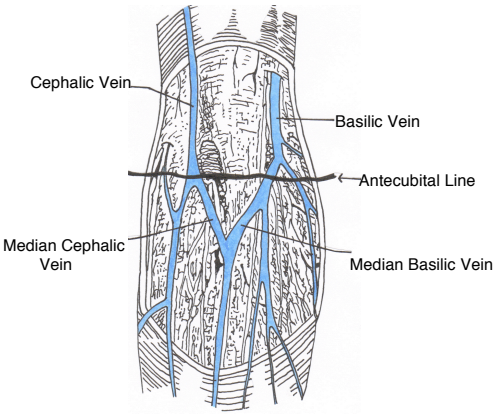
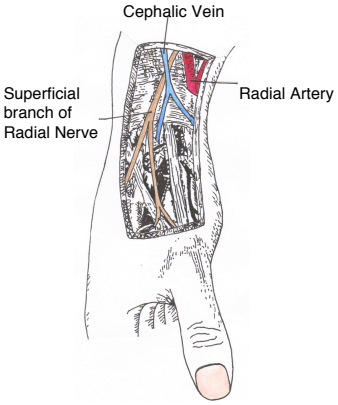
Vein Access Technologies
presents

The Science Behind the Skill of Vein Access for the IV

The Anatomy, Physiology, and Physics of the IV





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

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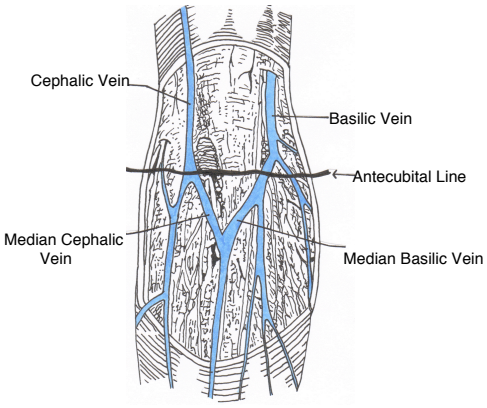

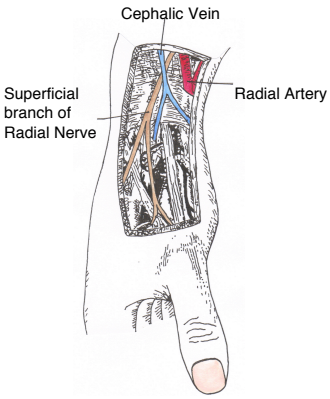

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About the Author

****

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 most of the 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 vein access 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

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Foreword

****

Nurses have struggled with IVs since the beginning of time (nursing time that is).

Ask any nurse about IVs, and they all say the same thing -

"There must be more to this skill than what I was taught."

There is. It's just not taught in nursing school. The **anatomy**, **physiology,** and the **other science** information that you need to know to confidently and competently access a vein for an IV start is taught in medical school – not in nursing school.

This information is NOT the domain of the medical doctor - It doesn't belong only to the M.D. This information is **available** to and can be used by every health care provider (including nurses).

And, because nursing school doesn't teach this information, you don't know that it exists. Most nurses assume that nursing school taught them **ALL** that there was to know about this skill. If the nursing program didn't teach it, then the information must not exist, and therefore, this skill is doomed to be a nightmare for the rest of eternity.

WRONG!

This information is simple, small in amount, and easy to apply – and it **will** make the skill of vein access the successful event that everyone envisions for it.

Introduction

****

This written description about vein access 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 **all** about the skill of vein access. This book meets and exceeds the current standards of care for vein access. Add this information to the current writings that are out there, and, you will have combined **this** detailed skill information with the rest of the nursing information that the other books have described.

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.

Vein access consists of two parts –

- ➢ **Part 1 - Locating a Healthy Vein**
- ➢ **Part 2 - Accessing That Vein With a Needle**

The vein site selection will vary depending upon the mission – IV push or IV drip.

And, by the way, the method for locating a healthy vein and accessing that vein are the same for all vein access procedures (i.e. blood draws, injection of contrast, IVs, or blood donations) – the *working* position of the needle varies depending upon the mission – but the locating and accessing are the same.

So, let's begin . . .

PART ONE

LOCATING A HEALTHY VEIN

Anatomy of the Arm and Wrist for Vein Site Selection

****

Let's identify the veins that you will be accessing for IVs -

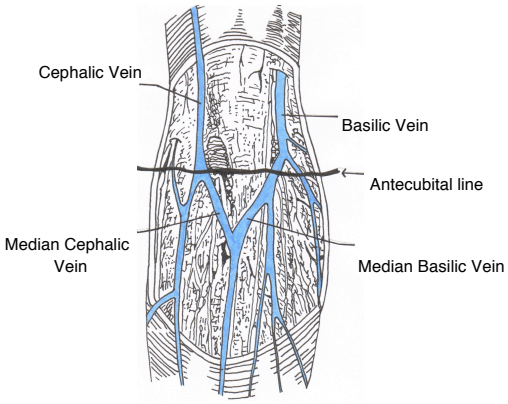
IV Push

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

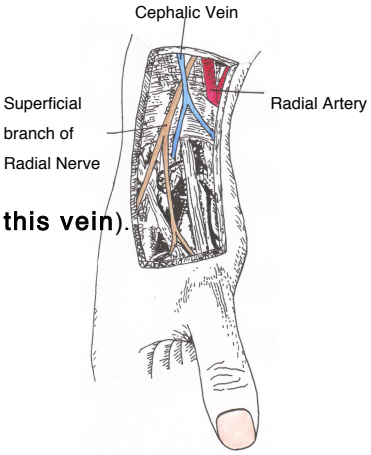
Now, any of these veins CAN be stuck - **if** they meet the criteria for "healthy", which you will soon learn about.

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

Right Arm



Right Wrist



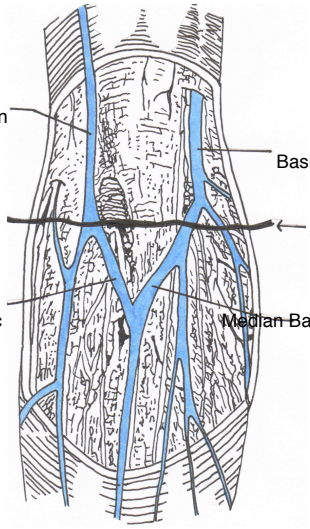
IV Drip

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

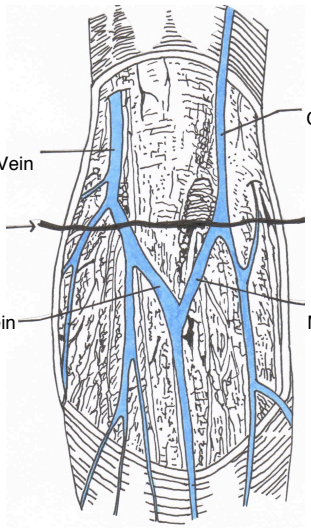
The hand is in the **handshake** position for a wrist stick, with the hand off the table and in alignment with the arm.

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 IV pushes will occur. 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 IV push – we are not interfering with a joint.

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 with IV push. 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 – 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 IV push. Other veins can be stuck if they are firm enough, large enough, and accessible.

Wrist Region

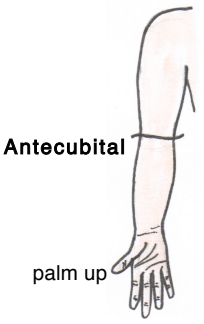
1. So, now let's look at the wrist diagram. The vein in the diagram is colored blue and is the continuation of the **cephalic** vein from the antecubital region. In the wrist region, the cephalic vein is the vein that should be stuck.

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 IVs, 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 IV pushes will occur in the antecubital region. But IV drips (long term IVs) will be placed in the wrist, to avoid a joint and allow for **movement** (which is critical to venous blood flow).

1st Choice for IV push



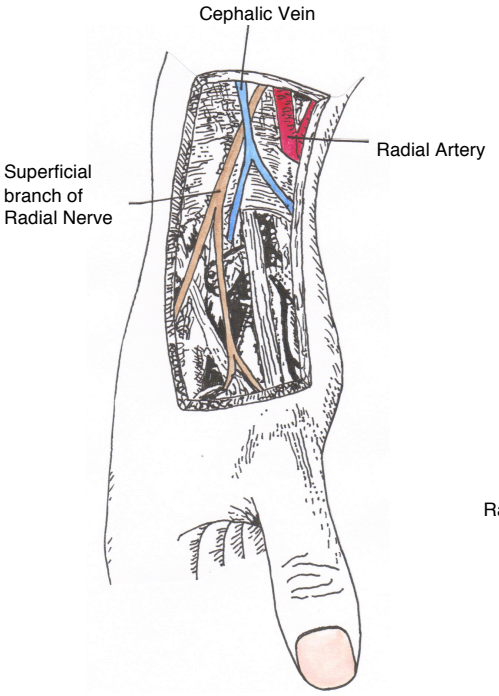
2nd Choice for IV push

1st choice for IV drip

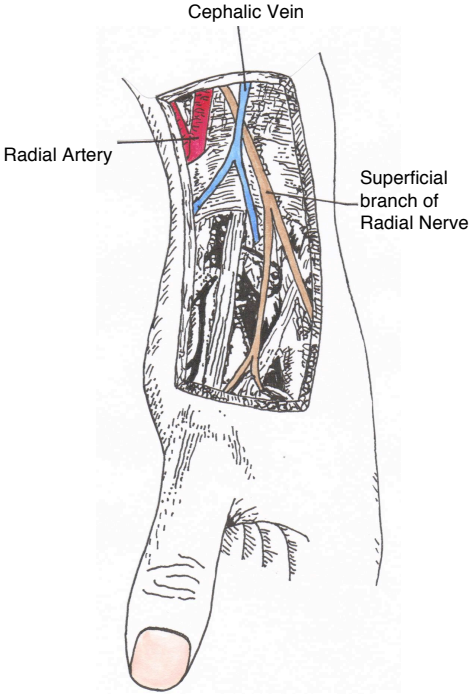
We are never going to stick a human hand vein – NEVER. As you continue to read, I will be explaining the anatomy and physiology of WHY this should never be.

Wrist Region

Right Wrist



Left Wrist



Diagrams based on *Review of Gross Anatomy*
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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).

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 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. **This** is the part of vein access that is 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.

Remember as I describe this method for locating veins, I am referring to

HEALTHY veins.

We can SEE lots of blue veins – but blue has NOTHING to do with HEALTHY.

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 any IV are Superficial Veins. Superficial Veins can be found at one of three levels in the human arm.

- **shallow or surface sitting** - These veins can VERY easily be felt and can easily be seen (the blue of the vein), but represent only a small portion of the healthy vein 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 healthy superficial IV drip 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!

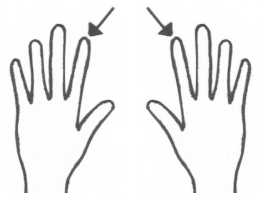
A successful vein access has everything to do with the integrity of the vein wall. The wall of the vein must be thick enough to tolerate the stick and hold, and the wall must be healthy, with its elasticity intact. If the vein wall is too thin to begin with (and made even thinner yet by placing the tourniquet 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 Grade the Vein.

