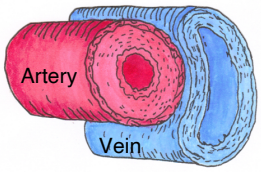
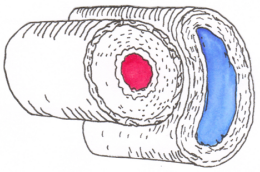
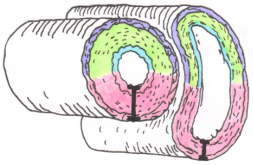
Vein Access Technologies
presents

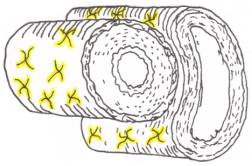
How to
Locate a Healthy Vein

What does 70% Isopropyl Alcohol have to do with locating a vein?
What does grading a vein have to do with vein wall rupture?




Lumen Size


Wall Thickness


Innervation

By
M. Gail Stotler, Vein Access Technologist / B.S.N., R.N. /
Biology / Anatomy / Physiology / Physics / Chemistry / Math

Vein Access Technologies
presents

How to
Locate a Healthy Vein

What does 70% Isopropyl Alcohol have to do with locating a vein?
What does grading a vein have to do with vein wall rupture?

By
M. Gail Stotler, Vein Access Technologist, B.S.N., R.N./
Biology / Anatomy / Physiology / Physics / Chemistry / Math

Illustrations By
M. Gail Stotler and Tami Tite

Published by
M. Gail Stotler, B.S.N., R.N. / Vein Access Technologist
Vein Access Technologies, a division of
The Nurses' Station, P.C.
#2 Terminal Drive, Suite 1
East Alton, Illinois 62024
618-259-7781
www.veinaccesstechnologies.com

ISBN: 0-9723656-2-1

About the Author

****

This book **IS** different from all of the other books written on this subject, and that's because **I am** different from all of the other authors who have written on this subject. It is this **difference** that makes this book "**THE BOOK"** on vein access.

Exactly what is this **difference**?

Unlike other authors who have written about vein access, I was pre-med before I did anything else. Here is a synopsis of my academic and experiential background -

1. A Bachelor's Degree in **Biology**, with a minor in **Chemistry** and all of the accompanying course work (i.e. **physics**, advanced mathematics, genetics, cellular biology, microbiology . . .), and

2. One year of graduate (**cadaver**) **Anatomy** at St. Louis University's School of Medicine and the accompanying course work (i.e. pathology, **neuroanatomy** . . .), and

3. Graduate hours in **Biology**, and

4. A Bachelor's Degree in **Nursing** from St. Louis University's School of Nursing, and

   (And it was while sitting in these nursing classes that I realized that nursing students are taught very LITTLE basic science information . . . they have NO cadaver anatomy, no physics, very little chemistry, minimal math, and skill instruction at the most minimal level.)

5. Graduate hours in nursing (i.e. graduate **physiology**, and didactic nursing classes. . .).

One of the things that I discovered on this academic journey was "what" these other levels of health care professionals were missing in their education. ***Each discipline teaches to their own level of science with respect to their field.*** And the lack of information is then perpetuated - continued on and on and on.

This is NOT a criticism – it is an observation.

Check out the academic course work of the other authors' (NOT TITLES) that came with their degrees.

Because I have experienced education in four different dimensions -

- *the **science world** with the Biology/Chemistry*
- *the **medical world** with graduate cadaver anatomy – a more advanced cadaver anatomy than even medical students are exposed to – really!*
- *the **allied health world** with the Nursing degree*
- *the **graduate/research world** with an emphasis on research and critical analysis of the facts and findings*

and I have a very diverse (clinical) work experience -

- *cardiovascular technologist (2D / M Mode echos, Treadmill Stress Testing, Basic Electrocardiography, 24 Hour Holter Monitoring and scan analysis, and Venous Doppler testing of the lower extremities)*
- *pulmonary function testing and function analysis*
- *EEG technician*
- *general skeletal radiology as an x-ray tech*
- *established and ran a diagnostic (medical center) laboratory*
- *established and ran a medical center based radiology department for*

general skeletal and chest exams, IV pyelograms, nuclear scans (i.e. bone and cardiac)

- *transcription in cardiology, internal medicine, radiology, pathology and medical records (to include all other disciplines) – resulting in a very advanced terminology education and understanding – that's why the word phlebotomy makes me crazy*
- *pathology technician*
- *etc.*

and a teaching background in a classroom and clinical setting -

- *I am an Illinois Department of Public Health certified CNA instructor and evaluator and have taught this program extensively.*
- *I have taught vein access (phlebotomy), as a self-owned corporate entity for the last 18 years, along with basic electrocardiography, injections (ID, SQ, IM, and IV), vital signs, ICD-9 and CPT coding, insurance claims filing, etc.*
- *medical seminar presentations*

I was able to see the medical profession in its totality. Other authors don't know the global medical picture as I know it. They were narrowly taught and trained in their specific area, and then they narrowly worked in their specific area. One "phlebotomy" book's author even flat out contradicts Gray's Anatomy in his one sentence description of the vein.

That's why I know all of this science information, and they don't. That's why they can't write about this. They don't know the level of anatomy, physiology, physics, and chemistry that I know.

That's why all of the other books out there are **MISSING INFORMATION**.
And maybe that's why they focus on the extemporaneous information and not on the anatomy, physiology, physics, chemistry, and math of the vein access procedure.

That's what's special about me and this book.

Critics might say that "with all of that academia, she was 'apparently' confused about what she wanted to do, and that she is just a *jack of all trades and a master of none*." Well, I wasn't confused. When I didn't get into medical school, I did what came next, and next after that, and next after that. And in the end, God knew what He was doing with me after all – He gave me this global knowledge of the sciences and medicine, and gave me the ability to apply this information to the clinical skills. This was no mistake at all.

Acknowledgments

The credit for this book and its content belong totally to God. God gave me all of the experiences (academic, clinical, and life) and the abilities (to think and to write) that it took to create this book.

I want to recognize the contribution that Kathleen M. Spooner made to this book. She is a phenomenal medical secretary and editor, who is extremely bright, with an innate intelligence about this field of medicine and a GREAT thinker. She critiques, corrects, comments, and brings a final touch to the content and to the diagrams that tie up the loose ends and makes it all flow. She read it from a secretarial and from a consumer perspective that challenged the process and forced the extraordinary detail that made this book the finished product that it is. She, too, thinks that this is revolutionary material, and that it will change the way that vein access is done from this point forward, and improve this procedure for everyone.

And, I want to sincerely thank my sister, Sherryl, and my niece, Kadie, for their unending and unconditional support and love. They have listened daily to this phlebotomy story of mine for the last 7 years. Kadie, when she was only 7 years old, sat in on her first phlebotomy class; and captured the skill of the tourniquet with one demonstration. She has yet to do her first stick, because she is only 13, but that is the only part she has not yet accomplished. And **I** will be her first stick!

And one more thing - there is a lot of repetition in this book, and that is on purpose. Please read this material with that in mind.

Table of Contents

****

Foreword

****

First and foremost, there are two significant parts to this book titled ***How to Locate a Healthy Vein*.**

- **Locating** a vein - The **#1 cause** for vein access failure is because the person doing the procedure did not know for sure the location of the vein.

- Locating a **healthy** vein - The **#2 cause** for vein access failure is because the person doing the procedure selected a "poor choice" vein - which resulted in vein rupture upon venipuncture, or the needle occupied the entire lumen of the selected vessel and suffered the inherent problems that go with that scenario.

This book will address both issues in detail - in *scientific* detail.

After all, you can't stick (*or shouldn't*) until you know **for sure** where that vein is actually located, and that it is a healthy vein – one that will tolerate not only the stick, but one that will also tolerate the procedure that you are about to do to it (i.e. infuse biologicals or withdraw blood).

So, no matter who you are -

RN	IV certified LPN	X-Ray Tech
"Phlebotomist"	Medical Assistant	Med Tech
Blood Donation Tech		

and no matter what you are about to do with your vein access –

- ✓ infuse fluids and/or medications
- ✓ infuse contrast
- ✓ withdraw blood for diagnostic laboratory testing, or
- ✓ withdraw blood for cells (blood donation) or for serum (plasmaphoresis),

you need to know this information. This skill is improvable. Really!

This new method is based upon scientific fact, and therefore, it is teachable, learnable, predictable, and repeatable (*meeting all the research criteria to be deemed successful*).

Introduction

****

How to Locate a Healthy Vein is different from anything else that has been previously written -

- ✓ Different in actual scientific content.
- ✓ Different in the focus.
- ✓ Different in the amount of information.

This manual is entirely focused on the skill of locating a healthy vein because all vein access procedures –

- ➢ Blood Draws (phlebotomy)
- ➢ Blood Collection (blood donation, cells or plasma)
- ➢ Infusion of fluids/medications (nursing)
- ➢ Infusion of diagnostic contrast (radiology)

require the location of a **healthy** vein before that vein can be successfully accessed with a needle.

This description and instruction is based on scientific fact. Start with *Gray's Anatomy*, *Guyton's Physiology,* and *College Physics* by Miller. Within these science texts are the basic facts about the human body and the laws of nature. It is entirely up to us to apply this information to the clinical skills.

You will learn how to use your sense of touch to locate a healthy vein, and then how to grade the vein to insure it can tolerate the insertion of the needle. Utilizing this information and these techniques can mean the difference between a single stick or multiple sticks.

The vein site selection and the working position of the needle in the vein will vary depending upon the mission of the procedure, but the method for locating a healthy vein is the same for all vein access procedures.

So, let's begin . . .

Anatomy of the Arm and Wrist for Vein Site Selection

****

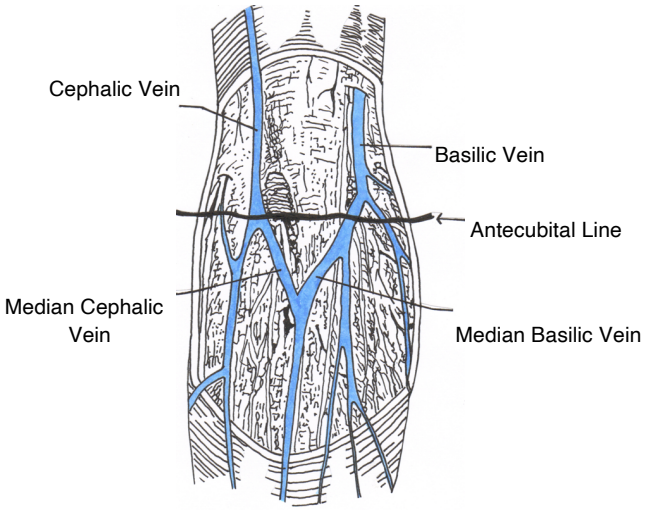
Let's identify the veins that you will be locating -

In the **antecubital region**, the veins most often stuck are the median basilic, first, and the median cephalic, second.

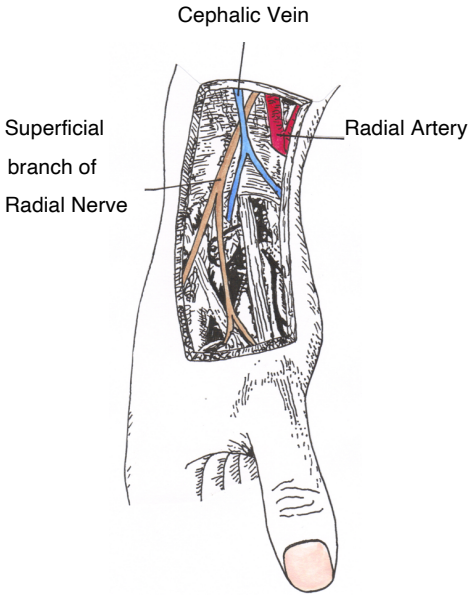
Now, <u>any</u> of these veins CAN be stuck - **if** they meet the criteria for "healthy", which you will soon learn about.

The hand is **palm up** for an antecubital vein access, with a natural bend in the arm at the elbow.

Right Arm



Right Wrist

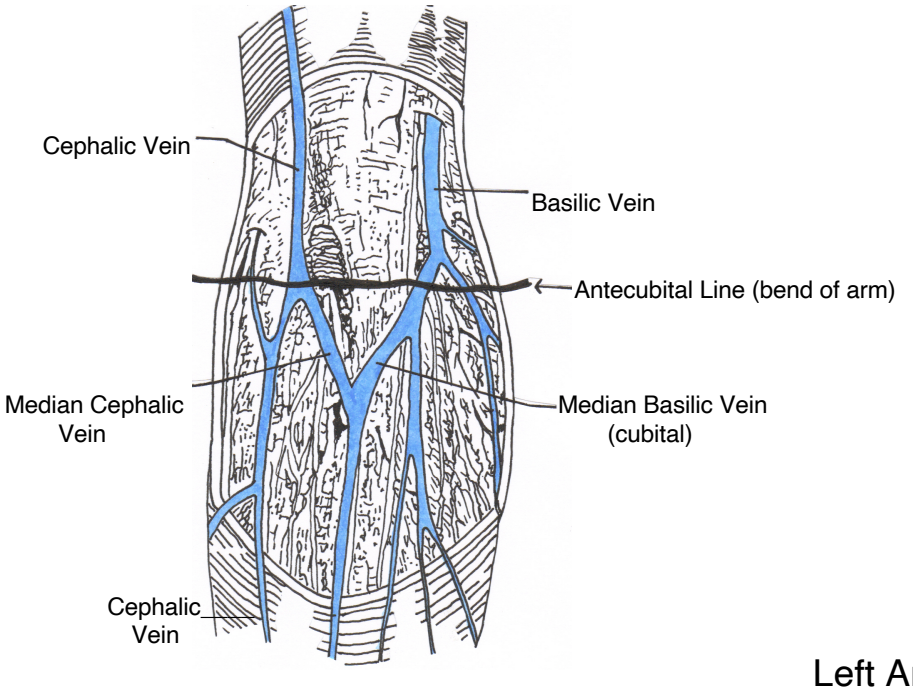


In the **wrist region**, the vein that <u>should be stuck</u> is the cephalic vein, located on the shaft of the wrist (and, technically, it should be the more superior segment of this vein).

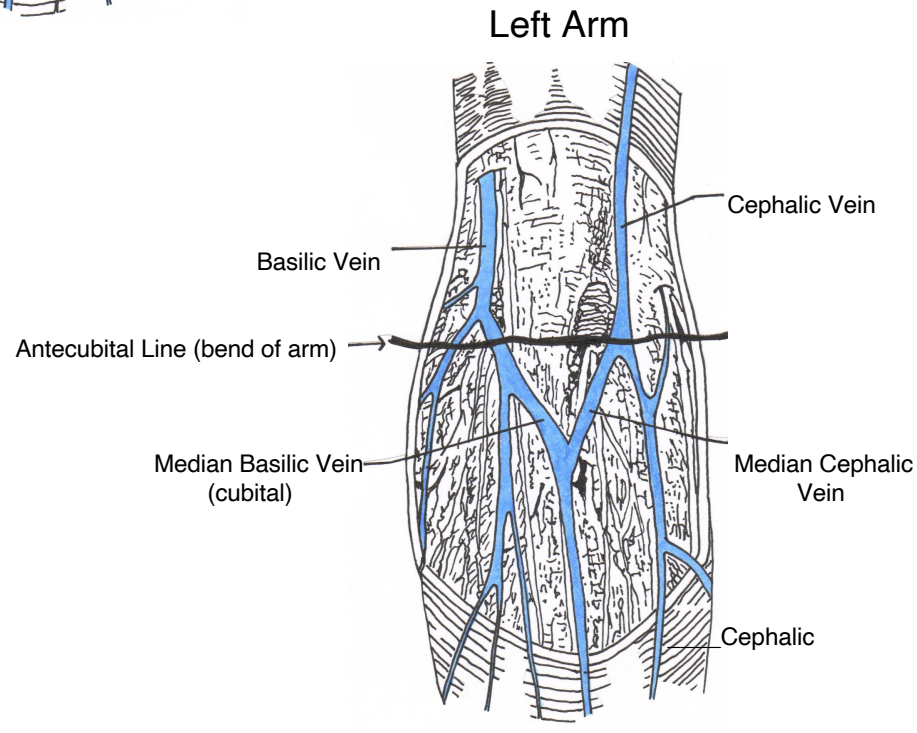
The hand is in the **<u>handshake</u>** position for a wrist access, with the hand off the table and in <u>alignment</u> with the arm.

