Home Infusion Therapy: Current Evidence & Implications

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OBJECTIVES

- Identify common complications associated with home infusion therapy.
- Discuss available research evidence aimed at complication prevention
- Evaluate patient cases for appropriateness of home care.
**COMPLICATIONS Addressed During This Presentation**

- "Line-related"
  - Central vascular access devices (CVAD) or "central lines"
    - 4 categories of CVADs: nontunneled; tunneled; PICC; implanted port
    - Complications addressed within this presentation:
      - **Infection**
        - Major focus of this presentation
      - Catheter associated venous thrombosis
      - Catheter occlusion
    - Peripheral IV catheters (PIV)
      - Infiltration/extravasation
      - Phlebitis
      - Nerve damage
  - Infusion-related: Drug toxicities – focus on renal and vestibular
SELECTED REVIEW OF PERTINENT HOME CARE LITERATURE

Patient Risk Factors for Infection

- Systematic literature review
- 25 studies met inclusion criteria
- Great variation in risk factor identification and infection rates
- Infusion therapy
  - Patients receiving PN at greater risk than those receiving other infusion therapies

Adverse Events in Home Care

- In another review of home care literature, “line-related” complications (including catheter-related BSI and site infections) was one of 8 categories of adverse events identified
- Few intervention studies identified
- Need for improved assessment
- Need for system-level approach that includes focus on caregivers/home environment
- Need for required data collection/reporting of adverse events


Selected Home Care Data

- 11 year surveillance from the University of North Carolina Health care system – very low annual rates of central line BSI ranging from 0-0.73 cases/1000 device days
- Outpatient antimicrobial therapy (OPAT) in Scotland, 0.4 infections per 1000 OPAT days (n=2233 patients); 10 year study
- Incidence of BSI in children receiving home PN highest in the first month after discharge from the hospital; need for care strategies immediately after hospital discharge
Home care Infection Prevention Policies & Procedures

- National survey – n= 423 home healthcare clinicians (9.2% response rate)
- Written policies for:
  - MDROs: 26.2%
  - Dedicated equipment: 62.8%
  - Teaching patient/family about prevention of spread of MDROs: 78.5%
- Takes nursing bag into home of patient with known MDRO: 31%
- Full time infection prevention/control nurse: 21.4% (but 33% have other job duties)


Example: Quality Improvement-Home Care

- A reduction in PICC infections by 46% in patients receiving home infusions (0.963 to 0.52 infections per 1000 central line days)
- Problem: Lack of standardized protocols
- Interventions:
  - Education: changes and ongoing education for nurses
  - Standardized home health central line orders (NC changing and disinfection, flushing, blood draws, site care)
  - Standardize home care through development of central line care checklist, flushing checklist

Available Home Care Guideline

- “Standardizing central venous catheter care: hospital to home” from the Nebraska Medical Center
  - These guidelines did not evolve out of a comprehensive or exhaustive literature search.
  - Standardizing Central Catheter Care in the Omaha Region: Care from Hospital to Home (SCORCH) Consensus Group

- The Consensus Group:
  - examined their respective current agency policies
  - compared them with what best practices would indicate appropriate care should look like, based on Centers for Disease Control and Prevention (CDC), Infusion Nurses Society (INS), and Oncology Nursing Society (ONS) guidelines
  - When lack of evidence in established guidelines (e.g., using heparin or not), review of literature to examine complications (e.g., heparin induced thrombocytopenia)

Home Care Malpractice Case Example

- Home care patient receiving parenteral nutrition develops septicemia with grave consequences

- Issues in case
  - Failure to recognize risk factors
  - Failure to provide relevant patient education
  - Failure to recognize signs of infection
  - Failure to analyze/report laboratory findings
INFECTION PREVENTION

Well-educated nurses – essential!!

- Infusion Nurses Society (INS) Standards: The nurse shall be responsible and accountable for attaining and maintaining competence with infusion therapy
  - Competence goes “beyond psychomotor skills to include application of knowledge, critical thinking skills, decision making”
  - The person validating the specific skill should be competent with the skill. When no one in the organization has the specific competency, arrangements for a skill validator from outside the organization may be necessary

Centers for Disease Control & Prevention (CDC)

Home care question: Do you have specific competencies in place related to infusion related procedures?