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

Use the palmar pad,
not the tip!
It's a brain thing!

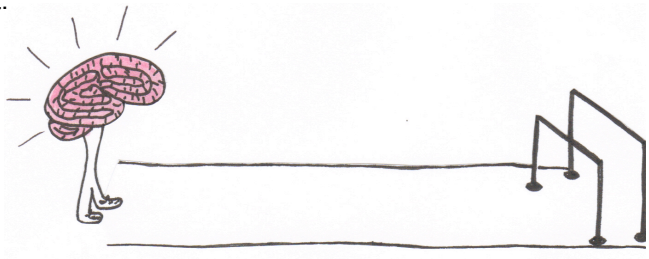
For the best **sensitivity**, **specificity** and **accuracy**, use the palmar pad of your dominant hand index finger to locate the vein. It is extremely important that the hand that "sticks" is the hand that palpates!

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).

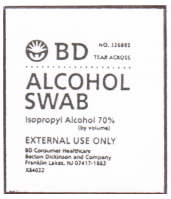
Technically speaking, when the applied external pressure matches the internal pressure of the water in that balloon (or the pressure of the blood in the vein – venous blood pressure), you will be able to feel the fluid bounce or rebound. So, since humans are not static, they are dynamic (constantly changing), 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! **Alcohol.** (70% Isopropyl Alcohol)



That's right, leave the area **wet** 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.

<u>Alcohol prevents friction!</u>

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 venipuncture, 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!!!

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**.

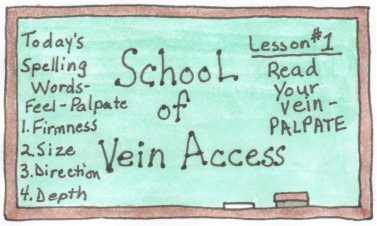
2. Palpate wet - glide your finger across the same antecubital line.
   - Do you notice any grab or drag? NO. It glides!
   - Is that "rope-like" structure more noticeable? YES. Does it feel bigger, more specific, more discernible, and more described?
   - Notice the water balloon bounce better?

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!!!!!

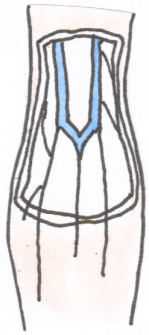
HAND: The vein wall in a hand vein is about as thin as the glove wall. And, when you apply a tourniquet too tight, you distend the vein which will stretch the wall even thinner (like the glove). You all know what happens, so frequently, with those hand veins . . . . quoting a phrase commonly heard, "blew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

WRIST: As we move UP the arm, the next stop is the wrist. Long-term IV drips only do well in this wrist region if you access the vein in the most superior wrist region, and IV pushes are done here as a 2nd choice vein site selection. 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 is 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 for IV push. 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.



Note: IV drips can occur in the cephalic vein segment **from the superior wrist all the way up to just below the antecubital line**.

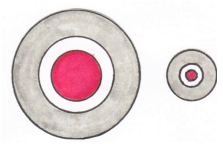
Remember, we are feeling for the **firmness** of the bounce when you depress the vein. We are grading on a scale from 0-10, with 10 being the firmest. If your vein scores less than 5 on the firmness scale, DO NOT STICK IT. That thin vein wall will most likely not tolerate the stick.

So, if the vein FIRMNESS has a -

- **Score 5-10 - Stick it.**
- **Score <5 - Do Not stick it.**

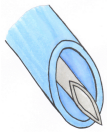
Size - The size of the vein is important because, obviously, the larger the "target", the easier it will be to hit. Think of target shooting. Which target would you rather shoot?

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.

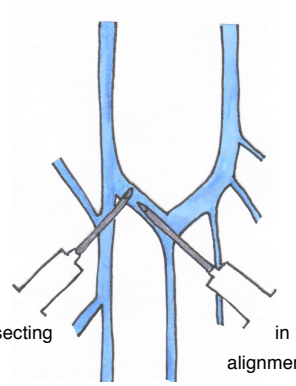
Ideally, you should select the best vein first, and then select the needle.



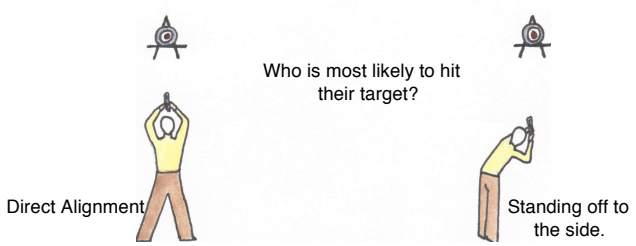
Direction - What direction is the vein running, and why is this important to know? It's important for two reasons -

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 of that IV needle.



Second, just like target shooting, you will be more accurate with the entry of the needle and, therefore, more successful with your IV if 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 is 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 45° angle of entry
   - average depth veins - approximately 45° angle of entry
   - deep superficial veins - approximately 60-75° 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).

And adjusting the angle of entry allows for the shortest route through the vein wall (which we are going to describe in detail shortly) minimizing the risk of vein wall dissection.

So, to insure a successful stick – accessing the vein on the first stick, with 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°).

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 access that 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 starting IVs 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.

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Anatomy and Physiology of the Vein

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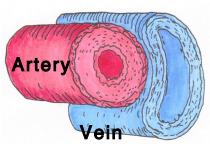
This information about veins IS in *Gray's Anatomy* and *Guyton's Physiology* (as well as other A&P texts used at the graduate or medical school levels). This information is just **not** in the nursing, lab, phlebotomy, or x-ray program texts, but is equally important to these groups.

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.

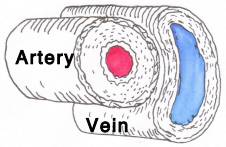


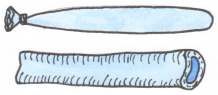
Long, skinny water balloon

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.

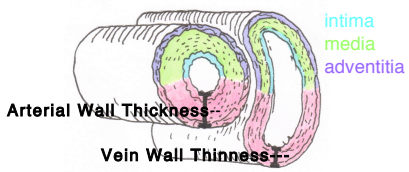
Compare the lumen sizes. The vein is very different from the artery. But, the vein is very similar to the water balloon.





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.

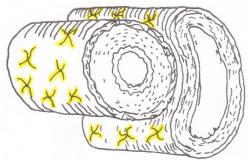


Compare the thin vein wall to the thick arterial wall. These wall thickness differences serve more than one purpose.

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. **Touch** (gentle) dilates.
Cold constricts. **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 IVs? EVERYTHING !!!!!!!!

Anatomy and Physiology of the Vein as Related to the IV

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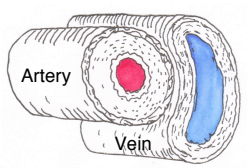
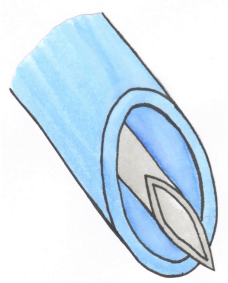
LUMEN - The huge **lumen** of this vein accommodates a lot of blood. That means that the amount of bounce to that vein will be very easy to feel. Again, think about the water balloon and the bounce sensation when you press on it. This is exactly what a human vein will feel like. The amount of bounce 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.

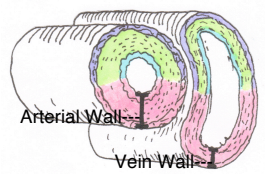


Hint: Select the appropriate gauge needle for the size of vein you have selected for your IV. Remember, you can't tell the size of the blood vessel by looking at it, but you can tell the size by palpating (feeling) it. So, **palpate** for a vein. When you have felt and determined the size of the vein,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

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 IV site.

Recall, one more time, that we are going to access antecubital veins first in IV push, and wrist veins as a first choice in IV drips. (And hand veins NEVER).

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 infusion of fluids or meds. 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.

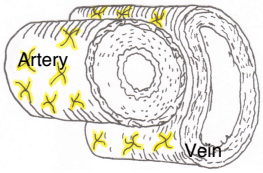
- If it is **(<) less than 5 - DO NOT STICK** IT!
  The wall is too thin and will not tolerate the stick.

- 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.

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 nurse slaps or smacks the vein.*

- *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. It does this by sending a message back to that same screaming nerve ending and tells 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, so that the patient can fly (so to speak).*
- *Now 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 then (later) . . . **vasoDILATATION**.

Here's a better suggestion. **MASSAGE** the vein. Remember what gentle touch does to the nerve ending?

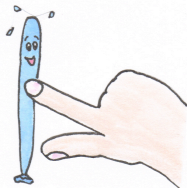
Hint: DO NOT slap or smack the vein. Instead, **MASSAGE THE VEIN**. Gentle touch sends a signal to the brain and the brain sends a signal back to the vein saying "this feels good, relax". The muscle in the vein wall relaxes, and dilatation allows for more blood to fill that vein.

THIS IS THE IMPORTANT PART OF THIS ARTICLE.
(Gentle) TOUCH 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. **Palpate it.** That's right. Not only do you palpate **for** a vein, you must palpate **the vein**.

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 for the vein starts the dilatation process, and once you have located the vein, palpating **the vein** will further dilate it. Let's try it.

PALPATE TO DILATE - 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 that 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 start IVs. Are you better able to locate the veins now?

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 nurse, 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 to locate, dilate, and grade the vein.

Antecubital Region

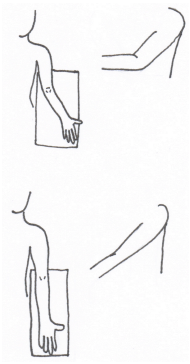
1. Place the arm on a table at a height that allows for a natural bend in the arm, and place the hand palm up. This insures that the inferior antecubital region is UP. DO NOT straighten the arm. Straightening the arm tightens the tissues of the antecubital region engaging muscles and tendons, causing 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. *(Nurses and 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.

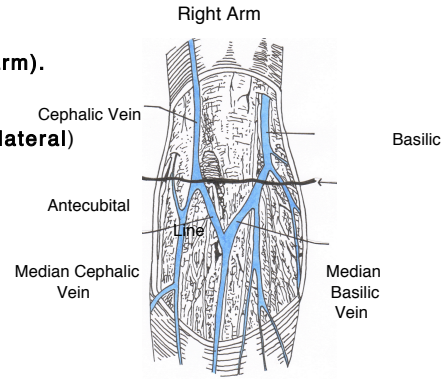


2. Identify the anatomical boundaries of the antecubital region. Remember, vein access is considered a "surgical" procedure, and like any surgical procedure, you must clean the ''football size field" to do the microscopic cut (or, in this case, the microscopic stick). It's all about killing microorganisms over a large enough field, preventing pathogens from entering our venipuncture site and giving organisms outside the 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)

Vein

- ✓ **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.

4. 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 besides 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 IV pushes will occur in the left or right antecubital region.

But, if you can't locate an antecubital vein, for whatever reason, then you will move down to the wrist (the superior segment of the cephalic, to be exact).

