Venous Access and Complications in Home Parenteral Nutrition
Objectives

- Name/describe the types of IV access used in PN therapy.
- Describe the etiology of line infections and the most common pathogens associated with them.
- List other major complications associated with central lines.
- List the preventative measures that can be taken to avoid line infections/complications.
- Name/describe the types of IV caps that are used on IV lines.
Long Term: PICC Lines

- Long (14-20”) line placed above antecubital fossa, extending into central circulation
- For mid range therapy (6-12 weeks)
- X Ray confirmation necessary: preferred position in distal SVC or SVC/RA junction
- Inserted at bedside with/without US guidance or via IR
- Easy to remove: at bedside or in home setting
- Higher risk occlusion, dislodgement, malposition than Tunneled CVCs
Long Term: Tunneled Catheters

• Long line surgically tunneled under skin, extends into central circulation
• For long term therapy
• X Ray confirmation necessary
• Catheter tubing extends out from the skin level (approximately 1 foot extension)
• Brand names: Groshong, Hickman (adult), Broviac (pediatric)
• Requires experienced MD to insert
• Can be used for PN
Tunneled Catheter
Tunneled

- Hickman™ (BARD)
- Broviac™ (BARD)
- Groshong™ (BARD)
Hickman® Cuffs

**VitaCuff** Antimicrobial Cuff

**SureCuff** Tissue Ingrowth Cuff
Device Tips

Hickman

Groshong
BARD® Groshong®

Three-way valve reduces risk of air embolism, blood reflux and clotting.

Tip-first placement allows measurement of catheter to size during implantation for more accurate tip placement.

Unique design virtually eliminates use of heparin, minimizes nursing time required for maintenance and improves cost-effectiveness of therapy.

Silicone material offers superior biocompatibility to improve indwelling and catheter time.
Long Term: Implanted Ports

- Short catheter (6”) surgically placed under the skin of the chest or abdomen extending into central circulation
- Indicated for long term, intermittent therapy
- Port access using a non coring needle: Huber
- Weekly Huber needle change required
- Best used for intermittent therapies (chemotherapy, antibiotics)
- Seldom inserted for PN alone
• M.R.I.™ Low-Profile Implanted Port
  (BARD Access Systems)
Port a Cath Accessing
Catheter Complications

- CRBSI’s
- Occlusions
- Thrombosis
## Catheter Related Blood Stream Infections

<table>
<thead>
<tr>
<th>Setting</th>
<th>Infections/1000 catheter days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pediatric ICU</td>
<td>7.9</td>
</tr>
<tr>
<td>Medical ICU</td>
<td>6.1</td>
</tr>
<tr>
<td>Surgical ICU</td>
<td>5.6</td>
</tr>
<tr>
<td>Coronary ICU</td>
<td>4.8</td>
</tr>
<tr>
<td>Home Infusion</td>
<td>1.0</td>
</tr>
</tbody>
</table>
80,000 CRBSIs in ICU’s.
Based on average of 5.3 per 1,000 catheter days…..
…Estimated 250,000 CRBSI’s annually in US hospitals

Attributable mortality is 12-25%

Estimated cost:
$34,508-$56,000 per line infection
$296 mill-2.3 billion per year in US!!!

Etiology of a Line Infection......
Biofilm: What is it ???

- BIOFILM!
CRBSI Pathogens

Common Pathogens Associated with CRBSI’s:

- *Staph Epidermis*:
  - Low Mortality
  - Lines saved in 90% cases
  - Treated with Vanco systemically and possibly antibiotic lock

- *Staph Aureus*:
  - Higher Mortality
  - Often treated with Penicillins or derivatives
  - If MRSA, much less likely to save line
CRBSI Pathogens (cont)

- **Gram Neg Bacillus**
  
  GI Source/water (i.e. E.Coli)

  Resp Source: Klebsiella (treated with Cephalosporins) and Pseudomonas (variety of antibiotics can be used depending on Sensitivity)

  Attempts to treat usually made before line removal

- **Candida**

  Higher Mortality

  Catheter almost always removed

  Treated with Ampho, Ambisome, Fluconazole

Dr Barry Farr
University of Virginia Health Systems
OLEY Conference 2003
Diagnosis of a CRBSI

1. Pull the line and culture the tip of the Catheter! But what if we really need to save the line?

2. Blood Culture peripherally and from CVL

   Indicative of CRBSI if……..

   a) Cx from CVL has 5-10x more colonization than peripheral

   or

   b) Cx from CVL grows positive 2 or more hours before peripheral

*Up and coming… Intraluminal swab and Cx.
Prevention of CRBSI’s

- **Prophylactic Antibiotic Locks**
  - Vanco, Amikacin, Ceftaz, Cefazolin in Heparin or NS
  - dosed at 100-5,000x MIC (Minimum Inhibitory Concentration)
  - allowed to dwell 12-24 hrs
  - Stability of 72+ hrs at 37°C
  **CDC does not recommend because of risk of resistant organisms**

- **Ethanol Locks:**
  - 25-98% solution of Ethanol instilled into catheter and withdrawn after 1-2 hours.
  - Has shown great promise in preventing infection, but is only being used in patients with a history of multiple line infections
On the Horizon.....

Showing promise in the future:

- Tetrasodium EDTA
- Sodium Citrate
- Ethanol/Trisodium Citrate
- **Mostly studied in dialysis catheters because of both antimicrobial and antithrombolic properties
- Taurolidine (Europe)
Innovations in Line Care

• BioPatch®

• Tegaderm™ CHG (3M)
For use on a swab-able luer access valve as a disinfecting cleaner prior to line access and to act as a physical barrier to contamination between the accesses.