- Only trained, competent persons should place and maintain peripheral and central IV devices


- Within our home care organizations, we must address/ensure competence of our staff and “zero tolerance” of infections – we owe this to the patients we serve

American Nurses Association Standards

- Hot off the press! Published summer 2014
- Available at: http://www.nursesbooks.org/Homepage/Hot-off-the-Press/Home-Health-Nursing-Scope-Standards-2nd.aspx
- Example: Standards of Practice
  - Standard 1: The home health registered nurse collects comprehensive data pertinent to the patient’s health or situation.
    - Competency example: Synthesizes available data, information, and knowledge relevant to the situation to identify patterns and variances. (ANA, 2014, p. 45)
  - Standard 5: The home health registered nurse implements the individualized plan of care.
    - Competency example: Uses evidence-based interventions, best practices, and treatments specific to the diagnosis or problem. (ANA, 2014, p. 51)
- Examples: Standards of Professional Performance:
  - Standard 8: The home health registered nurse attains knowledge and competence that reflect current nursing practice. (ANA, 2014, p. 62)
  - Standard 9: The home health registered nurse integrates evidence and research findings into practice. (ANA, 2014, p. 64)

Review: How microorganisms gain access to the bloodstream

- **Extraluminal**: Migration of skin organisms at the insertion site into the catheter tract and along the catheter surface, gaining access to the external catheter surface.
- **Intraluminal**: Direct contamination of the catheter or catheter hub by contact with contaminated hands or fluids or devices; microorganisms gain access through the internal catheter lumen of the catheter.
- **Hematogenously seeded** from another infection – less common.
- **Infusate contamination** – rare.

O’Grady et al. (2011) AJIC.

Reducing Risk during Catheter Insertion: Central Lines

- CVAD insertion not typical in home care – **but we need to understand risk reduction & EBP**
  - Inserter must follow central line bundle during catheter insertion (hand hygiene, chlorhexidine skin antisepsis, maximal sterile barrier precautions, optimal site selection).
- “Bundles that include checklists to prevent central line-associated bloodstream infections” are: **One of the top 10 “Strongly encouraged patient safety practices”**
Post-insertion care

- The term bundle is often used but there is no well established, well-tested post-insertion care bundle yet
- More challenging than the central line insertion bundle
  - Central line bundle mainly focused during time of insertion
  - Post-insertion care focused during entire dwell time
    - Involves many clinicians and potentially several health care settings
    - Involves every catheter access/care procedure
    - Challenging to monitor care behaviors

Increased focus on and importance of post-insertion catheter care

- Hand hygiene
- Attention to aseptic technique with all VAD-related procedures
  - Speaker experience/examples
- Ongoing assessment of the patient and the catheter site
- Regular site care & dressing changes
- IV administration set changes
- Needleless connector access
- Maintaining catheter patency
- Blood withdrawal from CVADs for laboratory studies – should we do this?
- Catheter removal as soon as it is no longer needed
- Safe injection practices
Poor compliance with dressing changes

- N=420 CVADs evaluated in a single hospital
- N=130 (31%) of CVAD dressings suboptimal and needed changing (e.g. blood under dressing, exposed insertion site, visible moisture)
- No correlation with BSI
  - Researchers believe infections complex and require multi-modal preventative programs
  - **Efforts must address CVAD maintenance** – beyond the central line insertion bundle


Dressings and Risk for Infection

- Secondary analysis of a randomized controlled trial 1636 patients (ICU) in initial trial; 1419 with at least one dressing change included in analysis
- 11,036 dressing changes, 67% unplanned due to soiling/undressing
- More than 2 dressing changes for disruption were associated with a greater than threefold increase in risk of infection/BSI
- Risk factors for dressing disruption included femoral/jugular sites
- Post-insertion bundles are insufficiently implemented/study reinforces need

**Needleless Connectors (NC)**

- Also called “valves,” “injection caps,” “injection ports,” “luer-activated devices”
- Many different NC products -- categorized into:
  - Simple: No internal mechanisms; fluid flows straight through the internal lumen. Includes those with a split septum
  - Complex: Characterized by an internal mechanism that controls the flow of fluid through the device, allowing both infusion and aspiration of blood

