I. Meningitis

A. Route of Infection

1. Organisms from nasopharynx invade underlying blood vessels and enter cerebral-spinal supply

2. Organisms form “thromboemboli” locally in CSF that release septic emboli into bloodstream

3. Organisms enter through a penetration wound e.g. Lumbar puncture, VP Shunt, skull fracture

B. Types

1. Aseptic (nonbacterial) Meningitis

   a. Cause: Most common cause is viral. Associated with mumps, measles, herpes, & Leukemia

   b. Signs/Symptoms: Gradual or sudden onset. Can see HA, fever, GI symptoms, malaise, meningeal signs, maculopapular rash. Symptoms usually disappear within 3-10 days. No residual effects are seen.

2. Tubercular Meningitis

   a. Signs/Symptoms: Fever, LOC altered, seizures, meningeal signs, CN involvement; seizures, and focal neurologic deficit. Frequent complication is hydrocephalus.

3. Bacterial

   a. Cause: H. influenza, meningococcus, pneumococcus, streptococcus, staphylococcus, and E. coli

      1) By age of incidence –

         a. Neonate - 3 months: streptococcus (Beta Strep) and E. coli
         b. 3 months - 3 years: H. influenzae Type B, streptococcus, pneumoniae, and Neisseria meningitidis (meningococcal), Staphylococcus aureus.
         c. School-age and beyond: Meningococcal due to high transmissibility through droplet form.
2) By season -- H. *Influenzae* is most common in autumn or early winter
Pneumococcal or meningococcal can occur anytime, but > in
later winter and early spring.

b. **Pathophysiology** : Usually from vascular dissemination from infection
somewhere else in the body (otitis media, sinusitis...). Could also be a
result of an organism that enters the body via a penetrating wound, a
surgical procedure or a lumbar puncture. Organism invades underlying
blood vessels and enters cerebral blood supply then it spreads into the
CSF and throughout spinal column. WBC accumulation, exudation and
inflammation occur around the brain surface. Tissue damage occurs in
varying degrees.

c. **Characteristic Signs/Symptoms : Symptoms differ depending on age of child**
   *These sx are common in children > 5 years:* Nuchal rigidity, HA, high
   fever, Kernig's and Brudzinski's signs present, Opisthotonos, seizure,
   irritability, and photophobia. VS changes: ↑ Temp, ↑ BP, ↓ P, ↓ R.
   Petechiae are most common with meningococcal meningitis.

C. Clinical Manifestations

1. **Brudzinski's Sign**: pt. is supine, passive flexion of neck causes flexion of thigh
   at hip & flexure of ankle and knee.

2. **Kernig's Sign**: pt. is supine & thigh is flexed @ 90 °angle toward abdomen.
   Extension of leg upward causes 1) spasm of hamstring, 2) resistance to further
   extension, 3) Pain.

3. **Opisthotonous position**: spasm of paraspinal muscle causing head and leg to
draw back in extreme overextension (arched position)

4. **Bulging fontanels**: in the infant whose fontanel has not yet closed,
   inflammation⇒ accumulation of exudate ⇒ fluid to accumulate in ventricles &
   exudate, vasculitis, hypoperfusion ⇒ cerebral tissue edema. {During the
   healing process, fibrin may be deposited causing scab tissue formation⇒
   blocked CSF circulation ⇒ obstructive hydrocephaly.

5. **Petechiae**: classic sx of meningococcal meningitis or complication of DIC.

6. **Skin rash**: more commonly seen in viral meningitis

E. Lab Findings

1. Primarily from Lumbar Puncture (LP) to Examine Cerebrospinal Fluid (CSF)
   (See Handout)

2. Other lab tests
   CSF Studies-- Gram stain, CIE or Latex Bacter Antigen,
   Skin Culture of petechiae to R/O meningococcal meningitis
   Blood glucose-- for baseline comparison to CSF glucose level
   C-Reactive protein-- ↑ in bacterial meningitis
F. **Treatment**

1. **Isolation**
2. **Quiet environment**
3. **Medications**— IV route essential to cross the blood-brain barrier
   - Ampicillin & Gentamycin IV
   - Cephalosporins as Rocephin IV
   - Dexamethasone IV (corticosteroids to down hearing loss)
4. **Fluid and electrolyte management**
5. **Seizure precautions**

G. **Prognosis**:  Neonate—50% mortality  
   Infancy—*H. Influenzae* or meningococcal—5-10% die, Pneumococcal 20% fatal  
   Potential Sequelae: may have learning impairment, hearing loss if in 1st month of life

H. **Nursing Care**

1. **Hyperesthesia**
2. **Positioning**—side is usually preferred
3. **Convulsions**
4. **Fever**
5. **Assisting with diagnostic tests**
6. **Neuro checks** (sx of ↑ ICP: ↓ pulse, ↓ respirations, ↑ BP, ↑ temperature)
7. **Hydration**
8. **Parental teaching and emotional support**

I. **Prevention**:

1. **HiB Vaccine**
2. **Beta Strep screening in pregnant women at 36 weeks gestation so that positive moms can be treated with Ampicillin or Penicillin IV in labor.**
SARA SMILEY is a 3 year old who has been admitted to the pediatric unit with a diagnosis of R/O MENINGITIS. You go in to admit her to your peds unit and you notice the following signs and symptoms:

    Irritability, temperature of 102F, C/O tummy hurting, presence of a maculopapular rash.

1. What do these s/s tell you about her potential diagnosis?

2. How long does Aseptic Meningitis usually last?

3. When you call the doctor with your initial assessment data, what kind of tests might you expect to be ordered?

4. What nursing actions can you do immediately for the patient?

5. Given her age, what ways can you help decrease Sara's anxiety regarding hospitalization?

6. What could you do to relieve some of Sara's parents' anxiety?

The doctor comes into the hospital and performs LP. You notice that the color of the CSF is clear. The results of the LP show:

    Normal glucose levels, a slight increase in protein, and an increase in WBCs, predominantly lymphs.

7. After notifying the doctor regarding the above CSF results, what type of nursing care do you plan to provide for Sara during her hospitalization?

8. What nursing diagnoses would you choose for her?

9. If Sara had actually had bacterial meningitis, how might her signs and symptoms have differed? What results would have come back on her CSF analysis? How would her treatment have been much different?
<table>
<thead>
<tr>
<th>Finding</th>
<th>Normal</th>
<th>Bacterial Meningitis</th>
<th>Viral Meningitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSF Pressure:</td>
<td>80-100 mm/H2O</td>
<td>&gt; 100 mm/H2O</td>
<td>slight ↑</td>
</tr>
<tr>
<td>Cell Count (WBC):</td>
<td>0-15 Newborn</td>
<td>&gt; 1000 cells/cc Neutrophils/PMN</td>
<td>Slightt ↑</td>
</tr>
<tr>
<td></td>
<td>0-8 Infant</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0-5 Child &amp; Older</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glucose:</td>
<td>2/3 blood glucose</td>
<td>0-15</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>20-40 newborn</td>
<td>&lt; 1/2 blood glucose</td>
<td></td>
</tr>
<tr>
<td></td>
<td>70-90 infant/child</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein:</td>
<td>20-129 newborn</td>
<td>&gt; 7500 mg/dl</td>
<td>Normal or slightly ↑</td>
</tr>
<tr>
<td></td>
<td>15-45 infant/child</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color:</td>
<td>Clear</td>
<td>Turbid, cloudy, purulent</td>
<td>Clear</td>
</tr>
</tbody>
</table>