

**Meningitis Cases****Case #1**

PT is an 8 month-old, 9 kg infant brought to the emergency department with a fever and change in behavior (as reported by her mother). According to the parents, the baby developed a fever ( $T_{max}$  103°F) 1 day prior to presentation with some mild rhinorrhea and decreased appetite. They reported that PT had a restless night, waking up numerous times with irritability and was inconsolable. This morning, mom called her pediatrician, who instructed her to take him to the emergency department for evaluation. The baby received two doses of amoxicillin for an ear infection diagnosed one day prior to admission. He is taking no other medicines, has NKDA and his immunizations are up-to-date. The infant lives with his mother, father and a 4 year old sister. Both children attend daycare. Physical Exam - VS: BP 85/50, HR 148, RR 52, T 39.7°C; Wt 9 The baby is noted to be lethargic and crying inconsolably. His fontanel is slightly bulging and he does not want to be touched. The remainder of the exam is unremarkable. CSF chemistry/cell count: color/appearance hazy, glucose - 25 mg/dL, protein - 281 mg/dL, WBC 1,200 cells/mm<sup>3</sup> (6% lymphs, 4% monos, 90% PMNs), RBC 50 cells/mm<sup>3</sup>, Gram stain (CSF): Pending. Cultures: Blood, urine, CSF pending.

1. Underline the clinical manifestations present in this infant consistent with a CNS infection.

2. Based on the CSF chemistry, should this patient be treated for bacterial meningitis? Why?

Yes  
 \* - hazy color \* - high WBC  
 \* - low glucose \* - predominantly PMNs (sometimes don't have high levels initially)  
 \* - high protein

3. What pathogens should be covered empirically in this child?

*S. pneumoniae*  
*N. meningitidis*  
*H. influenzae*  
~~Vancomycin 15 mg/Kg IV q6h~~  
 1 mo. - 29 y/o

4. What diagnostic tests would be helpful to assess to determine the pathogen causing this child's infection?

\* - lumbar puncture \* - antigen detection test  
 - gram stain \* - CHEM 7 & WBC count  
 - cultures

5. Outline an empiric antibiotic regimen for this infant. Include drug(s), dose, route.

Vancomycin 15 mg/Kg IV q6h

time-dependent so  
 q6h often used

6. The gram stain on the CSF shows gram positive cocci in pairs. What is the most likely pathogen?

*S. pneumoniae*

gram(+) diplococci = pneumococcal

7. Based on the culture results outline an appropriate therapeutic regimen for this child.

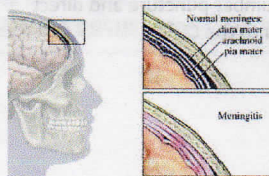
(include drug(s) dose, route and duration of therapy) depends on MIC  
 PCN susc. : Pen G 0.05 mU/Kg q4-6h IV or Amp 75 mg/Kg IV q6h  
 PCN inter. : Cefotaxime or Ceftriaxone (same doses above)  
 PCN resist. : Vanco + Cefotaxime or Ceftriaxone (same)

> For 10-14 days

8. What would you monitor in this patient?

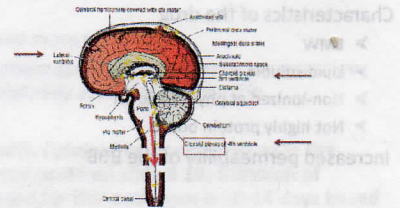
## CNS Infections

## Anatomy of the CNS



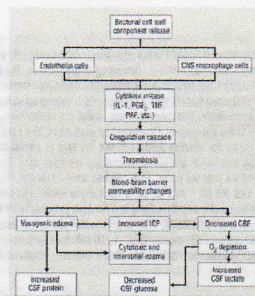
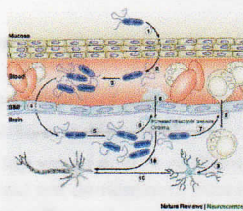
- Subarachnoid space is between the arachnoid and the pia mater.
- CSF flows through the arachnoid space

## Anatomy of the CNS

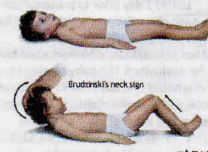


From DiPro J. Pharmacotherapy: A physiologic Approach  
Chapter 115 CNS Infections

## Pathophysiology



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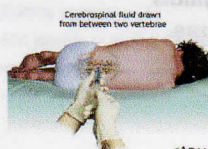
Brudzki's neck sign

#ADAM



Kernig's sign

#ADAM



Cerebrospinal fluid drawn from between two vertebrae

#ADAM

## Petechial Rash: Meningococcal Infections





## Factors Affecting CNS Penetration of Antibiotics

### Characteristics of the drug

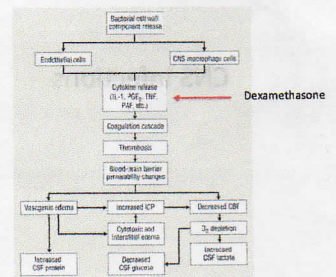
- LMW
- Lipid soluble
- Non-ionized at physiologic pH
- Not highly protein bound

### Increased permeability of the BBB

## Alternative Routes of Administration

- Intrathecal via lumbar puncture and direct administration into the CSF.
- Intraventricular