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**Attention to needleless connectors and catheter hubs**

- Needleless connectors and stopcocks are known sources of contamination (O’Grady et al., INS, 2011)
- Disinfection of the NC is recognized as a critical prevention strategy
- Adequacy of disinfection dependent upon antiseptic agent, contact time, method of application (friction and chemical kill critical)

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Accessing the needleless connector

- Simple but ... multiple steps
  - Gathering supplies
  - Performing hand hygiene
  - Scrubbing/disinfecting NC
    - What solution?
    - How long?
    - Dry time?
    - Prior to each access?
  - Attaching syringe/IV administration set maintaining sterility of syringe/set tip and no touch contamination of disinfected NC

Home care question: Do your clinical procedures define a disinfection time?

Infusion Nurses Society Standards

- “The needleless connector should be consistently and thoroughly disinfected using alcohol, tincture of iodine, or chlorhexidine gluconate/alcohol prior to each access. The optimal technique or disinfection time has not been identified.”
- NOTE: INS STANDARDS UNDER CURRENT REVISION (2016)

A 5 second scrub with 70% alcohol

- Inpatient setting/prospective observational study
- Cultures performed on CVADs with NC (split septum type) and no active infusion
  - Prior to disinfection, and after vigorous scrub with 70% alcohol for 5, 10, 15, 30 seconds
  - 5 second dry time, cultures by pressing NC onto agar plate
- In vitro assessment
  - Sterile NC inoculated with S. epidermidis and allowed to dry for 3 hours
  - Vigorous scrub with 70% alcohol for 0, 5, 10, 15, 30 seconds, 5 second dry time and then cultured


Results

- 363 NCs sampled in clinical phase
  - 58/87 NCs cultured without disinfection showed bacterial contamination
  - 5 second scrub (n=71) – one (1.4%) yielded microbial growth
  - Similar results with 10, 15, 30 second scrub times
  - No significant differences in microbial contamination rates between 5, 10, 15, 30 second disinfection times

Rupp, ME et al. (2012) Infection Control & Hospital Epidemiology.
## Results

- **In vitro results**
  - 100% of NCs sampled after no disinfection showed heavy microbial growth
  - When inoculum size was smaller, all NCs had sterile cultures when scrubbed for 5 or more seconds with 70% alcohol
  - For larger inoculum, minimal growth after 5 second scrub, sterile culture for 10 second or longer scrub

- **Implications**
  - The 5 second scrub was effective with the type of NC used – cannot be generalized to other types of NCs

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### About alcohol disinfection caps

Photo by Lisa Gorski
Example: Research - Alcohol disinfection caps

- Use of an alcohol disinfection cap placed on the needleless connector significantly reduced line contamination, density of organisms, and CLABSIs.
- 3 phases:
  - phase 1 baseline – standard scrub of needleless connector,
  - phase 2 – disinfection cap placed on all CVADs
  - phase 3 – back to standard scrub.
- Contamination and organism density were measured via an aspirate from the PICC.


2014 SHEA/IDSA Guidelines: Alcohol Disinfection Caps

- NOTE THAT THESE ARE ACUTE CARE GUIDELINES AIMED SPECIFICALLY AT CLABSI PREVENTION

- Use an antiseptic-containing hub/connector cap/port protector to cover connectors (Grade I)
  - Recommended as a “special approach” i.e. recommended in locations/populations with unacceptably high CLABSI rates despite implementation of basic practice recommendations

When no one is looking, do you and your colleagues **ALWAYS** scrub the hub?

Most of us **KNOW** that the needleless connector must be scrubbed before each access but what affects our decision to consistently do it?

**“Intention” to Disinfect the NC**

- Cross-sectional study
- N = 171 nurses from 4 Magnet hospitals
- Survey:
  - Demographic data
  - Autonomy and self-efficacy scales
  - “Smith-Becker Attitudes towards Disinfection Techniques” scale

“Intention” to Disinfect the NC

- Findings and some implications
  - There was a strong relationship between concern for preventing bacterial migration into bloodstream and propensity to use best practice
    - Teaching should focus not only on knowledge and skills but also address the affective domain of learning (caring, patient advocacy)
  - Experienced nurses have greater autonomy and self-efficacy
  - But recent graduates were more likely to disinfect every time
  - Tenured staff – do they avail themselves of educational opportunities that newer graduates have received?
  - Easy intervention: ready access to supplies
    - “ensure adequate supply of alcohol swabs at bedside”

Smith, JS et al. (2011) JIN.