Antecubital Region

Right Arm



Left Arm



Diagrams based on *Review of Gross Anatomy*
Ben Pansky, Ph.D., M.D., 6th Edition

Antecubital Region

1. The antecubital site in the right or left arm is where 99.99999….% of your venipunctures will occur for **blood draws, IV push administration of biologicals in nursing and x-ray, and blood donation**. The veins in this region are easy to locate, easy to access with a needle, and usually are the healthiest veins for venipuncture. So, the antecubital region is the **first choice** for the previously mentioned procedures.

Look at the diagrams of the antecubital region. When you study these diagrams and want to apply this information, place the arm on a table at a height that allows for a natural bend in the arm and place the hand palm up. Be sure that you are comparing the right arm to the right arm diagram and the left arm to the left arm diagram.

Note: Keep in mind, that although the anatomy is usually taught starting at the "top" and moving "down", the venous blood is traveling from the fingers towards the heart.

2. There are a lot of veins in this antecubital region, but we are going to focus only on four: the **cephalic** vein, the **median cephalic** vein, the **basilic** vein, and the **median basilic** vein (nicknamed the cubital vein, after the antecubital region).

Any of the antecubital veins CAN be stuck - **if** they meet the criteria for "healthy", which you will soon learn about. However, the **median basilic** (first choice) and the **median cephalic** (second choice) are the two most frequently stuck veins in this region. This is because they are usually the largest veins, and are in an anatomical position for easy access with the needle. (This means that, typically, the region palpated is most often just immediately below the antecubital line. The next most often palpated region is on the antecubital line. If the vein(s) are not palpable in these two specific regions – and remember to palpate BOTH arms – then expand the region.)

Take your highlighter and highlight the names – Cephalic Vein, Median Cephalic Vein, Basilic Vein, Median Basilic Vein. Starting with the cephalic vein, follow it down until it bifurcates (branches). At this point, follow the median Cephalic into the inferior (lower) antecubital region. Next, locate the basilic vein and follow it until it reaches the antecubital line where it also bifurcates, then follow the median basilic vein into the inferior antecubital region.

One more time, the median basilic vein and the median cephalic vein, in that order, are the most frequently stuck veins for blood draws, IV push administration of biologicals for nursing and x-ray, and for blood donation. Other veins can be stuck if they are firm enough, large enough, and accessible.

Wrist Region

1. So, now let's look at the wrist diagram. The vein in the diagram is colored blue and is the continuation of the **cephalic** vein from the antecubital region. In the wrist region, the cephalic vein is the vein that should be stuck. This site is accessed for **long term IV administration of fluids and/or medications, and is a second choice as a blood draw site or IV push site.**

Note: Long term IVs can be placed anywhere along the **cephalic vein** – from the **superior wrist segment of the cephalic vein up to the inferior antecubital segment of the cephalic vein**.

That entire segment of cephalic vein is usually healthy (in firmness, size, direction, and depth) for a long term IV. Just remember to palpate the wrist segment with the hand placed in the handshake position, and as you palpate UP the vein toward the antecubital region, the hand must now be placed in the palm up position to be able to easily and accurately locate that segment of vein.

2. Notice that the hand is in the handshake position, and the vein is then on the shaft of the wrist. This is important to notice because when you do antecubital vein access, the hand is in the palm up position. But, since the wrist portion of the cephalic vein is on the shaft of the wrist, the hand must be placed in the handshake position in order to locate and access the vein.

Note: The wrist veins on the palmar or dorsal aspect of the wrist should NEVER BE STUCK, because they will not tolerate the stick.

So, back to the original statement – 99.99999….% of your venipunctures occur in the antecubital region for blood collection and IV push, but if for whatever reason you cannot locate an antecubital vein, you will move down to the wrist.

Long term IVs (IV drips) will be placed in the wrist to avoid a joint and allow **movement** (which is critical to venous blood flow).

1st Choice
Blood Draws, IV Push, Blood Donation

1st Choice - Long term IVs (IV Drips)
2nd Choice - Blood Draws, IV Push

Antecubital

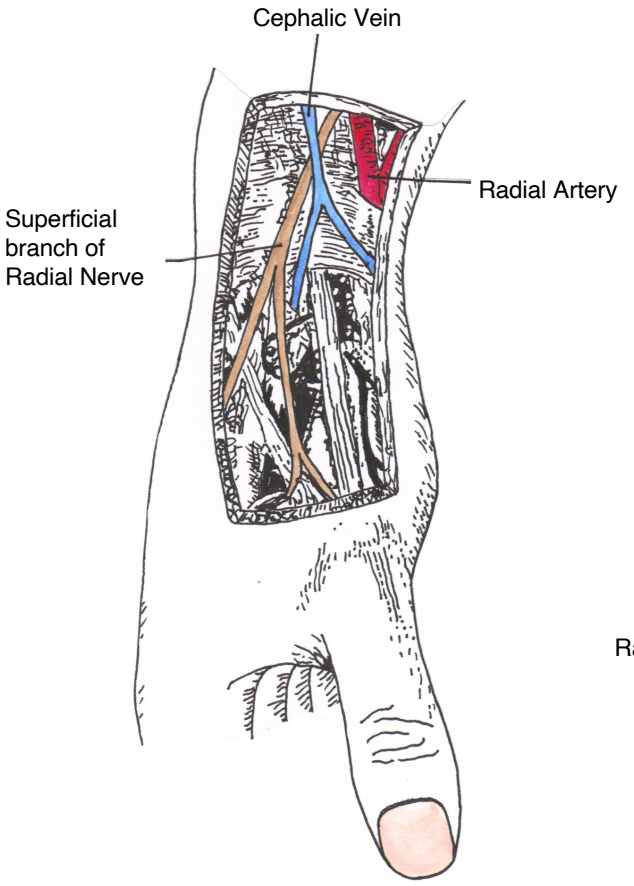
handshake
position

palm up

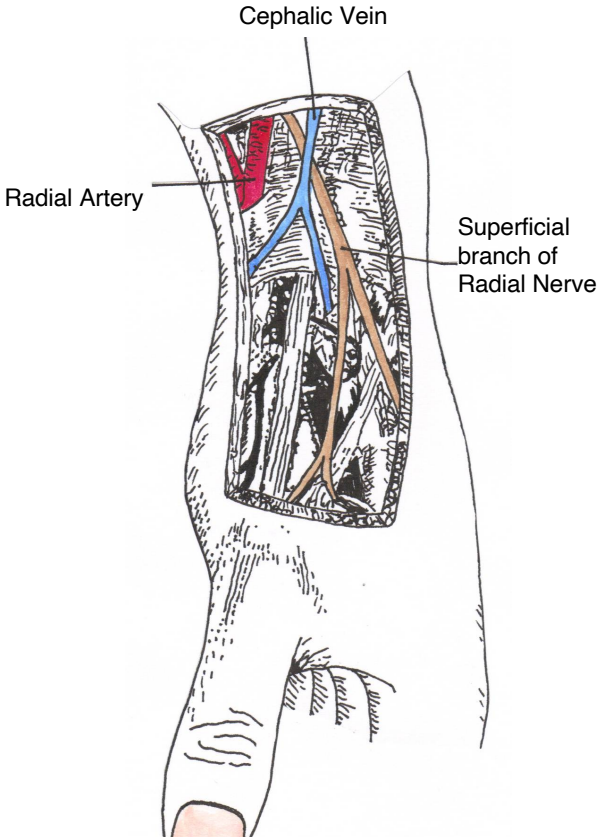
I am going to mention it here. That old adage – "start low and then move up" – is NOT correct! Not even in IV therapies!

Wrist Region

Right Wrist



Left Wrist



Diagrams based on *Review of Gross Anatomy*
Ben Pansky, Ph.D., M.D., 6th Edition

Dr. Gray (of *Gray's Anatomy*) dissected many cadavers to be able to describe, define, and draw these diagrams for us, as many other anatomists after him. What he and the other anatomists also discovered is that not all humans match these diagrams exactly. During my cadaver anatomy program, I learned that about 50% of the humans have anatomy just like the diagrams, but the other 50% have a variation of it. THEY HAVE THE VEINS, they're just not in that exact spot.

So, you can't trust a diagram to locate a vein for you - or you will "miss" 50% of the time.

That was never the mission of the anatomy diagram in the first place. It was never meant to be a map overlay that you place on a patient's arm to know where the vein is at. The diagrams (merely) demonstrate that the human body consists of these structures and in this manner (with the usual Bell curve distribution of variation in location).

Do we need to know the name of the vein to stick it? NO. But the more you know about what you are doing the more confident you will (should) be; and the more confident you are, the more competent you will (should) be.

Do we need to know the diagram to locate the vein? NO. But the diagram should convince you that if a patient has an intact arm (i.e. arm, forearm, wrist and hand), then that arm has these veins, and it teaches you where to expect to locate these veins and, consequently, builds your confidence.

But, remember, we can't trust a diagram to locate the veins for us.

So, if we are not using a diagram to locate a vein, how are we going to locate veins?

And, no, we're NOT going to LOOK for one either!
(There are some inherent problems with this approach as well).

We are going to use, and trust, our

Sense of Touch

to locate a healthy vein.

The Sense of Touch and Locating a Healthy Vein

****

Now that we know where we can expect to find the veins most often accessed for blood draws, blood donation, and IVs, let's learn how to use our sense of touch to **locate** a *healthy* vein. After all, you can't stick (or shouldn't) until you know the location of the vein AND if that vein will tolerate the stick. **These** are the parts of vein access that are least described in the current literature.

There are 5 steps to **locating** a *healthy* vein –

1. **PALPATE** – feel for the vein.

2. **USE YOUR DOMINANT HAND INDEX FINGER TO PALPATE** – the hand that sticks is the hand that palpates.

3. **"FEEL" FOR A LONG, SKINNY WATER BALLOON** – feel for the bounce, the shape, and the size.

4. **PALPATE WITH ALCOHOL** - alcohol insures a "clear touch signal to the brain.

5. **GRADE THE VEIN** – assess for firmness, size, direction, and depth.

Each of these 5 steps will be described in detail, and you will be given step-by-step instructions for utilizing this method. A tourniquet is not used during any part of this initial instruction – on purpose. We will discuss, describe, and use the tourniquet later.

1. Palpate

Palpate for a vein using your sense of touch. You're going to **feel** for a vein.

DO NOT LOOK  for one! WHY?

Because there are 3 inherent problems when using your sense of sight to locate a vein.

1. You can't always see  a vein.
2. You "can't judge a book by its cover".
3. Not all veins are created equal (≠).

1. You can't always see  a vein. The veins that we are accessing for blood draws, blood donation, and IVs are always Superficial Veins. Superficial Veins can be found at one of three levels in the human arm.

- **shallow or surface sitting** - These veins can easily be seen (the blue of the vein) and very easily felt, but are found only in a small portion of the population (10%).

- **average depth** - You can't see the "blue' of the vein, but many times you can see the "impression" of the vein, and it can also be easily felt. This represents the majority of the human superficial veins (about 80%).

- **deep in the subcutaneous tissue** - You can't see the "blue" of the vein, and you can't see the impression of the vein, BUT you can still feel it. These veins are also found only in a small portion of the

population (about 10%). (These percentages are (Bell curve) approximates.)

Superficial Veins vs. Deep Veins

And by the way, we are always dealing with Superficial Veins, NOT Deep Veins. There are two types of venous systems in the body: Deep and Superficial. Deep Veins (with a capital "D") run with arteries and are very "deep" in the extremity, protected by nature. You will never try to access a Deep Vein. The "deep" superficial vein described above is with a little "d", and these are found on or near the surface of the extremity.

Why don't we ever access Deep veins? Because, if you cause a vein injury in a Deep vein, and this injury results in a thrombus formation (blood clot), this clot **can** travel to the lungs and **can** instantly kill the patient (DVT - Deep Vein Thrombosis).

A clot formation (thrombus) in a deep vein (a Superficial vein) will not travel to the lungs and will not result in a DVT.

Since only about 10% of the population has palpable, healthy veins that are VISIBLE to the naked eye, trusting your sight to locate a vein is not a very good idea, and we can't trust that anatomical diagram to locate the vein, remember?

That means that 90% of the superficial healthy veins that we are going to access are **NOT** visible.

So, **FEEL (palpate)** for a vein; don't LOOK for one.

.

And even if you could see a vein, you don't know anything else about it. Because . . .

2. You "can't judge a book by its cover". You've heard that expression before. It means that you must read the book. Right? The same is true of the vein. You can't judge a vein by its cover (appearance) either. You must "read" the vein.

How do you read something you cannot see? *How does a blind man read?* By "feel". That's right, **palpate**!

Using your sense of touch you are going to **FEEL** for a vein and then **FEEL** the vein. And, literally, 100% of the time you will be able to locate a vein and be able to determine all of the other specifics that you need to know about that vein before you stick it.

Why do we need to know specifics about the vein we want to stick? Because . . .

3. Not all veins are created equal (≠). What's not equal about the veins? The thickness of the vein wall. Think about the veins that "blow" as soon as they're stuck, causing a huge hematoma. Why do some veins hold, tolerating the procedure, and

some don't? Because not all veins are created equal, and not all veins were meant to be stuck. It's anatomy!

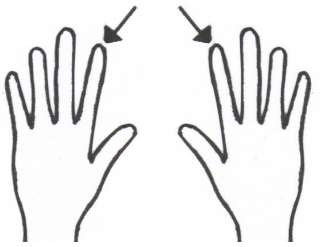
A successful vein access has everything to do with the integrity of the vein wall. The wall of the vein must be thick enough to tolerate the stick and hold, and the wall must be healthy, with its elasticity intact. If the vein wall is too thin to begin with (and made even thinner yet by placing the tourniquet on too tight), or if the vein is varicosed, this can result in the vein wall rupturing with the needle stick.

The only way to know about the integrity and health of the vein is to **feel** it. What are we feeling for? **Firmness**, **size**, **direction,** and **depth**. All of these criteria will determine if we stick that vessel or not. And, you can't SEE these things; you can only FEEL these things. These four criteria will be described in detail under vein anatomy.

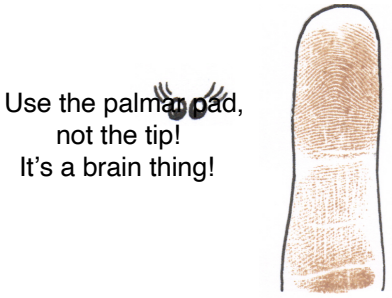
So, palpate for a vein, don't look for one. After you have located the vein, then you can LOOK.... to stick it!

