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Professor
Department of Pediatrics
UTHSCSA

A SMÖRGÅSBORD OF INFECTIOUS DISEASES

Topics
- HIV exposure
- Animal bites
- FUO
- Antibiotic choices
- Central Line Infections

HIV--Background
Mother-to-Child Transmission
- 25% risk of MTC transmission
- Triple antiretroviral therapy for woman + zidovudine* for the infant x 6 wks, reduces the risk to 1-2%
- What if the scenario is different?

*AZT, Retrovir®, ZDV

HIV Dilemmas

Case 1
- A 20 y/o woman is HIV (-) at 4 months gestation
- At delivery a rapid HIV antibody screening test is (+)
  - She will deliver before a confirmatory test (Western Blot) is available
  - What needs to be done?

Case 1
- Is this a true positive (infected) or a false positive test?
  - Unknown without the confirmatory test
- Options:
  1. Do nothing —if the woman is infected, infant has 25% risk
  2. Treat the woman —with ARV and start the infant on zidovudine after delivery—reduces the risk to 5-10% (est.)
Case 1

- Side effects of short term zidovudine are minimal
- The emotional impact/anxiety on the family is going to be significant
  - It might be alleviated somewhat by beginning treatment

Case 1

- Once the Western Blot result is available:
  - If WB(−) --- The woman is not infected — stop infant medication
  - If WB (+) --- The woman is infected — continue medication and begin evaluation of the infant
  - If WB is indeterminate —
    - Continue medication, but do not begin testing the infant until mom’s status is determined
    - Consider a PCR on mother

Case 2

- As for Case 1, but ELISA on the woman is not back at time of delivery
- Shortly after delivery the lab calls and indicates that the ELISA is positive

Case 2

- Begin zidovudine — the earlier the better
  - Risk will be reduced to 10-15%
  - There is no benefit if medication is begun after 72 hours
  - Benefit begins to decline after 48 hours

- Wound infections
- Rabies exposures
- Tetanus
**History is everything:**

- Type of bite/exposure
- Type of Animal
- Site of exposure
- Tissues penetrated

**Dog Bites**

- Dogs tend to tear when they bite

**Cat Bites**

- Cats cause deep puncture wounds (bones, joints, muscles, vessels, nerves)

**Animal Bite Wound Infections**

- Animal—type of bite
- Location
- Organisms
  - Animal’s oral flora
  - Skin flora
  - Environmental contaminants
- Assessment
- Initial treatment
- Follow-up

**Rate of Infections —with good wound care**

Bradley JS, in Jenson and Baltimore. Pediatric Infectious Diseases; 2nd edition 2002

- Animal
  - Dog bite - 4%
  - Cat bite - 50%
- Empiric Therapy
  - Dog bites typically do not require empiric ABx
  - Cat bites always need empiric ABx

**Animal Bite Wound Infections**

- Organisms
  - *S. aureus*
  - *Pasteurella multocida*
  - *Streptococci (various)*
  - *Corynebacterium*
  - Coag neg. staph
  - Aerobic GNR
  - Anaerobic streptococci
  - *Bacteroides*
- 40%
- 40% (higher in cats)
- 40%
- 20%
- 20%
- 15%
- 40%
- 20%
Other less common organisms
- Bartonella henselae
- Fusobacterium
- Pseudomonas
- Clostridium tetani
- Capnocytophaga canimorus
- Herpes B virus

Bradley JS, in Jenson and Baltimore; Pediatric Infectious Diseases; 2nd edition 2002

Wound Care
- Irrigation
  - Difficult with penetrating wounds (cats)
- Debride if possible
- Suturing
  - Do not suture penetrating cat bite wounds
  - Debrided dog bite wounds can be sutured (unless extensive or devitalized tissue remains)

Bite Wound Complications
- Hands, face and genital wounds are especially dangerous
- Nerves, tendons, bones, joints, blood vessels can be penetrated and deep infections may occur

Prophylactic Management of Animal Bite Wounds to Prevent Infection
AAP Redbook online (2009)

<table>
<thead>
<tr>
<th>Source of Bite</th>
<th>Organism(s) Likely to Cause Infection</th>
<th>Oral Route</th>
<th>Intravenous Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog, cat, or other mammal</td>
<td>Pasteurella spp., Staphylococcus aureus, Streptococci, Capnocytophaga species, Moraxella species, Corynebacterium spp., Neisseria spp., Amoxicillin-clavulanate (Augmentin®)</td>
<td>Amoxicillin-clavulanate (Augmentin®)</td>
<td>Extended-spectrum cephalosporin or Trimethoprim-sulfamethoxazole</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ampicillin-sulbactam (Unasyn®)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source of Bite</th>
<th>Oral Alternatives for Penicillin-Allergic Patients*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog, cat, or other mammal</td>
<td>PLUS</td>
</tr>
<tr>
<td></td>
<td>Clindamycin</td>
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<td>PLUS</td>
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<tr>
<td></td>
<td>Clindamycin</td>
</tr>
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</table>