Wrist Region

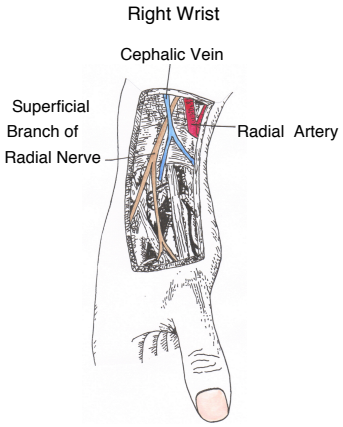
1. Place the arm on a table at a height that allows for a natural bend in the arm, but this time the hand must be in the handshake position. Because the patient's hand can get in the way of your "approach" to the vein, **move the patient's hand off the table and place it in alignment with the arm**. 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 IV.

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.

4. Now that you have located a healthy vein, clean the area using 70% Isopropyl Alcohol as described below.

- ✓ **Locate a healthy wrist vein.**
- ✓ **Identify where you will stick.**
- ✓ **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 access the vein 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 IVs or blood draws and how they can help locate the vein for the nurse who doesn't know where their vein is at . . .

The antecubital and wrist veins are not the only veins that can be accessed for IVs. Any 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** **both extremities** before you select. 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 not been previously described, and it makes a "neural world" of difference in the skill of locating a vein.

And **THIS** information on vein anatomy and physiology 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. Review the summary, and then we'll move on to the tools.

SUMMARY

Part 1 - Locating a Healthy Vein

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

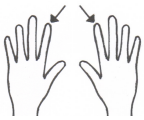
DO NOT **LOOK** for one,

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".

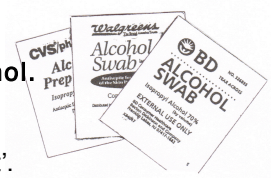
It's a brain thing! Neuroanatomy says that the connection between your brain and your dominant hand index finger is more specific and more sensitive (therefore more accurate) than your non-dominant. It is extremely important that the hand that "sticks" is the hand that palpates!

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

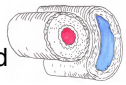
Imagine palpating for water balloons in the arm! No other structure in the human body "feels" like a water balloon.

4. PALPATE WITH ALCOHOL - **Palpate with Alcohol.** Clean the area with 70% Isopropyl Alcohol and leave the area '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 important to vein access.



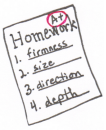
- The **lumen** of the vein is very large compared to the lumen of the artery.

- 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, 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 needl

7. VEIN SITE SELECTION Proper **vein site selection** for a successful IV.

ANTECUBITAL - in the right or left arm.

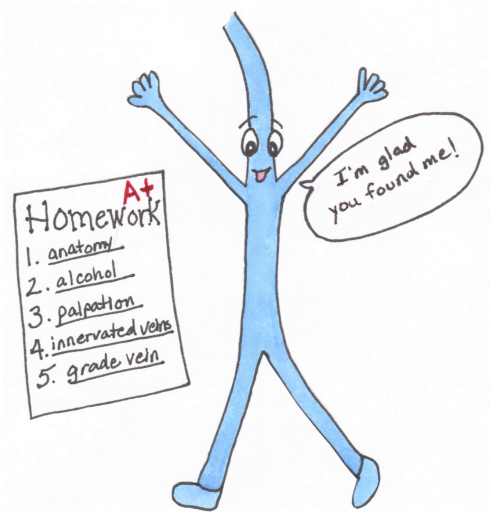
1st Choice for IV pushes (99.999…% will occur here).

WRIST - in the right or left wrist.

1st Choice for long term IVs (IV drips)

2nd Choice for IV push (only if you are not able to locate a healthy antecubital vein).

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.

PART TWO

ACCESSING THE VEIN

Accessing the Vein with the Tools

****

Now let's learn about the IV tools and how to use them proficiently and safely.

The Tools

1) Gloves
2) Tourniquet
3) Alcohol Wipes
4) Band Aid
5) Needle

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The importance of this section is strictly to make you aware of the inventors' intended use and method of these tools in the process of accessing that vein for an IV. While on the surface this appears to be a rather "obvious" statement, but the facts are that most health care professionals don't use these tools correctly.

The success in IV starts is in the "detail", and these tools have a lot of detail – detail that has not necessarily been thoroughly described in the already existing literature. At the very least, even if this information has been read, it is rarely implemented.

So, let's describe these tools in detail, describe the mission of each as intended by their respective inventor, realize the effectiveness of these tools when used correctly, and MOST IMPORTANTLY, the safety and "safeness" of this skill when the tools are used correctly.

1. Gloves

There are two types of gloves in the health care field: **Sterile** and **Non-Sterile**.

STERILE gloves – protect the patient from germs.

NON-STERILE gloves – protect the worker from germs.

Did you catch that HUGE difference in mission and purpose?

In the vein access of IV starts, we wear NON-STERILE gloves. And there are some things that you need to know about the non-sterile glove – to prevent hospital acquired infections through that IV start.

Sterile vs. Non-sterile

1. What does NON mean? **NOT** So, really we have Sterile vs. **NOT**-sterile

2. In terms of **germs,** what do we have? NO germs vs. **HAS** germs

Let's assign terms clean and dirty **based on germs**.
No germs = CLEAN
Has germs = **DIRTY**

I know, I know . . . these applications of the words clean and dirty are not how the health care industry defines them. Medically speaking, these words "sterile", "clean", "dirty", and "non-sterile" have their own definition.

Sterile = guaranteed NO germs.
Clean = not sterile, but coming out of a box or package that is not dirty, therefore, not soiled, **not used**.
Dirty = implies soiled, and/or **used**, and/or visibly dirty.
Non-sterile = **not** sterile, has some germs(?), but clean-until used-then soiled!

I can see how confusing all of this can be. So, let's clarify it, re-define it, and globally agree on one understanding of it because NOT-STERILE gloves are touching the needle insertion site every day. **This is the primary cause of HAIs.**

First off, non means NOT. So . . . . **Non-sterile means NOT sterile**.

That's how I want to begin this chapter because there is a huge misconception out there about non-sterile gloves. . Some health care workers and nearly all patients think that non-sterile gloves are without germs and/or that the patient's are protected from germs because GLOVES are worn, and this couldn't be further from the truth – *this is only true if the GLOVES worn are **STERILE** gloves!*

We are wearing **NON-STERILE** gloves, **NOT STERILE** gloves.

Now that you realize that the non-sterile glove can be a source of infection for your patient let's describe the true mission of the non-sterile glove.

The little scientist who invented the glove meant it for one purpose with regards to the IV vein access. That purpose is to protect the nurse from the patient's blood. That is its only mission!

Gloves protect us from the patient's blood. That's it!
Keep this statement in mind as we continue describing the glove.

The non-sterile glove wasn't meant to **protect the patient** from us. *That's the role of the sterile glove.*

The reason this is so important to emphasize is because you see health care providers TOUCH the vein access SITE, right before they stick it, with that NOT sterile glove.

And we wonder how hospital acquired infections occur!

Don't touch the site right before you stick it with that DIRTY glove. If you have problems remembering where the vein is at, then "landmark" it.

There is a technique called "landmarking" for those healthy veins that you have located but there is no **VISIBLE** indicator on or near the vein (i.e. the blue of the vein, a freckle, a dimple, an impression of the vein), thus, making it hard for you to recall where it is at when it is time to insert the needle. This technique will allow you to "mark" the site of your vein – so when you look away to pick your needle up and then look back to the site to insert it – you will know where to stick.

Landmarking

Recall that superficial veins come in three different depths -

- **shallow superficial veins** - visible as well as palpable. These veins sit so close to the surface that not only are they easily palpable, they are visible - you can see "blue".

- **average depth superficial veins** - palpable, but not necessarily visible. These veins sit a little deeper in the arm. They are very palpable, but they are not necessarily visible. You definitely CANNOT see blue. However, you may be able to see the impression of the vein on the surface of the arm - a sense that there is a "water balloon" sitting just beneath the surface.

- **deep superficial veins** - not easily palpated, and NOT visible. These veins sit very deep in the superficial tissue of the arm and cannot usually be palpated (felt) by the gliding technique. And, these veins are not visible AT ALL. These veins can only be palpated by "pressing" your way across the antecubital region.

Shallow veins can easily be seen, so you know where to stick. Average depth veins can usually be visually appreciated, so you know where to stick. But deep superficial veins usually do not give you a visible clue. So, you must now find a "clue", or create one, that will help you identify or landmark the spot beneath which the vein is located. Here are 4 ways to landmark.

1. Identify a dermal depression (microscopic dimple) on or near the vessel,

2. Identify a skin discoloration like a freckle on or near the vessel,

3. Create a fingernail mark directly over the vessel with the nail mark going in the same direction as the vessel.

4. Using a felt tip marker, place dots above and below the intended site of insertion, again in the same direction that the vein is running (**do not** insert a needle through a marker site).

You will develop your own "sense" of landmarking with experience.

The next important consideration for the use of that glove is PALPATION. You know, locating the vein by palpating for it.

Can you palpate with a glove on? Or more accurately stated, can you **feel** to the same degree of accuracy with a glove on as without a glove? **NO**. The fact is that you cannot feel as accurately with a glove on your finger as you can without a glove. This is neuroanatomy and neurophysiology. It's a brain thing! A glove is a barrier between your sense of touch and the object you are feeling.

So, you must palpate **without** a glove, and when the patient voices his/her concern over your dirty finger touching their arm, inform the patient that the same alcohol that is cleaning their skin so that you can stick a needle through it, is also cleaning your finger! That's right. Your finger will be just as sterile as their skin.

The patient usually recognizes the logic and truth of this and concedes, but then asks, "why not wear the glove and sterilize it?" Now you can educate them about the palpation process and the need to "feel" for a vein, that you (the healthcare worker) cannot **FEEL** the vein with the glove on (not very well anyway, and definitely not well enough).

In fact, some workers who have already been palpating (dry) for a vein realize they cannot "feel" with the glove on, so they tear a hole in the glove to expose the pad of the palpating finger. (This is largely done in blood draw.) What's wrong with this?

- The little scientist who invented the glove would have a heart attack if he saw them intentionally breach the integrity of that glove . . . (not to mention OSHA).
- The health care worker obviously doesn't understand the purpose of the glove – to protect him/her from any of the patient's blood.
- And when the patient discovers you purposefully put a hole in that glove, trust just went out the window

Don't breach the integrity of the glove; don't tear a hole in it!

And, here is another frequently occurring situation already just briefly mentioned. Right before the nurse inserts the needle into the vein, he/she reaches up with their other gloved index finger to feel the vein *one more time,* right before they stick, touching the very site that they intend to insert the needle **through** and **into** the blood stream!!! Was that a clean glove? **NO!** It was a **NOT-sterile** glove. It was a glove that had touched non-sterile tools (i.e. the tourniquet, the bed side table, the needle package, the patient, etc.) potentially picking up whatever germs were lurking about. How dangerous is that? How often do you see that happen?

So, the **patient** ISN'T necessarily safe just because **we** are wearing gloves. You must **THINK** while you are wearing gloves, and

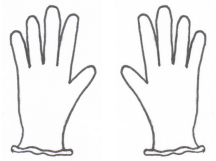
- Use them correctly – NO holes, and
- Don't touch the site right before you stick. (In fact, palpate wet without a glove, locate the vein, and landmark it!)

Let's see – the patient isn't necessarily safe because we are wearing gloves, so is the nurse safe? Not if the nurse purposefully tore a hole in the glove. And, there's one more real hazard – **THE NEEDLE**. Will a glove protect you from the needle? **NO!** The needle can easily penetrate the glove. So, the only way you are safe is if you bring your brain and **THINK** about what you are doing with that needle.