2. Use Your Dominant Hand Index Finger to Palpate

Now that we know we need to **PALPATE** for a vein, how do we do that? **Use your dominant hand index finger.**



Left Right



For the best **sensitivity**, **specificity** and **accuracy**, use the palmar pad of your dominant hand index finger to locate the vein. It is extremely important that the hand that "sticks" is the hand that palpates!

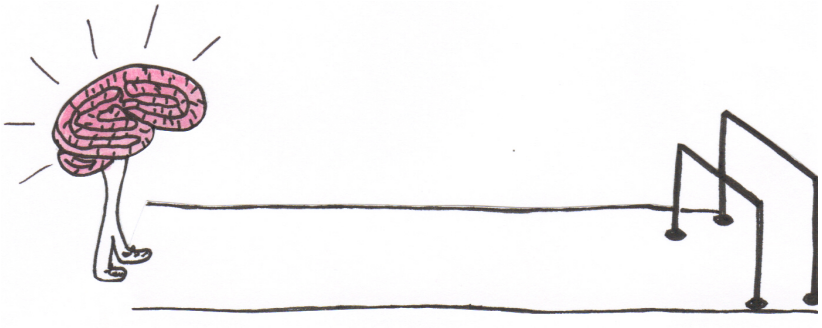
Think about it: if you were going to pretend to shoot a target, which finger do you point with? That's right. Your dominant hand index finger. It's neuroanatomy and neurophysiology – It's a Brain Thing!

And, when you are palpating with that index finger, **lift the rest of the arm and your hand up off the table**, because every part of that arm or hand that is touching a

surface while you are palpating will be sending a touch signal to the brain as well, and will compete with the touch signal from the pad of your index finger. Again, this is neuroanatomy.

Imagine this: Your brain is getting a touch signal from all of the surfaces from your hand and your arm, and the brain now has to filter out the extra touch signals and focus on the one signal from the pad of your finger.

Why make the brain do those gymnastics? Send just the signal from the pad of the index finger, and not the rest.



3. Feel for a Long, Skinny Water Balloon

Now that we know which hand and which finger to use, what are we "feeling" for? We are **feeling for a long, skinny water balloon**.

Long, skinny water balloon

Close your eyes, if you have to. Feel the bounce. You must focus on your sense of touch.

The vein feels like a long, skinny water balloon. No other structure in the human body feels like a water balloon - not even the artery! Can you now imagine how easy it's going to be to feel for a vein when you now understand that you'll be feeling for a structure that feels like a water balloon? Yeah! It's that easy!

Place a long, skinny water balloon on the table (or imagine it), and place the pad of your dominant hand index finger on the water balloon. Depress it. (DON'T POKE IT!) Feel the water's rebound bounce?

You must adjust the force of the pressure that you are applying when depressing, because -

- If you press too soft, you can't feel the fluid bounce.
- If you press too hard, you press right through it, and you will feel the table (if this were a vein in an arm, you would feel whatever is on the

other side of the vein - i.e. tendon, muscle, bone).

- If you press just right (like Goldie Locks), you'll feel the fluid bounce or rebound of the water in the balloon (or the blood in the vein).

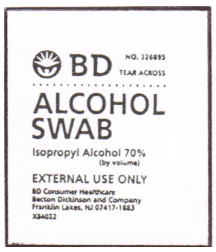
Technically speaking, when the applied external pressure matches the internal pressure of the water in that balloon (or the pressure of the blood in the vein – venous blood pressure), you will be able to <u>feel</u> the fluid bounce or rebound. So, since humans are not <u>static</u>, they are <u>dynamic</u> (constantly changing), you must adjust the pressure that you are applying until you can feel that bounce.

Hint: Start soft and increase your pressure from there.

Imagine - water balloons in the arm and feeling for those water balloons.

4. Palpate <u>With</u> Alcohol

There's one more thing that can improve your sense of touch, making it even better than it already is! **<u>Alcohol.</u>** (70% Isopropyl Alcohol)



That's right, leave the area **<u>wet</u>** with alcohol and now palpate.
Alcohol is going to improve your sense of touch!

First, let's describe what happens when you palpate dry-

When you move dry skin across dry skin, you create friction. (Friction is physics.) Anytime you move one surface across another surface you create friction.

Friction creates grab and drag. This gives the sensation that the surface you are moving across is rough. The dry skin on your finger feels like it is "catching or sticking" to the dry skin on the arm.

Friction is the equivalent of "noise" to the brain. So, your brain can't get a <u>clear</u> touch signal because of the interference of the "noise" or friction.

Your brain now has to filter out the noise . . . that's a lot of unnecessary work for the brain and makes it much more difficult to locate the vein.

Analogy: Think of the static on your car radio when the station isn't fully tuned in. Now, imagine your favorite song on the radio. Your brain knows the song frontwards and backwards, but it's not "tuned in" all the way, there is static..... your brain says, **"TUNE IT IN, or turn it off!!!** The brain doesn't like noise, especially when you're trying to discern and be specific. The same is true when feeling for a vein.

The friction that palpating dry creates is as irritating and interfering to the brain as that radio static. So, how do we get rid of friction noise?

Alcohol - 70% Isopropyl Alcohol to be exact.

Alcohol prevents friction!

Now, let's describe what happens when you palpate with alcohol -

When the area is wet with alcohol, your finger now glides across the area - no grab or drag. All of a sudden, the structures in the arm seem very noticeable. It feels like the vein got bigger, but it didn't. Your sense of touch got better. Or, more accurately stated, the brain is now getting a clear touch signal - **NO NOISE** - and that is what makes it seem like your vein got bigger.

When you palpate with 70% Isopropyl Alcohol, the touch signal describing the vein to your brain does not have to compete with the noise signal from the friction.

Note: The traditional alcohol wipes are useless for this new use of palpating wet. There's enough alcohol in the traditional pad to clean the area, but not enough alcohol to leave the area wet. So, carefully select an alcohol wipe that is loaded with alcohol, or use a cotton ball saturated with alcohol.

And, by the way, even if you use an entirely different agent to prep the site for the blood draw, blood donation, or IV, use alcohol to palpate with, to locate the vein.

Let's try this. Let's perform the alcohol "test", and remember **DO NOT LOOK!**

FEEL!!!

For this experiment, we will be using an antecubital vein. If the antecubital vein is not the vein you typically use, you can try this new WET palpation technique later on the sites that you will be accessing for your specific vein procedures.

First, let's do the test dry.

1. Palpate dry - glide your finger across an antecubital line.
   - First, notice the grab and drag?
   - Second, notice any "rope-like" structures?
   - Third, notice any water balloon bounce to that "rope-like" structure?

Now, wet the area with alcohol. Make sure it's **70% isopropyl alcohol**.

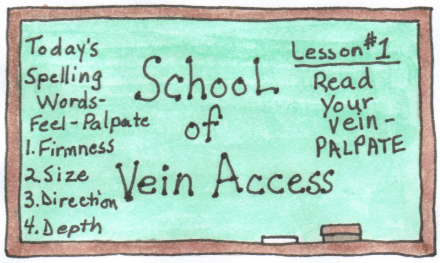
2. Palpate wet - glide your finger across the same antecubital line.
   - Do you notice any grab or drag? NO. It glides!
   - Is that "rope-like" structure more noticeable? YES. Does it feel bigger, more specific, more discernible, and more described?
   - Notice the water balloon bounce better?

5. Grade the Vein

Remember "not all veins all created equal", so we need to grade the vein on four very important characteristics –

Firmness, **size**, **direction,** and **depth**.

Veins vary in these characteristics from patient to patient, and from site to site on the same patient.



Firmness (0-10) - The firmness criteria is the most important. This criterion must be met and be met first. In fact, the size, direction, and depth does not matter if we cannot satisfy the firmness criteria. And this is why....

Firmness is a direct correlation to the vein wall thickness. Vein wall thickness varies throughout the body. As veins get closer to the heart, they get bigger, and the walls get thicker. (Think of a hand vein compared to the inferior vena cava.)

The thicker the wall of the vein, the better the vein wall will tolerate a needle stick. The thinner the wall of the vein, the more likely it will be that the vein wall will rupture upon insertion of the needle. We grade the firmness of the vein on a scale of 0-10, with 10 being the firmest.

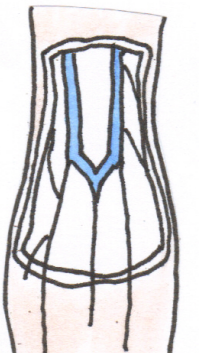
Analogy: Let's compare the vein wall thickness this way. Get a non-sterile latex glove. Feel the thickness of one wall of that glove. Pretty thin! Stretch that portion of glove over your finger, thinning it even more. What will happen to it if you stick that stretched, thinned wall with a needle? Rupture? Yep!!!!!

HAND: The vein wall in a hand vein is about as thin as the glove wall. And, when you apply a tourniquet (or BP cuff) too tight, you distend the vein which will stretch the wall even thinner (like the glove). You all know what happens, so frequently, with those hand veins . . . quoting a phrase commonly heard, "blew that vein", and now you have a huge hematoma. (Hand veins usually score 0-2.)

WRIST: As we move UP the arm, the next stop is the wrist. Venipunctures usually go a little bit better here. That's because the vein wall is starting to get thicker. But again, feel the vein for firmness and grade it (0-10). If the firmness of the bounce is less than a 5 (<5) on your firmness scale, do not stick that segment - it won't hold either. Palpate a little further UP (like one inch) until it feels firmer (scoring between a 5-10 on the scale), and stick it there. (Superior wrist veins usually score 5-7)

Analogy: Get a tourniquet (a real one, not a cut piece of surgical tubing). Feel the thickness of the tourniquet? Now stretch it over your finger. Still thick! Right? You can even stick that tourniquet with a 16 gauge Red Cross needle, and it will still hold. It will NOT rupture!

ANTECUBITAL: As we move UP the arm, the next stop is the antecubital region. The vein wall of a healthy median cephalic or healthy median basilic vein is as thick and as resilient as the tourniquet. (Typically, a healthy antecubital



vein scores 7-10.)

Don't assume that just because it is antecubital, the vein will score a 7-10. It must be "healthy" to score a 7-10. Varicose veins can occur anywhere. (A varicose vein is a vein that is unnaturally and permanently distended.) So, palpate and grade before you make your selection.

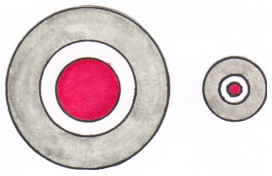
Remember, we are feeling for the **firmness** of the bounce when you depress the vein. We are grading on a scale from 0-10, with 10 being the firmest. If your vein scores less than 5 on the firmness scale, DO NOT STICK IT. That thin vein wall will most likely not tolerate the stick.

So, if the vein FIRMNESS has a - Score 5-10 - Stick it.
Score <5 - <u>Do Not</u> stick it.

Already, those of you who do IVs (in nursing and x-ray) are going to have to face the <u>reality</u> that the hand is never a good site for vein access! **<u>NEVER</u>!**

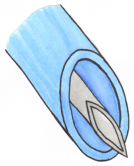
<u>Size</u> - The size of the vein is important because, obviously, the larger the "target", the easier it will be to hit. Think of target shooting. Which target would you rather shoot?

That's right. The larger one! Same way with a vein. Pick the largest, firmest vein.



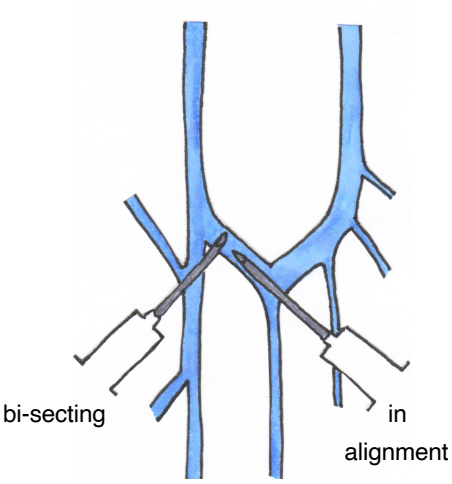
And, there's one more aspect to consider when sizing up your vein. The size (gauge) of the needle that you are placing in that lumen (the space within the vein) cannot occupy the entire canal. If it does, blood won't be able to flow around it taking the infusing fluid with it, or the powerful vacuum of the tube can suck the wall of the blood vessel into the bevel of the needle, corking it off.

Ideally, you should select the best vein first, and then select the needle.



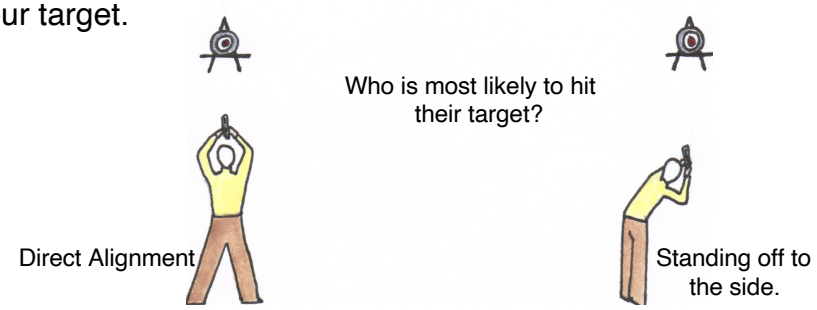
Direction - What direction is the vein running, and why is this important to know? It's important for two reasons -

First, you need a certain amount of the vein to work with. The bevel of the needle is a certain length, depending on the gauge. If you enter the vein in a bisecting direction, you may not have enough luminal width to accommodate this length.



You want the needle to enter the vein in the same direction that the vein is running to accommodate the complete insertion and positioning of the bevel and a minimal amount of the shaft of the needle.

Second, just like target shooting, you will be more accurate with the entry of the needle and, therefore, more successful with your vein access it you have lined up with or directly behind your target.



So, determine the direction the vein is running by palpating up and down and all around the site. Once you have determined the direction, get positioned directly in alignment with that vein and balance on both feet. Now you are ready for a controlled, accurate, and swift entry into the vein.

Depth: Remember, we are dealing with Superficial Veins, and superficial veins can be found at approximately three different levels -

- **shallow** superficial vein - is surface sitting and is easily palpable and visible (you can see the "blue" of the vein).
- **average** depth superficial vein - is just a little bit deeper

in the subcutaneous tissue and are easily palpable, but is not necessarily visible. You may see the "impression" of a vein on the surface of the arm, but you cannot see the "blue"

- **deep** superficial vein - NOT to be confused with DEEP Veins – is deeper yet in the subcutaneous tissue. It is more difficult to locate and is not visible at all. This vein cannot be located by gliding across the region. You must depress the tissue methodically and in small increments as you work your way across the region, until you feel that characteristic "water balloon" fluid bounce. These veins have a less pronounced bounce.

Hint: When palpating a deep superficial vein - to insure that you indeed are feeling a deep vein – bounce on the vein and then step off to one side or the other of the vein, and bounce. You will feel that that tissue is very flat, almost hard (so to speak). Now come back to the vein and bounce again. There should be a very noticeable bounce now because you gave your brain a new reference for comparison. (This will be explained in detail in another lesson.)

