

2023

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Recommended Citation

Dong, MD, Michael (2023) "A Manual for Ultrasound Guided Intravenous Access: Allay your Fears, Alleviate with Humor, Approach with Confidence," *The Medicine Forum*: Vol. 24, Article 17.

DOI: <https://doi.org/10.29046/TMF.024.1.016>

Available at: <https://jdc.jefferson.edu/tmf/vol24/iss1/17>

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A Manual for Ultrasound Guided Intravenous Access: Alay your Fears, Alleviate with Humor, Approach with Confidence

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INTRODUCTION

"Hey, can you help get IV access on a patient? The nurses have tried many times already."

If this message fills your heart with trepidation, it may be because you do not have a systematic approach to ultrasound guided intravenous catheter (IV) placement or any prior training in this procedure. At our institution, after failed nursing attempts, the responsibility for obtaining IV access may fall on the physician. Early in the year, this physician may be an intern who has limited experience with IV access, let alone ultrasound guided IV placement. They may have previously undergone a brief training course using a low-fidelity gel model simulation. However, this form of training is often insufficient and impractical. The purpose of this manual is to allay your fears and anxieties and teach a systematic approach to ultrasound guided IV access. It is a guide that provides technical tricks and steps learned from several hundred hours of experience. And because we all know how enjoyable it is to read a dry step-by-step instruction manual, this guide is written in a humorous light for your reading pleasure.

PREPARATION

Review your patient's indications and risks. Though the procedure is relatively benign, reviewing a few key details is essential.

1. Is there any reason NOT to use a limb: Do they have a limb alert because of end-stage renal disease? Cellulitis or abscesses in one of the limbs? Superficial or deep vein thrombosis? Axillary lymph node dissection from breast cancer?
2. What is their bleeding risk? While you can perform this procedure while the patient is on anticoagulation or antiplatelet agents, knowing their bleeding risk will help you weigh the risks and benefits of repeated attempts or attempts on veins near an artery. Not that you'll need more than one attempt,

of course. And always confirm with the bedside nurse before you start.

Obtain your supplies. You will need an IV start kit (containing chlorhexidine/alcohol, Tegaderm, tourniquet, and tape), IV extension tubing, saline flush, ultrasound jelly (sterile lubricant jelly is a great alternative), and your IV catheter.

1. The length of your IV catheter is an important detail. Increasing the length of the catheter that rests in the vessel will increase the lifespan of the IV and reduce the risk of infiltration. Therefore, I almost always use the 48mm "long" IVs rather than the standard 30mm "short" IVs.
2. The size of your catheter is also important. An 18 gauge IV is considered a "large bore" IV, which you may need if the indication for access is acute blood loss, for example. I would not use anything smaller than a 20-gauge IV, though.

MEETING THE PATIENT

This is a critical juncture. One of the most challenging steps in placing an ultrasound IV is making the patient feel at ease. At this point, the patient has been "stuck" a dozen times, and they will be quite frustrated at anyone who walks through their door holding a needle. You have the fortune of being that person who walks in and says they will stick the patient more times. Therefore, our introduction to the patient and the first words we say will carry considerable weight.

Here are some common things we say, and this is how the patient interprets them:

What we think we say: "Hi, I'm here to do an IV for you."

What they hear: "Hi, I'm another health professional who doesn't even introduce themselves by name, and I'm going to torture you again."

What we think we say: "It's not going to hurt at all."

What they hear: "It's definitely going to hurt, and I'm lying to you."

What we think we say: "Let me try to put an IV in you."

What they hear: "I have no confidence that I'll be able to put an IV in you."

What we think we say: "I'm good at IVs."

What they hear: "I'm bad at IVs."

What we think we say: "I think I'm in the vein."

What they hear: "I totally missed the vein."

What we think we say: "Hm, that's interesting."

What they hear: "I just put my needle somewhere it shouldn't be."

Here are suggestions that I have found work well:

"Hello, my name is _____. It's a pleasure to meet you; I am one of the physicians called to help with difficult IV access. I'm sorry to hear that you've had a tough time recently. Your doctors specially requested that I come to help you with an ultrasound guided IV."

"I'm one of the best in the hospital."

- I find that saying this helps put them at ease in 90% of cases. 10% of the time, they are skeptical and unamused.

"This is going to be a big poke. 1, 2, 3, OUCH!"

- I find that saying "OUCH" loudly distracts them from the stick.

VENOUS ANATOMY: WHAT ARE MY OPTIONS?

1. Upper arm Cephalic vein:

This vein runs over the bicep and is isolated from other arteries and nerves. It is often ~0.5cm deep and runs straight up the arm. It is best in obese patients and patients with thick arms. It may not be present in thin patients and especially in older patients.