## ????Dexamethasone ???



## Underline the clinical manifestations that are consistent with a CNS infection.

PT is a 8 month-old, 9 kg infant is brought to the emergency department with a fever and change in behavior (as reported by her mother). According to the parents, the baby developed a fever ( $T_{max}$  103°F) 1 day prior to presentation with some mild rhinorrhea and decreased appetite. They reported that PT had a restless night, waking up numerous times with irritability and was inconsolable. This morning, mom called her pediatrician, who instructed her to take him to the emergency department for evaluation. The baby received two doses of amoxicillin for an ear infection diagnosed one day prior to admission. He is taking no other medicines, has NKDA and his immunizations are up-to-date. The infant lives with his mother, father and a 4 year old sister. Both children attend daycare. Physical Exam - VS: BP 85/50, HR 148, RR 52, T 38.7°C, Wt 9 The baby is noted to be lethargic and crying inconsolably. His fontanel is slightly bulging and he does not want to be touched. The remainder of the exam is unremarkable. CSF chemistry/cell count: color/appearance hazy, glucose - 25 mg/dL, protein - 281 mg/dL, WBC 1,200 cells/mm<sup>3</sup> (6% lymphs, 4% monos, 90% PMNs), RBC 50 cells/mm<sup>3</sup> Gram stain (CSF): Pending. Cultures: Blood, urine, CSF pending.

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## Based on the CSF chemistry, should this patient be treated for bacterial meningitis?

Yes

Why?

## Based on the CSF chemistry, WHY should this patient be treated for bacterial meningitis?

CSF chemistry/cell count is consistent with a bacterial meningitis: color/appearance hazy, glucose - 25 mg/dL, protein - 281 mg/dL, WBC 1,200 cells/mm<sup>3</sup> (6% lymphs, 4% monos, 90% PMNs), RBC 50 cells/mm<sup>3</sup>

- Increased CSF WBC
  - Predominantly PMNs
- Decreased glucose
- Increased protein
- Hazy appearance

## What pathogens should be covered empirically in this child?

- *S. pneumoniae*
- *N. meningitidis*
- *H. influenzae*

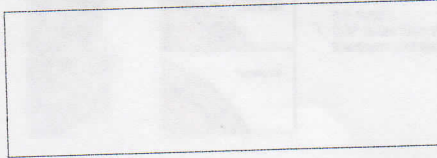
## What diagnostic test(s) would be helpful to assess to determine the pathogen causing this child's infection.

- An antigen detection test
  - e.g. Latex Agglutination

Outline an empiric antibiotic regimen for this infant. Include drug(s), dose, route.

Vancomycin (15 mg/kg) 135 mg IV Q 6 h  
and  
Ceftriaxone (50 mg/kg) 450 mg IV Q 12 h  
or  
Cefotaxime (75 mg/kg) 675 mg IV Q 6 h

The gram stain on the CSF shows  
gram positive cocci in pairs. What is  
the most likely pathogen?  
***Streptococcus pneumoniae***



Based on the culture results outline an appropriate therapeutic regimen for this child. (include drug(s) dose, route and duration of therapy)

You need more information.

Your patient grows *Streptococcus pneumoniae* *intermediately sensitive to penicillin*.

Treat with Cefotaxime or ceftriaxone in the dose and route on slide # 19. Duration of treatment for this pathogen is 10-14 days based on response.

What would you monitor in this patient?

- ✓ Fever
- ✓ Clinical symptoms (irritability, inconsolable etc...)
- ✓ Repeat blood cultures (if originally positive)
- ✓ Peripheral WBC and differential
- ✓ Repeat CSF tap would only be performed if the patient did not demonstrate improvement of symptoms or if symptoms get worse.

FL is a 19 year old woman who is brought to the ER by her college roommates because she is lethargic and has a fever of 103.5 °F. FL is college freshman who lives in the dorm at a University in Philadelphia (not Temple). FL's roommates state that she was fine until the night before admission when she woke up in the middle of the night complaining of feeling hot and of having the worst headache of her life. This morning she was difficult to arouse. FL takes a calcium and a multi-vitamin. On physical exam FL is noted to have a temperature of 104°F. BP is 90/60 mmHg, HR 120 beats/min, RR 20/minute. Weight = 52 kg. Neurologic examination showed evidence of nuchal rigidity; she is lethargic and difficult to arouse. Brudzinski's and Kernig's signs are positive. The patient exhibits photophobia when the physician shined a light in her eyes. The only other pertinent finding was a petechial rash visible on her extremities. A lumbar puncture is performed and the CSF chemistries are consistent with bacterial meningitis. FL received all immunizations as an infant, but has not received any vaccines since she was 10 years old.

Recommend an empiric antibiotic regimen.

Although this patient's presentation is consistent with *N. Meningitidis*, you would still cover for *S. pneumoniae* and *H. influenzae* (unless she was vaccinated against Hib as an infant).

Vancomycin (15 mg/kg) 810 mg Q 8 h and  
ceftriaxone 2 g Q 12 h or cefotaxime 2 g Q 4 h

Note: When treating meningitis with a cephalosporin which has time dependent killing I recommend the highest dose and dose at the most frequent interval recommended. Remember pediatric doses need to be assessed on a mg/kg basis.

The CSF culture and two blood cultures are positive for *N. meningitidis* (penicillin MIC 0.06).

Recommend a treatment regimen for this patient.

Since this organism is penicillin sensitive:

Penicillin G 4 mUnits IV Q 4 h Or  
Ampicillin 2 g IV Q 4 h for 7 days.

How can the potential spread of meningococcal disease be prevented in persons with whom F.L. has had contact?

Close contacts should be given one of the following antibiotic regimens\*:

- Rifampin 600 mg PO Q 12 h X 4 doses
- Ciprofloxacin 500 mg PO (> 12 y) X one dose
- Ceftriaxone IM 250 X 1 dose

• Adult doses