Major Infectious Complications Seen in Children on Dialysis

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Objectives

- At the end of this session the learner will be able to discuss:
  - Major infectious complications
  - Management of infections within the chronic dialysis unit
  - Preventative approaches for avoiding infectious complications

Major Infections in Hemodialysis

- Access site infections (includes catheter related infections)
- Bacteremia/Sepsis
  - Access site infection
  - Water/dialysate related (Pseudomonas aeruginosa, Ralstonia Enterobacter cloacae, etc.)
- Pneumonia and Influenza
- Transmission of blood-borne pathogens (HBV, HCV, HIV)
- Tuberculosis
One-year adjusted hospitalization rates for infection in incident pediatric patients (aged 0-21 years), by age, 2003-2007 and 2008-2012

Data Source: Special analyses, USRDS ESRD Database. Includes incident pediatric ESRD patients in the years 2003-2012, surviving the first 90 days after ESRD initiation and followed from day 90. Adjusted for sex, race, primary cause of ESRD, and Hispanic ethnicity. Ref: incident ESRD patients aged 0-21, 2010-2011. Abbreviations: HD, hemodialysis; PD, peritoneal dialysis; Tx, transplant.

USRDS 2015: 2012 Data

- Hospital admissions
  - Significant societal and financial burden
  - Negative impact on well being and QOL
  - Overall rate 1.73 admissions/pt yr
- Re-hospitalization
  - Important indicator of morbidity and QOL
  - 35.2% of discharges within 30 days!
One-year adjusted rates of mortality due to infection in incident pediatric patients with ESRD (aged 0-21 years), by age, 2003-2007 and 2008-2012

Age

Data Source: Special analyses, USRDS ESRD Database. Incident dialysis and transplant patients defined at the onset of dialysis or the day of transplant without the 60-day rule; followed to December 31, 2013. Adjusted for age, sex, race, Hispanic ethnicity, and primary cause of ESRD. Ref: incident ESRD patients aged 0-21, 2010-2011. Abbreviations: HD, hemodialysis; PD, peritoneal dialysis; Tx, transplant.

One-year adjusted rates of mortality due to infection in incident pediatric patients with ESRD (aged 0-21 years), by modality, 2003-2007 and 2008-2012

Modality

Data Source: Special analyses, USRDS ESRD Database. Incident dialysis and transplant patients defined at the onset of dialysis or the day of transplant without the 60-day rule; followed to December 31, 2013. Adjusted for age, sex, race, Hispanic ethnicity, and primary cause of ESRD. Ref: incident ESRD patients aged 0-21, 2010-2011. Abbreviations: HD, hemodialysis; PD, peritoneal dialysis; Tx, transplant.

Vascular access type at initiation of incident pediatric hemodialysis patients (aged 0-21 years) by year, 2006-2013

Year

Data Source: Special analyses, USRDS ESRD Database. ESRD patients initiating hemodialysis in 2006-2013. Abbreviations: AV, arteriovenous; ESRD, end-stage renal disease.
Vascular access type at initiation of incident pediatric hemodialysis
patients (aged 0-21 years) by age, 2006-2013

Data Source: Special analyses, USRDS ESRD Database. ESRD patients initiating hemodialysis in 2006-2013.
Abbreviations: AV, arteriovenous; ESRD, end-stage renal disease.

Distribution of vascular access type in prevalent pediatric hemodialysis
patients (aged 0-21 years* as of December 31, 2014), 2014

Data Source: Special analyses, USRDS ESRD Database. Hemodialysis patients initiating treatment for ESRD at least 90 days prior to December 1, 2014, *who were <22 years old as December 1, 2014, and who were alive through December 31, 2014. Catheter = any catheter use; fistula and graft use shown are without the use of a catheter. Abbreviations: AV, arteriovenous; ESRD, end-stage renal disease.

Hemodialysis

<table>
<thead>
<tr>
<th>Table 2. Microorganisms isolated from blood cultures from access-related bacteremias reported to dialysis surveillance, September 1999 through March 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Catheter-related bacteremia (N=5275)</strong></td>
</tr>
<tr>
<td><strong>Microorganism</strong></td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
</tr>
<tr>
<td>Other Gram-positive</td>
</tr>
<tr>
<td>Gram-negative rods</td>
</tr>
<tr>
<td>Coagulase-negative staphylococci</td>
</tr>
<tr>
<td>Fungi</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

Nephrology News & Issues • June 2005
Breaks in Infection Control

- Not cleaning blood spills or splatters; including prime buckets on side of machine, or W.H.O.
- Not cleaning or disinfecting commonly touched environmental surfaces between patients (e.g. machine, chair or station)
- Sharing equipment and supplies that were not disinfected; shared multi-dose vials placed on the top of the machines
- Sharing a common medication cart
Surveillance