Initiate antimicrobial therapy
- Moderate or severe bite wounds, especially if edema or crush injury is present
- Puncture wounds, especially if penetration of bone, tendon sheath, or joint has occurred
- Facial bites
- Hand and foot bites
- Genital area bites
- Wounds in immunocompromised and asplenic people
- Wounds with signs of infection
- Follow-up
  - Inspect wound for signs of infection within 48 h

*AAP Redbook online (2009)
Rabies

*Rabere* (lat.)—to rage

Rabies virus (a rhabdovirus)
- Bullet shaped RNA virus
- Mammals
- Central nervous system
  - Found in neural tissue
  - Found in saliva
  - Not in blood

Rabies Exposure
- Did an exposure occur?
- The animal
  - Domestic
  - Wild
  - Bat exposures—a special situation
- The Situation

The animals
- Domestic
  - Cats
  - Dogs
  - Cattle
  - Horses
  - Goats/Sheep
- Wild
  - Bats*
  - Skunks
  - Raccoons
  - Wolves/coyotes
  - Foxes
  - other

Small rodents—(squirrels, hamsters, guinea pigs, gerbils, chipmunks, rats, and mice), and Lagomorphs (rabbits and hares) are almost never infected with rabies and have not been known to transmit rabies to humans (CDC and ACIP)

Exposure
- Bite
- *Saliva* into open wound or mucosa
- Contact with *neural tissue*
- Exposure to blood
  - or fur is *not*
  - considered contact
Situation

- Wild animal
  - Unprovoked attack
  - Abnormal behavior
- Domestic animal—
  - known to be immunized?
  - provoked by child?
  - Unprovoked?
  - Available for observation?

**Bats – Special Situation**

- Rabies postexposure prophylaxis is recommended for all persons with bite, scratch, or mucous membrane exposure by a bat, unless the bat is available for testing and is negative for evidence of rabies.

  [Link to CDC website](http://www.cdc.gov/rabies/exposure/animal/s/bats.html)

**Postexposure prophylaxis should be considered** when direct contact between a human and a bat has occurred, unless the exposed person can be certain a bite, scratch, or mucous membrane exposure did not occur.

[Link to CDC website](http://www.cdc.gov/rabies/exposure/animals/bats.html)

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**Table 3.57. Rabies Postexposure Prophylaxis Guide (AAP Redbook)**

<table>
<thead>
<tr>
<th>Animal Type</th>
<th>Evaluation and Disposition of Animal</th>
<th>Postexposure Prophylaxis Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogs, cats, and ferrets</td>
<td>Healthy and available for 10 days of observation</td>
<td>1. Prophylaxis only if animal develops signs of rabies³</td>
</tr>
<tr>
<td></td>
<td>Rabid or suspected of being rabid¹</td>
<td>2. Immediate immunization and RIG²</td>
</tr>
<tr>
<td></td>
<td>Unknown (escaped)</td>
<td>3. Consult public health officials for advice</td>
</tr>
<tr>
<td>Bats, skunks, raccoons, foxes, and most other carnivores; woodchucks</td>
<td>Regarded as rabid unless geographic area is known to be free of rabies or until animal proven negative by laboratory test²</td>
<td>Immediate immunization and RIG²</td>
</tr>
<tr>
<td>Livestock, rodents, and lagomorphs (rabbits, hares, and pikas)</td>
<td></td>
<td>Consult public health officials. Bites of squirrels, hamsters, porcupines, gerbils, chinchillas, rats, mice and other rodents, rabbits, hares, and pikas almost never require antirabies treatment.</td>
</tr>
</tbody>
</table>
Prophylaxis (Passive immunization)
- Rabies Immune Globulin (RIG)
  - 20 IU/Kg
  - Infiltrate wound (as much as feasible)
  - Remainder is given IM
- Begin as soon as possible after injury
  - Ideally within 24 hours
  - If unavailable give active vaccine first and RIG later (if within 7 days)

Active Immunization
- Begin active rabies vaccine concomitantly with RIG (separate site)
- IM – deltoid
  - Anterior thigh for young children
- 4 Doses* -- days 0, 3, 7, 14