2. Upper arm Basilic vein:

This vein runs medial to the brachial neurovascular bundle (closer to the triceps muscle). It is isolated from arteries and nerves and runs straight. It is one of the largest diameter veins in the arm and often is ~1cm in depth.

3. Lower arm cephalic vein:

This vein runs from the antecubital fossa down the midline of the arm, an extension of the upper arm cephalic vein. It is ~0.5-1cm in depth and does not have any directly adjacent arteries.

4. Upper arm brachial vein:

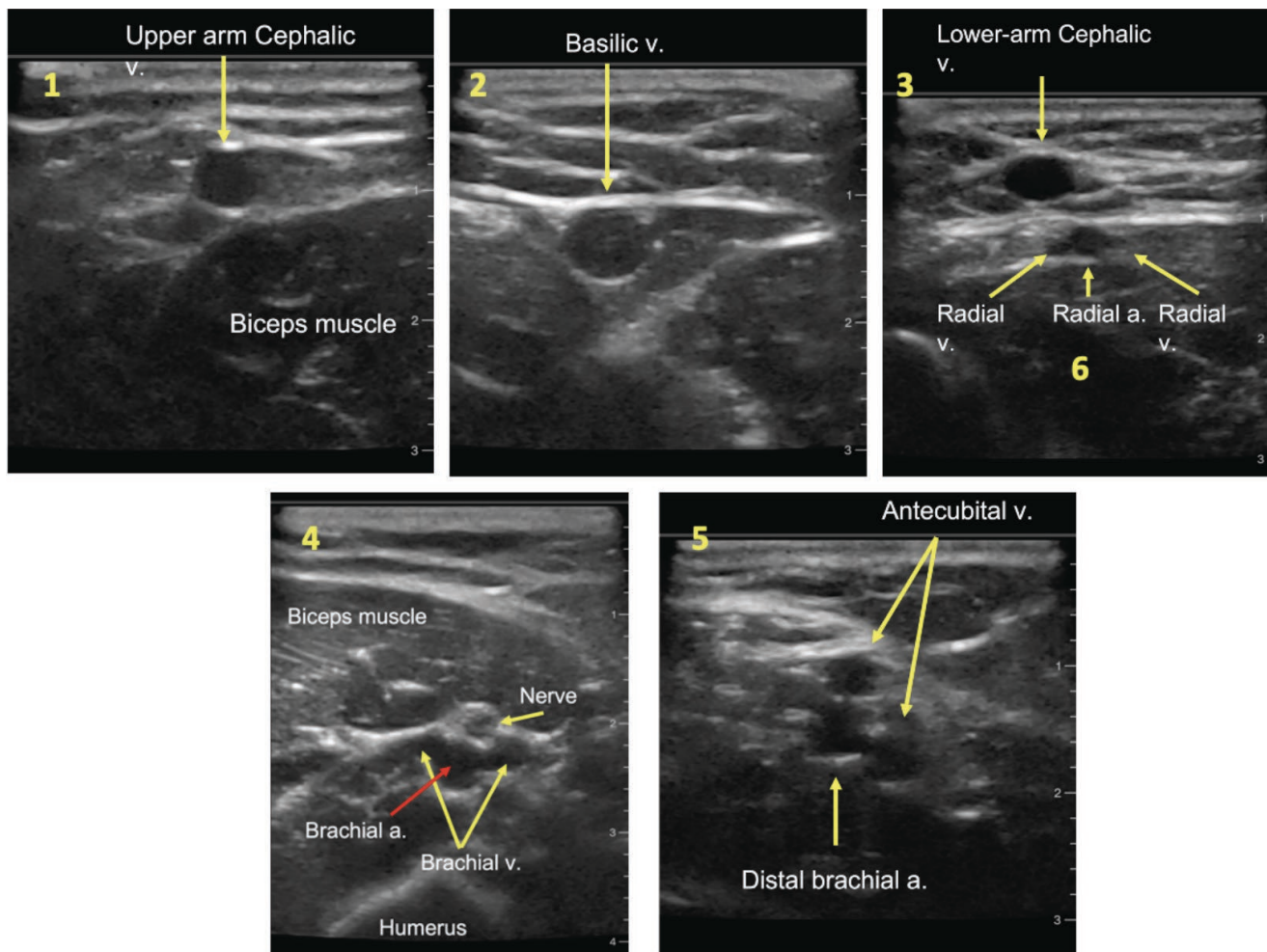
There is a brachial vein to the left and right of the brachial artery. The brachial vein on the lateral side of the brachial artery is often not a good target because your needle would have to pass through the edge of the biceps muscle and run too close to the nerve. The brachial vein on the medial side of the artery is usually an appropriate target. Still, it is located adjacent to the artery and at times can be under the bicep muscle. Extra care must be taken to confirm the vein and the needle approach.