Determining the depth of the vein is important for two reasons -

1. Because you can expect to locate veins at any of these levels, you will have to adjust the pressure you apply in your palpation, and adjust your expectations of where you will feel these veins.

2. Also, the angle of entry of the needle will be determined by the depth of the vein.
   - shallow veins - approximately 45º angle of entry
   - average depth veins - approximately 45º angle of entry
   - deep superficial veins - approximately 60-75º angle of entry

Adjusting the angle of entry allows for the least amount of needle to be inserted into the tissue which reduces the risk of injury to underlying tissues, and reduces the amount of fear that the patient can experience from the visual (scared to death if it appears you have buried the whole needle in their arm).

So, to insure a successful vein access with minimal or no discomfort to the patient, and without injury to the tissues -

I emphasize, **GRADE THE VEIN** before you stick.

1. Firmness (0-10), requiring a score of 5-10 to stick.
   This reflects thickness of the vein wall and its integrity.

2. Size - Think of target shooting and the size of the needle.

3. Direction - Line up behind your target, and more vein to work with.

4. Depth – Shallow, average, and deep superficial veins with an accommodating angle of needle entry (45, 45, 60 degrees).

Summary

Use these 5 steps –

1. PALPATE – Feel for a vein.

2. USE YOUR DOMINANT HAND INDEX FINGER TO PALPATE – The hand that sticks is the hand that palpates.

3. "FEEL FOR A LONG, SKINNY WATER BALLOON – Feel for the

fluid rebound bounce, the shape, and the size.

4. PALPATE WITH ALCOHOL – Alcohol provides a "clear" touch signal to the brain.

5. GRADE THE VEIN – Assess for firmness, size, direction, and depth.

.....and you will be able to locate a healthy vein 100% of the time and successfully access the vein on the first stick 99.999…% of the time (life's not perfect). But this means that maybe only one out of 300, 400, or better, might get stuck twice. Think about how many repeat sticks occur with the old method.

How much more fun will vein access be, for both you and the patient, with this new technique?

Now you need to know some detail about the vein itself. After all, it is the structure that you are about to put a needle into, and this information will make locating, dilating and grading that vein even easier yet.

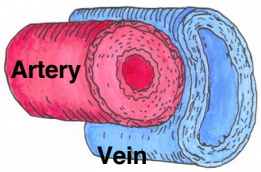
Anatomy and Physiology of the Vein

****

This information about veins IS in *Gray's Anatomy* and *Guyton's Physiology* (as well as other A&P texts used at the graduate or medical school levels). This information is just

not in the nursing, lab, phlebotomy, or x-ray program texts, but is equally important to these groups.

Here's a diagram of a vein. The vein is sitting next to an artery for comparison. And, here's a picture of a long skinny water balloon (imagine it with just enough water in it without distending or stretching it). We are going to compare the vein to the water balloon. The vein is just like the water balloon in many ways. The artery is not.

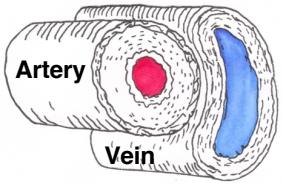


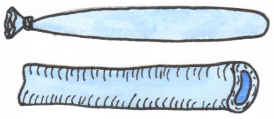
Long, skinny water balloon

1. The **lumen** is the space within an artery or a vein. Compare the lumen size of the artery to that of the vein. The lumen of the artery (red) is very small compared to the lumen of the vein (blue), which is very large. There's a physiological reason for this, but, at this point, just appreciate that there is a difference, and that due to the volume of blood in the large lumen of that vein, you will be able to feel the "water balloon" bounce very easily.

Imagine the vein, and imagine the water balloon; imagine the fluid bounce.

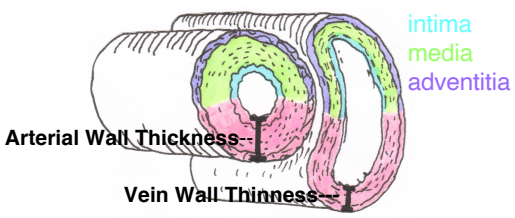
Compare the lumen sizes. The vein is very different from the artery. But, the vein is very similar to the water balloon.





2. Compare the **thin** vein wall to the **thick** arterial wall. This wall thickness has to do with the amount of blood pressure (mm Hg) that these walls have to hold or contain. We will come back to this concept, but for now, just notice the difference between the **vein wall thinness** and the **arterial wall thickness**.

Note: **All** blood vessel walls have **3 layers** of tissue (intima, media, adventitia). The media (middle layer) is composed of MUSCLE fibers. This has a function, too.



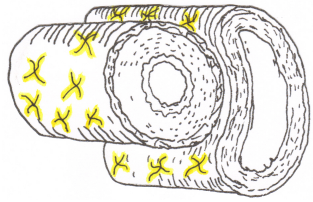
Compare the thin vein wall to the thick arterial wall. These wall thickness differences serve more than one purpose

Artery blood pressure = 80-120 mm Hg
Vein blood pressure = 10-20 mm Hg

3. The walls of all blood vessels are **innervated**. This means they have nerve endings just like your skin! And, just like your skin, these nerves endings respond to stimuli (i.e. hot, cold, touch, and pain) in a specific and predictable manner. These stimuli cause either vaso**constriction** or vaso**dilatation**.

Hot (heat) dilates.
Cold constricts.

Touch (gentle) dilates.
Pain constricts.



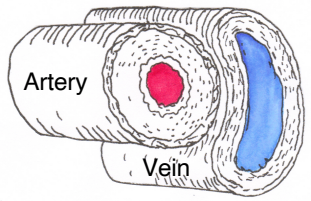
The walls of all blood vessels are innervated. The nerve endings tell the muscle in the wall of this vein to either contract (constrict) or relax (dilate).

What does this anatomy and physiology of the vein have to do with vein access? **EVERYTHING !!!!!!!!**

Anatomy and Physiology of the Vein as Related to the Vein Access

****

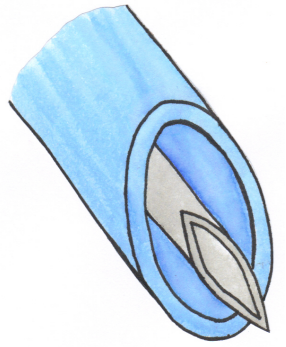
LUMEN - The huge **lumen** of this vein accommodates a lot of blood. That means that the amount of bounce to that vein will be very easy to feel. Again, think about the water balloon and the bounce sensation when you press on it. This is exactly what a human vein will feel like. The amount of bounce sensation you feel will vary as you compare an infant vein to a toddler vein, to an adolescent vein, to an adult vein because of the difference in size.



Long, skinny water balloon

Here's one more factor you need to take into consideration with the lumen size of the vein. As mentioned previously, you are going to be placing a certain size needle into that lumen, and that needle will occupy a certain amount of that inner space. Can you visualize this? Look at the diagram below.

You must have enough space left in the lumen of the vein for blood to flow around the needle, allowing for continued circulation of blood.



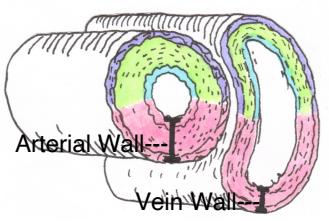
Hint: Select the appropriate gauge needle for the size of vein you have selected for your vein access. Remember, you can't tell the size of the blood vessel by looking at it, but you can tell the size by palpating (feeling) it. So, **palpate** for a vein. When you have felt and determined the size of the vein, then you can select the appropriate size needle.

For those in the blood donation world, you are always using a 16 gauge needle and therefore must select a vein that is large enough to accommodate that needle.

VEIN WALL - You now know that the vein wall is thinner than the arterial wall. But the thinness of the vein wall varies throughout the body, also. (Remember? We just described this under grading the vein for firmness.) As veins get closer to the heart, the vein gets bigger, and the walls get thicker! Right?

While most of you have never seen human veins on an anatomical level (cadaver dissection), you can conjure up the image of small and large veins in the body and conjure up the image that smaller veins have thinner walls and larger veins have thicker walls.

This anatomical fact is so important because the thicker the wall, the better the wall will tolerate a needle stick!

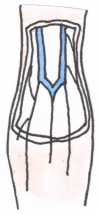


Again, keep in mind the water balloon.

Think of the wall of a balloon. What will happen to that wall when a needle penetrates it? If it's too thin, it will rupture. If it's thick enough, it will hold. **(How does a water balloon wall get too thin? Over distend it!)**

Nature designed the vein to distend to a certain size. Exceed that limit, and you can damage the wall temporarily or permanently (varicose vein). When you cause the vein wall to thin beyond what is natural for it, and when the needle penetrates it, the vein wall will rupture which will result in a hematoma or the squirting of blood from your venipuncture site.

ANTECUBITAL - The vein wall of a (healthy) median cephalic or (healthy) median basilic vein in the antecubital region is as thick as the tourniquet and as resilient. Typically, a healthy antecubital vein scores 7-10.



WRIST - The vein wall is thinner here (we are more distal from the heart). The more superior segment of this vein wall is thicker than the more inferior segment of this same vein. It is extremely important that in this region you carefully grade the vein wall for thickness (firmness) and select the segment that is scores greater than 5.

HAND - The veins in the hand are the most distal (furthest away from the heart), and therefore, have very thin walls. The wall in a hand vein is about as thin as the glove wall, and they usually

do not tolerate a needle stick and frequently rupture. That is why I recommend that you never stick a hand vein. (Hand veins usually score 0-2.)

Remember, **grade the vein** for the firmness of the bounce. The **firmness** of the bounce is the key to determining the thickness or thinness of the vein wall. Grade the firmness on a scale from 0-10, with 10 being the best.

You can't **see** thickness, so don't **LOOK.**

Palpate (feel) the vein.
What are we feeling for? **Firmness.**

We have to pick that segment of the vein where the wall is **thick enough** to tolerate the stick and the procedure we are about to do to it (i.e. blood draw, IV push, IV drip, or blood donation). How?

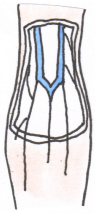
PALPATE TO GRADE - Here are some helpful exercises to aid in performing this assessment by comparing the antecubital veins, to the wrist veins, to the hand veins.

1. Pick an ideal body weight male arm.
2. **DO NOT** apply a tourniquet.
3. Visibly identify an antecubital vein, a wrist vein, and a hand vein that you intend to palpate (feel).
4. Wet all three sites with alcohol and leave them wet.
5. Feel all three veins by bouncing on them, one right after another - antecubital, then wrist, then hand. DO NOT grade them – just feel the bounce.

Did you notice the difference in the **firmness** of the bounce? If yes, proceed. If no, do it again. Notice the difference in the firmness of the bounce.

Now, let's **grade the firmness** of these veins. Start with the antecubital vein, then compare and score the other veins against the bounce of the antecubital vein.

6. **Feel** the **firmness** of the bounce of the antecubital vein, and automatically give it a score of 9 or 10. Score _____



7. Now **feel** (palpate) the wrist vein and bounce on it. Compared to the firmness of the bounce of the antecubital vein, what score would you give this wrist vein? Score _____

Hint: In the wrist area, palpate high on the wrist and low on the wrist and compare the scores assigned. You should discover that the lower wrist segment is very weak, scoring usually about a 4 on your firmness scale. <u>One inch</u> higher on that same wrist and that same vein should score about a 5-7. (Remember, the vein wall gets thicker as we go UP.)

8. Now **feel** (palpate) the hand vein and bounce on it. Can you even feel a "fluid bounce"? If no, score it a "0". If yes, compare it to the wrist vein and/or to the antecubital vein and score it. What score is this bounce? Score _____

Hint: If you feel the hard bone behind the vein, you have palpated too hard - lighten up and feel for the fluid rebound bounce.

Remember, the score must be between a **5-10** on your **firmness** scale to stick the vein.

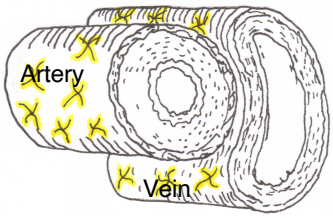
- If it is **(<) less than 5 - DO NOT STICK** IT!
  The wall is too thin and will not tolerate the stick.

- If it is **between 5-10 - YOU CAN STICK** IT!
  The closer you get to a 10, the better. This reflects a thicker vein wall.

  If the wall of the blood vessel is too thin, the vein wall will not tolerate the stick, and the vein will rupture. Now you have a hematoma. Now we have an unsuccessful event.

But, there's a bit more that you need to know about the vein that will make your job of locating it and grading it even easier!

INNERVATION - Your vein wall has nerve endings, remember? These nerve endings respond to external stimuli like hot, cold, touch and pain.

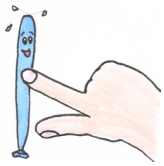


Nerve endings stimulate the muscle in the wall of the vein to either constrict or dilate.

Hot (heat) - causes **dilatation**. Think of a whirlpool or sauna. What does that warmth do to a normal human being? Relax you? Yep! Heat relaxes the muscle layers in the vein wall and allows the relaxation and stretching of that wall, and the filling of that vein with blood.

Cold - causes **constriction**. Think of jumping into a pool of ice water. What does that kind of cold do for you? Does it make you want to relax and stay in the water? Or does it make you want to <u>withdraw</u> from the water? Yep, withdraw!

Touch (gentle) - causes **dilatation**. Think of a back massage. Do you say "give me more", relaxing and giving into it, or do you say "give me less" and pull way? If you are normal (and not all people are), the response is to relax and open up, dilate. (We will discuss neurovascular anomalies later which will explain normal vs. abnormal with regards to touch. There is a small segment of the population who have neurovascular anomalies and these people <u>do **not**</u> like to be touched, and neither do their veins.)



Pain - causes **constriction**. Think of someone slapping your face. Does your face lean in and say "give me more"? NO! Your face immediately withdraws (constricts). And, **<u>the vein has the same reaction when you smack it!</u>** If you smack or flick the vein, you cause it to **VASOCONSTRICT**! Is that what you wanted?

FRIGHT/FLIGHT SYNDROME

Now, I can tell you the **Fright/Flight Syndrome** story as related to the vein.

Imagine the arm and its vein . . . . attached to a person with a brain. . . .

- *The brain is in charge.*

- *The brain watches as the vein gets slapped, smacked, flicked, or tapped. .*

- *The nerve endings in the vein wall scream - sending a message to the brain that says - "I've been hurt, BAD!" (This is **fright**.)*

- *The brain's job is to keep the body alive, and the brain responds by sending a message back thru that same screaming nerve ending to tell the muscle in the vein wall to **constrict**, squeezing all the blood away from that site. This is because the brain wants to bring all the blood to the vital organs to keep the body alive. (It thinks it's going to die.)*

*At this point, there is **no blood in that vein** !!!*
*Sticking the vein now will get you **nothing**, literally!*

- *This segment of hurt vein will remain constricted until the danger (fear) has passed (i.e. you quit smacking it, or while you go get someone else to stick it), or the muscle in the vein fatigues.*

- *When the danger has passed, the brain looks around and says, "We're not dead yet, let's get out of here!" (This is **flight**.)*

- *The brain then sends a message to the vein's nerve endings to tell the muscle in the vein wall to relax and **dilate**. This allows the vein to super fill (dilate), so that the patient can fly (so to speak).*

- *<u>Now</u> there is a lot of blood in that segment of vein.*

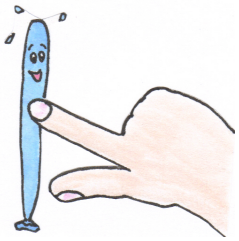
So, if you're going to smack the vein, you must wait for it to go through that entire process of **vasoCONSTRICTION** . . . and <u>then</u> (later) . . . **vasoDILATATION**.
Here's a better suggestion. **MASSAGE** the vein. Remember what gentle touch does to the nerve ending?