*Advisory Committee on Immunization Practices June 24, 2009

Tetanus-Prone Wounds

<table>
<thead>
<tr>
<th>History of Absorbed Tetanus Toxoid (Doses)</th>
<th>Clean, Minor Wounds</th>
<th>All Other Wounds*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Td or Tdap&lt;sup&gt;b&lt;/sup&gt;</td>
<td>TIG&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>&lt;3 or unknown</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3 or more&lt;sup&gt;d&lt;/sup&gt;</td>
<td>No&lt;sup&gt;h&lt;/sup&gt;</td>
<td>No</td>
</tr>
</tbody>
</table>

Fever of Unknown Origin
- FUO is a term that is often misused
- It has a specific definition(s):

1. ≥ 38.5° (101.3° F) on > 4 occasions over 2 weeks<sup>1</sup>
2. Fever for > 3 wk - undiagnosed cause despite evaluation or Fever ≥ 1 week with undiagnosed cause despite inpatient evaluation<sup>2</sup>
3. >38° (100.4° F) at least 2x/wk for 3 wks<sup>3</sup>

<sup>1</sup> 1975 Pizzo
<sup>2</sup> McClung 1972
<sup>3</sup> Steele 1991
Practical Definition of FUO in Children

- Fever >101ºF (38.3ºC) of at least 8 days, when no diagnosis is apparent after initial outpatient or hospital evaluation

This requires a careful Hx, PE & initial laboratory assessment.

1 Lorin and Feigin in Textbook of Pediatric Infectious Diseases; Feigin and Cherry 1988

It’s not an FUO just because you don’t know what it is!

Fever Without Localizing Signs (FWLS)

- The duration does not yet meet the criteria for FUO (< 8 days)
- or the w/u is not yet complete

Practical Tips

- Fever ≠ Infection
- Antibiotics ≠ Antipyretics
- Significant Infections will usually declare themselves in a short time
- Most common viral infections resolve in 5-7 days

FUO—What to Do

- Take a thorough history
  - Has fever been truly documented?
  - “100 and 4” (100.4º or 104º?)
  - What type of thermometer (if any)?
    o Axillary, oral, rectal?
- Thorough Physical examination

- Fever for a few days every week or month is not typical for infections –Periodic fevers often have an immunologic (genetic) origin
FUO-Basic Workup

- CBC
- UA
- Liver enzymes
- Chemistry
- ESR or CRP?
- PPD
- CXR?

- Blood cultures
- Urine culture
- Throat culture
- Stool culture
- CSF cultures (cell count & chemistry)
- Serologic tests based on known exposures, travel history, etc.

- If the appropriate length of time has passed and fever persists
  & Preliminary tests are not revealing
  & The patient remains without localizing signs

Diagnosis of FUO is reasonable

<table>
<thead>
<tr>
<th>Etiology</th>
<th>McClung (1972) %</th>
<th>Steele et al. (1992) %</th>
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</thead>
<tbody>
<tr>
<td>Infection</td>
<td>29</td>
<td>20</td>
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<tr>
<td>Bacterial/Fungal</td>
<td>28</td>
<td>11</td>
</tr>
<tr>
<td>Viral</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Collagen Vascular Disease</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>JRA</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>SLE</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>ARF</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Malignancy</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Leukemia/Lymphoma</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Scurva</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Factitious</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>No Etiology</td>
<td>41</td>
<td>62</td>
</tr>
</tbody>
</table>

Next steps ($$$)

- ANA
- RF
- C3, C4, CH50
- Serologic tests
  - Fungi
  - Viruses (CMV, EBV, HIV)
- Bone Marrow
  - Cultures (Viruses, bacteria, fungi)
  - Stains
  - Cytology
  - MRI, CT, Bone scan, etc.

Avoid antibiotics when possible
Avoid antipyretics when the diagnosis is unclear
  - Antipyretics can mask symptoms that may be useful in the diagnosis
Antibiotic-related consults fall into these categories:
1. Starting Antibiotics- yes or no
2. Which Antibiotics?
3. Changing Antibiotics
4. Stopping Antibiotics

“I went against your advice and started antibiotics. When should I stop them?”

Antibiotic—Wise Choices
- More Expensive ≠ better
- Newer ≠ Better
- When you choose an antibiotic ask yourself:
  - Why any antibiotic?
  - Why this antibiotic?