My concern is this – if everyone thinks they are safe just because a glove is worn, then we have created a false sense of security and safety in one of the highest risk environments.

SUMMARY

Gloves have a purpose, but a limited one – Gloves are to protect you, the nurse, from the patient's blood. That's it! No other purpose! And remember, they are **NOT** sterile.



Think that the NOT-sterile glove is dirty. **Think** that you do not want to touch the sterile needle or the sterile site with a NOT-sterile glove. **Think** what can happen if you do.

GLOVES DO NOT PROTECT THE PATIENT FROM INFECTION.

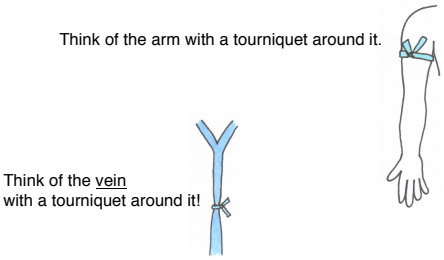
GLOVES DO NOT PROTECT THE NURSE FROM THE NEEDLE.

GLOVES ONLY PROTECT YOU FROM BLOOD!
This is their only purpose.

2. Tourniquet

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

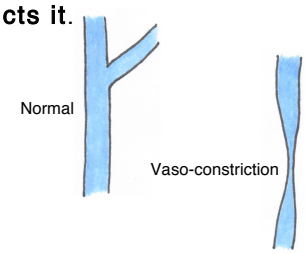
I know, everyone puts that tourniquet on tight – **so . . . tight**, that the patient is uncomfortable (the same uncomfortable as when the BP cuff is pumped way up). There is a misguided perception that the tourniquet must be tight, so I am going to give you the scientific documentation for why the tourniquet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



As you read this section, recall the anatomy of the vein from Part 1 - **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.

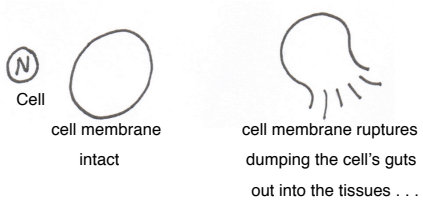
Here are **5 good reasons** why the tourniquet should be **SNUG**, not tight.

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 chemicals, which according to the medical literature, can end up immediately in the blood stream, and potentially affect blood tests.



In IVs, we are not taking blood for blood tests, but we still don't want to injure the surrounding tissue either.

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?

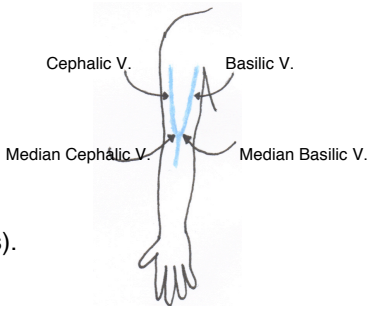
The pressure of the blood in the artery (or the "BP") is 120/80 mm Hg, on the average.

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 <u>same point</u> of tourniquet placement on the arm? The venous blood pressure is approximately 10-20 mm Hg! (See Guyton's Physiology)



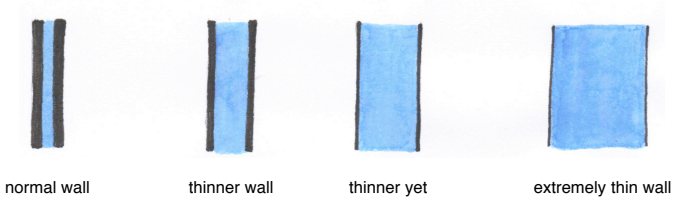
Remember, we are dealing with **Superficial Veins**. (Not DEEP Veins).

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 **<u>stop</u>** the flow (or the return) of venous blood <u>at the point of the tourniquet</u>, and the vein <u>distal</u> to that point of pressure will continue to fill and dilate . . .

The vein gets bigger, and bigger, and bigger . . . **<u>over distended</u>**!



What's in the wall of all blood vessels?

Nerve endings!!!

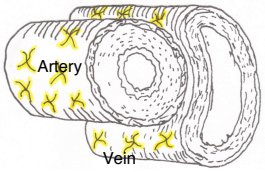
What does a ***<u>stretched</u>*** nerve ending feel like?

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 start the IV 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.)

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 for IVs?

   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!

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. That is a HUGE distinction! A tourniquet can be more harmful than helpful if it is on too tight. A tourniquet works best when it is **SNUG**, not tight.

A "too tight tourniquet" can cause extravasation of serum across the vein wall, the venule wall and the venous part of the capillary bed wall into the tissue of the arm. This is an infiltrate, albeit a small one, we still don't want. This is explained in greater detail shortly.

Use a Tourniquet as a Tourniquet!

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.

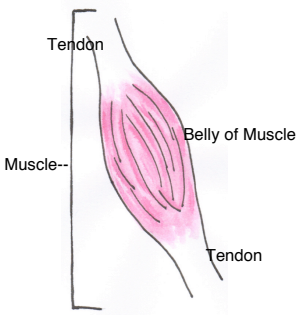
Use a tourniquet as a tourniquet!

Proper Placement of the Tourniquet on the Arm

Next question. Where should the tourniquet be placed on the arm? Whether you are doing vein access to start an IV or for drawing blood, the tourniquet should **always** be placed halfway between the shoulder and the antecubital line, at the belly of the biceps muscle. Again, we don't want to OVER distend a vein and placing a tourniquet within one to two inches of your needle insertion site will OVER distend that segment of vein and cause all of those problems that we just described. And because not all humans are the same size, placing the tourniquet halfway between the shoulder and the antecubital line on every patient will properly place the tourniquet every time. This placement will adequately dilate even the wrist veins that you will be accessing for long term IVs (drips).

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 – 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 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.

Whether you are accessing an antecubital site or a wrist site, this tourniquet must be placed over the belly of the biceps (1/2 way between the shoulder and the antecubital line). It WILL still help dilate the wrist section of vein from this position, without OVER distending that vein.

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 start an IV? NO!

You were always using the tourniquet to dilate the vein, so you could locate it easier. You just learned that you can locate and dilate the vein by palpation. Now that you know where the vein is at, and that it is healthy, insert your needle. 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 (in the really hemodynamically compromised patient). But apply it **snug**, not tight!

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. What does that have to do with a tourniquet?

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.

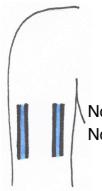
There are no lymph nodes in that arm to **fight infection** or to remove **extra**vascular fluid (swelling).

Again, what does all of this have to do with a tourniquet and starting IVs?

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.

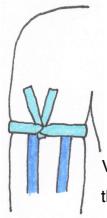
1. These are normal veins in an arm. Notice how thick the walls of the veins are.



Normal veins in arm.
Note the thick walls.

2. Someone comes along and applies a "too tight tourniquet" or a BP cuff. These two things cause an **artificial dilatation** 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 – notice the vein wall now - the wall thins! (*Just like the wall of an over distended water balloon.)*



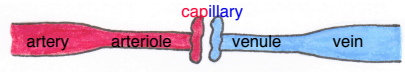
Veins dilate, and
the vein walls thin

too tight
tourniquet = BP cuff
□
"tourniquet effect"

□
resulting in an
"artificial dilatation"
of the vein.

This wall 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
extravasate, or an **infiltrate**, or **edema.**
*infiltrate
The person without lymph nodes can't get rid of this interstitial fluid. They have 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.

This leakage is called an:

The too thin walls leak SERUM into = swelling tissue.

*edema

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

(Note: Think of your IV infiltration! This is one method of occurrence.)

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 start the IV. Remember, you can palpate and dilate without a tourniquet.

They still have veins and arteries, they just don't have lymph nodes.

Here are the rules:

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

And **DO NOT** use a tourniquet.

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.

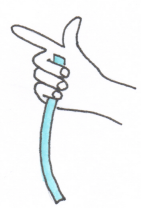
Insert the needle into the vein.

Run the IV fluids/biological.

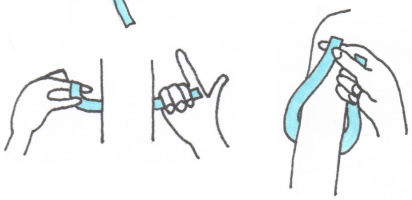
Step by Step Instructions for Applying a Tourniquet

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.

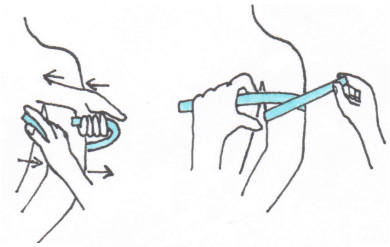


3. Gently pull the tourniquet out and towards you.

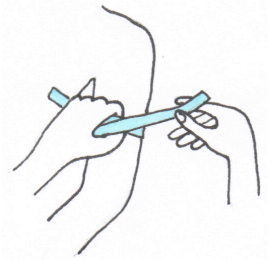
4. With the support hand (non-dominant hand) reach out in front of the tourniquet (vs. behind) and grab the piece that is in the last 3 fingers of the dominant hand. Make sure that only the four fingers of your support hand are wrapped around that piece (with the thumb free and pointing to the floor).

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 past each other, completely.

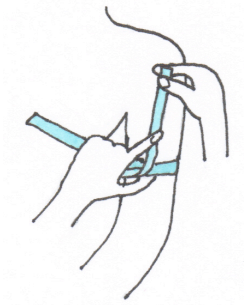


7. Take the support hand thumb and flip it back and under the two pieces of tourniquet where they cross each other, and rest the support thumb on the patient's arm and leave it there.



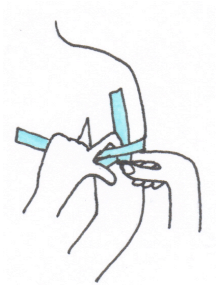
8. Take the piece of tourniquet that is in the dominant hand and move it forward towards the patient's shoulder and stay put.

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, before you start infusing the fluids/meds,

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!

AND DON'T YANK ON THE TOURNIQUET AS YOU RELEASE IT!
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 IV process.... **ALWAYS BE GENTLE!**

And one last important detail, DO NOT have the patient MILK THEIR HAND (during this process of locating a vein) while the tourniquet is still on the arm!

Here's why. Milking the hand engorges the vein. We don't want to engorge the vein. We don't want to OVER distend the vein with blood. You will cause all of those previously described problems for the vein, AND that OVER distended vein will squirt blood from the site when you insert the needle. Milking the hand to engorge the vein was "*necessary*?" when the nurse needed to enlarge a vein so that they could SEE it easier. You now know a better method for locating a healthy vein. PALPATE – FEEL.

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

PRACTICE

Now that you have the instructions on the tourniquet, let's take time to apply this tourniquet to an arm, and while we're at it, let's get some 70% isopropyl alcohol and practice palpating to locate, dilate, and grade some veins at the same time. (You can practice this tourniquet application by yourself by placing it on your thigh. It goes on your thigh the exact same way it goes on an arm.)

Place the arm on the table with a natural bend in the arm.