Hint: DO NOT slap or smack the vein. Instead, **MASSAGE THE VEIN**. Gentle touch sends a signal to the brain and the brain sends a signal back to the vein saying "this feels good, relax". The muscle in the vein wall relaxes, allowing for more blood to fill that vein, and dilatation has just occurred!

THIS IS THE IMPORTANT PART OF THIS ARTICLE.
(Gentle) <u>TOUCH</u> DILATES THE VEIN!

Your job of locating that vein is much easier because of the nerve endings in the vein wall telling the muscle layers of the vein wall to relax, allowing for a natural stretch of the wall and allowing for more blood to fill the vein.

How do you massage the vein? The same way you locate it. **<u>Palpate it.</u>** That's right. Not only do you <u>palpate **for** a vein</u>, you must <u>palpate **the vein**</u>. Palpation is a gentle, relaxing massage.



Note: Did you know that "gliding" is called effleurage in massage therapy? Did you know that "pressing" is called petrissage in massage therapy? So, **palpation is massage.**

The process of palpating <u>for</u> the vein starts the dilatation process, and once you have located the vein, <u>palpating **the vein**</u> will further dilate it. Let's try it.

<u>PALPATE TO DILATE</u> - Follow the instructions below, and let's prove (or disprove) that this new technique really works. Read through these steps entirely before you begin.

1. Pick an obvious surface sitting antecubital vein (not yours)
.
2. Clean the antecubital region with alcohol and leave the area WET.
   (Alcohol enhances your sense of touch.)

3. Place the pad of your dominant hand index finger over one segment of that vein and stay put.

4. Remaining on <u>that</u> spot, and without lifting your finger off the skin,

begin to depress and feel the return. Continue this maneuver.

5. Tune into your sense of touch (close your eyes if you need to), and feel the change in the vein – **it should be dilating and filling, feeling fuller, bigger, and firmer**.

Now, let's take this information and technique and apply it to the veins that you cannot see. Pick an arm where the veins are NOT visible. Palpate all the regions of the extremity where you typically access the veins. Are you better able to locate the veins now?

Note: Did you notice we did not need to use a tourniquet to dilate the vein?

And always remember, for those veins you can see, just because you can see blue doesn't mean it's a good vein, **FEEL** it. If you can feel a water balloon bounce, and it's firm, you can stick the blue vein that you can see. But if you can't feel a firm wall with a fluid bounce, don't stick it (even if you can see it) because it won't hold.

Proper attention to these details can mean the difference between a single stick event and a multiple stick event. Utilizing this information and this touch technique will minimize immensely the amount of time you spend locating the vein. And, when you add grading the vein to this, the odds get even better for a successful vein access on the first stick! Isn't that the mission for everyone involved - the patient, the vein access technician, and the institution?

Let's Palpate to Locate, Dilate, and Grade the Veins

****

Get an arm (not yours), and let's practice what we have learned so far - palpate, locate, dilate, and grade the vein.

Antecubital Region

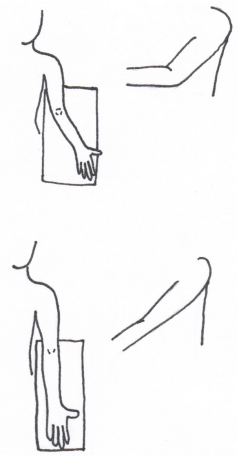
1. Place the arm on a table at a height that allows for a natural bend in the arm, and place the hand palm up. This insures that the inferior antecubital region is UP. DO NOT straighten the arm. Straightening the arm tightens the tissues of the antecubital region engaging muscles and tendons, causing all of the tissues to be "hard" and not pliable, and this will prevent you from feeling the fluid bounce of the blood in the vein. *(Technicians were taught to straighten the arm to increase the visibility of the "blue" in the vein – because they LOOK for a vein. And, we have already discussed this and decided that LOOKing for a vein will not work well.)*

The natural bend vs. straight.

First, place a patient at the table in such a manner that the arm has a natural bend in it. (See the diagram.) Now, press across the antecubital region with your palpating finger and FEEL how supple and pliable the tissues are.

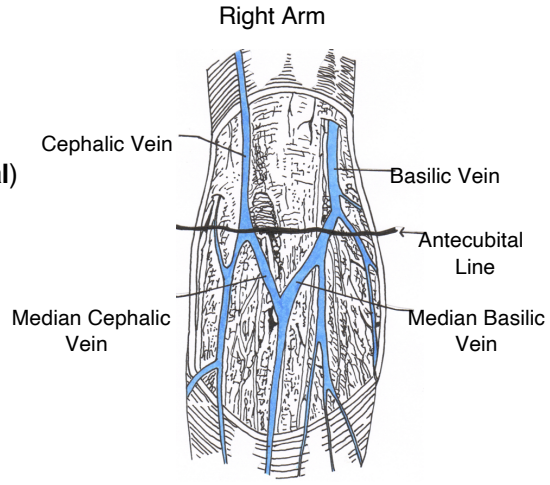
Now straighten the arm (raise the arm or raise the table). Now press across that same region with your palpating finger. Do you FEEL how hard the tissues are in that region? In fact, can you FEEL the water balloon bounce of the vein now? NO!

Straightening the arm engages muscles and tendons and brings the bone closer to the surface (where your superficial veins are). This causes a "flattening" of the superficial veins. Not only is the tissue "hard", but the vein is no longer palpable! Put a natural bend in the arm and appreciate how palpable the region and the vein is now.



2. Identify the anatomical boundaries of the antecubital region. Remember, vein access is an invasive procedure, so you must clean the ‘’football size field” to do the microscopic cut (or, in this case, the microscopic stick). It’s all about killing microorganisms over a large enough field, preventing pathogens from entering our venipuncture site and giving organisms outside that field a long distance to travel before they reach our venipuncture site.

- ✓ **Identify the antecubital line (the bend in the arm).**
- ✓ **Clean the area: 1 1/2 inches above the line**
  1 1/2 inches below the line
  from side to side (medial to lateral)
- ✓ **Encompass the entire anterior surface of the antecubital region.**



3. Using 70% Isopropyl Alcohol, clean the region as described above and leave the area WET. Using the palmar surface of your dominant hand index finger, **glide** slightly below the antecubital line first feeling for any rope-like structures (the veins). If you feel one, bounce on it. If it feels like a water balloon, it’s the vein.

If you can’t feel a vein by gliding (because the deep superficial vein is too deep in the tissue to feel with surface gliding), then start at one side or the other of the antecubital region and begin to depress, methodically and in small increments, as you move across the antecubital region. When you feel the water balloon bounce, you have located a vein. Remember – palpating dilates – improving your chances of locating a vein.

4. When you have located a vein, continue to palpate **it** - to dilate it.

5. Remember, not all veins are created equal! So, now we must grade the vein on those four criteria - **firmness, size, direction,** and **depth**.

6. Tune into your sense of touch (close your eyes if you need to), and feel the change in the vein - it should be dilating and filling, feeling fuller, bigger, and firmer.

Note: Obviously, there are other tissues in the arm that you can feel besides the vein, like muscle and tendon.

Muscle - feels like a firm mushroom. Imagine a huge portabella mushroom sitting on your kitchen counter top. Press on it. It feels firm and spongy - that's (relaxed) muscle.

Tendon - feels like a guitar string. Imagine the largest guitar string on a guitar, in your arm - that's a tendon.

Can you now imagine from the descriptions just given, the different palpation sensations that you will experience when palpating these tissues? Try it. Again, get an arm (not yours) and palpate a muscle and palpate a tendon.

That's how easy it is to locate a healthy vein in the antecubital region. As mentioned previously, 99.999...% of your vein accesses will occur in the left or right antecubital region for blood draws, blood donation, and IV push.

But, if you can't locate an antecubital vein, for whatever reason, then you will move down to the wrist.

Wrist Region

The wrist region is where you will access a vein for long term IVs (IV drip) or as a second choice in blood draws, blood donations, and IV push.

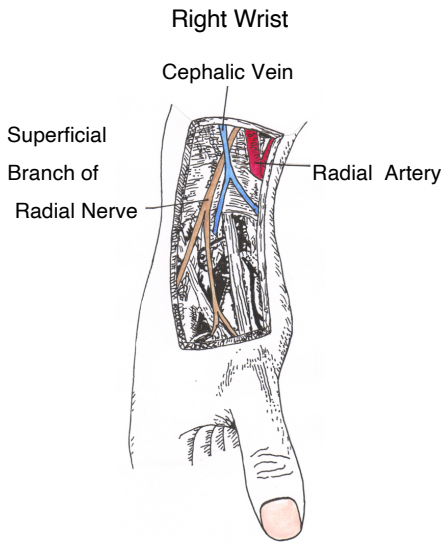
1. Place the arm on a table at a height that allows for a natural bend in the arm, but this time the hand must be in the handshake position. Because the patient's hand can get in the way of your "approach" to the vein, **move the patient's hand off the table and place it in alignment with the arm**. DO NOT OVER EXTEND the hand. This tightens the skin (causing a more painful stick) and flattens the vein, all of which can adversely affect the vein access procedure.

2. Using 70% Isopropyl Alcohol, clean the distal shaft of the wrist leaving the area WET. Using the palmar surface of your dominant hand index finger, glide over the area feeling for any rope-like structures (the veins). If you feel one, bounce on it. If it feels like a water balloon, it's a vein. Continue to palpate it and dilate it.

3. Grade the vein, especially for **firmness**. It is critical that you palpate and grade the vein for firmness **here** because the thickness of the wall changes very quickly in this segment of the vein – one inch can make a huge difference. Remember that the wall of the wrist vein gets thicker as you move proximally, closer towards the heart.

One last note for wrist vein accesses, after you have located a healthy vein -

- ✓ **Identify where you will stick**.
  AND
- ✓ **Clean a 2 inch circumference around the vein site.**



In fact, this is a good time to mention that when you go to palpate both extremities (both antecubitals and/or both wrists), moving from one side of the patient to the other, expect that the patient might become a little concerned. The patient may even be thinking, "Oh no, this person doesn't know what they are doing!" Reassure them - explain what you are doing (palpating, locating, and dilating) - so you get blood on the first stick. They will immediately be cooperative, giving you both extremities and encouraging you to **take your time**, because they only want stuck once, too.

Note: Some patients will even think that this method of locating a vein is neat, and might even want to feel their own "water balloon", already thinking about future blood draws, IVs, and blood donations and how they can help locate the vein for the person who doesn't know where their vein is at . . .

Hint: The antecubital and wrist veins are not the only veins that can be accessed. Any superficial vein that meets the **firmness**, **size**, **direction,** and **depth** criteria can be accessed. (Example: If your patient does not have arms, you must access veins somewhere else - i.e. ankles.)

So, **take your time**, and **palpate <u>both upper extremities</u>** before your selection. Remember, **palpating dilates** the veins. And, again, I emphasize **grade the vein** for **firmness, size, direction,** and **depth**.

This new technique and new use for palpation, and the method for grading the vein have <u>not</u> been previously described, and it makes a "neural world" of difference in the skill of locating a vein.

And **<u>THIS</u>** <u>information on vein anatomy and physiology</u> just described to you (to my knowledge) has not been described in your texts. (If such a book exists, let me know. They will be given proper credit.)

The art of palpation has been around forever, and the use of palpation in locating veins is mentioned in the literature and in the training programs, but it is not focused upon. The health care industry still heavily relies upon LOOKING for a vein. This sight technique does not work well. Right?

So, now you have all of the scientific facts that you need to palpate, locate, dilate, and grade the vein.

Regardless of what vein access procedure you are about to do, this is the method for locating a healthy vein specific to the site you are selecting for your vein access procedure.

You have been taught ALL of the sites to use (i.e. antecubital and wrist) and about the site to totally and unequivocally avoid (the hand) in a demonstration of vein wall thickness (or thinness) and its variations as you travel up and down that extremity.

- Blood Draws – should be done in the antecubital region as a first choice, and in the superior wrist region as a second and last choice.
- Blood Donation – always occurs in the antecubital region.
- IV Drips – can be placed anywhere between the superior wrist portion of the cephalic

vein all the way up to the inferior antecubital region – avoiding joint regions.

- IV Push – should be done in the antecubital region as a first choice, and in the superior wrist region as a second and last choice.

All of this palpating, dilating, and grading thus far has been done WITHOUT a tourniquet. This is all achievable WITHOUT a tourniquet. But, if you absolutely insist on using a tourniquet, we have provided a bonus section to this book to thoroughly and scientifically describe the proper use and placement of that tourniquet.

And, because everything in life is PERFECTLY imperfect, we have also included in this book 3 bonus sections on oddball information that will describe some of the challenges you will face in vein access with some of your patients. Fortunately, these challenges are few and far between.

Please read the summary to locating a healthy vein next, and then complete this read with the following bonus sections.

SUMMARY

Locating a Healthy Vein

****

1. PALPATE - **Palpate** for a vein, using your sense of touch.

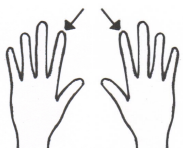
DO NOT **LOOK** for one,

because –

- You can't always see a vein.
- You can't judge a book by its cover.
- Not all veins are created equal (≠).

So, use your sense of touch to **"FEEL"** for a vein.

2. DOMINANT HAND INDEX FINGER TO PALPATE - Use your **dominant hand index finger** to palpate for a vein.



Use the palmar pad to **"feel".**

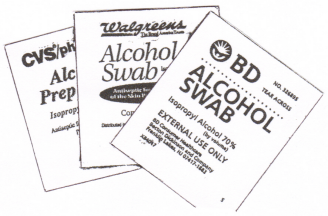
It's a brain thing! Neuroanatomy says that the connection between your brain and your dominant hand index finger is more specific and more sensitive (therefore more accurate) than your non-dominant. It is extremely important that the hand that "sticks" is the hand that palpates!

3. "FEEL" FOR A LONG, SKINNY WATER BALLOON - You are **"feeling" for a long, skinny water balloon**.

- "feel" the bounce
- "feel" the shape
- "feel" the size

Imagine palpating for water balloons in the arm! No other structure in the human body "feels" like a water balloon.

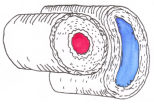
4. PALPATE WITH ALCOHOL - **Palpate with Alcohol.** Clean the area with 70% Isopropyl Alcohol and leave it **WET**.



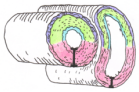
Palpating dry creates friction. Friction causes grab and drag as you move your skin across your patient's skin, and friction is the equivalent of "noise" to the brain. The brain cannot get a clear touch signal. **Alcohol** prevents friction, and now the brain gets a **clear touch signal**!

5. VEIN ANATOMY AND PHYSIOLOGY - **Vein Anatomy and Physiology** is everything in vein access.

- The **lumen** of the vein is very large compared to the lumen of the artery.



- The **vein wall** is very **thin** compared to the very thick artery wall. (The vein is "floppy" by nature).