Research: Maintaining catheter patency

- Optimal catheter flushing protocol remains un-defined by research
- Recent home care study
  - Purpose: Evaluate most effective flushing solution for PICC maintenance in home care patients
  - Method: Randomized study – non-blinded
    - Group 1: control group; saline only flushing (10 mL) (n=28)
    - Group 2: SASH high [10 mL saline; lock with heparin 3 mL (100 units/mL)] (n=32)
    - Group 3: SASH low [10 mL saline; lock with heparin 5 mL (10 units/mL)] (n=30)
  - Population: 18 or older; PICC placed at university center; anticipated need for PICC > 1 week

Lyons, MG, Phalen, AG (2014) A randomized controlled comparison of flushing protocols in home care patients with peripherally inserted central catheters. JIN
Research: Maintaining catheter patency

- Data collection: Weekly call to patients (any incidence of PICC sluggishness or occlusion, extra RN visits); review of records to validate patient reports
- Results:
  - Only significant finding: longer catheter dwell time (days), the more complications occurred (p=0.003)
  - Overall inconclusive; no statistically significant differences between groups
  - Clinically important findings
    - SAS protocol – highest % of additional visits to assess sluggishness (32%) and use of alteplase for occlusions (25%)
    - SASH low protocol – lowest % of additional visits to assess sluggishness (27%), additional RN visits (13%)
    - SASH low and high protocols, % of alteplase use 10% and 9.4%

Discussion issues

- Confounding issue: 3 mL vs. 5 mL heparin flushes
- Flushing protocol from hospital stay – no heparin – length of stay issues

Conclusions

- 3 flushing protocols equally effective
- SAS group more visits and alteplase use but not statistical significance
- Organization decision – use 5 mL heparin (10 unit/mL) flush

Lyons & Phalen (2014) JIN
CVAD Blood Withdrawal for lab studies

- An issue of catheter manipulation
- 2011 INS Standards: consider risks vs. benefits
- A.S.P.E.N. guidelines “VADs used for PN administration should not be used to obtain blood samples for laboratory tests unless no peripheral access available”
  - PN is an independent risk factor for BSI which means that long-term care and home care clinicians be especially vigilant in policies addressing VAD care
- Retrospective study of patients receiving home PN
  - Obtaining blood for lab sampling: significant CLABSI risk factor

Home care question: If you care for patients on PN, how do you educate the nurses about this complex infusion therapy?


Catheter Removal

- INS Standard
  - VADs shall be removed upon unresolved complication, therapy discontinuation, or if deemed unnecessary.
- Element of the central line bundle
- Nurses must be patient advocates in obtaining orders for VAD removal, especially in home care -- case examples

Infection and PIVs; Lower Risk but important, additional preventative interventions include:

- Appropriate site (avoid lower extremities)
- Adequate skin preparation – clean skin, hair removal, skin antisepsis (70% alcohol, tincture of iodine, iodophor, chlorhexidine gluconate)
- Dressing to protect site
- Change PIVs placed in emergent situations as soon as possible
- Catheter stabilization to decrease catheter movement which potentially allows pathogens to migrate into the catheter tract
- REMOVE PIV WHEN NO LONGER NEEDED

Safe Injection Practices

- Aseptic technique during preparation & administration
- One syringe – one patient
- One syringe – one use
- Never administer single-dose, single use vials, ampules, bags, bottles to > one patient
- Dedicate multi-dose vials to single patient whenever possible
- Safe sharps disposal

Catheter-Associated Venous Thrombosis

ALSO REFERRED TO AS DEEP VEIN THROMBOSIS (DVT), VENOUS THROMBOEMBOLISM (VTE)