Place the antecubital region facing up, and this can be achieved by placing the hand palm up. Apply the tourniquet at the belly of the biceps muscle - **snug**, not tight.

We are going to grade these veins for firmness of the bounce, and we are going to score them on a scale from 0-10, with 10 being the most firm.

First, wet all three sites: the antecubital region, the wrist (remember to place the hand in the handshake position), and the dorsum of the hand. Now, LOOK at the veins. When you **LOOK** at these sites, there appear to be some "good looking" veins at all three sites. But don't trust SIGHT! **PALPATE!!!!!!**

We are going to do a global comparison first. The mission is to make you instantly aware of how different the firmness of the bounce is in the veins in these three areas.

- So, start with the antecubital vein and feel the bounce, firm
- and then move quickly to the wrist vein, and feel the bounce, less firm
- and then move quickly to the hand vein and notice.....no bounce

Now let's start over, and grade the firmness of each vein on the scale from 0-10.

Antecubital vein - usually between a 7-10 on the firmness scale.

Wrist vein - palpate at least a 2 inch segment
the more proximal the vein, the more firm, usually a 5-7
the more distal the vein, the less the firmness, usually a 4

Hand vein - usually between a 0-2 (younger than age 25 may be 2-4)

Firmness, as stated previously, is a direct correlation to the thickness of the vein wall.

Now, don't confuse firmness with "hard". You must be able to feel the rebound bounce of the vein. Hard is a different thing altogether, and you can make the vein feel "hard" by over distending it. Try it.

Crank down on that tourniquet. A "too tight tourniquet" can make a vein feel very hard. and especially if, while the tourniquet is on tight, you have the patient "milk their hand" which will further engorge the vein.

THIS is not good.

Also note, that placing the tourniquet at the wrist for a vein access in the hand will cause a severe thinning of the vein walls. So, **do not** place the tourniquet anywhere but at the belly of the biceps muscle.

3. Alcohol Wipe
(70% Isopropyl Alcohol)

You now know that the alcohol wipe has two important functions:

1. for sterilizing the site (and your finger), removing all microorganisms (in particular, pathogens) from the area, and

2. for palpating.

To my knowledge, there is no other chemical out there that palpates the same as 70% isopropyl alcohol.

Note: Water does not remove friction. Think about it. When they instruct on self breast exam or testicular exam, they have you palpate with **soap** and water. Right? Because water by itself still permits friction, creating grab and drag, and you cannot glide and feel as you need to.

The latest trend in prepping a site for vein access involves using a substance called Chlorhexidine Gluconate and 70% isopropyl alcohol. This substance has an oily base to it, and it, also, will not allow for easy palpation. The oil does not remove the friction, and, therefore, your touch signal is "clouded" with a film of oil.

So, if they insist that you use this new prepping agent, that's okay. Locate the vein with alcohol **FIRST**, and then you can prep your vein site with the agent of their choice.

Another thing to consider is the quality of the alcohol wipe. The hospital wipe will clean a site, it just won't leave it **wet** because the wipe itself is not saturated with enough alcohol to leave it wet. Also, the hospital alcohol wipe is made of a thin sheet of fiberfill material that **glides on itself**.

My advice is to buy a thicker, wetter alcohol wipe. (BD, Walgreen's and CVS make a wipe that is a thick pad of cotton and is saturated - check it out. There are probably others, too.) Use one of these.

Note: Alcohol comes in different strengths.

90% Isopropyl Alcohol	**70% Isopropyl Alcohol**
10% water	30% water
used in a surgical setting	will remain on the site a little longer
because of rapid evaporation	allowing for the time that it takes to palpate

There is also a cheaper version of alcohol, **50% Isopropyl Alcohol**, which then is 50% water. Not only will this not work as a palpating tool because it won't prevent friction the same, but it won't kill the organisms as effectively either. Evaporation must occur for the sterilization process to occur, so if the area is still wet with water this can't happen. Fortunately, this 50% alcohol is not sold to the medical profession - but it is sold to households throughout America. (Check your cabinet.)

And one more piece of interesting information - You know those alcohol based hand sanitizers that are common and frequently used in place of hand washing? Do you know what strength of alcohol they are made of?

64% Isopropyl Alcohol

Yep. They are less in percent of alcohol than the wipes. So if you have any concerns at all about using your bare finger and alcohol to palpate with, let this remove all doubt for you here and now. The 70% alcohol that you palpate WITH is higher in alcohol content than the hand sanitizers that you use.

4. Band Aid

The band aid is applied at the end of the procedure to protect the site from infection - the venipuncture site is now a portal of entry for pathogenic microorganisms and must be protected.

Contraindications to band aid use: ALLERGY to tape products (the adhesive).

For those patients who are allergic to tape products, this little tool can cause a huge injury and a huge problem.

You, the nurse, may not be allergic to tape, and this concept of a tape allergy may not even enter into your brain. But if the patient is allergic to tape, it's an important concept to them.

I teach my students to ask the patient the question "Are you allergic to tape?" right before they apply the band aid. Why is it necessary to even ask the question?

Some patients are in a "stupor" after you remove their needle. Can you recall that look? Fear takes them to another dimension, and they won't "think" to tell you about their allergy. Asking this question "Are you allergic?" brings those that are allergic instantly out of that stupor. So, "wake the patient up" with that question.

Allergies to tape can be mild, moderate, or severe.

Mild Allergy - When the band aid is applied, the site begins to itch. The patient removes the band aid and the skin underneath is red and irritated. This will heal rather quickly and, usually, without problems. No big deal.

Moderate Allergy - Now more of a concern . . . the skin is more irritated, and there may even have mild swelling, but still manageable. No big deal.

Severe Allergy - The instant the band aid is applied, there is **instant** blister formation. No matter how quickly the patient responds, as they pull the band aid off, the blistered skin comes off with it !!!!! Now the patient has the equivalent of a chemical "burn". That is what this adhesive does to sensitive tissue, it burns it.

Think about this "burn" injury that was just inflicted upon the patient:

- If the patient is healthy, it will take 7-10 days to heal that burn.
- If the patient is DIABETIC, it will take 3 weeks, OR LONGER, to heal that burn, and that's if the site doesn't become infected – because diabetes delays the healing process and increases the risk of infection. **Think about that !!!!!**

Don't give your patient a whole new problem.

What can you use if they are allergic to tape products? A dry cotton ball and gauze cling.

Note: Coban is a popular tool of use these days. But some patients are even allergic to Coban - so be careful.

Applying the Band Aid

It sounds silly to think that I should even want to describe this simple procedure, but we all know that nearly everyone who applies the band aid touches the sterile gauze pad when handling this tool. So, yes, I need to mention this and a few more things about the band aid.

Definitely, DO NOT touch the sterile gauze pad of the band aid. **It** is sterile, and if you touch it, it will no longer be sterile.

This is a big deal because we have just created a portal of entry for pathogens to enter the system (albeit a small entry if your inserted the needle bevel up). But, nevertheless, an "opening". How do hospital acquired infections occur? Could this be one possible route?

The new band aids with antibiotic ointment already on the pad are a phenomenal idea !!!

Try this little maneuver for getting the tabs to pull away from the band aid itself, without the possibility of contaminating the sterile pad.

1. Take the band aid out of the wrapper.

2. With the gauze pad side facing up, hold the ends of the band aid between an index finger (on the top) and a thumb (underneath) close to the pad but not on the pad area; now TWIST one direction and then the other quickly, until the plastic strips that are covering sterile gauze pad pop loose - the ends will lift up and off of the band aid all by themselves. Now the plastic strips will be easy to grab because they are not even close to the sterile gauze pad portion of the band aid.

3. Next, place the sterile gauze pad portion of the band aid directly over the site, and support the site by applying light pressure over the venipuncture site. While supporting the site carefully secure one end of the band aid to the arm by touching the adhesive part of the band aid to the skin and then the other.

DO NOT yank on the band aid to stretch it over the skin. Why?

IT'S NOT NECESSARY! And because, if you are yanking on that band aid while applying it, pulling on the tissue of the arm,

you will disturb the clot,

and the potential for bleeding starts all over again. (We're not talking a hemorrhage.) But, bleeding is what causes bruising (see the article in this book on bruising), and it takes 1-3 minutes of applied pressure to form a clot. And if you disturb the clot while applying the band aid you will have to apply 1-3 minutes of pressure all over again.

Be thoughtful and be **gentle**.

5. Needle

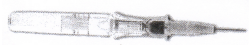
IV Push – Use a syringe/needle system.
IV Drip – Use an IV needle and then attach tubing.
OR use the butterfly needle for IVs.

The most important fact you want to know about the needle is that the seal is still intact. If the seal is intact, the needle is sterile. If the seal is broken, consider that needle **not sterile**. Immediately place that needle into a sharps container and get a new needle with the seal still intact.

Now that we have determined that you are dealing with a sterile needle, we can look more closely at the detail about the needle.

There are "regular" needle/syringe systems.
(Typically used for IV push.)

The Shielded IV Catheter system.
(Typically used for IV drips.)

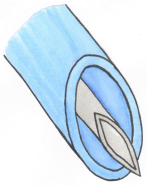


The butterfly needle system.

You all know about gauge and length. But here's a little history that you probably don't know about gauge.

The electrical industry gauges wire the same way.
The weapons industry gauges bullets and barrels of guns the same way.
The golfing industry gauges clubs the same way.
There must be a good reason for this.

The important thing to note about needles is that concept of needle size with respect to size of the lumen of that vein that you have selected. If the needle or plastic catheter sleeve of the IV drip system occupies the entire lumen of that vein, then you will have no space for the blood to travel around and past that needle insertion – this won't work. You need flowing blood to carry the substrate that you are infusing.



WORKING WITH THE NEEDLE

Always pick the needle up with your **DOMINANT HAND**.

It's a brain thing. Picking up the needle system with the dominant hand from the start also avoids transferring the needle system from hand to hand, and therefore, avoids potential contamination of the needle.

Example: You will see a right handed nurse -

a) pick the system up with the left hand,
b) remove the cap with the right hand, and
c) then transfer the system back to the right hand for the stick.

This extra handling of the needle can result in injury to the nurse and/or an incidental touch and contamination of the sterile needle . . .

So, with the needle properly placed in your dominant hand, we are now ready to remove the cap.

It is this instructor's opinion that there is only one correct way to take this cap off safely and without the potential for contaminating the needle with your NOT-sterile glove – dominant hand holds the system while the support hand holds the tip of the needle cap and removes the cap from the needle system.

You see nurses take these caps off every which way . . .

1. Some nurses use their mouth to remove the cap. This method involves placing the cap end of the needle in your (dirty) mouth and while the teeth and/or lips hang on to the cap the nurse pulls the needle out. While you probably did not contaminate the needle, it LOOKS DISGUSTING! And you will probably never convince the patient that this method did not contaminate the needle - especially if that patient eventually ends up with a site infection or systemic infection after your IV.

2. The nurse removes the cap by holding the cap at its base. If NOT-sterile gloved fingers are too close to the joint (where the cap meets the needle) when removing the cap, a loose glove may actually touch the needle without you even "feeling" it. Touching the STERILE needle with the NOT-STERILE glove results in a potential contamination of the needle with lethal pathogens, and therefore, a NOT STERILE needle.