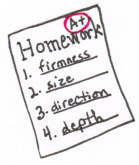


- <u>All</u> blood vessels walls are **innervated**. Nerve endings stimulate the muscle that is found in the walls of the blood vessels. These **nerve endings respond** to hot, cold, touch, and pain

by either **constricting** or **dilating** the blood vessel.
<u>Gentle Touch dilates the vein</u>.

6. GRADE THE VEIN - **Grade the vein** before you stick. Remember, not all veins are created equal? Some will tolerate a needle stick, some won't. What's different? The thickness of the vein wall.

Before you pick to stick, grade the vein for –



- **<u>FIRMNESS</u> (0-10) - Must be 5-10.**
- **<u>SIZE</u>** - The bigger the better (target).
- **<u>DIRECTION</u>** - Determine what direction the vein is running, and line up with your target.
- **<u>DEPTH</u>** – Correct angle of entry of the needle.

7. VEIN SITE SELECTION - Proper **vein site selection** for successful vein access.

<u>ANTECUBITAL</u> - in the right or left arm.

1st choice in blood draw
1st choice in IV push
- of meds/fluids
- of contrast

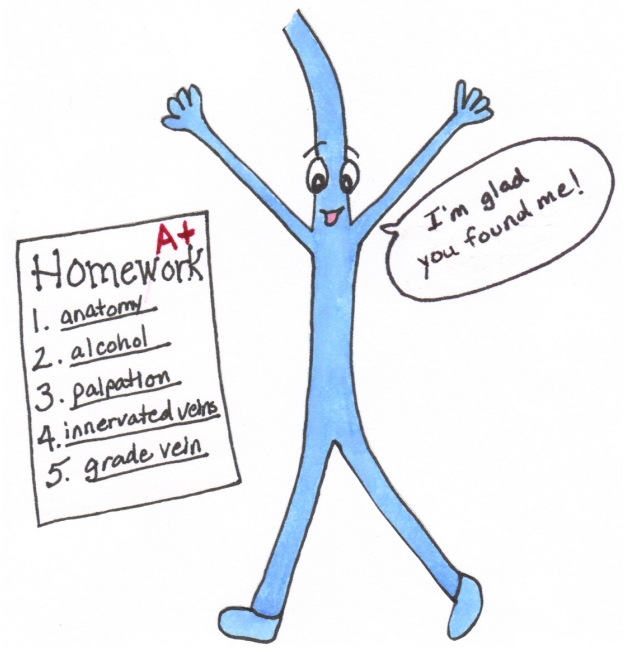
1st choice in blood donation

<u>WRIST</u> - in right or left wrist.

1st choice in long term IVs (IV drip)

2nd choice in blood draws
2nd choice in IV push

HAND - NEVER - The veins walls are too thin.



YOU NOW HAVE 5 NEW TOOLS FOR LOCATING A HEALTHY VEIN.

1. **Anatomy** - You know from the diagrams where to expect to "feel" the veins and the confidence of knowing that the veins do exist - *Gray's Anatomy* says so.

2. **Alcohol** - Alcohol removes friction, making is exceptionally easy to "feel" these veins by improving your sense of touch.

3. **Palpation** – You use your sense of touch, locating a healthy vein 100% of the time.

4. **Innervated Vein Walls** - The blood vessel walls have nerve endings that stimulate the muscle layers to relax, allowing the wall to stretch, dilate, and fill with blood.

5. **Grading the vein** - Pick the best vein for the procedure, one that will tolerate the stick and make it easy for you to be successful.

The Tourniquet

****

The Tourniquet Should Be **SNUG,** Not Tight!

I know, everyone puts that tourniquet on tight – **so . . . tight**, that the patient is uncomfortable (the same uncomfortable as when the BP cuff is pumped way up). There is a misguided perception that the tourniquet must be tight, so I am going to give you the scientific documentation for why the tourniquet should be **snug**, not tight, and tell you about the potential injuries that a "too tight tourniquet" can cause.

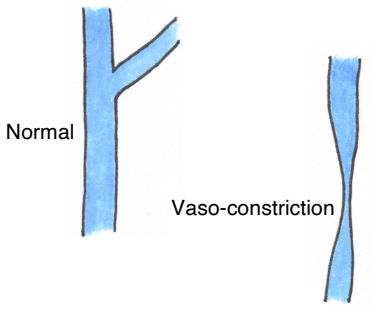
Think of the arm with a tourniquet around it.

Think of the vein
with a tourniquet around it!

As you read this section, recall the anatomy of the vein - **vein walls have nerve endings**. Also remember that the arm consists of skin, subcutaneous tissue, muscle, (Deep) veins, nerves, arteries, bones, and tendons. So, when you place a tourniquet around an arm, you are placing a tourniquet around all of these tissues, and these tissues can be affected by that tourniquet as well.

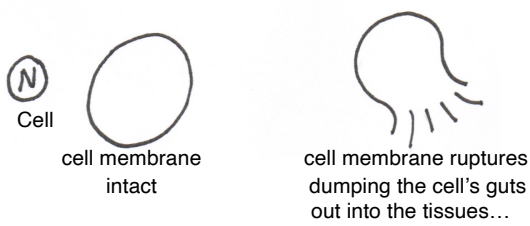
Here are **6 good reasons** why the tourniquet should be **SNUG**, not tight.

1. Pain does what to the vein? **Vasoconstricts it**. So, if the tourniquet is on so tight that it is causing pain, then the patient's neuro system (the brain) is going to respond to this. The vein wants to constrict. If it can, it will. If it can't, because the vein is already engorged with blood, the brain will remain in conflict.



   This is not what we wanted! Don't cause pain! **Snug**, not tight!

2. Pain is an indicator of tissue injury. Injured tissues release their cellular content which can end up immediately in the blood stream.



Note: In phlebotomy, these chemicals can potentially affect some of the very levels we are about to test the blood for. That's why some programs teach the phlebotomist to release the tourniquet as soon as they see blood in the first tube drawn, because their tourniquet is on **so tight** that is causing tissue injury. (Tissues: skin, subcutaneous, muscle, tendon, nerve, artery, vein, lymphatics, etc.)

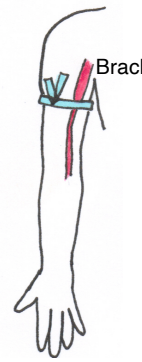
Another tissue injury never mentioned is a Volkmann's contracture which is a tendon injury caused by a tourniquet that is applied too tight. We'll talk more about this injury at the end of this section under proper placement of the tourniquet on the arm.

A snug tourniquet will not cause injury. **Snug**, not tight!

3. We need arterial blood to make venous blood. Right?

The pressure of the blood in the artery (or the "BP") is 120/80 mm Hg, on the average.

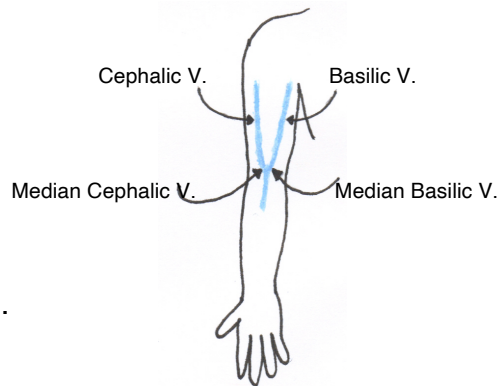
Think! If your tourniquet is on **as tight as** a BP cuff, or tighter then you have stopped the flow of arterial blood to the lower part of the arm. Right?
That's not a good thing.



At the level of the tourniquet, the pressure of the blood (BP) in this artery is 120/80 mm Hg. (Think of a BP cuff and a BP reading at this same level.)

We need arterial blood to make venous blood. **Snug**, not tight!

4. What's the pressure of the blood in the vein at the same point of tourniquet placement on the arm? The venous blood pressure is approximately 10-20 mm Hg! (See Guyton's Physiology)



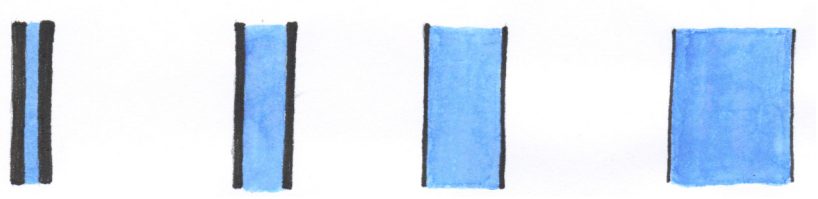
Remember, we are dealing with **Superficial Veins**. (Not DEEP Veins).

Think! What would a BP cuff **feel** like if it were pumped up to only 10-20 mm Hg? **SNUG!**

If you apply more external pressure to the vein than 10-20 mm Hg, you can cause the following problems for the vein.

a) Applying pressure greater than 10-20 mm Hg will actually **stop** the flow (or the return) of venous blood at the point of the tourniquet, and the vein distal to that point of pressure will continue to fill and dilate . . .

The vein gets bigger, and bigger, and bigger . . . **over distended**!



normal wall thinner wall thinner yet extremely thin wall

What's in the wall of all blood vessels?

Nerve endings!!!

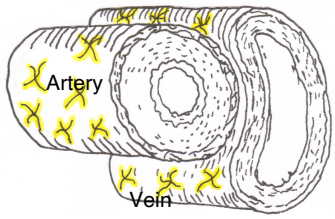
What does a *stretched* nerve ending feel like?

Painful !!!

And what does pain do to the vein?

The vein wants to **constrict**.

But you have it over dilated – imagine the "**conflict**" . . .



And, how cruel would it be to stick a needle into an already screaming nerve ending?

Snug, not tight!

b) Every structure in life, natural or man-made, has limits, including the vein wall. This means that there is a limit to how much you can stretch the vein wall before you injure it or alter it – temporarily or permanently.

This over distended blood vessel now has extremely thin walls. What would happen to the wall of an over distended water balloon if you stuck it with a needle? Rupture!!!

The same thing can happen to the vein . . .
Now you need your gloves because you probably have a bloody mess . . .
Or now you have a huge hematoma and an unhappy patient, and
If you can't get blood from this site, you're not happy either . . .

Or, when the wall reaches a state of super thinning (right before it ruptures), the vein wall can get so thin it starts leaking serum (the liquid part of blood) into the tissues of the arm. This **leakage** is called an **extravasate** in the science world, an **infiltrate** in the IV world, and **edema** in the med/surg world. (This is described in more detail later on pg. 49.)

Normally, the lymphatic system picks up this fluid and puts it back into the vascular system. Normally! But it still is not a healthy thing to do to the vein wall.

Or, you can cause a permanent loss of elasticity of the vein wall by over distending it. Can you recall what the walls of the balloon look like after you have removed the air from the balloon? All stretched out! The same happens to the vein. This over distention of the vein wall can cause a permanent loss of elasticity of the vein wall. This loss of elasticity is called a varicosity. The vein is varicosed, or it is more commonly known as a "varicose vein". Varicose veins can occur anywhere in the body not just in legs.

Grade that vein on your firmness scale from 0-10, and you will now have a "0-2".

Thank goodness you have only injured a segment of vein, not the entire length of the vein. But, injuring even a segment is not necessary or desirable.

Do not over distend the vein with a tight tourniquet. **Snug**, not tight!

5. There are two vein systems in the body – Superficial veins and Deep Veins. What type of veins are we accessing?

Superficial Veins.

We are locating, dilating, and accessing **Superficial** veins. So, when you think of applying the tourniquet, think of applying that tourniquet superficially, on the surface . . .

Superficial
Surface
Snug, not tight!

6. **Specifically to phlebotomy**, how does blood get into the tube? What's unique about the tube?

   Tubes are vacuumed! That's right. Tubes suck blood. You don't have to build up the blood pressure in the vein to force blood into the tube.

   Apply the tourniquet **snug**, not tight!

SUMMARY

A tourniquet **helps** dilate the vein. You know from "Locating a Healthy Vein" that palpating a vein naturally dilates it. A tourniquet artificially dilates it. There is a huge difference. A tourniquet can be more harmful than helpful if it is on too tight. A tourniquet works best when it is **SNUG**, not tight.

Use a Tourniquet as a Tourniquet!

Having said all of that . . . one more thing you need to know and do –

Always use a scientifically designed tourniquet as a tourniquet.
Do NOT use a cut piece of surgical tubing.

Surgical tubing is thinner in consistency than the tourniquet and because it is a tube, it rolls on itself, making a very thin "rubber band" type structure around the arm. AND, because it has a thinner consistency than a true tourniquet, you have to stretch it "more" to make it effective . . . and a tightly stretched rubber band around the arm is painful. And, you know what pain does to the vein, the tissue, and the patient. Not Good!

If the guy who made surgical tubing meant for you to use it as a tourniquet, the box would have read "Surgical Tubing/Tourniquet – Cut a Piece"! It doesn't.

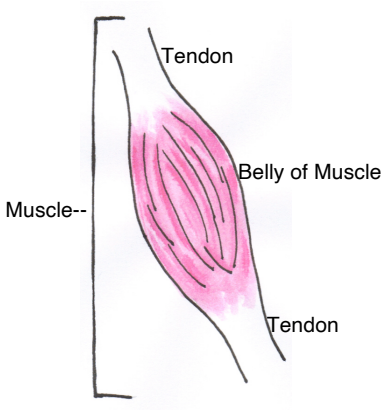
Use a tourniquet as a tourniquet!

Proper Placement of the Tourniquet on the Arm

Next question. Where should the tourniquet be placed on the arm? It should be placed halfway between the shoulder and the antecubital line, at the belly of the biceps muscle. Not all humans are the same size, so halfway will properly place the tourniquet or BP cuff every time.

Why does it specifically need to be over the belly of the muscle? Let's look at the anatomy of the biceps and triceps muscle to understand this reasoning.

A muscle has an origin, a belly, and an insertion (a beginning, middle, and end). The origin and insertion are made up of tendons. Larger tendons are innervated with nerve endings! (Think of your patellar tendon {knee} – when the doctor whacks it for a reflex!)



So, placing the tourniquet too high, or too low, on this muscle will place the tourniquet right over the tendinous area – which is not comfortable and can actually be harmful.

Note: There is an actual injury that can be caused by applying a tourniquet too tight over a tendon – a "Volkmann's Contracture".

However, the belly of the biceps is all muscle – very soft, supple, and pliable, and when the tourniquet is placed here it is **comfortable** and **safe**.

So you can't place the tourniquet 3-4 inches above the antecubital line on every patient because this will not be at the belly of the biceps on every patient.

All of the above information also applies to the placement of the blood pressure cuff in blood donation.
Instructions for proper placement of tourniquet: Look objectively at your patient's arm and place the tourniquet halfway between the shoulder and the antecubital line (at the belly of the biceps muscle) **AND** remember . . . **SNUG, not tight**.

Do we really **need** a tourniquet to access a vein? NO!

In blood draw, we located and dilated the vein by palpation, and the tube is vacuumed - it sucks blood out of the vein and into the tube all by itself. Neither activity requires the

use of the tourniquet to accomplish them. But, show up with a tourniquet. It's what the patient expects to see, and it can help. But apply it **snug**, not tight!

In IVs, especially a hemodynamically stable person does NOT need a tourniquet applied. But, again, show up with one because it is what the patient expects, and if it is properly applied, it can help.

When You Cannot Use a Tourniquet

When **can't** you use a tourniquet? When there has been axillary lymph node removal.

Patients who have had a mastectomy, or other surgery, with axillary lymph node removal have been instructed to "never allow anyone to touch that arm!". No blood pressures, no IVs, and no blood draws! And this is not a totally accurate instruction.