Thrombus Formation

- Virchow’s Triad – A time honored pathophysiologic explanation

ALTERED BLOOD FLOW

HYPERCOAGULABILITY

BLOOD VESSEL WALL INJURY
Increased Risk with PICCs

- PICCs are associated with a higher risk of catheter-associated venous thrombosis than other types of central lines
- Research study:
  - Purpose: Define frequency of PICC-related VTE
  - Method: Meta-analysis - 64 studies including 29,503 patients met eligibility criteria (18 years or >, PICC placed in arm, reported DVT, PE or both after PICC insertion)
  - Results: PICCs associated with increased risk of DVT
    - OR 2.55 (95% CI 1.54-4.23; p<0.0001)
    - Increased risk in critically ill and those patients with cancer


Discussion Points

- Why do PICCs increase risk?
  - Take up more space in vein?
    - Smaller diameter PICCs
  - Injury to intimal layer of vein from repeated arm movements?
    - PICCs placed in internal jugular lower incidence of VTE
- Study found no increase in risk for pulmonary embolism
  - Thrombophlebitis in vein – physiological barrier to clot embolization?
  - More clinically apparent s/s, earlier treatment?

INS Standard 52: Catheter-Associated Venous Thrombosis

- ...the majority of catheter-associated venous thromboses are clinically silent and do not produce overt signs and symptoms, although pulmonary emboli have been linked to catheter-associated venous thrombosis.
- Clinical signs and symptoms of catheter-associated venous thrombosis are related to obstruction of venous blood flow and include, but are not limited to:
  - Pain in the extremity, shoulder, neck, or chest;
  - Edema in the extremity, shoulder, neck, or chest;
  - Engorged peripheral veins on the extremity, shoulder, neck or chest wall;
  - Difficulty with neck or extremity motion.

Role of the Home Care Nurse

- Monitor for s/s
- Report s/s to MD
- Diagnosed via ultrasound or venography
- Recognize/understand consequences:
  - Permanent venous obstruction
  - Increased risk of sepsis
  - Pulmonary embolism
- Anticipate treatment: anticoagulation
  - Heparin/low molecular weight heparin/warfarin
PERIPHERAL IV COMPLICATIONS

Risks of PIVs

- Phlebitis (not addressed in this section)
- Infiltration or extravasation
- Nerve injury
- Infection (not addressed in this section)

- Prevention of PIV related complications requires knowledge and attention to:
  - appropriate use of PIVs,
  - appropriate site/device selection,
  - skin preparation,
  - catheter stabilization,
  - and assessment.

- A WORD ABOUT MIDLINE CATHETERS
2013 INS IV Safety Practice Survey: USA

- Lack of consistent education and training related to PIV placement
  - 57% of nurses reported not being taught how to place a short PIV
  - 71% reported “on the job” training
  - 11% reported “see one, do one” approach to training

Home care question: How do you assess the competency of nurses who place PIVs?

Vizcarra et al, 2014

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When is the PIV an appropriate choice?

- Considerations include:
  - Duration of intended infusion therapy
    - Less than 7 days
    - Intermittent infusions
  - Infusate characteristics
    - pH between 5 and 9 – Is this based on evidence?? – Paper submitted to *Journal of Infusion Nursing* that challenges recommendations related to pH range for intermittent medications – new evd
    - Osmolarity < 600 mOsm/L
  - Patient characteristics

INS, 2011, p.537; O’Grady et al., 2011
Site Selection

- Adults: dorsal and ventral surfaces of upper extremities
- New sites always proximal to previous sites
- Areas to avoid according to INS & CDC
  - lower extremities
  - areas of flexion; includes antecubital fossa
  - ventral surface of wrist; cephalic vein above thumb for 4-5 inches
  - where there is pain upon palpation
  - compromised veins
  - near valves
  - affected extremity: axillary node dissection, radiation therapy, presence of lymphedema, stroke affected side

INS, 2011, p.537; O’Grady et al., 2011

Research: Site Selection

- Secondary analysis of randomized controlled trial that addressed PIV dwell time
- Findings related to site selection
  - PIV more likely to accidentally dislodge and more likely to occlude when placed in the hand or the antecubital fossa as compared to forearm
- Researchers recommendations: preferential use of forearm for PIV placement

Catheter Selection

- Avoid steel needles; limit to single dose or short-term use
- Smallest gauge/length of catheter to accommodate prescribed therapy
  - Research: Increased risk of phlebitis with larger diameter catheters but increased risk of accidental dislodgement with smaller gauge catheters (22 gauge or smaller compared to 20 gauge) (Wallis et al., 2014)
- Safety needles - passive vs. active
  - Know your product!