Why Do We Overprescribe Antibiotics?
- Lack of confidence
  - It’s easy to give an antibiotic (“shotgun”)
  - Fear of your attending
  - Hope for dramatic results with a powerful medication
  - Fear of omission/fear of lawsuits
- Peer Pressure—Patient Pressure
  - Competition
    - “The other doctor gave me an antibiotic last time”
    - “The last time I had a cold Dr. Malfunction gave me a Z-Pack and I got better”
- Pharmaceutical industry pressure

The most common Situations for Antibiotic Abuse
- Fever
- Viral URI
- Sore Throat
- Diarrhea

Indications for Antibiotic Use
1. **Definitive therapy/proven infection**
   - Narrow spectrum
   - Least toxic
   - Easy to administer
   - Inexpensive

   e.g. (+) throat culture or rapid test for grp A strep

   **Drug of choice:** penicillin V (oral)
   amoxicillin (oral),
   penicillin G benzathine (IM)
2. Empirical therapy

- Try to restrict to critical cases
  - inadequate time to get culture results before a decision is necessary
  - Supportive laboratory evidence of significant infection (leukocytosis; CSF pleocytosis)
    - e.g.
      - Sepsis
      - Severe invasive disease likely to be bacterial
      - Immunocompromised

3. Prophylactic therapy

- Susceptible patients
- Specific infections
- Definite detrimental effect
  - e.g. endocarditis prevention—

Antibiotic prophylaxis for dental procedures:

1. Prosthetic cardiac valve
2. Previous endocarditis
3. Congenital heart disease only in the following categories:
   - Unrepaired cyanotic CHD
   - Completely repaired CHD with prosthetic material
   - Device for the first six mo.
   - Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization)
   - Cardiac transplantation recipients with cardiac valvular disease

Circulation. 1997;96:358-366

Which Antibiotic?

- Site of infection
- Type of infection
- Severity
- Isolate and it's sensitivity
- Host factors—immunity, prematurity, pregnancy, renal or hepatic failure, hypersensitivity
- Drug factors—penetration, route, frequency
- Age of patient
- $$$

Type of Infection

- Localized vs disseminated
- Mild vs severe
- Superficial vs deep
- Chronic vs acute
- Intracellular vs extracellular

- e.g. *Staphylococcus aureus*—impetigo vs endocarditic

Changing or Stopping Antibiotics

- Change when cultures are positive for a specific organism
- Consider change if patient appears to be failing therapy
  - May require other strategies:
    - I & D abscess
    - VATS procedure
    - Reassessment for other causes
Stopping Antibiotics

- When it is clear that it is not a bacterial infection
- When cultures are negative and patient is improving in a “rule out”
- When appropriate length of time (5, 7, 10, 14 days, 4 weeks) have passed
  - Based on organism
  - Type of infection (pneumonia, osteomyelitis, endocarditis, meningitis)

Types of catheter infections

- Catheter colonization
- Exit Site infection
- Tunnel infection
- Pocket infection
- Bloodstream infection
  - Infusate-related
  - Catheter-related

Catheter Types

- Short term
  - Peripheral IV
  - Percutaneously placed catheters in large central vein
    - e.g. PICC line
- Long term
  - Broviac or Hickman
  - Inserted into large central vein with subcutaneous tunnel
- Totally implantable
  - Port-a-cath
  - Infuse-a-port
Factors Which Increase Risk of Infection
- Location
  - Femoral vs. Subclavian
- Number of lumens
- Home care
- Underlying illness
- Tunneled vs. non-tunneled
- Characteristics of infusate

Presentations, Signs and Symptoms
- Fever
- Sepsis
- Redness, pus, cellulitis at insertion site
- Hot, tender cord (phlebitis)
- Disseminated infection
  - (osteomyelitis, endocarditis)

Organisms
- Common
  - Coag negative staph*
  - S. aureus*
  - *Together approximately 50%
  - Candida albicans
  - Enterococcus
- Less common
  - Non-albicans Candida
  - Other yeasts
  - GNR
    - E. coli
    - K. pneumoniae
    - Enterobacter
    - Pseudomonas

Laboratory Diagnosis
- Blood cultures
- Catheter
- Peripheral—When possible

"Out, damn'd line! out, I say!"*
*Apologies to Wm. Shakespeare
If both peripheral BC and line culture are positive—bacteremia is confirmed
- Quantitative cultures are rarely done, but if catheter has 5-10x more organisms than peripheral culture, it is likely to be a catheter source

Indications for Line Removal
- Sepsis
- Clinical worsening despite appropriate ABx
- Persistently positive BC after 48-72 hours of ABx
- Septic thrombophlebitis
- Embolic lesions
- Fungal infection
- Tunnel infections or pocket infections usually require removal

Antibiotics—Initial Therapy
- Vancomycin (or Clindamycin)
- +/- 3rd generation cephalosporin
- Repeat Peripheral and line cultures 24-48 hours after start of abx
Duration
- Usually based on organism
  - Typically 7-14 days after sterilization of blood cultures
- For Disseminated infections
  - 2-6 (occasionally longer) weeks depending on organism and organ system

Other Treatment Options
- Antibiotic lock technique
- Ethanol lock technique

The End