- Someone designated as infection control officer
- Centralized log of adverse events (including pyrogenic reactions, infections and other reactions)
- Collect infection data and analyze
  - Should be part of overall CQI/CQA program
  - Identify problems
  - Know when to report a problem

Hepatitis C Infections

- CDC has received an increased number of reports of acute HCV infection among patients undergoing hemodialysis
  - Assess infection control practices, environmental cleaning, & disinfection
  - Address gaps identified
  - Screen patients for HCV
  - Report acute HCV infections to local Health Department

Training and Education

- Staff Members
  - Occupational health issues
    - Blood-borne pathogen standard
    - Respiratory protection
    - Hazard communication
  - Infection control practices
    - Vascular access care, cannulation, catheter access
    - Disinfection and sterilization
    - Dialysis unit precautions
    - Hand hygiene
- Patients and Family
  - Basic hygiene and appropriate hand hygiene
  - Access care
  - Recognizing infections
  - Importance of vaccinations
Clinical scenario

- You have a 10 month old that will need dialysis
- Parents are physicians and Dad will be starting an Infectious Disease fellowship
- "Tell me everything"

Peritoneal Dialysis

- Infectious complications are the most significant cause of morbidity in children on chronic PD
- Peritonitis occurs more frequently in children than in adults
- Peritonitis is the most common reason for hospitalization and dialysis modality change
Peritonitis Rates

- Range: 1 episode every 18-37 patient months
  - NAPRTCS 2011
  - IPDN
  - SCOPE

Known risk factors for peritonitis

- Young age
  - Especially <1 year of age
- Ostomies
- Touch contamination
- Exit site/tunnel infection
- Catheter perforation/leakage

1st Published in 2000

ISPD GUIDELINES/RECOMMENDATIONS

CONSENSUS GUIDELINES FOR THE TREATMENT OF PERITONITIS IN PEDIATRIC PATIENTS RECEIVING PERITONEAL DIALYSIS

Bradley A. Warden, Franz Schaefer,1 Maggie Holliday,2 Steven Alexander,3 Marianne Kendert,4 Beth Franz,5 Nitzu Sebastian,5 Arik Toth Tamecz,5 Jose Disea,6 Nejat Gokcel,7 Salim Mujais,8 and Enrico Verrina9 for the International Society for Peritoneal Dialysis (ISPD) Advisory Committee on Peritonitis Management in Pediatric Patients.
Establishment of International Pediatric Peritoneal Dialysis Registry

- Generated data from
  - Consortium of 47 pediatric dialysis centers in Europe, Turkey, Asia, and America
  - 501 episodes of peritonitis


ISPD GUIDELINES/RECOMMENDATIONS

**Consensus Guidelines for the Prevention and Treatment of Catheter-Related Infections and Peritonitis in Pediatric Patients Receiving Peritoneal Dialysis: 2012 Update**

Bradley A. Wasyly,1 Sevcan Baskaloglu,2 Jason Newland,2 Michelle Cantwell,1 Enrico Verritta,1 Alicia Neu,2 Vimal Chudha,1 Hu-Kim tsp,2 and Franz Schoeffel2

This is the most important slide.

Prevention of PD Catheter Associated Infections
Treat the constipation before surgery

Catheter Type

Linea alba
Rectus sheath and muscle
Exit Site

PD Catheter and G-tube
• If possible G-tube should be placed prior to or concurrent with PD catheter insertion
• If G-tube placed after
  • Use open surgical technique vs. PEG
  • Withhold PD for 1 or more days and reinitiate dialysis at a lower fill volume
  • Increase to full volume over a week

What the surgeons will focus on
• The exit site should be made with a puncture hole vs. scalpel
  • Tighter fit around catheter
• Give a dose of IV antibiotics at the time of catheter placement
• No sutures at the exit site
• Catheter anchoring at the exit site
• Fibrin glue?
Early exit site care

- Once weekly sterile dressing change at the exit site by a trained health professional until site healed
  - Unless soiled
  - Do not let the patients shower or bathe until exit site healed

When to use the catheter

- If possible wait 2 weeks prior to using the catheter
  - Early use higher risk of dialysate leakage

Training

- Dedicated PD unit
- Experienced nurse with pediatric training
- Handwashing, aseptic technique, and exit site care
- Recognition of complications including contaminations and signs of infection
On-going exit site care

- Performed by caregiver
- Goal to prevent exit site infection that can lead to peritonitis
- Regular exit site cleansing
- Antibiotic ppx with dressing changes based on center-specific patterns
- Examining exit site at each visit