Catheter Dressing & Stabilization

- INS Standards
  - A sterile dressing shall be applied and maintained on VADs.
    - An inadequately secured site allows increased microbial growth and increases risk of accidental dislodgement, phlebitis, & infiltration
  - Minimize catheter movement at hub, prevent dislodgment and loss of access
  - Engineered stabilization device preferred alternative to tape
  - Some dressings may serve to stabilize catheters
    - Randomized controlled trial: Use of a peripheral IV catheter with an integrated stabilization feature in combination with an IV securement dressing performed as well as a standard peripheral IV with a stabilization device (Bausone-Gazsa et al., 2010)
Site Rotation: Based on Clinical Indications, not time

- Major change in 2011 INS SOP
  - The nurse should consider replacement of the short peripheral catheter when clinically indicated... the decision to replace the short peripheral catheter should be based on assessment of the patient's condition; access site; skin and vein integrity; length and type of prescribed therapy; venue of care; integrity and patency of VAD; dressing; and stabilization device.
  - Recommendation based on randomized controlled trials as cited in the Standards
- However -- If placed in emergency situation, replace as soon as possible and no later than 48 hours

INS, 2011, p. S57

Clinically Indicated PIV Replacement: Complication rate compared to routine replacement

- 2014 study published in the Lancet
  - Hypothesis: Patients with clinically indicated replacement of PIVs would have equivalent phlebitis rates (and no difference in complications) compared to routine replacement
  - N=3283 patients randomized to either routine (n=1690) or clinically indicated replacement (n=1593)
  - No difference in phlebitis rates between groups
  - Rates of infiltration, occlusion, accidental removal equivalent between groups
  - Study conclusion – safe to remove PIVs based on clinical indications rather than a routine time frame (i.e. every 72 hours) (Rickard et al., 2014)

Regular assessment of the PIV site is a critical factor allowing quick intervention in the event of a complication.

2012 INS position paper: Recommendations for frequency of assessment of the short peripheral catheter site.

When an infusion is running (whether continuous or intermittent), PIV sites should be routinely assessed:

- For redness, tenderness, swelling, drainage, and/or the presence of paresthesias, numbness, or tingling at the site
- Assessment should include visual assessment, palpation, and subjective information from the patient.
- If there is tenderness at the site, the dressing may be removed to more carefully visualize the site

INS Recommendations for frequency of Assessment

- **At least every hour for:**
  - Neonatal patients
  - Pediatric patients
- **Every 5-10 minutes**
  - Vesicant infusions
- **With every home care/outpatient visit**
  - For patients receiving peripheral infusions at home as overseen by home care or outpatient nurses

What about temperature as an aspect of assessment?

- The possibility of catheter-associated bloodstream infection should be considered when there is fever in any patient with a PIV even in the absence of site redness, tenderness, swelling, or drainage.
- Check temperature at a frequency according to organizational policy/procedure
  - AND more often based on nursing judgment


PIV COMPLICATIONS
Infiltration/Extravasation

- Definition – based on type of infusate, vesicant vs. non-vesicant
- May nurses consider infiltration a routine and almost inevitable complication
- BUT... large infiltrations and even small extravasations can result in significant injury – loss of limb, permanent nerve damage, loss of function

Severe extravasation in a one year old child – preventable complication!