5. Antecubital veins:

There are usually 1-3 veins in the antecubital fossa surrounding the distal brachial artery before they split into the lower arm vessels. These veins are shallow and easily accessible. However, it is difficult for the patient because every time they bend their arm, it will alarm their infusion pump for downstream obstruction.

6. Radial veins:

Two veins are on either side of the radial artery. It is a less ideal location because it runs deeper in the arm, sometimes under the muscle, and is directly adjacent to an artery.



TECHNIQUE

1. Position the patient and bed appropriately. You are young, and you must save your back! Make sure you raise the bed and position the patient's arm so that your hands rest comfortably in a neutral position while performing the procedure. I find that an optimal position is for the patient to be completely supine, with their arm extended out 90 degrees and their hand supinated.
2. Use the vascular probe on the ultrasound machine. Minimize the depth on the ultrasound machine so that the image on the screen is as large as possible. Optional: turn on the "centerline" or "guideline" to help you visualize the needle entry.
3. Identify a vein that is between 0.5 to 1.5cm in depth and runs linearly for at least the length of your catheter. Identify other structures, such as arteries and nerves. Make sure you understand the direction of the vein; For a beginner, it can be helpful to mark

the path of the vein on the skin so that you can ensure the direction of your needle entry lines up with the course of the vein.

TIP: Hold your ultrasound probe in your non-dominant hand and your needle in your dominant hand.

4. Apply the tourniquet proximal to your target location.

TIP: Prolonged use of a tourniquet will increase the risk of infiltration of that vessel, even if you cannulate the vein perfectly. If the patient has a history of IV infiltrations and the target vein is large, I recommend against using the tourniquet.

5. Insert your needle bevel up at a 45-degree angle to the probe and in line with the vessel's path. Hold the probe perpendicular to the skin. I always insert the needle ~0.5cm deep at first. The ultrasound beam cannot properly visualize the needle tip if the needle is too shallow on insertion.

TIP: Always have as much contact with the patient as possible during this procedure. Bracing your

hand against their skin stabilizes you in relation to the patient; thus, their unintentional movements will lead to fewer changes in your position. Even while holding the needle and ultrasound probe, you should endeavor to rest the side of your palm or a couple of fingers against the patient.

TIP: With the hand holding the needle, I use the 5th digit to pull the skin taut before I insert the needle. If your patient has “loose” skin with poor skin turgor, your needle entry in the skin can cause you to shift position by several centimeters. With your probe holding the skin on one end, your finger pulls the skin taut from the other end, and thus you create a patch of smooth skin for your needle entry.



- Finding your needle tip is the hardest part. Move the ultrasound probe to overlap with the insertion site at the skin. Then move proximally up the arm (and away from the needle) slowly while “nudging” the needle.

TIP: It is easiest to see the needle tip when the tip is in motion. By “nudging” the needle, you are not advancing the needle, but applying repetitive and gentle forward pressure to deflect the soft tissue. The needle is ideally deflecting tissue without causing any trauma or moving forward. On ultrasound, you can see a “V” deflection of soft tissue with the bright needle tip at the center of the “V.”

TIP: As you slowly move down the length of the needle away from the needle insertion site, you will see tissue deflection even before you have reached the tip. I advise you to keep moving your probe systematically in this manner until you see NO deflection at all. This is the point where you know you have moved beyond the tip of the

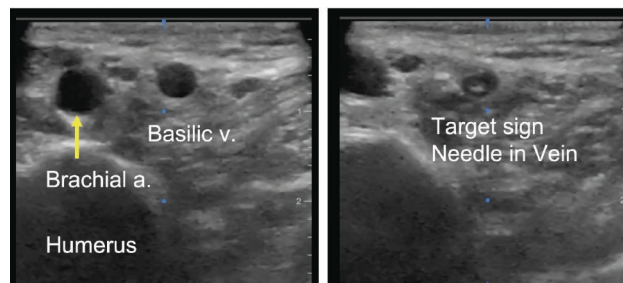
needle. Then move the probe slowly back towards the needle again, and the first point of tissue deflection you see MUST be the most distal tip of the needle. After you find your needle tip, you can purposefully advance the needle while directly visualizing it.

- Once you find the needle tip... DO NOT LOOK DOWN AWAY FROM THE SCREEN! This is the most common rookie mistake. You just spent so much time finding your needle tip, so trust in your hands and proprioception and glue your eyeballs to the screen. Advance your needle and ultrasound probe at the same rate to always keep your needle tip on the center of the screen and guide the needle into the vessel.

