. Evaluation and Management of Well-Appearing Febrile Infants 8 to 60 Days Old. Pediatrics. 2021;148(2):e2021052228