Short Peripheral IV Catheters and Infections

CHICA- Manitoba
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Financial Disclosure

• None
I think I’m very funny, not everyone thinks I’m funny.
I am a glass half empty girl. I look for the undesirable outcomes.
Multiple challenges obtaining data regarding peripheral outcomes.
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Lynn Hadaway currently serves as president of Lynn Hadaway Associates, Inc, a consulting and education company specializing in infusion therapy and vascular access. Her company designs, develops and delivers infusion therapy education through Internet based technologies and in traditional classroom settings. She provides consulting services to device manufacturers on issues of product design, clinical applications for products, review of literature and other published evidence, and education and training. She is an active member of the Infusion Nurses Society, currently serving as the Chair of the INS Infusion Team Task Force and has served on the Standards of Practice committee since 2004. She is also a member of the Association for Vascular Access, the Association for Practitioners in Infection Control, and the Georgia Nurses Association.

She holds two national certifications -- infusion nursing from the Infusion Nurses Certification Corporation and nursing professional development from the American Nurses Credentialing Corporation. She also holds a Masters in Education from the University of Georgia.

Lynn has more than 40 years of experience in infusion nursing and adult education. Her experience comes from multiple acute care settings, healthcare manufacturing, and continuing professional education. Her publications include many aspects of vascular access devices, anatomy and physiology, nursing care of all types of vascular access devices, infusion and vascular access complication management, legal and regulatory issues, and principles of adult learning.
1400 abstracts, 588 Publications.
Medline (via PubMed), Ingenta, CINAHL, Google Scholar.
Included data/discussion of any type if infection associated with short peripheral catheters.
Excluded any data on mechanical and chemical causes of phlebitis.
Intravenous Catheters and Infection

- Intravenous (IV) catheters are now reported to be the single most common source of bacteremia and fungemia. (1)
- 1.7 billion sold annually worldwide.
- 330 million sold annually in the USA.
Voluntary submission of infection data for CDC.
Includes data on any vascular access device.
Addresses both patient and healthcare worker safety.
Central Line Associated Bloodstream Infections (CLBSI) are addressed.

- Tip location in the SVC/CAJ
- Definitions include:
  - CVAD present 48 h before S&S develop
  - Not related to any other infection site
No mention of surveillance on Vascular Access Devices (VAD) within the peripheral vessels.

- Yet these devices are part of the reporting system.
CRBSI- laboratory findings that identify CVC as BSI source and used to determine diagnosis, treatment, and possibly epidemiology of BSI in patients with CVC.

Not typically used for surveillance (more in clinical research).
CLBSI

- CLABSI - laboratory confirmed BSI only requires a CVAD to be present with in 48 hrs of S&S and it not be related to any other source.
  - Not a rigorous criteria. May lead to an overestimation of the actual rates.
  - These rates would NOT include infection from a short peripheral catheter.
Financial Implications

- 2008 Medicare & Medicaid Services disallowed payment for certain hospital acquired conditions.
- List included *vascular catheter-associated infections*.
  - No clarity on type of catheter, location of catheter.
  - No clarity on type of infection.
Nosocomial BSIs reported to be the 8th leading cause of death in the US (3).

$23,242 +/- $5184 (2005 dollars) (3).
Financial Implications

- Hospital must prove the infection was *present or incubating on admission.*
Financial Implications

- Hospitals participating in NHSN system has no formal way to document infections related to peripheral IV.
- No real incentive as these would be considered hospital acquired with no payment to the hospital for their treatment.
What's the Big Deal?

3 cases - Osteomyelitis.
5 cases - Cardiac Implantable electronic devices \(^{(24)}\).
2 cases - Peritonitis in PD catheters \(^{(25)}\).
4 immunocompromised oncology pt with probable cutaneous zygomycosis from adhesive tape on a peripheral catheter \(^{(26)}\).
Center for Disease Control (CDC) 2011 **does** include peripheral catheters.

However, the discussion section only includes CVADs.

Includes a table of catheters for venous and arterial, but states “rarely associated with bloodstream infection.”
Types of Infections

- Local: cellulitis and soft tissue.
Types of Infections

- Phlebitis or thrombophlebitis
Types of Infections

- Suppurative thrombophlebitis: presents of purulent drainage.
- The clinical S&S may overlap making it difficult to identify the problem without additional diagnostic tools such as ultrasound and cultures.
Phlebitis

- Definition: *inflammation of the vein* (4)
- Nursing/medical literature describes 3 causes:
  - Chemical
  - Mechanical
  - Infectious
Chemical

- Infusion of hyperosmolar fluids (>600 mOsm/liter) and/or solutions and medications with a pH <5 or >9.
pH

- Indicates hydrogen ion concentration in a solution
- Blood = 7.35 - 7.45
- pH of 6 - 8 minimizes disruption of venous endothelium
- Blood has significant buffering capacity
**Mechanical**

- Catheter size, insertion technique and methods of catheter and joint stabilization.
Infectious

- Deficits in skin antiseptics, catheter handling and joint stabilization.
Confusion?