A more correct and accurate instruction is that no one should apply a **blood pressure cuff** or a **tourniquet** to the arm where the axillary lymph nodes have been removed. Why? Because the patient doesn't have a **working lymphatic system** now.

The lymphatic system **fights infection** and **removes excess extravascular fluids**.

For example, if the patient without axillary lymph nodes gets a bee sting in that arm and the area swells, that arm cannot get rid of the swelling (extravascular fluid). The lymphatic system would normally "suck the fluid up" and put it back into the vascular system. But this arm doesn't have a working lymphatic system.

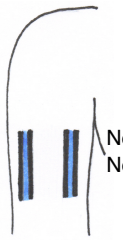
There are no lymph nodes in that arm to **fight infection** or to remove **extra**vascular fluid (swelling).

Well, what does all of this have to do with a tourniquet and vein access?

Let's describe in detail what can happen to an arm, a vein, and its vascular fluids when a "too tight tourniquet" or a BP cuff is applied, whether the arm has its lymph nodes or not.

Note: Blood is made up of **serum** (the liquid part of blood - clear yellow) and **cells** (the solid part of blood - red). Cells can't leak through the wall, they're too big, but serum can.

1. These are normal veins in an arm.
Notice how thick the walls of the veins are.

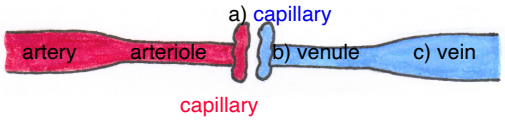


2. Someone comes along and applies a "too tight tourniquet" or a BP cuff. These two things cause an **<u>artificial dilatation</u>** of the vein *(vs. the natural dilatation of palpation)*. This results in an over distention of the vessel with blood and an extreme thinning of the blood vessel wall - think of the overfilled water balloon - the walls thin!

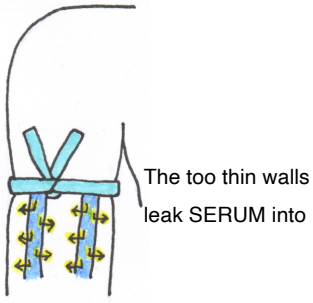
too tight
tourniquet = BP cuff
↓
"tourniquet effect"
↓
resulting in an
"artificial dilatation"
of the vein

This thinning occurs at three levels:

a) the venous part of the capillary bed,
b) the venule, and
c) the vein



3. This thinning results in the leaking of serum (the liquid part of blood) across the vessel wall and into the tissue of the arm - this is called **extravascular fluid**, or an **extravasate**, or an **infiltrate**, or **edema.** The person without lymph nodes can't get rid of this interstitial fluid. They have



This leakage
is called an:
*extravasate
*infiltrate
*edema
= swelling

to take their swollen arm to a physical therapist or a massage therapist who then milks the fluid through the tissue of the arm, up and into the chest area where there are lymph nodes that can pick up that fluid and place it back into the vascular system.

tissue

No lymph nodes means no way to get rid of "swelling".

So, when providing care to the patient without axillary lymph nodes:

- You CANNOT place a BP cuff on that arm because it will cause vein and tissue injury as described above.
- So, you CANNOT take a BP reading.
- You CANNOT place a tourniquet on that arm because this will also cause the type of vein and tissue injury described above.

But, you CAN draw blood and do IV pushes and drips. They still have veins and arteries, they just don't have lymph nodes.

Avoid the blood donation due to all the "milking of the hand!

Here are the rules:

1. Definitely do not touch their site with a **NOT-sterile** glove.
   They cannot fight infection.

2. And **DO NOT** use a tourniquet.

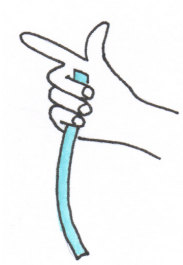
3. Palpate WET for a vein using 70% Isopropyl Alcohol.
   Continue to palpate the vein to dilate it.
   Clean your site with alcohol or the approved cleansing agent of your facility.
   Insert the needle into the vein.
   Do your specific procedure (draw blood, infuse fluid or biologicals).
   Apply the proper amount of pressure for the proper amount of time.
   Dress the site after the vein access.

Step by Step Instructions for **Applying a Tourniquet**

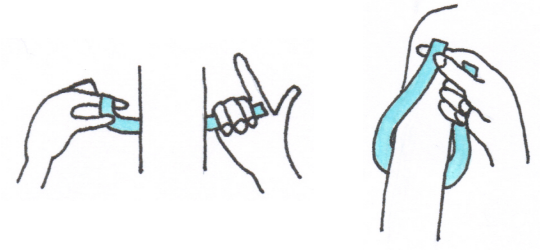
If applying the tourniquet goes well, the patient doesn't give it a thought. But if it doesn't go well because the tourniquet comes loose, or you have to apply it 2 or 3 times, or you

pinch them, or it's too tight and hurts..... then the patient starts to WORRY! So, do it right.

1. Make a gun with your dominant hand and place the tourniquet in the three fingers. While securely holding the tourniquet with the three fingers, practice pinching the gun fingers together.

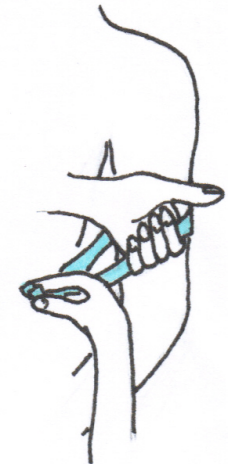


2. Drop the tourniquet under the arm, and with the support hand pull it up, and grab the other end, at the tip, with the gun fingers.



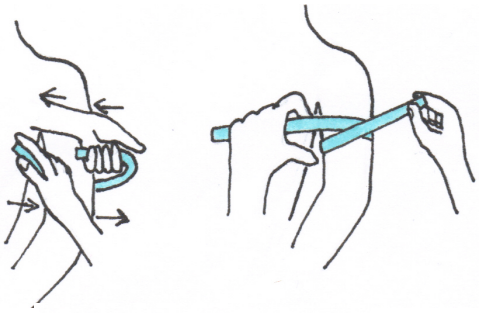
3. Gently pull the tourniquet out and towards you.

4. With the support hand (non-dominant hand) reach out in front of the tourniquet (vs. behind) and grab the piece that is in the last 3 fingers of the dominant hand. Make sure that only the four fingers of your support hand are wrapped around that piece (with the thumb free and pointing to the floor).

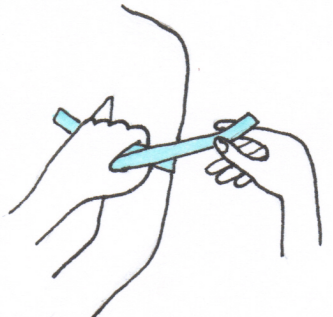


5. Now, turn loose (let go) of the piece of tourniquet that is in the last three fingers of your dominant hand.

6. At this point, both hands are holding only one piece of tourniquet, and your arms are crossed (so to speak). Uncross your arms or take these two pieces <u>past</u> each other, completely.

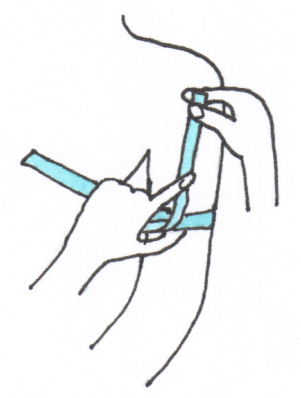


7. Take the support hand thumb and flip it back and under the two pieces of tourniquet where they cross



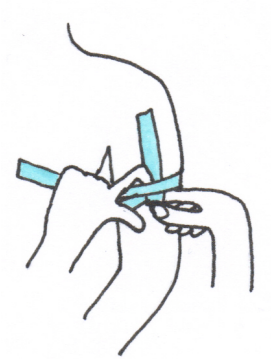
each other, and rest the support thumb on the patient's arm and leave it there.

8. Take the piece of tourniquet that is in the dominant hand and move it forward towards the patient's shoulder and stay put.

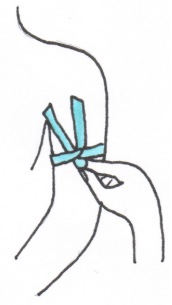


9. Next, wiggle the support hand index finger free and place it on the outstretched piece of tourniquet being held by the dominant hand.

10. Make the support hand index finger pin the outstretched tourniquet to the support thumb and, in one continuous movement, barely tuck the tourniquet under with the support index finger and stay put.



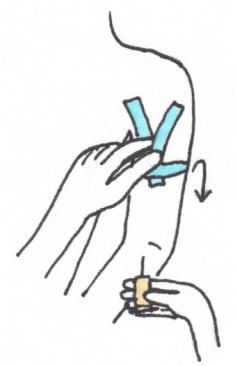
11. The dominant hand can turn loose of the piece of tourniquet that was stretched towards the patient's shoulder and can now hold the tuck, pinching the support index finger and the tourniquet that is stretched over it and stay put.



12. While the dominant hand holds or pinches the tuck, you can remove your support hand index finger, and allow the tourniquet to sit down on itself.

How to release this tourniquet, at the end of the blood draw, or at the beginning of the infusing of the fluids or biologicals -

KEEPING YOUR EYES ON THE NEEDLE (because your dominant hand still has a needle in the patient's arm) -



Reach up with the support hand and with the index finger and thumb, and getting as close to the tuck as you can get (or at the very least the bottom piece), pinch the two strands of tucked tourniquet, and gently roll the tourniquet towards the needle until the tourniquet releases. Then immediately let the tourniquet go.

DON'T TRY TO PUT THE TOURNIQUET "AWAY".
The tourniquet is not important. The needle in the patient's arm is important!

Grabbing the end piece of the tourniquet piece, and yanking on it to release it, creates a LOT of MOVEMENT - you move, the patient's arm moves, and THERE'S STILL A NEEDLE IN THAT ARM!!!!!

The **gentle release** of the tourniquet will insure that there is no movement of the patient's arm and no movement of the needle that remains in their arm.

Like the rest of the entire vein access process.... **ALWAYS BE GENTLE!**

Practice applying the tourniquet as instructed, and remember - **SNUG**, not tight.

PALPATING PROBLEMS

****

As you continue to practice, you are getting an opportunity to do a lot of palpation. And, you probably have come to discover that locating a vein can occur quickly, which is usually the case, or it can take a while. The reality is that you will spend whatever amount of time it takes to locate that vein . . . because you can't stick if you don't know where to stick.

But sometimes, the palpation process can be a challenge. So, let's describe a few things here that might be helpful to you with your "real" vein access experiences. I call these challenges "palpating problems".

If you are ever in a situation where you have palpated the appropriate regions on both the right and the left and still can't "feel" a vein, here are a few things to consider:

1. FEAR - Not your fear, but the patient's fear - fear of the needle stick. Remember the Fright and Flight Syndrome. Fear causes vasoconstriction, just like pain and just like cold. If a patient's fear is big enough, it may be able to cause vasoconstriction. Vasoconstricted veins cannot be palpated because there is no blood there (it's all in vital organs - remember?).

You now know from the Fright and Flight story that whenever nature vasoconstricts, it always vasodilates, later. But, if you would like to speed that process up a bit, give the patient something else to think about besides the venipuncture. Ask them to think of their children or grandchildren, or their favorite vacation spot, or where they're headed after the procedure . . . anything that will take their mind off of the stick. This should result in the relaxing of their face muscles and the color returning to their face . . . and now you should be able to "feel" blood in their veins.

2. HYPOVOLEMIA - (low volume). **In blood draws**, someone told your patient to fast for their test. They told your patient, "nothing to eat or drink for 12 hours, including no water!" Boy, was that the wrong instruction. True - your patient cannot have anything with calories to eat or drink, **but your patient can have water.** In fact, your patient should have water.

<u>In IVs</u>, perhaps your patient has been vomiting for 2 days, diarrhea for 3 days, and has had a fever, and can't drink because of the vomiting – your patient may be very low on fluids and maybe even dehydrated.

Here's the explanation: The body has 5 quarts of blood. (Imagine a quart of oil.)

Now imagine 5 quarts of blood:  946 ml = 1 qt.

That's not a lot of blood, but that's all we need, and it's enough to "feel". But here's what happens when the patient is fasting and <u>doesn't have water</u> for 12 hours.

To maintain the 5 quarts of blood, we must drink approximately...

2500 ml(s) of fluid per day
(that's 5 little water bottles)  500 ml = 1 bottle

So, the patient who has been fasting and has not had their water (the night before the test, during the night, and the morning before their test) is missing at least 1 bottle of water (500 ml), and, if they are normally good water drinkers, they may be missing as much as 2 bottles of water - that's a lot a fluid compared to the five quarts we previously described. We won't call them dehydrated, but we will call them HYPOVOLEMIC, low volume. Now we <u>can't</u> "feel" the fluid (blood) in their vein.

The same applies to the sick patient. The patient who is hypovolemic or dehydrated due to vomiting, diarrhea, fever, or a combination of these will have the same "volume" problem.

So, how do you fix this problem?

a) Give them water. How much? One of those little 500 cc water bottles would be just right. Have them drink it all.

If the sick patient can't drink or keep anything down, or is NPO due to doctor's orders – you may have to apply that tourniquet a little tighter than snug – but this is **the only time** you will apply a tourniquet tighter than snug and **release it as soon as you are in the vein**.

b) And then wait for 15 minutes – not less than and not more than 15 minutes. Why? It takes the gut about 15 minutes to absorb the water, placing that water in the blood stream where you can now "feel" it.

If you wait longer than 15 minutes, the blood will filter through the kidneys, and the water will be extracted and put in their bladder - it won't do you any

good there . . . unless you want a urine specimen from them.

3. NICOTINE - Where do you find nicotine? In cigarettes! And what does your patient have to have right before you stick them? A cigarette! (Their "last" cigarette, like you're going to kill them!) And what does nicotine do to a blood vessel? It vasoconstricts it - just like pain, just like cold, and just like fear. It takes about 30 minutes for the affects of nicotine to wear off. So, confiscate their cigarettes, and then wait about 30 minutes for the nicotine to wear off.

Here's the good news: You will **rarely** not be able to "feel" a vein - **rarely**. But if you can't "feel" a vein, assess the three things we just discussed – fear, hypovolemia, and nicotine - and make those corrections. This should fix your palpating problem.

If you still can't "feel" a vein, you have to consider that your "feeler" isn't working right that day. Maybe you slightly burned your finger the night before while cooking. or maybe it is swollen from too much hammering (microtrauma). In any case, if you can't "feel" a vein, I advise that you do not attempt the stick, and get someone else to perform the venipuncture. Always set yourself, and your patient, up for success.

Neurovascular Anomalies

****

I'll never forget the first time I experienced a vein shrinking beneath my finger. That's right. I was gently palpating the vein. It got big like it was suppose to, and then as I decided this was "the one" that I wanted to stick, I felt that once huge healthy vein shrink to nothing. Can't stick that! Vasoconstriction had just occurred. But why? I wasn't doing anything to it to precipitate the constriction like smacking it or causing pain with a "too tight tourniquet". How on earth does that happen? Can this happen?

The explanation: Neurovascular Anomaly.

It turns out that there are human beings out there with a neurovascular system that does not respond to stimuli the way that they should. These human beings have an ultrasensitive neural system, and that makes their vein walls ultrasensitive to stimuli.