TIP: Commonly, when you look down at the needle and away from the screen, you will slightly and unconsciously move either your hand holding the ultrasound probe or your needle and thus lose your position.

TIP: When I see my needle tip first in the vessel, I do not immediately look down for the “flash” of blood in the IV catheter. This is one of the most critical junctions in the procedure, and you need to ensure you don’t lose your position.

- When you have a “Target Sign” with the needle tip in the center of the vessel, drop the angle of your needle to match the vessel’s direction. In most vessels, this means you are flattening your angle considerably. Then advance the needle through the vessel for another few millimeters to ensure your needle path is lined up perfectly with the vessel.

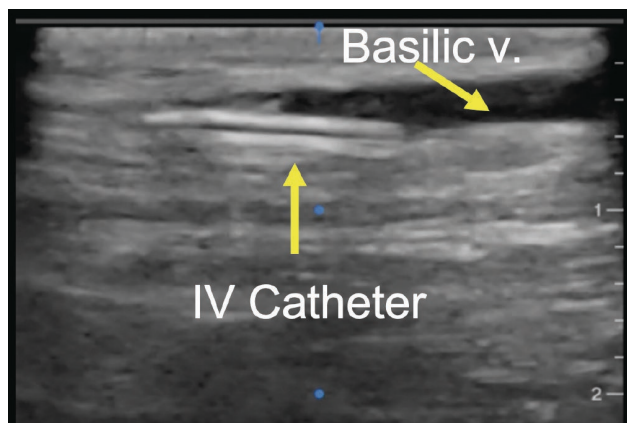


At this point, I will stabilize my needle hand and look down to confirm that I have the “flash of blood.”

Drop your ultrasound probe and with that free hand, slowly advance the catheter. Because you have lined up the needle path with the path of the vessel, the catheter should be advancing down the center of the vessel, and there is a far lower risk of you advancing the catheter through the back wall of the vessel.

There should be no resistance. If you feel resistance while advancing the catheter, stop and re-ultrasound your position.

9. When the catheter is fully advanced, click the needle retract button and put the retracted needle aside. Attach the IV extension tubing and pull back on the flush to confirm easy blood return. When you flush the IV with the saline, make sure the tourniquet is off. Flushing against a vein with a tourniquet on can cause damage to the vein and infiltration of the IV.
10. Ideally, you will image the vein in the longitudinal axis and visualize your catheter in the vein. When you flush the saline, it should be seen as a slightly echogenic fluid appearing at the tip of your catheter and moving up the vein.



CLEANUP

1. Breathe a sigh of satisfaction and contentment and announce your success to the patient.
2. Confirm that the tourniquet has been removed.
3. Make sure to dispose of your sharps and trash in the appropriate containers.
4. Dress the IV with the start kit Tegaderm and use extra tape to secure the Tegaderm and the IV extension tubing.
TIP: You can never use too much tape. If the patient is at risk of pulling out their IVs, ask the nurse to put a sleeve over the arm to protect the IV.
5. Lower the patient's bed to its lowest level and ensure all the bed rails are in the upright position with all the patient's limbs within the bed.

6. Inform the nurse of your success.

TIP: Even if the IV placement was easy, tell everyone in earshot that it was very hard. Bask in the compliments.

TIP: If you've properly cleaned up your mess and positioned the bed appropriately, you'll earn many brownie points on that nursing unit.

7. Write a short note documenting the procedure, including the vein, the number of attempts, and any complications.
8. Clean the ultrasound machine and return it to where it belongs. Take good care of the ultrasound machines; they are more expensive than a resident physician's yearly salary.

FINAL WORDS

Absorb and apply this knowledge and become a master of ultrasound guided IVs! This is one of the relatively few things we do as Internal Medicine physicians that can provide instant satisfaction and relief for the patient. I also find ultrasound guided IV placement to be a delightful task. In recent years during the pandemic, healthcare providers have created many barriers between ourselves and patients, such as physical barriers (gowns, masks), fear of entering rooms because of anxieties about contracting COVID, and reliance on EMRs and computers. Ultrasound guided IVs are a way for me to break down barriers and return to the bedside to provide a service to the patient. It gives me an opportunity to listen to a patient's story and build rapport. The time you spend in the room talking and connecting will build trust, especially when you cap off the conversation with a pronouncement that you successfully placed their IV, and they do not have to undergo any more sticks.

I write this manual and reflection in a humorous light, but as with all procedures, ultrasound guided IV placement should be conducted with thoughtfulness and preparation. Always respect your patients, approach every interaction with consideration and grace, and bring positive energy to the bedside.

Acknowledgments:

Thank you to Dr. Bailey Harrison, Dr. Sean Reilly, and Dr. Youssef Elfatraty for their assistance in image acquisition.