- This leads confusion about whether the inflammation allows for the infection, or if the infection creates the inflammation.
Cherie’s Opinion

- All three contribute to infection.
January 1966-July 2005 (38.5 yrs).
110 studies of plastic catheters.
10,910 catheters; 28,720 device-days.
13 BSIs = pooled mean rate 0.1 event per 100 days.
0.4 pooled mean events per 100 device days.
Lowest rates of all devices by percentage. (23)
Culture Results

- Most prevalent pathogen in peripheral catheters BSI is *Staphylococcus aureus* (5-7).

- Retrospective analysis of all US hospital admissions estimate > 10,000 S. Aureus bacteraemia from peripheral catheter occurring annually (8).
Rates of each type of Infection

- Zingg and Pittet (6) widely held assumption that thrombophlebitis can become BSI.
- They estimate 5%-25% of peripheral catheters were colonized at the time of removal.
- Reasons for the low BSI rate vs high colonization- short dwell time, fewer manipulations and lack of surveillance.
Issues Related to BSI

- Catheter design,
- Skin Antiseptic,
- Inserters skill level,
- Predisposition to phlebitis,
- Use of vein visualization technology,
- Catheter stabilization.
Sources of Contamination

Pathophysiology of Catheter-Related Infection

All sources of infection are potential targets for prevention

Critically ill patient: 2-4 vascular access devices
Catheter Design

- Ported catheters - multiple injection ports, or ones with non-replaceable caps.
Injection Ports

- Attachment of stopcocks known risk for infection.
- Germany study reported 27 BSI cases per 100 patients, 104 events per 1000 catheter days.
- 27% of patients experiencing possible infections, there is little doubt about the risks of injection ports. (11)
One hospital in London had 30 reported MRSA bacteremia's. Changing to a closed system decreased rates to 14 MRSA bacteremia's.

BUT...Also introduced split septum, CHG along with other policy changes and a massive educational campaign.
Microbiology of the Skin

- 80% of the resident bacteria exist within the epidermis.
- 20% are found in biofilms within hair follicles and sebaceous glands.

Complete re-colonization can occur within 18 hrs of antiseptic application.
Skin Antisepsis

- Primary source of organisms colonizing the IV catheter comes from the skin.
- Careful attention to the antiseptic agent, method of application and the total contact time for application and drying.
- Familiarization of the various products and their uses directly contributes to their effectiveness.
Antiseptic Agents

- Traditional teachings involved inner/outer concentric circles.
- This typically involved simply painting the skin.
- Three impregnated sticks.
Use of a back and forth scrubbing method (Manufactures IFU).

Only 1 published study available on the application technique. (12)

Several studies show CHG produces better outcomes for blood donation and blood culture collection. (14-17)
Best Practice Guidelines

- Infusion Nurses Standards and CDC (2011) states CHG is preferred skin antiseptic (except infants less than 2 months).
- Tincture of iodine, iodophor, and 70% alcohol are also acceptable for short peripheral catheter insertion.
- Both state should be applied to CLEAN SKIN.
These list alcohol, tincture of iodine, or alcoholic CHG as acceptable.

State povidone-iodine is not adequate.

Emphasizes the need for adequate contact and drying time. (18)
Two studies assessed the skill of inserters.

One reported ER nurses had a greater phlebitis rate than IV therapists (3.7% vs. 2.1%). (13)

Second reported 36% inserted by generalists and 20% by infusion nurses were removed for complications. (19)
Pt experiencing phlebitis with the first catheter were 5.1 times more likely to suffer from phlebitis from subsequent catheters. (19)

Why?
- Is related to the infusions?
- The insertion site?
- The skill of the inserter?
Use of Vein Visualization Technology

- Infrared and ultrasound
Infrared

- Infrared is hands free.
- No change in technique for insertion.
- Does not touch the patients skin.
Ultrasound

- Widely available in most hospitals.
- Requires one hand to hold the probe.
- Coupling gel.
CVAD insertions: sterile procedure
  - covers and sterile coupling gel.
Short peripheral catheter insertion is not considered sterile.
Mini Ultrasound Equipment

- Smaller, portable equipment
- Individual, sterile probe tips.
- Assists in determining vessel size, appropriateness of catheter
Disadvantages

- Formal education not available.
  - Healthcare workers picking up the device and using it.
  - Poor site selection
  - Poor vessel: vein ratio
  - No training on anatomy (nerve identification)

- No peripheral infection data reported on any vein technology.
Catheter Stabilization