**SwabCap™**

Use aseptically. Follow Excelior Medical's instructions for use. FOR SINGLE USE ONLY

**Peel.**

Remove protective cover by pulling tab. Do not remove SwabCap from white plastic holder.

**Twist.**

Hold luer access valve in one hand while pushing and twisting the SwabCap in a clockwise direction onto the luer access valve.

**Protect.**

After SwabCap has been twisted into place, gently pull white plastic holder off luer access valve.

**To Remove for access to valve**

Two-handed removal must be used to make sure luer access valve is not removed unintentionally. Grasp luer access valve and twist SwabCap counter clockwise away from valve. Remove and discard. Inspect luer access valve to verify that it is connected securely to the catheter. Valve is ready for access. No further swabbing is necessary after removal.

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**CUROS™ Port Protector**

Hospital acquired bloodstream infections challenge our U.S. healthcare system with extended lengths of stay, increased cost of care, rising patient mortality and basic concerns for patient safety.

At a time when our healthcare system is facing the reduction of reimbursement for the treatment of these infections, the new and innovative CUROS™ Port Protector provides healthcare providers and patients with a new confidence in patient L.V. care.

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The CUROS™ Port Protector: Simply Changing Infection Control Practice.

Luer-activated, needleless IV injection ports are always exposed to potential contamination. They are unprotected prior to and following each port access procedure.

The CUROS™ Port Protector, a simple disposable medical device, guards against infection by providing healthcare providers the ability to keep luer-activated injection ports always "protected and clean."

CUROS is dramatically more effective than a standard alcohol swab in reducing bacterial counts and it potentially reduces patients' exposure to the risk of hospital acquired L.V. bloodstream infections. CUROS also works to help maintain hospital infection control protocols.

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A New Confidence in Patient L.V. Care

*Tests conducted at an independent laboratory confirmed CUROS achieved -3 log reduction in bacterial counts compared to -3 log reduction achieved with alcohol swab. A summary of these studies is available on request.*
90% of CVL occlusions are thrombolytic in nature

* Unique to TPN patients: Lipid or mineral occlusions.
Catheter Stabilization

Important for Keeping Catheter from Moving!!

Grip Lock®  Stat Lock ®  Cath Secure®  Hub guard®
Treatment for Occlusions

For Thrombolytic Occlusions:

CathFlo Activase®
(Alteplase)

For > 30 kg: 2mg in 2ml (sterile H2O)

For < 30 kg: 110% internal volume of catheter
(not to exceed 2mg in 2ml)
• For Lipid Occlusions:
  3.0 ml of 70% Ethanol or NaOH

• For Mineral Occlusions:
  3.0 ml of 0.1N HCL
Other CVL Complications:

- Venous Thrombosis
  
  **Causes:**
  
  a) Stasis
  
  b) Injury to vessel wall by trauma, infection or irritation by chemo or TPN
  
  c) hypercoagulability

  **Sx:** Pain, edema, erythema

  *May lead to pulmonary embolism, cerebral anoxia,

  **Diagnosis/Treatment:**

  a) Venography
  
  b) Anticoagulants, ? Clot lysis
Other CVL Complications, cont.

• SVC Syndrome (rare):
  Causes:
    a) clot/fibrin
    b) tumor pressing against SVC
  Sx: Upper Body edema, cyanosis. May lead to ↑ ICP
  Diagnosis/Treatment
    a) Radiographic confirmation
    b) anticoagulation
    c) seek alternative access
    d) supportive treatment of symptoms
IV Line Caps…

- What is a Split Septum???
- What is a MV???
- What is a PPMV???
- What is a Neutral Valve???
Split Septum Caps

- Interlink (Baxter)
- Q Syte (BD)
MV and PPMV Caps

**Mechanical Valve**
- **CLAVE** (ICU Medical)
- **Clearlink** (Baxter)
- **SmartSite** (Alaris)
- **Safesite** (B Braun)

**Positive Pressure Valve**
- **MaxPlus** (Medegen)
- **CLC2000** (ICU Medical)
- **Posi-Flow** (BD)
- **UltraSite** (B Braun)
- **SmartSite Plus** (Alaris)
- **Flolink** (Baxter)
Neutral Valve

- InVision Plus (Rymed)

- MicroClave (ICU Medical)
More Innovations……..

• **Baxter V-Link**

• “The first **antimicrobial** IV connector with a unique coating designed to help prevent microbial contamination and growth of pathogens in the device.”*
Preventing Catheter Related Complications

- EDUCATION IS THE KEY!
Preventing Catheter Related

- Know the type of catheter the patient has. Is it a midline or a PICC? Where is the tip? Is it a Hickman or a Groshong?
- Follow manufacturer’s recommendations for catheter flushing and maintenance
- Chlorhexidine to cleanse insertion sites
- Transparent semi permeable membrane dressing changes at least once per week
Preventing Catheter Related Complications

- Know what kind of cap is on the end of the catheter and follow manufacturer recs. Is it a split septum, mechanical valve or PP mechanical valve cap??
- *Scrub* caps with an alcohol wipe for 15 seconds before each connection. Friction!!
- Know the signs and symptoms of potential complications.
• **S**crupulous hand hygiene before and after contact with all vascular access devices and prior to insertion.

• **A**spetic technique during catheter insertion and care

• **V**igorous friction to hubs. Vigorous friction with alcohol wherever you make or break a connection to give medications, flush, change tubing or access injection port or add on device.

• **E**nsure Patency- flush all lumens with adequate amount of saline or heparinized saline to maintain patency per institution policy.

AVA (Association for Vascular Access)
Thank you for your attention.