ULTRASOUND FOR VASCULAR ACCESS
SPEAKER DISCLOSURES

• Employee at AngioDynamics, Inc.
OBJECTIVES

• Identify the challenges associated with common vascular access procedures
• Define DIVA (Difficult IV Access) patients
• Review the standards for the use of ultrasound for vascular access
• Identify the challenges associated with the use of ultrasound
• Describe the steps for implementation of an ultrasound program
INTRODUCTION\textsuperscript{1,2}

An estimated 300 million vascular catheters are placed every year in the United States – making vascular access the most commonly performed procedure for patients.\textsuperscript{1}

Majority of hospitalized patients receive at least one peripheral intravenous catheter (PIV), making this one of the most common clinical procedures. Up to 90\% of PIVs fail before treatment completion.\textsuperscript{2}
TYPICAL APPROACH TO PIV INSERTION

Visual inspection
Palpation
Heat
Tourniquet
Dangling extremity
Irritating the vessel
I try, you try, someone else tries…
WHAT DO YOU SEE WRONG?
PIV COMPLICATIONS$^{2,3}$

- Failure
- Cost
- Replacement
- Complications
- Anxiety
- Pain
- Multiple Re-attempts
Hand Hygiene
Use hand hygiene prior to the procedure to prevent infection\(^3\)

Visualization
Use vascular visualization to increase success for patients with difficult access\(^4\)

Area of Non-flexion
Place PIVs in areas of non-flexion to provide better stability and improve comfort\(^3,4\)

Catheter to Vessel Ratio
Place the smallest gauge catheter to support prescribed therapy\(^4\)

Secure
Stabilize the catheter and site to prevent dislodgement and ensure site visualization\(^4\)

Prompt Removal
Prompt removal when no longer needed or when symptomatic\(^3,4\)
WHY THE ANTECUBITAL FOSSA IS NOT IDEAL$^{3,4}$

- Nerves
- Arteries
- Area of flexion

The Infusion Nurses Society recommends avoiding areas of flexion for peripheral IV access.

https://anatomybody101.com/elbow-anatomy-nerves/
Antecubital Fossa
FORMAL EDUCATION ON VASCULAR ACCESS IS LACKING

Formal education is often not provided in nursing programs.

Hospitals often create their own programs which may include the “see one, do one” approach.

57% of surveyed nurses reported not being taught how to start an IV in nursing school.

71% of nurses reported receiving “on the job training” for PIV insertion.

11% reported the “see one, do one” approach upon employment.
If the majority of hospitalized patients receive a PIV and up to 90% fail\(^2\) – why is there not more formal education for health care providers that insert and care for them?
The ENA reports that ultrasound guidance is particularly valuable in patients with difficult vascular access including patient conditions such as:

- Obesity
- Chronic Illness
- Hypovolemia
- Vasculopathy
- Intravenous (IV) drug use

Repeated attempts to insert catheters can cause peripheral vessel depletion—that is, a decrease in the number of usable veins. Unfortunately, in many cases of difficult vascular access, HCPs decide to insert CVADs instead of peripheral lines, despite the inherent risks.
CONSIDERATION FOR THE COST OF A FAILED PIV

Cost to Insert
Consider catheter, insertion kit, and inserter time

Cost of Failure
Waste of supplies and time

Procedure Time
Procedure time may result in delays in treatment

Delays in Care
Emergency bed time is critical

Cost to the Patient
Pain, anxiety, potential injury
# Economic Model of a Peripheral IV

<table>
<thead>
<tr>
<th>Description</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; Attempt</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; Attempt</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; Attempt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion (Nursing time, IV start kit, gloves, etc.)</td>
<td>$35</td>
<td>$35</td>
<td>$35</td>
</tr>
<tr>
<td>Cost of additional supplies</td>
<td>N/A</td>
<td>$15</td>
<td>$35</td>
</tr>
<tr>
<td>Care for 3 days ($35 per day for flushing, site checks, etc.)</td>
<td>$105</td>
<td>$105</td>
<td>$105</td>
</tr>
<tr>
<td>Total PIV cost for 3 days</td>
<td>$140</td>
<td>$155</td>
<td>$175</td>
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</table>
WHY ULTRASOUND FOR VASCULAR ACCESS, WHY NOW? 8,9

- There is increased pressure on healthcare facilities to decrease the number of attempts at needle placement.
- Fewer “sticks” may improve patient comfort and satisfaction.
- Ultrasound guidance has been shown to decrease the number of complications and lower the risk of infection.
- Ultrasound guidance has also been shown to increase the rate of successful cannulation.
DIFFERENCE BETWEEN NEAR-INFRARED TECHNOLOGY AND ULTRASOUND

NEAR INFRARED TECHNOLOGY

Allows for visualization of superficial vessels and vessel pathways


ULTRASOUND

Allows for:
- Differentiation of veins and arteries
- Visualization of nerves
- Real-time visualization of needle access into the vessel
- Visualization of vessel patency & compressibility
- Vessel depth
- Avoid back-walling
- See valves and bifurcations

