IV Placement Tidbits

Course ID: 1022 - Credit Hours: 2

Author(s)
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Audience
This course is designed for Registered Nurses and Licensed Vocational Nurses and will serve as didactic training. Clinical competency will need to be validated at local facility per institutional policy.

Accreditation
KLA Education Services LLC is accredited by the State of California Board of Registered Nursing, Provider # CEP16145.

Course Objectives
At the end of this educational offering the participant will be able to identify

1. Three anatomical principles related to IV placement
2. Four tidbits for successful IV placement
3. Three factors contributing to failure
4. Three measures for infection control
5. Three complications associated with IV placement
6. Two resources for help

Disclosures
None
Introduction

The primary goal of this education offering is to empower nurses with knowledge and clinical insight to provide quality infusion care to their clients. The acquisition of this skill is usually not an overnight success. Some nurses may learn it quicker and some are more inclined to the “feel and touch” for the “hard-to-get” veins. For the majority, it takes perseverance, inquisition, attention to details, patience and practice to acquire the *finesse and precision* essential to excellent IV insertion skill.

Empowerment is a tool for success. The ingredients for this endeavor are knowledge and clear understanding of the following elements:

- What does it take to become an expert in IV placement?
- How can a practitioner avoid multiple attempts?
- Why do we do what we do?

Empowerment comes with the deep understanding of reasons for “why we do what we do”. Abetting principles and rationales in nursing education will help guide nurses character to stand by the practice standard and not “cut corners”. This is an important tool in the healthcare arena for rendering quality of care!
Principles and Rationales

Why is it important to be confident, patient and gentle? Needle stick always hurts. Patients are anxious and anticipating pain and uncertainty about the number of sticks they will be enduring. The demeanor, attitude, professional appeal and approach of the nurse will help ease the fear and anxiety. The goal is to engage patient as a team to achieve the best possible outcome: A “one-stick” success!

http://www.sciencephoto.com/media/275080/enlarge
Physiologically, fear will aggravate the sympathetic response, whereas the calming effect from a nurse will alleviate the intensity of the vaso-constriction triggered by the “flight or fight” survival strategy. Although needle stick is a painful procedure, the trust from a patient whom believes his/her nurse can get “this job done” will work “wonder”.

The Anatomical Principles: Why does one need to know about anatomy in relation to IV start? Gaining insight of the following elements is fundamental for IV placement:

- Where are the veins?
- Why here not there?
- Upper versus lower, Pros & Cons
- What will impact the venous structure?

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The distribution of veins in the upper extremities is significantly denser in the downstream. There are many venous tributaries at the dorsum of the hand. Veins located in the upper arm are the cephalic, basilic and brachial tributaries. In the forearm, veins are moderately less in number and more hidden compared to the hand. The current recommendation for IV placement from the Infusion Nurses Society is one inch above the wrist and one inch below the antecubital fossa. In most patients, it is not easy to do so without the ultrasound technology. There is a balance between the best achievable outcome and location of placement.

Anatomically, the cephalic vein is the most superficial vessel accessible to IV placement without visual aid. The rest can be readily visualized with the ultrasound device. The upper arm veins are often reserved for Peripherally Inserted Central Catheter (PICC) placement, particularly for patients with poor venous access and needs for long term antibiotics, total parenteral nutrition and chemotherapy. Furthermore, the upper arm veins are preserved for patients succumbed to progressive renal diseases needing dialysis over time.

Nurses have always been taught about starting IV low before moving upstream. It is apparent that this principle is going against the physiology of blood flow. What is being considered here is the rule of moving upstream to avoid leakage from distal needle puncture attempts. Furthermore, the
number of options and its accessibility in the dorsum of the hand is also a consideration. Without visual aids, the ideal location of IV placement is not always a possibility. Avoiding pain and suffering from multiple sticks and timely access for treatment become a priority in site selection. The upper arm veins are fewer and more importantly, they are reserved for other vascular access devices in specific patient populations.

**Avoid placing IV close to any joints** in the upper extremities with the following issues in mind:

- Potential injury to joint ligaments
- Dislodgement
- Intense pain because of nerve innervation

**Placing IV in foot** subjects the patient to potential loss of the affected limb. Because of the pooling effect of slower flow rates compounded with gravity, the infusate will remain in that part of the circulation and thereby inflicting irritation to the endothelium.

![Anatomy of Veins](http://www.authorstream.com/Presentation/loire77-353538-iv-therapy-ivf-revised-web-entertainment-ppt-powerpoint/)

The endothelium interacts directly with the infusate. The natural state of this single-celled layer demands perfection in structural integrity. However, the pH and osmolarity profiles of the intravenous medications will determine the immediate risks of infiltration, phlebitis, extravasation and thrombophlebitis and long term risk for vessel health impediments.
This is a reference table for blood flow rates in different sections of the venous system. It provides a perspective of site selection versus “risk and benefit”.

The recommendation for a PICC placement will protect patients from harmful effects elicited from irritants and vesicants. The high flow rate in the superior vena cava will rapidly disseminate any irritants into the circulatory system within seconds.

Some of the pharmaceutical agents are as caustic and corrosive to veins as Drano to the household drainage pipe system. The pH of Drano is 13-14, whereas the pH of Acyclovir is 10.5-11.6. Although not as caustic, a pH above 10 is definitely not physiologic and undoubtedly harsh to the endothelium.