- Gained attention over the past 15 yrs.
- Initially advertise to replace sutures.
- Studies showed decrease in unplanned restarts, no data on infectious outcomes. (20)
Tape

- Tape is not sterile
  - Pockets, on bedside tables, on IV poles, window etc.
  - The adhesive picks up fuzz, bacteria and other debris.
  - NEVER place this under a sterile dressing.
Prior to 2011, all documents recommended routine removal/replacement after a specific dwell time. The length of time was increased from 48 hours to 96 hours. CDC revised wording states “... No more frequently than every 72-96 hours for the purpose of reducing infection...”
INS, 2011

- Removed the routine removal recommendation.
- “The nurse should consider replacement of the short peripheral catheter when clinically indicated…” 4(pS57).
Scrub the Hub

- When you access a catheter to administer medications, change the end cap, or flush the catheter. You can inadvertently introduce microorganisms into the catheter.
flushing Techniques

- Use of a 5-10mL syringe
- Do not use the pump to flush your catheter
- It is the pressure exerted from a syringe that really forces fluid through the device and clears it of blood and residual drugs.
Cherie’s Opinion: Education

- Inserters skill level directly influences success rate, increases longevity of the device and decrease infection risks.
- 1-3 hours spent in traditional classroom theory surrounding infusion therapy.
- 3-10 hours spent in “lab” type environments.
- Opportunity to develop skill fragmented.
Cherie’s Opinion: Skill Level

- No literature supporting a required amount of time or XX number of insertions before becoming proficient.
- I estimate 3 months, full time hours on VAT before advancing beyond “novice”.
- Average of 10 “insertions” day, can be 40/week. 3 months = 480 ish.
- The generalist nurse may get 2/wk= 25 ish in the same time period.
Vascular Access Specialized Training

- Education on skin cleansing agents.
- Education on dressing material and application.
- Education on solutions/ medications (pH and osmolarity).
- Education on vessel assessment.
- Education on vessel preservation.
- Admit when you are licked.
Protect the Skin

- The skin or integument is the first organ affected by vascular access.
- It is a barrier against micro-organisms and provides sensory temperature regulation.
- Inserting an intravenous device breaks this natural barrier and increases the risk of infection.
Measure twice, cut once.
Site selection aides in the longevity of the device.
CDC states “In adults, use an upper-extremity site for catheter insertion. Replace a catheter inserted in a lower extremity site to an upper extremity site as soon as possible.” Category II (2)
Nursing textbooks recommend starting low on the extremity and moving upwards.
Site Selection

Perhaps this is related to the low success rate on the first attempts necessitating the need to go above previous insertions?
Smallest device, in the biggest vein for the desired therapy.

“Go big, or go home...”

7 rights of medication, 7 IV rights

- Appropriateness of request.
- Device size, (diameter/ length), design, need.
- Insertion site, vessel size (diameter/ length), health.
Nursing Assessment

- Consideration regarding the use of the device is upmost importance (i.e. CT, Chemo, pre-op, blood transfusion etc.).
- This determines site selection, gauge and even appropriateness of the need/request.
Blood Flow

- Blood flow to the hand is approx. 10 ml/minute.
- Multiple small, short vessels.
- Subject to movement due to decreased tissue/muscle in the hand.
Blood flow

- Forearm vessels offer a longer, straighter pathway.
- Higher blood flow for greater dilution.
- Bones of the ulna and radius act as natural splints which allow for freedom of movement and greater independence.
Danger Zone

- Devices placed at or about the wrist area.
- Must be a minimum of two fingers above the bend at the wrist.
- Can take up to 3 months for the numbness to resolve.
- Many suffer permanent nerve damage.
Dressing

- Decreases the movement within the vessel.
Documentation

- Often overlooked and poorly done.
- **Must include:**
  - All attempts.
  - Site location (vessel name, description).
  - Gauge/ length of catheter.
  - Cleansing agent.
  - Add on equipment.
  - Blood returns/ flushing.
  - Patients tolerance.
Summary

- Numerous practice changes in 30 yrs.
- Sicker patient population, living longer.
- Improved skin cleansing agents (CHG).
- Removed teams with highly skilled infusion nurses, giving this task to primary care/ generalists.
Summary

- 330 million IV catheters sold in the US.
- Venipuncture success rates of 2.18 attempts (21) and 2.35 attempts (22) to establish one site.
- If ½ the catheters sold are successfully inserted, **0.1% of these produce a BSI**.
- 165,000 infections annually.
- Clearly, more research is needed.
Cerie’s Opinion

- Devices/equipment do not directly cause infection.
- People cause infection.
- Protect the skin.
- Follow the Best Practice Guidelines.
- Follow the Manufacturer’s IFU.
Questions
References


References