All this constant talk about potential for infection. Forbes Magazine (June 19, 2006, pg. 62) has a very well written article about these very concerns. Read it, and then THINK about what I have been describing about non-sterile gloves and needles. And then draw your own conclusions.

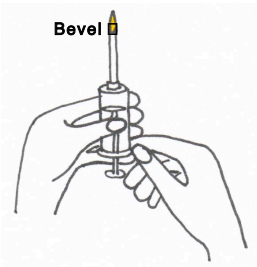
So, when removing the cap from the needle, be sure that your gloved fingers do not in any way, shape, or form, touch that needle. And also be sure that you do not accidentally loosen the needle from the adapter.

Now that we have the cap safely off, we need to see if the bevel of the needle is in the **UP** position.

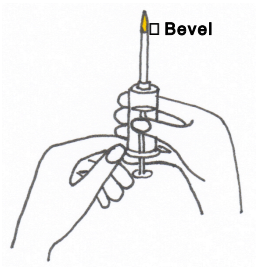
THE BEVEL

You obviously already know that the bevel is the opening at the end of the needle. But to position this bevel up without contaminating the needle, hold the barrel of the syringe securely with your dominant hand, and using your non-dominant hand, rotate the syringe till the bevel is up. Do this so as not to accidentally touch the needle with your NOT-sterile glove. *(This picture depicts a generic barrel for demonstration purposes only. But, whatever device you are using, you should hold the barrel of that device in the same manner.)*

Left Handed



Right Handed



Why must the bevel be **UP**? To minimize the "pinch" felt by the patient, and to minimize the hole that the needle creates with its insertion and withdrawal through the skin and the vein wall.

With the bevel in the **UP** position (and the needle at the proper angle with the skin on insertion), it is the microscopic tip of that needle that penetrates and leads.

This means that -

- The patient will feel a pinch the size of the tip of that needle - microscopic! The rest of the tissue stretches to accommodate the increase in size of the needle as the remainder of the needle is inserted.

- The hole that is created on insertion and left behind upon withdrawal of that needle is microscopic - (the hole in the skin and the hole in the vein wall). These little holes will seal easily and quickly with a clot - resulting in no bleeding and, therefore, no bruising. (See the article on bruising.)

Now, let's describe the entry with the bevel **DOWN**.

First, LOOK at the bevel. See how large that opening is (this varies with the gauge of the needle). That is how big this whole event is going to be. Compare the microscopic tip to the huge bevel opening!!!!

As you insert the needle into human tissue with the bevel **DOWN** -

- You cut a hole the size of the bevel opening. Ouch!!!!! You went from a teeny tiny (microscopic) pinch to a huge PAIN.

- The hole that is created and left behind upon withdrawal is HUGE. This big hole will not seal easily or quickly with a clot, resulting in bleeding, and therefore, bruising. (See the article on bruising.) And again, remember that this huge hole is in the skin and in the vein wall.

Let's prove this. Place a folder down on the table for this demonstration. Draw two circles on it. Follow the diagrams below for right and left handed.

We are going to do two sticks into this folder, a stick in each circle. And, we are going to listen and feel as we do these sticks.

1. The first stick will be bevel **UP**.
2. The second stick will be bevel **DOWN**.

And, again, we are going to listen and feel as we do these sticks -

1. With the bevel **UP**, you will not hear or feel the stick.
2. With the bevel **DOWN**, you can **hear** and **feel** the stick.

Read this thoroughly before you begin, so that you can do all the steps in one continuous movement and be able to appreciate the difference.

1. Hold the needle correctly in your dominant hand.
2. Remove the cap (correctly).
3. Place the bevel in the **UP** position.
4. Place your support hand down. (See diagram.)
5. Place the tip of the needle to the folder in first circle.
6. Keeping the angle of the needle at 45°, listen and feel as you insert the tip into the folder. Stop as soon as you feel resistance.

Now back the needle out and prepare for insertion with the bevel **down**. (2nd circle)

7. Change the position of the bevel (correctly) to **DOWN**.
8. Place your support hand back down.
9. Place the needle to the folder in the second circle.
10. Keeping the needle at the same 45° angle, listen and feel as you insert the needle into the folder. Did you hear it?! Did you feel it?!

LOOK at the two sites.
Bevel **UP** - you can't even see where you stuck.
But bevel **DOWN** - reveals a huge tear!

If you were the patient, which experience would you want, bevel **UP** or **DOWN**?

Now let's talk about recapping this needle. In the real world you will most likely NEVER recap a needle (or shouldn't have to). You will dispose of the needle (needle down) into a sharps container.

But because we are going to practice with this needle over and over again, you need to know how to safely recap this needle, per OSHA standards and instructions.

1) With the needle remaining in the dominant hand,

2) Place the needle cap on the table with your support hand. (Let the cap lie on the table – do not hold it with the support hand.)

3) The dominant hand then introduces the tip of the needle into this cap. **DO NOT try to scoop this cap UP**.

4) With the tip of your needle safely in the cap, use your support hand to reseat the cap by holding the cap at its **base** (NOT from the tip of the cap).

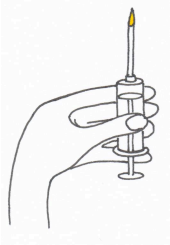
Now this needle can be used again and again for **practice purposes**.

Thoughtfully practice this recapping over and over again till you are safe and skilled with this part of handling the needle.

Instructions for IV Push with a Needle/Syringe System

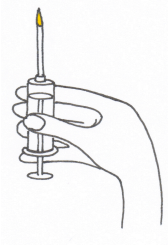
If you are doing an IV push, you will be using a needle and syringe system. Here are the instructions of use for that system.

The syringe is held in the dominant hand, three to four fingers underneath and the thumb on top, perpendicular the to syringe. The fingers are in the open position and relaxed position.



Left Handed

Notice the remaining finger(s) are in the open position, **not** clenched to the palm and making a partial fist which would create tension.



Right Handed

The dominant hand index finger must be one of the fingers underneath the barrel - it's a brain thing. For specificity, sensitivity, and accuracy, you must include the dominant hand index finger. The index finger must remain on the body of the barrel and must not protrude past the end of the barrel, approaching the needle. So again, if the length of the barrel accommodates three of your fingers, use three – if the length of the barrel accommodates all four of your fingers, use all four.

1. With the syringe part of the system held properly in your dominant hand, carefully and appropriately remove the cap.

2. Position the bevel up, utilizing the just previously described technique.

3. Hold that syringe and needle at a 45° angle, place the tip of the needle onto your insertion site, and gently but swiftly, insert the needle into the vein.

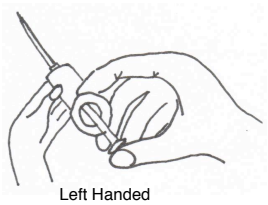
At this point, you have two choices:

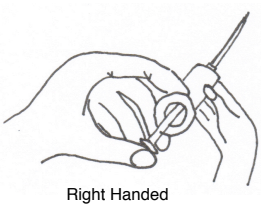
4a. If you want to drop the angle of that needle and rest the syringe portion against the patient's arm – you must rotate (twirl) that needle 180° first to position that bevel facing down – facing the canal of blood – allowing the fluids to infuse smoothly and without resistance. (If you are infusing bevel up, against the anterior wall of the vein, you may meet with some resistance when infusing the fluids.)

OR

4b. You can remain at that 45° angle, with the bevel of the needle facing the canal of blood, with easy infusion of fluids into the blood.

5. With the dominant hand remaining on the barrel of the syringe (in control of the attached needle that is in the patient's arm), use your non-dominant (or support) hand to depress the plunger – slowly.


Left Handed


Right Handed

Note: How slowly? How fast is the blood flowing through that vein? Think: What is the heart rate on that patient, and how quickly is blood moving at that rate?

6. During this infusion of fluids/meds, have the patient "milk their hand" ever so gently. We don't want the movement so large that it moves the arm, but we do want a gentle drawing up of the fingers to their palm to cause -

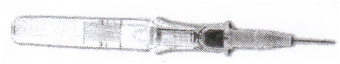
the skeletal muscles to contract, squeezing the veins
and milking the blood and fluids/meds along

- to the target intended (be it pneumonia in the lungs, infection in the kidneys, fluids for the system . . .).

7. Infuse over the recommended amount of time per the biological's description.

Note: An "easy" infusing of the fluids/meds indicates you are still in the vein. Or better yet, if you meet with resistance at all as you are infusing the fluids/meds – you know, it gets harder to push the fluids/meds in – this means you are not in the vein.

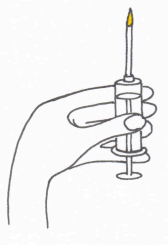
Instructions for the Use of the Catheter IV System for IV Drip



BD Angiocath-N™ Autoguard
Shielded IV Catheter

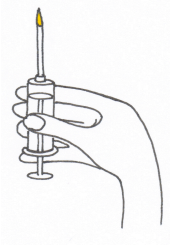
For long term IV infusion (IV drip), you will be using a shielded catheter IV system – a system that you will be taping down onto the patient's arm and leaving it in place for hours or days.

The same rules apply for holding that catheter IV needle system when inserting that needle into a vein. Hold it as you were instructed on the syringe system – three to four fingers underneath and the thumb sitting perpendicular to the system on the top. Bevel up, 45° angle of entry into the vein, and insert.



Left Handed

Notice the remaining finger(s) are in the open position, **not** clenched to the palm and making a partial fist which would create tension.



Right Handed

But with this system, you don't have to worry about twirling the position of that needle once you are in the vein because the plastic sleeve that is left behind after you remove the metal needle insert, has a round, perfectly centered hole at the tip. This tip always faces the canal of blood – the infusing fluids blend without creating turbulence in the stream of flowing blood in that vein.

Here is where the needle position of IV push differs from the **position** of the IV push needle. Once you have inserted this needle into the vein, drop the angle of the system, and remove the needle insert. Finish positioning the remaining sleeve in that vein, and tape that remnant down to the patient's arm.

The Butterfly Needle

****

The **butterfly** needle does NOT have **magic** in the wings.

You hear people talk almost "reverently" about the butterfly. It is a wonderful tool, but it really doesn't have magic. It's not the needle system that makes a nurse good. It's a good nurse who can make any needle system work, resulting in a successful IV start.

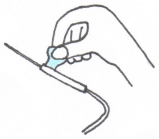
When you hear them say "get the butterfly, it's easy." I can almost promise you that the butterfly is not being used as it was originally designed to be used. Because this tool, when used as the insert instructs, requires a huge amount of **fine motor function**, and this isn't easy.

The syringe/needle system utilizes **gross motor function** on our part.
The hand holds the syringe and it's the arm that inserts needle.

The butterfly needle system utilizes **fine motor function** on our part.
The fingers hold the needle and the arm inserts.

As originally designed, the butterfly is held by its wings only. See the diagram.

You must pinch the wings such that the rough sides (grippers) are to the outside so that your fingers can grip the wings.



And, the wings must be in the straight up position. This is the only way the bevel will be up.

