Clinical Concern for Meningitis
(See Box 1)

History and Physical, IV Access, CBC, Renal, Lactate, blood cultures x 2, CRP (+/- procalcitonin)

> 1 hr delay from door to LP?
Yes
1. Obtain blood cultures
2. Give dexamethasone (see Box 3)
3. Start empiric antibiotics (see Box 4)

No

Need for CT prior to LP?*
Yes
1. Obtain blood cultures
2. Give dexamethasone (see Box 3)
3. Start empiric antibiotics (see Box 4)

CT normal?
Yes
1. Pursue workup based on finding
2. Continue antibiotics and admit

No

Laboratory Studies (see Box 2 for interpretation guide)
1. Cell count
2. Glucose, protein
3. CSF culture
4. CSF cell count and hold
5. Other tests?**

Perform LP – obtain opening pressure, get 1-2cc per tube and attempt to fill tube 4 with 10cc

Begin antibiotics, steroids and acyclovir (see Box 3 & 4)

Call neurology for admission, admit to medicine if they do not believe the patient needs neurology intervention.

Consider admission to neurology if AMS, seizure (non-status)

Admit to NSICU if in status epilepticus, severely altered, airway compromise requiring intubation, hemodynamic instability

* Need for CT prior to LP3,7
1. Immunocompromised patient (HIV/AIDS, chemo, chronic steroids, s/p transplantation)
2. History of CNS disease (mass lesion, stroke or focal infection)
3. New onset seizures (within 1 week of presenting symptoms)
4. AMS
5. Focal neuro deficit (dilated nonreactive pupil, abn ocular motility, abn visual fields, gaze palsy, arm or leg drift)
6. Papilledema

** Other Tests to Consider
1. History of recent travel to endemic areas, PMHx significant for exposure send West Nile, crypto antigen/India Ink, TB PCR
2. History of HSV or VZV; lesions on exam send HSV/VZV PCR
3. Consider India ink, crypto antigen if immunocompromised (HIV, chemo, transplant) or high clinical suspicion
4. Summer months consider enterovirus PCR

9-21-15
**Box 2** : CSF Interpretation

Typical Values in various CNS infections

<table>
<thead>
<tr>
<th>Index</th>
<th>Normal</th>
<th>Bacterial</th>
<th>Viral</th>
<th>Fungal</th>
<th>TB</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC/μl</td>
<td>&lt;5</td>
<td>&gt;1,000</td>
<td>5-1000</td>
<td>&lt;1000</td>
<td>5-1000</td>
</tr>
<tr>
<td>Differential</td>
<td>&lt;15% PMNs</td>
<td>&gt;80% PMNs</td>
<td>&lt;50% PMNs</td>
<td>&gt;50% PMNs</td>
<td>&gt;80% lymphs</td>
</tr>
<tr>
<td>Glucose (mg/dl)</td>
<td>45-65</td>
<td>reduced</td>
<td>normal</td>
<td>reduced</td>
<td>&lt;40</td>
</tr>
<tr>
<td>CSF:Blood glucose</td>
<td>0.6</td>
<td>&lt;0.4</td>
<td>normal</td>
<td>reduced</td>
<td>reduced</td>
</tr>
<tr>
<td>Protein (mg/dl)</td>
<td>20-45</td>
<td>&gt;250</td>
<td>100-300</td>
<td>30-150</td>
<td>40-150</td>
</tr>
<tr>
<td>Opening Pressure (cm/H2O)</td>
<td>&lt;20</td>
<td>elevated</td>
<td>normal/elevated</td>
<td>elevated</td>
<td></td>
</tr>
</tbody>
</table>

*Significant overlap in findings can occur between various etiologies of meningitis.

**Box 3** : Steroids

Steroids: to be given prior to or in concomitant with first antibiotic

- Dexamethasone: 0.15 mg/kg or 10 mg q6hr

**Box 4** : Antibiotics

<table>
<thead>
<tr>
<th>Neonates (birth-1m)</th>
<th>Children (1m-2y)</th>
<th>Healthy Adults (2y-50y)</th>
<th>Elderly (&gt;50yo)</th>
<th>Immunocompromised</th>
<th>Nosocomial Infections</th>
<th>Healthy Adults – Beta-Lactam Allergy</th>
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</thead>
<tbody>
<tr>
<td>Amoxicillin 50mg/kg q8hr</td>
<td>Vancomycin 15-20mg/kg q8-12hr</td>
<td>Vancomycin 15-20mg/kg q8-12hr</td>
<td>Vancomycin 15-20mg/kg q8-12hr + Ampicillin 2g q4hr + Ceftriaxone 2g q12-24hr or Cefotaxime 2g q6hr</td>
<td>Vancomycin 15-20mg/kg q8-12hr + Ampicillin 2g q4hr</td>
<td>Vancomycin 15-20mg/kg q8-12hr + Meropenem 2g q8hr</td>
<td>Vancomycin 15-20mg/kg q8-12hr + Meropenem 2g q8hr</td>
</tr>
<tr>
<td>Cefotaxime 50mg/kg q6hr</td>
<td>Cefotaxime 50mg/kg q12hr</td>
<td>Cefotaxime 2g q12-24hr or Cefotaxime 2g q6hr</td>
<td>Cefotaxime 2g q12-24hr or Cefotaxime 2g q6hr</td>
<td>Cefotaxime 2g q12-24hr or Cefotaxime 2g q6hr</td>
<td>Cefotaxime 2g q12-24hr or Cefotaxime 2g q6hr</td>
<td>Cefotaxime 2g q12-24hr or Cefotaxime 2g q6hr</td>
</tr>
<tr>
<td>Acyclovir 20mg/kg q8hr</td>
<td>Acyclovir 20mg/kg q8hr (0-3m)</td>
<td>Acyclovir 10mg/kg q6hr (ideal body weight)</td>
<td>Acyclovir 10mg/kg q8hr (ideal body weight)</td>
<td>Acyclovir 10mg/kg q8hr (ideal body weight)</td>
<td>Acyclovir 10mg/kg q8hr (ideal body weight)</td>
<td>Acyclovir 10mg/kg q8hr (ideal body weight)</td>
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<tr>
<td>Microorganism</td>
<td>Recommended therapy</td>
<td>Alternative therapies</td>
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<td>--------------------------------------------</td>
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</tr>
<tr>
<td>S. pneumonia</td>
<td>Vancomycin+3(^{rd}) generation cephalosporin</td>
<td>Meropenem, fluoroquinolone</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>N. meningitides</td>
<td>3(^{rd}) generation cephalosporin</td>
<td>Penicillin G, ampicillin, chloramphenicol, aztreonam, fluoroquinolone</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>L. monocytogenes</td>
<td>Ampicillin, penicillin G</td>
<td>Bactrim, meropenem</td>
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<tr>
<td>S. Agalactiae</td>
<td>Ampicillin, penicillin G</td>
<td>3(^{rd}) generation cephalosporin</td>
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<tr>
<td>H. influenza</td>
<td>3(^{rd}) generation cephalosporin</td>
<td>Chloramphenicol, cefepime, meropenem, fluoroquinolone</td>
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<td></td>
</tr>
<tr>
<td>E. Coli</td>
<td>3(^{rd}) generation cephalosporin</td>
<td>Cefepime, meropenem, aztreonam, Bactrim, fluoroquinolone</td>
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References