It is important to recognize the pH profiles of any drugs being administered. The following tables provide valuable information for the acidic and caustic property of drugs most commonly used in clinical practice. The co-founder of IvyLeagueNurse, Kevin Arnold, has created a website furnishing pH
profiles for a wide range of pharmaceutical agents. The following link will direct learners to Kevin’s site: [http://www.ivaccess.com/](http://www.ivaccess.com/)

### pH Profiles of Common IV Drugs

<table>
<thead>
<tr>
<th>Drug</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenytoin</td>
<td>10–12.3</td>
</tr>
<tr>
<td>Acyclovir</td>
<td>10.5–11.6</td>
</tr>
<tr>
<td>Trimethoprim-Sulfamethoxazole</td>
<td>10</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>8–10</td>
</tr>
<tr>
<td>Aminophylline</td>
<td>8.6–9</td>
</tr>
<tr>
<td>Erythromycin Gluceptate</td>
<td>6–9</td>
</tr>
<tr>
<td>Dexamethasone</td>
<td>7–8.5</td>
</tr>
<tr>
<td>Sodium Bicarbonate</td>
<td>7–8.5</td>
</tr>
</tbody>
</table>

### pH Profiles of Common IV Drugs

<table>
<thead>
<tr>
<th>Drug</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisplatin</td>
<td>3.7–6</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>3.5–4.6</td>
</tr>
<tr>
<td>Dopamine</td>
<td>3.3–3.6</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>3.3–3.6</td>
</tr>
<tr>
<td>Dobutamine</td>
<td>2.5–5.5</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>2.5–4.5</td>
</tr>
<tr>
<td>Adriamycin</td>
<td>2.5–4.5</td>
</tr>
<tr>
<td>Morphine Sulfate</td>
<td>2.5–6.5</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>1.8–3.3</td>
</tr>
</tbody>
</table>
The practice of rotating IV site every 72 to 96 hours is not purely embraced for infection control. The body will react to the continuous presence of a foreign body (angiocath) and constant exposure to harsh chemicals with clotting and cell repair. Over time, the affected vessel will become thickened and thereby imposing stenosis and impeding blood supply to the affected areas.
The notion of “the bigger the better” in IV catheter selection is a prevalent practice habit and tradition. The fact that a 22 gauge IV catheter can deliver up to 2 liter of fluid per hour with a standard bore extension set becomes a piece of conspicuous information in IV placement procedure. A smaller catheter in a bigger lumen will facilitate the dispersal of the medication to the circulatory system.

The popular belief that blood transfusion must be administered with a 20 gauge or bigger IV catheter is another “die hard” habit and tradition in nursing practice. Besides trauma victims, the majority of the patient population will not require a large bore catheter for rapid blood loss replacement. A 22 gauge will be less painful for insertion and better for the dissemination of infusate, and is adequate for 90% of patients requiring intravenous infusion or blood product transfusion.

Infection Control Measures:

- Meticulous hand hygiene
- Scrub insertion site with chloroprep for 30 sec
- Use aseptic technique
- Scrub the injection cap for 15 seconds before accessing
- Change tubing every 72 hrs
- Change IV site every 72-96 hrs

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Tidbits

- Apply warm compress if needed
- Apply tourniquet 4-6 inches above insertion site
- Gravity & Position to assist the venous filling
- Avoid rope-like veins (i.e. peripheral vascular disease)
- Don’t attempt to access spider veins
- Bevel up
- Steady hand & firm grip
- Dominant hand to stick while non-dominant hand hold and stabilize the body part
- Angle-Proprioceptive, something to acquire with experience
- Controlled and precise action-Gently and quickly pop through the skin, but not to over penetrate
- Once blood return is observed, retract the cannula slightly to prevent nicking the vein
- Advance the cannulae without moving the needle
There is always a struggle for gaining venous access with patients on dialysis, post mastectomy, post stroke and living with psoriasis. The affected arm is off limit because of the presence of a AV shunt or fistula, absence of lymph nodes, exacerbation of skin conditions and presence of paralysis. Often, ultrasound technology will be the savior for these patients.
Infiltration is commonly caused by the malposition of IV catheter. Instead of intravascular containment, the infusate leaks to the interstitial space manifested by localized swelling depending upon the volume of the infiltration. With warm compress and elevation, the extracellular fluid will dissipate and be reabsorbed by the body.

Extravasation is a serious complication specific to the leakage of vesicant or irritant to the extravascular space that often leads to tissue necrosis. It may not involve dislodgement. The vesicant can escape the vascular structure by virtue of chemical alteration to the vessel wall. The early warning sign is frequently a burning sensation felt by the patient.

Phlebitis is an endothelial inflammation in response to the irritation of intravenous medications with acidic or caustic property.

Cellulitis is an infection of the skin. A contaminated venous puncture is an opportunistic port of entry for the pathogen. Multiple IV attempts will increase the risk of this complication by many folds in the elderly population and cancer victims who are immuno-compromised.
Measures for preventing complications:

- Observe hand hygiene
- Practice good technique
- Routine assessment and reassessment
- Listen to the patient
- Adhere to policy & procedure
- Know your resources

Summary

There were 20 millions of people hospitalized in the United State in 2004. Eighty percent of these patients required intravenous infusion and/or medications as part of their medical treatments (Kagel & Rayan 2004). The prevalence of infusion therapy permeates the continuum of care from acute care to home maintenance. With the current healthcare trend, the necessity for vascular access devices will not diminish in demand. What nurses do and how they practice in IV placement will impact the outcome of patient survival and healthcare resources. It is important to embrace the following measures in IV insertion for quality infusion care:

- Exert positive demeanors
- Establish rapport
- Be well prepared
- Be patient
- Look for the best option before sticking
- One stick if possible!

Resources

- Improve own IV insertion skill
- Meticulous assessment and reassessment
- Know your sharp shooters
- RNs trained for ultrasound guided peripheral IV placement
- Your PICC Nurses
REFERENCES


Infusion Nursing Standards of Practice. (2011). INS.