Neurovascular anomalies do exist. Here are two perfect examples of neurovascular anomalies -

Raynaud's Phenomenon – a vasoconstrictive arterial disorder that effects the fingers and toes and sometimes the ears and nose.

In Raynaud's, there is "intermittent ischemia, usually of fingers and toes but can also involve the ears and nose . . . brought on by cold and emotional stimuli . . ." as quoted from Dorland's Medical Dictionary, page 1420.

Raynaud patients are actually quite easy to spot. As you prepare their extremity for venipuncture you will (or should) notice the "blue" of the finger tips, or the extreme bright red of their digits.

Prinzmetal's Angina – a vasoconstrictive arterial disorder that affects the coronary arteries – coronary vasospasm.

Dr. Prinzmetal described this type of coronary event. The coronary artery ***spasms*** and this cuts off the flow of blood, and oxygen, to the myocardial tissue and initially causes "chest pain" – hence the name Prinzmetal Angina. And, if the spasms last long enough an infarct (cellular death) occurs.

You know from your anatomy lesson in the first part of this book that veins are also innervated and that they respond to stimuli just like the arteries. But, to my knowledge, no one has yet described this anomaly with respect to the veins during a vein access procedure. So, we'll describe it now.
The patients that I have observed in vein access who have this neurovascular anomaly are **HYPER** sensitive to hot, cold, touch, and pain.

These patients **hyper**-react to these stimuli by **hyperconstricting** or **hyperdilating**. They overreact!

Their condition is not as obvious like Raynaud's is. The only clue you might get is from the patient, who, before you even start the vein access routine, resignedly says to you –

" Let's get this over with - they usually have to stick me at least 6 times . . ."

That should set off all kinds of bells and whistles that this might be one of those patients.

Do your usual vein access routine of applying the tourniquet, palpating, locating, dilating, and grading the vein, and **PAY ATTENTION**.

- If it is a visible vein, watch to see if the blue disappears before the stick.
- Pay attention as you palpate to FEEL if the vein reduces in size after it initially dilated.
- Ask some tell tale questions: Do your feet swell with tight shoes? Do your lips swell with iced drinks? Do your ears turn bright red and get hot, while your feet and fingers are ice cold? Are you the type of person who doesn't like a back rub or foot massage?

If you do determine that they are indeed a patient who might have this hyper-reactivity to touch, here's how you handle that patient.

These patients are so sensitive that putting on a SNUG tourniquet is even too much for their ultrasensitive little nerve endings. Really! And sometimes, even palpation, as gentle as it is, is too much for them as well. So, if you are able to locate the vein,

landmark it, because now you want to release that tourniquet and leave the patient and their vein, sit. They must go through vasoconstriction and <u>then</u> vasodilatation.

Yes, that vein will dilate - it will **SUPER DILATE**. That's the time to stick it – **<u>without</u> a tourniquet!** We don't really need that tourniquet anyway.

In fact, after you have landmarked the vein, released the tourniquet, allowed the vein and the patient to sit and relax (recover), and allowed the vein to dilate, you will then quietly and quickly approach that vein site - <u>NO</u> tourniquet and <u>do NOT</u> re-palpate - **gently** swipe clean only the site you intend to stick (because the entire site should still be sterile from your previous prep) and insert the needle . . . you be able to access the vein with very little or no problem. The vein could still vasoconstrict in response to the pinch of the stick, but my experience has almost always been good.

The patient is shocked. Success on the first stick?!?!?! "That never happens!" They are just thrilled. Explain to them the "what" and the "why" so that they can tell the next vein access technician (who doesn't know this story) how to handle them.

This neurovascular anomaly or abnormality that I just described comes in varying degrees. Some patients have a very mild form of it, and some have a very extreme form of it, and consequently, the reactions (or hyperreactions - if you will) vary accordingly.

If, from the start, a patient identifies themselves as "one of those", ideally, you don't want to put a tourniquet on them at all (not even initially). Remember, you can locate and dilate that vein without a tourniquet. Do it very gently!

In that we don't really need that tourniquet for venipuncture anyway, and the tourniquet itself can make one feel "claustrophobic" (fear), and a "too tight tourniquet" (pain) can cause so many problems . . . maybe we should rethink the tourniquet all together.

What, exactly, is this abnormality or anomaly that I just described? I'm not sure. Unfortunately, it's the one thing that I have not been able to document with medical or scientific literature, and I have searched. To my knowledge, no one has addressed this scientific observation in vein access yet.

I know that what I have observed and then described to you is accurate. So there's a little mystery for you.

<u>Dorland's Medical Dictionary definitions pertinent to this story.</u>

<u>neurovascular</u> (Dorland's pg 1260)

neu,ro.vas.cu.lar (noor"o-vas'ku-l r) pertaining to both the nervous and vascular elements; pertaining to the nerves that control the caliber of blood.

<u>vasoneuropathy</u> (Dorland's pg. 2010)

vaso.neu,rop.a.thy (vas'o-, va"zo-noo-rop' -the) a combined vascular and neurologic defect, the lesions being caused by simultaneous action of both the vascular and the nervous systems, or by the interaction of the two systems. See also angiopathic neuropathy and angioneuropathy (def.2).

Raynaud's phenomenon (Dorland's pg. 1420)

Raynaud's p. intermittent bilateral ischemia of the fingers, toes, and sometimes ears and nose, with severe pallor and often paresthesias and pain, usually brought on by cold or emotional stimuli and relieved by heat, it is usually due to an underlying disease or anatomical abnormality. When it is idiopathic or primary it is called Raynaud's disease.

It's a Brain Thing

****

Here's the story. Your brain is in charge. Most people can easily agree with that statement. But here's what you probably don't know - the brain can only do one thing at a time. It's true. Neuroanatomy and neurophysiology say so.

Here's an example. You think you can do 2 things at once. Huh! Put your right hand on a typewriter and your left hand on a calculator. Now take a letter while you add up a column of numbers. You can't! You can alternate, but you can't do the calculator and the typewriter at the same time. Sorry!

You're already thinking of another argument, aren't you? You're thinking, I can walk and talk at the same time. Really?! First off, how many years did it take you to coordinate that function? And secondly, how well do you really do both at the same time? Think about it. You'll realize that what we are really doing is **coordinating** the two functions, like the left hand learns to coordinate with the right hand to play the piano. But it definitely is a **coordination,** and one that requires lots of practice. **It's a brain thing.** To do anything really well, you can only do one thing at a time.

Think about it. You are walking along having a serious conversation with a friend, and the conversation gets really juicy . . . how many times have you stopped walking, instantly, to get the juicy details? . . . and then started walking again. In order not to miss anything, you stopped walking - to listen.

Unfortunately, our society has developed and tried to evolve to a new concept called multi-tasking. We not only think we can do more than one thing at a time, we expect it, of ourselves and of others. But, when you multi-task, something is getting cheated.

You've read "it's a brain thing" many times throughout this book. That's because venipuncture is an invasive procedure with the potential for serious complications if we

don't do it correctly. So, if ever there was a time to put your undivided attention to something, it's with an invasive procedure. You cannot keep your eye on the needle AND look up to have a conversation with a co-worker who just came in the room.

You can apply this "it's a brain thing" to any field, to any walk of life, to any activity, and at any given time. I didn't make this rule, but what a wonderful rule. Just think how skilled we could be at everything if we just gave it our undivided attention. And just think how much more you will enjoy each and everything that you do, when you give it your undivided attention. And, one more wonderful benefit to this wonderful rule of "one thing at a time" - **no more multi-tasking**. Boy, that takes the pressure off of a few things – especially vein access. (By the way, this is why you can't drive **and** use a cell phone at the same time.)

Enjoy!
It's a brain thing!
One wonderful thing, exclusively, at a time!

Glossary

****

adventitia – the outermost covering of a structure or organ

anatomy – the structure of an organism; the branch of science dealing with the structure of organisms; dissection or cutting apart

antecubital – in front of the elbow, at the bend of the elbow

artery – a vessel carrying oxygenated blood from the heart to the tissues

bevel - sloping at an angle; slant

bifurcate – the separation into two branches

bisecting – division into two parts by cutting

blood pressure – the pressure exerted by the blood on the wall of any vessel

cadaver – a body used for dissection

dilatation – expansion of an organ or vessel

dissection – the cutting of parts for the purpose of separation and studying

distal – farthest from the center, or from the trunk

distend – to stretch out, to become inflated

dominant –prevailing; superior; exercising control

dorsum – the back or posterior surface of a part

dynamic – active, in motion

edema – condition in which body tissue contains an excess amount of tissue fluid; swelling

extravasate – fluids escaping from a vessel into the tissues

extravascular – outside a vessel

friction – the resistance an object encounters when moving over another object

gauge – a standard of measurement, ie. the thickness or diameter of a needle

hematoma – a swelling or mass of blood confined to an organ, tissue, or space, caused by a break in a blood vessel

hemorrhage – abnormal internal or external bleeding

hypovolemia – decreased or low blood volume

infection – the invasion of a pathogenic agent into the body or a part of it

inferior – beneath or lower

inferior vena cava – the principal vein with drains the lower part of the body

infiltrate – to pass into a substance or space

infusion – a liquid introduced into the body through a vein for therapeutic reasons

innervated – stimulated by nerves

intima – the innermost coating of a structure or blood vessel

intravenous (IV) – within or into a vein

ischemia – a reduction of the supply of blood to a part of the body

lumen – the space within an artery, vein, intestine, or tube

lymphatic system – the system including all structures that are involved in moving lymph from tissue into the bloodstream

media – the middle coating of a structure or blood vessel

median – middle or central

microorganism – very small living body not seen by the naked eye

microscopic – visible only by using a microscope

neuroanatomy – the study of the anatomy of the nervous system

neurophysiology – the study of the function of the nervous system

palmar – concerning the palm area of the hand from the wrist to the finger tips

palpate – to examine by touch, to feel

pathogens – a microorganism or substance that can produce a disease

phlebotomy – a surgical opening of a vein to withdraw blood

physics – the science dealing with the properties and interactions of matter and energy

physiology – the study of the function of living organisms and the chemical and physical processes involved

pronation – the act of turning the hand so the palm faces downward; lying face down

proximal – nearest the point of attachment or center of the body

static – at rest, not in motion

subcutaneous – beneath the skin

superficial – limited to the surface

superior – situated above something else, higher than

supination – turning of the palm (or foot) inward; lying on the back

thrombus – a blood clot obstructing a blood vessel

vacuum – a space or vessel in which the air has been removed by a pump

varicose – distended, swollen, knotted veins

vasoconstriction – the narrowing of the blood vessels

vasodilatation – the relaxation of the blood vessels

vein – a vessel carrying unaerated blood to the heart

venipuncture – the puncture of a vessel for any purpose

Volkmann's Contracture – the degeneration, contracture, fibrosis, and atrophy of a muscle due to an injury to its blood supply, usually seen in the hand

List of current and future books (b) or articles (a)

Vein Access for RNs (b)
Vein Access for the IV Certified LPN (b)
Vein Access for X-ray Techs (b)
Vein Access for Phlebotomists (b)
Vein Access for the Blood Donation Techs (b)

Locating a Healthy Vein (b)

Palpate to Locate, Dilate, and Grade A Vein (a)

Grade A Vein (a)

The Anatomy and Physiology of the Vein (b)

Neurovascular Anomalies (a)

Venous Blood Return (a)

Veins Don't Roll (a)

The Bruise (a)

It's a Brain Thing (a)

The Vein Access Tools – for blood specimen collection (b)

The Heel Stick (a)

The Finger Stick (a)

The Vein Block (a)

The Ergonomically Correct Blood Draw Station (b)

The Ergonomically Correct Position for Vein Access (a)

How Did That Infiltrate Occur – for Nurses (b)

Venous Blood Return and The Infiltrate (a)

Venous Blood Return and The Prevention of Edema (a)

IV administration of Meds: IV Push vs. IV Drip (a)

Opportunities for the Vein Access Tech -

- Physician Groups - for their “in house” draw station

- Laboratories - referring to reference labs
    1) on site, where the lab tests are done.
    2) their free standing blood draw stations
    3) contracted nursing home draws
    4) contracted hospital positions (they sometimes staff hospital labs)

- Hospitals

- Blood Donation Organizations: American Red Cross, Community Blood Centers, plasmaphoresis units, etc.

- Veterinarian clinics - critters need blood draws and IVs, too

- Staffing agencies

- Occupational Medicine Clinics

- Kidney Dialysis units

- Weight Loss Organizations (LA Weight Loss)

- Prison Systems

- Insurance Examination Industry for insurance exams

- Drug Research Organizations (Gateway Medical Research, The Cunningham Group), etc.

References

College Physics, Franklin Miller, Jr.,
Third Edition

Dorland's Illustrated Medical Dictionary (30th)

Gray's Anatomy, Henry Gray, F.R.S.,
1901 Edition

Review of Gross Anatomy, Ben Pansky, Ph.D., M.D.,
6th Edition

The Textbook of Medical Physiology, Arthur C. Guyton, M.D., and John E. Hall, Ph. D.,
10th Edition

Thank you Dr. Pansky for giving me permission to use your diagrams in this little book. (Permission granted by phone on 3/20/07.)

Thank you Becton, Dickinson and Company for granting me permission to use printed images of the alcohol wipe. (Permission granted by e-mail 06/06 and receipt of poster cards 12/06.)

Did you know . . .

...that you can't always see a vein ...that not all veins are created equal
...that you can't judge a book (or a vein) by its cover

Did you know . . .

1. The vein wall is innervated, and

- ✓ that these nerve endings, just like those in your skin, can feel hot/cold/touch/and pain.
- ✓ that these nerve endings respond to these stimuli in a predictable manner –
  hot – dilates cold – constricts
  (gentle) touch – dilates pain – constricts
- ✓ that when you use (gentle) touch on a vein, that specific segment of vessel wall relaxes and allows the wall to stretch, filling with more blood (dilating), resulting in a bigger, more palpable vein.

2. If you use your <u>sense of touch</u> to locate a vein (instead of LOOKing for one), you will be able to locate a vein EVERY time (100%), and

- ✓ that your sense of touch has a sensitivity and specificity of 99.999…% in your dominant hand index finger (the pad of the finger, not the tip).
- ✓ that if you palpate (feel) for that vein with alcohol, you can enhance your sense of touch.
- ✓ that alcohol removes the "friction" that is created when you pass your skin across the patient's skin.
- ✓ that friction is the equivalent of "noise" to the brain, and that noise signal interferes with your brain's ability to discern.

After you locate the vein, then you can LOOK to see where to stick it!

ISBN: 0-9723656-2-1

3. The vein feels like a long, skinny water balloon (imagine the rebound bounce of water against your index finger as you gently push down on the water balloon), and

- ✓ that no other structure in the human body feels like a water balloon – NOT EVEN THE ARTERY.
- ✓ that there are only two other tissues that are palpable in that region of the superficial veins –
  the muscle – feels like a firm mushroom
  the tendon – feels like a guitar string

4. You can determine the integrity of the vein wall by grading it as you palpate it, and

- ✓ that integrity of the wall determines whether the vein will tolerate the procedure or not.
- ✓ that you can grade the vein by the firmness of the bounce.
- ✓ that if your vein scores 5-10 on the firmness scale of 0-10, it will tolerate the needle stick, and if it is less than 5, it won't.
- ✓ that a tourniquet "artificially" dilates the vein, and maybe larger than nature intended for it to be.

Did you know all that?

Well, inside this text, you can learn all of this . . . and more!!!