Good news - no loss of limb or function however permanent scarring
Infiltration/Extravasation Risk Factors

- **Mechanical**: catheter itself irritates or injures the endothelial cells lining the vein wall
- **Physiologic**: blood clot formation and lymphedema.
- **Pharmacologic**: pH, osmolarity, vasoconstrictors

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Infiltration/Extravasation: Signs and Symptoms

- Cool skin temperature at the PIV site
- Skin that appears blanched and taut
- Patient complaints of skin tightness, pain, or discomfort
- Swelling at the PIV site
- Decreased mobility of the extremity
- Leaking of fluid from the insertion site
- Changes in the infusion flow quality
- Lack of a blood return

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INS, 2011, p.S67
Infiltration/Extravasation Interventions

- Stop infusion immediately
- Attempt to aspirate any residual drug/IV fluid
- Notify
- Limb elevation
- Cold vs. warmth
- Document – measurement/description
- Monitor

*“An IV infusion should not be painful if the drug is diluted and slowly injected through a catheter that has been properly selected, inserted, and secured. Pain on injection is an immediate indication to stop. Most severe complications occur because the infusion continues while staff consider other explanations for the pain”* (Hadaway, 2007)

Infiltration/Extravasation Prevention

- Appropriate infusate
- Appropriate site
- **No more than 2 PIV attempts per nurse**
- Small catheter
- Never place new PIV proximal to previous site
- Catheter stabilization
- Never rely on infusion pump – will not detect this complication – after infiltration, fluid/drug will continue to infuse and worsen problem!
- **ASSESS** PIV site

*INS, 2011*
Nerve Damage

- Nerve injuries are the most commonly reported insertion-related complication (direct puncture nerve injury)
- Preventable when appropriate IV sites are selected, when proper IV insertion technique is used, and when PIV sites are assessed and monitored

Nerve Damage

- Nerve compression injury may occur as a result of infiltration or extravasation of an infusion.
  - A compartment syndrome may occur when the IV fluid or medication collects in tight spaces bound by the fascia, bone, muscle, and skin. The increased pressure of the fluid decreases perfusion in the area which can lead to irreversible nerve damage and loss of function. Early identification and intervention for infiltration/extravasation reduces risk.
Signs and Symptoms: Direct Puncture Nerve Injury

- Immediate symptoms sharp acute pain at the venipuncture site.
- Sharp shooting pain up or down the arm.
- Sensation of pain that changes in severity depending on needle position; “pins and needles” sensation or an “electric shock” feeling.
- Pain or tingling discomfort in the hand or fingertips.

Signs/Symptoms: compartment syndrome due to a severe infiltration/extravasation

- May result in nerve compression injury!
- Pain, pallor, paresthesia (e.g. numbness, tingling), paralysis, and/or pulselessness.
- Restricted joint movement and resistance to passive motion.

(Talbot & Rogers, 2011)
Interventions

- If the patient complains of paresthesias, numbness, or tingling upon catheter insertion, the catheter should be immediately removed and the physician promptly notified, as rapid attention may prevent permanent injury.

Nerve Damage Prevention

- Avoid the lateral surface of the wrist for approximately 4-5 inches because of the potential for nerve damage.
- Avoid the ventral surface of the wrist due to pain on insertion and possible nerve damage. Avoid the antecubital area for routine PIV placement.
- Avoid excessive probing for the vein.
- Infiltration/extravasation prevention.
INFUSION MEDICATION RELATED COMPLICATIONS:
DRUG TOXICITIES

Commonly administered drug groups

Penicillins
- Allergic reactions most common adverse reaction; up to 10% of population; can be immediate/delayed

Cephalosporins
- Allergic reactions; cross allergy may occur in those allergic to penicillins; use should be avoided in patients with anaphylactic reactions to penicillin

Vancomycin
- Commonly administered in home setting; must administer over at least one hour; faster infusion can result in "red man (neck)" syndrome caused by a release of histamine- hypotension, flushing maculopapular rash of trunk, face, and neck may occur
- ototoxic and nephrotoxic

Aminogycosides (gentamicin, tobramycin, amikacin)
- ototoxic and nephrotoxic
Assess and monitor

- Signs/symptoms related to improvement in infection
- Response to the drug therapy
  - Drug-related side effects
  - Laboratory tests
  - Be alert to adverse reactions specific to the disease state and the antibiotic regimen (e.g. nephrotoxicity/ototoxicity with aminoglycosides)
- VAD for signs of complications.