ANGPT 919 GL Rev 01
The experts agree on the use of ultrasound guidance

Ultrasound guidance in venous access is recommended in the clinical practice guidelines of many organizations including:

- Infusion Nurses Society (INS)\textsuperscript{4}
- Emergency Nurses Association (ENA)\textsuperscript{6}
- Association for Vascular Access (AVA)\textsuperscript{10,11}
- Centers for Disease Control and Prevention (CDC)\textsuperscript{12}
- American College of Emergency Physicians (ACEP)\textsuperscript{13}
- National Institute for Health and Care Excellence (NICE)\textsuperscript{14}
- American Society of Anesthesiologists (ASA)\textsuperscript{15}
- American Institute of Ultrasound in Medicine (AIUM)\textsuperscript{9}
INFUSION NURSES SOCIETY

- Recommends using vascular visualization – including ultrasound for inserting every type of vascular access device (VAD), including:
  - Short peripheral catheters
  - Central venous access via peripherally inserted central catheters (PICCs)
  - Central vascular access devices
Ultrasound guided access should be considered for adult and pediatric patients with difficult access that have had unsuccessful PIV attempts using traditional methods.

Evidence Level A - High
Position paper on the use of real-time imaging modalities for PICC and midline placement and note improved insertion success.

Note the use of real-time ultrasound guidance for vascular access procedures is recommended by multiple organizations, associations, guidelines and standards (2018).
Use ultrasound guidance to place central venous catheters (if this technology is available) to reduce the number of cannulation attempts and mechanical complications.

Ultrasound guidance should be used only by those fully trained in this technique.
Ultrasonography has spread throughout all levels of medical education, integrated into medical school curricula through residency to postgraduate education of physicians, and extended to other providers such as nursing, advanced practice professionals, and pre-hospital providers.
2-D imaging ultrasound guidance is recommended for:

- IJs placed CVCs in adults and children
- Elective and emergent CVC insertion
- Insertion clinicians should have appropriate training and competency
During assessment, consider using a single use condom or commercially manufactured transducer sheath during all use where there is the possibility of contact with blood/body fluids or non-intact skin.

There is a risk for transmission of healthcare-associated pathogens and infection anytime a medical device is used between patients.

Perform all ultrasound guided vascular access device insertions (PIV, midline, PICC, CVC, arterial line) with the use of a sterile sheath.
With all of these recommendations, why isn’t every vascular access device placed with ultrasound?
CHALLENGES TO USING ULTRASOUND

- CDC’s recommendation that ultrasound be used “when available” and that it should be used “only by those fully trained in this technique.”
- Training complexity - Didactic, simulation, practice support
- Additional dexterity
- Device cost
HAZARDS TO “BLIND STICKING”\textsuperscript{16}

- Inability to visualize the anatomical complexity and variations of veins, nerves, and arteries
- Increase risk of nerve injury
- Nerve injury does not present immediately after venipuncture

Types of nerve injury:
- Neurapraxia – least severe, resolves in 6-8 weeks, can be caused by IV cannulation
- Axonotmesis – may take weeks/months/year to resolve
- Neurotmesis – most severe, complete transection
Non-compressible segment of the vessel representing thrombus formation
Large peripheral valve visualized with ultrasound
# GENERALIST VS. EXPERT

PIV failure was higher with Generalist insertions.

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<thead>
<tr>
<th></th>
<th>Generalist</th>
<th>Vascular Access Specialist</th>
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<tbody>
<tr>
<td>PIV Failure</td>
<td>54%</td>
<td>48%</td>
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<tr>
<td>PIV Insertion Success</td>
<td>72% success</td>
<td>100% success</td>
</tr>
<tr>
<td>Mean Insertion Procedure Time</td>
<td>11 minutes</td>
<td>2 minutes</td>
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<tr>
<td>Median Overall Satisfaction (0= not satisfied, 10 = satisfied)</td>
<td>4.5</td>
<td>7</td>
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PIV insertion success was 100% by the Vascular Access Specialist group.
How do I get started with implementing an ultrasound vascular access program?
ULTRASOUND IMPLEMENTATION PROCESS

- Identify opportunities for improvement and the project complexity
- Gather information and data from various stakeholders to evaluate the opportunity
- Analyze opportunities with data, content, and experience to make the right decision
- Implementation involves planning, education, and roll out
- Monitor outcomes that track progress of the project and sustainability over time
IMPLEMENTATION OF A NURSE-LED ULTRASOUND-ENHANCED VASCULAR ACCESS PRESERVATION PROGRAM\textsuperscript{19}

- Identified key stake holders
- Selected ultrasound equipment and team
- Provided education
- Audit tool and data analysis

Decreased first stick success from 5.5 to 1.5 attempts
Decreased PIV catheter failure by 55%
Decreased non-essential PICCs by 40%
When you can “see”, your opportunities for success are much greater!

Unfortunately, veins like this aren’t that common!
REFERENCES


REFERENCES (CON’T)


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ULTRASOUND FOR VASCULAR ACCESS

Presenter’s Name, Credentials