Exit-site scoring system

<table>
<thead>
<tr>
<th>Symptom</th>
<th>0 points</th>
<th>1 point</th>
<th>2 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swelling</td>
<td>No</td>
<td>Exit site only; &lt;0.5 cm</td>
<td>&gt;0.5 cm and/or tunnel</td>
</tr>
<tr>
<td>Crust</td>
<td>No</td>
<td>&lt;0.5 cm</td>
<td>&gt;0.5 cm</td>
</tr>
<tr>
<td>Redness</td>
<td>No</td>
<td>&lt;0.5 cm</td>
<td>&gt;0.5 cm</td>
</tr>
<tr>
<td>Pain</td>
<td>No</td>
<td>Slight</td>
<td>Severe</td>
</tr>
<tr>
<td>Drainage</td>
<td>No</td>
<td>Serous</td>
<td>Purulent</td>
</tr>
</tbody>
</table>

Infection:
1. Score ≥4 (regardless of culture)
2. Purulent drainage = infection
3. Score >2 with pathogenic organism on culture

Tunnel infection

- Presence of redness, edema, and tenderness along the subcutaneous portion of the catheter
  - With or without purulent drainage
  - Exit site score of 6 or greater
**Connection Methodology**

- Flush before fill
- Accidental touch contamination
  - **Before** the clamp of the transfer set is opened
    - Sterile transfer set change **without** need for antibiotics
  - **After** the clamp of the transfer set is opened, discovery of a hole, disconnection in the system during operation
    - Sterile transfer set change **with** empiric intraperitoneal antibiotics

**Beware of pets**

**Prophylaxis: Table 4 ISPD Guidelines**

<table>
<thead>
<tr>
<th>Situation</th>
<th>Type of prophylaxis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of fungal peritonitis</td>
<td>Anti-fungal</td>
</tr>
<tr>
<td>Touch contamination</td>
<td>Antimicrobial &amp; possibly fungal</td>
</tr>
<tr>
<td>Invasive dental procedure</td>
<td>Antimicrobial</td>
</tr>
<tr>
<td>GI procedure</td>
<td>Antimicrobial &amp; possibly fungal</td>
</tr>
</tbody>
</table>
Diagnosis of Peritonitis

- Cloudy peritoneal effluent
- Clinical signs: abdominal pain/tenderness, chills, emesis
- Cell count, differential and culture
  - WBC > 100/mm³, at least 50% PMNs
  - Dwell time >2 hours

Overview of Treatment of Acute Peritonitis

- Empiric treatment with IP antibiotics
  - IV if systemically ill or if can’t perform PD
  - Initial loading dose followed by maintenance dosing
  - Fungal ppx
  - Adjunctive therapies – heparin, decreased fill volumes, longer dwell times
  - Focus on preservation of peritoneum rather than preservation of catheter

Empiric Treatment of Peritonitis

![Empiric Treatment of Peritonitis Diagram](image)
**No response to therapy…**

- If no improvement at 72 hours:
  - Repeat cell count and culture; if cell count elevated with negative culture, culture for unusual organisms
  - Catheter removal if no improvement after 5 days
    - Refractory peritonitis

**Relapsing Peritonitis**

- Peritonitis with same organism within 4 weeks of completing abx therapy
- Seen following 10-20% of primary episodes
  - Increased risk of peritoneal membrane failure
- Reinitiate therapy based on initial culture
- Intraluminal instillation of fibrinolytic agent
- Catheter removal if:
  - Relapsing peritonitis is accompanied by persistent tunnel infection
  - Second relapsing episode

**Modification of Therapy for Fungal Peritonitis**

- Prompt catheter removal
- Systemic antifungals
- ≥2 weeks of antifungal treatment after catheter removal
- Timing of catheter replacement
  - 2-3 weeks after catheter removal
PD Catheter Removal and Replacement

- Refractory bacterial peritonitis
  - No resolution after 5 days of appropriate antibiotic therapy
- Fungal peritonitis
- Persistent/recurrent exit site or tunnel infection
  - Simultaneous catheter removal and replacement
- ESI/TI and peritonitis with same organism
- 2nd relapsing peritonitis
  - Simultaneous removal and replacement after clearing of the effluent (WBC < 100) in relapsing peritonitis

After each infection

- Perform root cause analysis
- Patient & family re-education

Standardizing Care to Improve Outcomes in Pediatric End Stage Renal Disease (SCOPE) Collaborative

North American multi-center quality transformation effort whose primary aim is to minimize catheter related infection rates among pediatric chronic peritoneal dialysis patients
SCOPE Center’s Peritoneal Dialysis Bundles

- Insertion
- Follow-up
- Training

Hemodialysis Bundles

- Fistula/graft cannulation
- Connection/entry procedure
- Disconnection/cap change
- Dressing and exit site care
- General care & maintenance
Our 10 month old

- Treat constipation
- Talk to surgeons
- Start the training
  - Adult learning
- Give the family reasons to call
- Refer to the ISPD guidelines

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