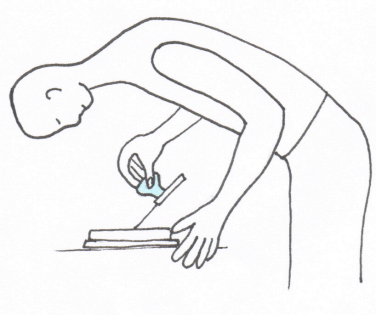
To hold the butterfly with the wings in the upright position, you will have to draw your shoulder up and in, so you can line the needle up with the vein. This is uncomfortable and awkward. So, a lot of nurses lay the wings of the butterfly on their side, making it easier to hold the needle, and making it easier to see the insertion. Well, this won't work (and doesn't work), because -

- The bevel isn't up if the wings are on their side. And you already know by now the bevel story. The bevel must be up on insertion, or you cut a huge hole in the skin and vein wall and cause the patient a lot of pain.

- If you are turning the wings to the side to be able to SEE the needle insertion, then your head is not in the right location and position for that needle insertion.

- To be able to see the insertion, you have dropped the angle (of entry) of that needle. The angle of that needle is probably not 45˚. The angle of that needle is probably 30˚ or less. As described before, if the angle of the needle is too low, then the bevel of your needle won't be facing the canal - the bevel will be facing the anterior wall of the vein.

Once you have inserted the needle into the vein, the needle must remain at a 45° angle with the bevel facing the canal, OR you must twirl the needle 180° to face the bevel down – allowing fluids to infuse and allowing for the back flash of blood when checking on the patency of the flow.



Another error that a lot of nurses make with this butterfly is dropping the angle of the needle (lowering the needle) as they insert it, mimicking a "scooping" motion.

Needle insertion must be at approximately a 45° - once in the vein, then you **scoop and sit**.

So, these little butterfly wings are great for scooping and sitting in IVs!

I am going to suggest a new technique for holding that butterfly system. Keep the insertion technique for regular needle systems in mind because this exact same needle technique applies to the butterfly needle as well.

(Some of you are already thinking that the short butterfly needle is "just right" for hand veins . . . you see it all the time . . .)
REMEMBER, YOU ARE NEVER GOING TO STICK THE HAND.

Just like with the regular needle system, the butterfly needle is held at a 45° angle on entry, and must remain at that angle once in the vein for an IV push, so that the bevel of the needle continues to face the canal (faces blood). For an IV drip, you would twirl the needle facing the bevel down and then scoop and sit in the vein.

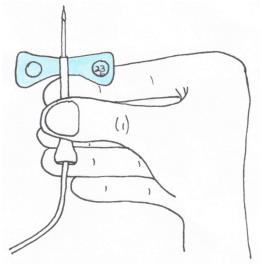
To achieve the proper needle insertion, recall that your head is positioned directly over the needle's insertion site. By positioning your head over the needle site you insure two things -

- ✓ You are placed in a stable position over the site and will not move – guaranteeing that the needle stays right where you have inserted it, and at the angle you inserted it.

- ✓ The bevel of the needle remains centered in the lumen of the vein, facing the canal of blood.

But I have, what I think, is a better method for using a butterfly. Read this and try this, and decide for yourself which method of handling the butterfly works better for you. After all, **your comfort level affects your skill level**, and you need to be comfortable and skilled with this tool just like any other.

Hold the butterfly, NOT by its wings, but as if it were a "mini barrel of a syringe".



- ➢ Now it is a comfortable, familiar skill technique.

- ➢ The bevel is easy to see, and your shoulder remains in the dropped and relaxed position.

- ➢ The angle of the needle can now be easily achieved and maintained, for IV pushes, or the system can be twirled and taped to the patient's arm.

Your brain must stay focused on the needle in the vein.

The NEEDLE is the critical function that only you can do, and the only function you should be doing. I advise that if you are using a butterfly system that you have someone assist you, and have that second person do the infusing of the fluids or the meds. It's a brain thing!

Again, try both methods - pinching the wings AND holding it as if it were a mini-adapter. Feel which one works the best for you.

The same rules for infusing fluids/meds and for removal of that system apply here.

Sharps Container

****

Although the sharps container is not a tool used to access the vein, it is a very important and necessary piece of equipment when doing IVs.

The sharps container is used to dispose of **HAZARDOUS WASTE ONLY**!

What is hazardous waste? Any object that has bodily fluids on it.

- the needle
- the blood soaked wipe or cotton ball
- gloves – ONLY if they have blood or bodily fluids on them
- tourniquet – ONLY if there is blood on it
- needle insertion piece

So, what DOESN'T go into a sharps container?

- gloves – if they do not have blood or other body fluids on them
- the band aid wrappers
- the tourniquet that does NOT have blood on it
- the needle caps
- the wrappers from a butterfly needle

The sharps container is, in and of itself, not cheap - **Don't fill them up with garbage.**
The disposal of that sharps container is not cheap - **Don't fill them up with garbage.**

How do we use the sharps container?

- The tip of the needle must be fully inserted past the lip of the container.

  You want the needle fully past the lip of the container so that there is no way you will accidentally drop that needle outside of the container when you let go.

- But, your fingers **CANNOT** be past the lip of the container.

  Your fingers cannot be past the lip of that container or you RISK getting stuck by a sharps (probably a needle) that could be sticking UP in that container.

As with all things regarding vein access, **THINK** while you are doing this function. It's a brain thing too, and requires your undivided attention while you are doing it – or you will get hurt.

Following the OSHA guidelines and instructions for using a sharps container is an absolute must – and it is the law!

I insist that the sharps container be **placed at your dominant side**. It can be on the floor or on the table if space permits. But, it absolutely must be –

- immediately at your side, and
- on your dominant side

because running around with a potentially lethal needle is risky business.

If that sharps container is a distance from your IV location, you run the risk of injury in that distance. **MINIMIZE RISK** by placing that sharps container close.

PART THREE

TECHNIQUES

THE VEIN BLOCK
(OR TISSUE FLAP)

****

Now I want to introduce a teaching tool that can be used to demonstrate some of the very Laws of Physics (nature) that you will experience with a vein access. This tool is called a vein block or a tissue flap. And, we want to make sure you have the right kind.

In the beginning, there existed a vein block where the veins were visible and visibly palpable. What do I mean by this? If you were to LOOK at this vein block, not only could you see the "blue" of the veins, but you could also SEE the raised impression where the veins actually sit in that block - in other words, visible bumps. Also, these original veins blocks were made of a very pliable material.

Later on, vein blocks started to change. They got "hard". The material they were made of was no longer pliable - it is just plain "hard". And, the veins were situated deeper in this block of hard material such that you could no longer SEE the impression of veins on the surface - in other words, the surface was now flat and smooth. However, these vein blocks pronounced the "blue" even more. People who use these blocks **LOOK** for veins - they **don't "feel"** for veins.

So, first and foremost, you must have a **palpable** vein block for this first demonstration. This means that the veins in that block must be **palpable** - not just visible. So, close your eyes, and if with your eyes closed you can "feel" the veins when gliding across the surface, then you have a palpable vein block.

Now that we have determined we have the correct vein block, we are ready for this demonstration. What are we demonstrating? How wonderful alcohol is as a palpating tool!

WITHOUT Alcohol

1. Glide across the tissue flap.
2. "Feel" the bumps where the veins are.
3. Notice the "grab and drag" of your finger as you move across the flap.
   At first it feels sticky - but tap it - it's not sticky.
   So, what is this "grab and drag" - FRICTION.

WITH Alcohol

1. Glide across the tissue flap. WOW!!!!!
2. "Feel" the veins now - they feel huge and very discernible.
3. No more "grab and drag"!

ISN'T ALCOHOL A WONDERFUL PALPATING TOOL?!!!!!!!

No matter what agent you clean your site with - before you stick it, you **must** locate the vein using **70% Isopropyl Alcohol!**
There are some other fun things you can do with this block that will extend your education on this skill of vein access.

Think about this first. As the needle travels through human **tissue** (skin, subcutaneous tissue, and finally the vein wall), there is that "grab and drag" friction sensation on this needle - UNTIL - the needle "pops" through the vein wall and into **liquid** - at which point you immediately experience the sensation of a "give". **(This sensation can best be appreciated if you "swiftly" insert the needle.)**

As a solid mass (the needle) passes through another solid mass (the tissue),
FRICTION (grab and drag) is created,
until the solid mass (needle) enters into liquid (blood),
then you feel the "give" (no more friction).
This is Physics!

You can actually experience this same sensation with this vein block because the Laws of Physics apply to all structures, natural and man-made.

So, whether you have an original vein block or a later version, this demonstration will still work. The original vein block feels closer in magnitude of the "give" to a human, than the magnitude of the "give" with the hard vein block which is very pronounced. But, nevertheless, you can feel the "give".

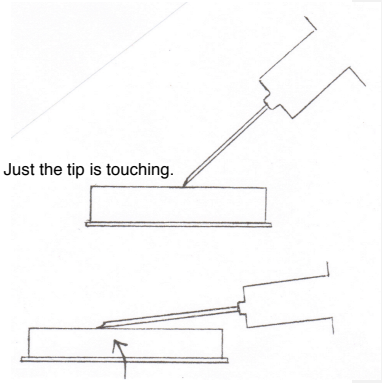
Instructions:

1. Properly hold your needle.
2. Cap off and bevel up.
3. Support thumb down on the vein block.

Before you do step 4 - read this:

When you go to insert the needle into the vein block, be sure that just the tip of the needle is touching the vein block.

If you drop the angle of the needle at all or lean on that needle at all, then more of the back surface of the needle will be touching the vein block. This will be creating more FRICTION grab and drag on the extra surface of the needle as it is inserted into the tissue.



a) This will cause more discomfort to the patient.
b) The entry of the needle will drag and feel "harder" and be slower.
c) You won't feel the "give" because of all the friction drag.
d) And, if all of this occurred because you leaned on the needle as you inserted it, you (and the patient) will see the needle actually bend!

4. With the needle at a 45º angle to the vein block, place the tip on the tissue flap and then swiftly insert the needle. Did you feel the "give"?

   If not, do it again. Do it a couple of times, correctly, to fully appreciate that sensation.

   Now, do it incorrectly - with more of the back of the needle touching the surface of your vein block and slightly leaning on the needle as you enter.
   (Just describing that sounds awful!)
   Could you feel the drag? Could you feel the "give"?

This demonstration should convince you of two things:

First, that a "give" can usually be experienced as your needle enters a vein. This little indicator also tells you when your bevel is in the lumen of the vein. If you pay attention for this "give" and stop the insertion of your needle (immediately) when you feel the "give", your bevel should be properly placed in the vein every time (given you have the right gauge needle for that particular sized vein). No "halfway in and halfway out" of the vein with that bevel.

Insert the needle within 1/4 inch of the top end of the vein in your vein block and when you feel the "give", stop immediately. Support your needle in that position, and lift your vein block up. Now LOOK in the lumen of the vein and SEE where your bevel is positioned. It should be dead center, with the bevel facing the canal.

And second, never lean on that needle when you are inserting it into the

patient's arm. Leaning (even slightly) will bend the needle, depress the patient's tissue, drag the needle as you enter the tissue (creating friction grab and drag), cause more discomfort to your patient with that insertion, and prevent you from feeling the "give".

Another fun thing you can experience with the palpable vein block is differentiating, by feel, the difference between the shallow superficial vein, the average depth superficial vein, and the deep superficial vein. Here's how:

1. Take a real tourniquet and fold it into thirds (3 pieces thick).

2. Place the folded tourniquet over one end of the vein pad.

3. Wet two areas with alcohol: where the tourniquet is and where it isn't.

4. To feel an example of a **shallow superficial vein**, glide over the part of the vein block where there is no tourniquet. It is very palpable and visible.