Renal function

- Renal function tests (serum creatinine, BUN, trough levels) should be regularly measured in patients treated with nephrotoxic antimicrobials. Examples:
  - Aminoglycosides – twice weekly
  - Vancomycin – once weekly
  - When multiple nephrotoxic agents are used together, increased frequency of monitoring should be considered. (Tice, 2006)
- Be aware that renal toxicity can occur even with appropriate serum concentrations, teach patients about signs and symptoms such as decreased urine output.
- Generally reversible – managed with hydration, discontinuation of drug
- Case example

Renal Function

- Be aware that risk of changes in renal function are more likely in older patients, children, and those taking other nephrotoxic drugs
- Patient education adequate hydration
- Ensure accuracy of drug levels; trough levels just prior to drug administration; peak levels (less commonly done) generally one hour post infusion
- Anticipate adjustments in dosage and frequency with increase in creatinine, drug levels

**Critical Nursing Actions:**
- Collaborate/discuss with MD if no labs are ordered
- Follow-up to obtain results of labs on the day they were done
- Never administer next dose until results verified

Vestibular and hearing dysfunction

- Irreversible bilateral sensorineural hearing loss beginning at high frequencies (cochleotoxicity) or as an combination of vertigo, nausea, vomiting, nystagmus, ataxia (vestibulotoxicity)
  - Due to progressive loss of outer hair cells from base of cochlea to apex; progressive loss of inner ear hair cells in more severe cases
  - Xie et al. (2011) *Hearing Research.*
- Monitoring for vestibular and hearing dysfunction should be assessed at each visit
  - Aminoglycosides
  - Vancomycin
- Be aware that ototoxicity can occur even with appropriate serum concentrations
Vestibular and hearing dysfunction

- Teach patients about risk
- Maintain timing of antibiotics to ensure consistency of serum levels

**Critical Nursing Actions:**
- Ask about changes in hearing, dizziness, tinnitus, fullness in the ears
- Report findings immediately

PATIENT EDUCATION
Gorski Model for Safe Home Infusion Therapy
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- Patient Selection
  - Positive patient outcomes
  - Reduced risk for complications
  - Patient satisfaction
  - Healthcare provider satisfaction

Patient/CG Education

Patient care & Monitoring

Today’s presentation focused on:

Infection Prevention in LTC and Home Care: Patient Education

- Excellent technical skills & infection prevention actions on the part of the nurse are not enough!
  - We must teach effectively
  - We must address anxiety, resistance to learning, functional limitations that limit/preclude independence
  - We must periodically re-evaluate technique even in patients who are independent
  - We must re-evaluate technique after a negative outcome
    - CASE EXAMPLE – 45 year old patient on home PN who developed a BSI
Patient/Caregiver Education: Do not underestimate its’ importance!

- Hand hygiene
- Rationale for placement
- Insertion process
- Expected dwell time
- Care and maintenance
- Signs and symptoms to report

Challenges of Implementing Evidence-based practices

- Lack of time
- Lack of autonomy to change practice
- Too much reliance on education and transmission of information as a change strategy

SHEA/IDSA Implementation Strategies

- A helpful framework
  - Engage
    - Involve organization champions
  - Educate
    - Address knowledge, critical thinking, behavior, psychomotor skills, attitudes, beliefs
    - Documented competency
  - Execute
    - Standardize care processes – implement guidelines, bundles, protocols
  - Evaluate
    - Link process and outcome data to competency assessments
    - Surveillance

Summary

- The trend for patients who require VADs/infusions beyond the hospital will continue to expand
- As with acute care, the emphasis on infection prevention is strong -- we live in an era of zero tolerance for infections
- A number of factors put patients at risk for infection
  - Patient related characteristics/factors such as receiving PN
  - Organizational factors -- uneducated staff, failure to address competency, lack of sound policies and procedures that incorporate evidence-based practices (site care, aseptic technique, blood sampling)
  - Especially, but not only (!) In the home setting, failure to adequately educate patients and families.
- Patients are also at risk for other complications beyond infection including thrombosis, infiltration, nerve damage, and drug-related toxicities.

Nursing knowledge, skill, and understanding of potential risks is vital in protecting our patients.
Final Thought

“My view you know is that the ultimate destination is the nursing of the sick in their own homes...I look to the abolition of all hospitals and workhouse infirmaries. But it is no use to talk about the year 2000.”

Florence Nightingale, 1867

Thank you for your attention

It's QUESTION TIME!!

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