5. Next, to feel an example of an **average depth superficial vein**, glide over the part of the vein block that is covered by the tourniquet (in other words, glide over the tourniquet section). It is still palpable, but not visible.

6. Next, to feel an example of a **deep superficial vein** (you can't feel these by gliding), you must press (bounce) on the vein. The deep superficial vein has the same consistency or resiliency of bounce as the vein with the tourniquet over it. So,

   a) Bounce on the large vein where there isn't a tourniquet. There is the "expected" bounce.
   b) Bounce on the large vein with the tourniquet over it. There is a "dull" bounce.

   The "dull" bounce is what a deep superficial vein bounce feels like. To convince your brain that it really is a water balloon bounce and you really are over a vein, give your brain a whole new reference for discerning that bounce. Here's how:

   Working strictly with the area that is covered by the tourniquet -

   - Palpate the vein (by bouncing) - a "dull" bounce, not pronounced.
   - Step off to one side or the other and palpate there - flat/hard.
   - Now come back to the vein and bounce - now the bounce is discernible.

   You gave your brain a new reference for comparison. This method for discerning a deep vein works the same in the human arm as well.

PALPATING PROBLEMS

****

After practicing a lot of palpation (to perfect your palpating skill), you probably have come to discover that this part of the IV start 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 palpating experiences. I call these challenges "palpating problems".

If you are ever in a situation where you have palpated both antecubital regions and both wrists 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 IV 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 the Fright/Flight story?).

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 IV. Ask them to think of their children or grandchildren, or their favorite vacation spot, . . . anything that will take their mind off of the needle stick. When you see their face muscles relax and the color returns to their face, then you should be able to "feel" the blood in their veins.

2. HYPOVOLEMIA - (low volume). Perhaps your patient has been vomiting for 2 days, diarrhea for 3 days, and fever, and can't drink because of the vomiting – your patient may be very low on fluids. What % of the body is water? What % of the blood is water? So your patient is low volume (hypovolemia), 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 low volume or dehydrated.

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

Some of these patients may not have enough fluid. Now we can't "feel" the fluid (blood) in their vein.

So, how do you fix this problem? (Fortunately, most of the time the vein is still palpable – it will still dilate with gentle palpation and fill enough to feel.)

a) If they can drink, give them water. How much? One of those little 500cc water bottles would be just right. Have them drink it all. *(If they can't drink or keep anything down – 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 about 15 minutes before palpating – not less than 15 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 into their bladder - it won't do you any good there . . . unless you want a urine specimen from them.

NURSES – here's a little note when preparing a patient for a blood draw.
Don't tell a patient **"nothing to eat or drink for 12 hours, including no water!"** **That** is a 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.

Because 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.

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, wait 30 minutes and then begin your palpation process.

Here's the good news: When palpating for a vein, on any patient, 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 locate that vein and start that IV. Always set yourself, and your patient, up for success.

Natural Stick Ability

****

Let's check your "**natural stick ability**". We are trying to mimic the exact same stance as in a real IV start, so begin by standing in front of a waist high stack of chairs or kneel down in front of a chair. (Do not lean over to a seat cushion from a standing position.) Now we're going to stick the seat cushion of the chair.

Get your needle system and let's do this -

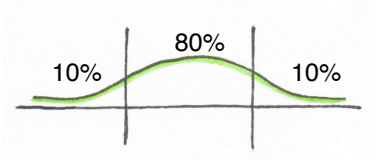
1. Cap off.
2. Bevel up.
3. Support thumb down.
4. Insert the needle into the chair (seat cushion).

Stop! And leave the needle exactly where it ends up.
Don't remove it, don't adjust it. Just remain right there!

I have each student do this, and I make some observations about the insertion as well as the final status of that needle in that chair.

Here's the story. Nurses fall into one of three categories for stick technique. I separate them into the groups as they demonstrate their "natural" skill.

In statistics, there's an entity called a Bell Curve.



Nurses follow this naturally occurring phenomenon, and their stick technique falls into one of these three groups.

Group #1 - 8 out of 10 students end up in the middle (average) group. When they look at their 1½ inch needle at the end of this stick, there is approximately 1 inch of needle still out and a ½ inch of needle in the chair. (Now the vein isn't ½ inch in the arm, it's because we are inserting that needle at an angle – right?

The vein is approximately ¼ inch in.) Now, nobody told them to do that. Nowhere have I even discussed this aspect of vein access yet. So, how did they know to insert the needle this far and stop? They didn't know. They just did what came "natural" to them.

Here's what's so fun! In 80% of all the patients they will stick, this is exactly where the vein will be located.

These 80% of patients also represent the "average", and to be exact, it is that "**average depth vein**" that we described under vein anatomy. (Recall that veins come in three depths: shallow superficial vein, average depth superficial vein, and deep superficial vein.) And as I told you then, the "**average depth veins**" represent about 80% of the palpable veins you will locate.

Isn't Nature smart? How fun that 80% of all nurses will be sticking 80% of the population that has a vein at the exact spot where nature told them to stick that needle!

I didn't make this up. It's statistics, math, and the mathematic laws of nature.

Group #2 - 1 out of 10 students steps up and barely inserts the needle. When you look, you see approximately 1¼ inch or more of needle out. That means that they only inserted about ¼ inch of needle. Why? Because they're afraid, afraid they're going to hurt the patient. So their brain tells them "Don't go too far!" and "Go slow!".

Well, the good news is that these nurses are so gentle that the patient won't even know that they've been stuck (not even a pinch is felt). However, the bad news is that in those "80% patients" who have the average depth veins, this nurse won't be in far enough. So, when they won't see a back flash of blood. They will need to place their support thumb back down and continue to advance their needle in just a little bit further.

The patient population that has a **shallow superficial vein** will be just the right patient for this phlebotomist, but the **shallow superficial vein** only represents about 10% of the population.

This nurse needs to focus on "the give" that is usually felt when the needle penetrates the vein wall and moves into blood. They will need to override their brain's natural instincts and instructions to go slow and shallow

Group #3 - 1 out of 10 students step up to the chair and **(more than swiftly)** inserts and **buries** nearly the whole needle. This is scary! When you look at their needle, you see only a ¼ inch (of that 1½ inch needle) still out. They have buried 1¼ inch needle into that arm.

These people **really** need to focus on "the give" and override their brain's natural instincts to aggressively bury the needle. They are just as afraid as those in group 2, but these guys just want to "get it over with" and consequently insert too fast and too deep.

As with the other groups, there are a group of patients and veins that fit with this type of nurse. They are the **deep superficial veins**. But keep in mind - these only represent about 10% of the vein population. Remember, most of our patient population has average depth veins and some have shallow depth veins. **And** what's on the other side of the vein in that arm? Muscle, tendons, nerves, arteries, DEEP veins, and bone. We don't even want to stick these structures!

With all types of nurses and with all sticks, the nurse should be focusing on feeling for "the give", not focusing on how much needle length is in or out of the arm, or trusting their natural instincts to stick.

The point of this section was to:

- Identify the three types of nurses.
- Make students realize they should focus on the "give", regardless of their group and natural instincts.
- Realize that even if you are in one of the extreme (10%) groups, you can still be a skillful nurse.

Now, look at your needle in your cushion. Which group do you fall into?

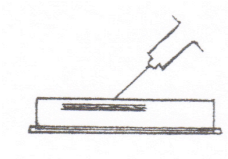
Needle Insertion and Positioning

****

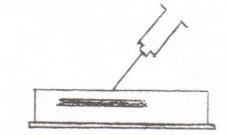
Angle of Entry of the Needle: Now that you are grasping the concept of shallow superficial veins, average depth superficial veins, and deep superficial veins, let's discuss the proper angle of entry of the needle for each type of vein.

Again, for those with natural instincts, you will automatically adjust the angle of the needle as you approach that vein for insertion based upon the depth of the vein. For those of you who have to "think" about it, here are the facts that will help you understand the concept.

shallow veins sit close to the surface. To reduce the friction grab and drag on the needle, it must be inserted at a 45° angle of entry.

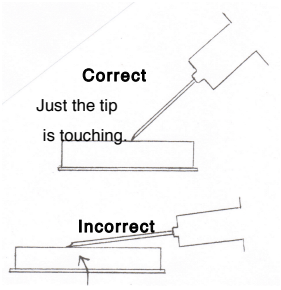


average depth veins sit a little deeper, but you will still need to approach at a 45° angle with the arm.



deep veins sit much deeper, and you will really need to steepen the angle of the needle to 65° to reach this one and to avoid having to use all one and one half inches of the needle.

Do Not Lean on the Needle: As described before, when inserting the needle, you must make sure that it is just the tip of the needle that touches the skin and leads. If any other part of the needle, other than the tip, touches the skin of the patient, then the needle is not at the correct angle for entry.

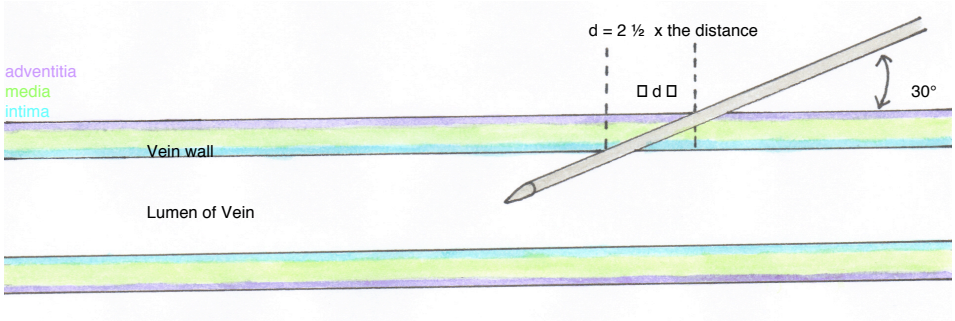


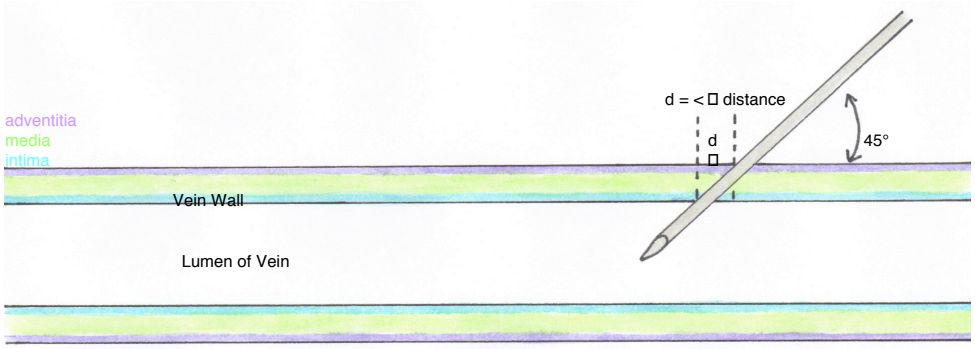
More than just the tip is touching.

IVs differ from blood draws in that with when you insert an IV needle you **scoop and sit**.

The initial insertion is the same as you move through the skin, the subcutaneous tissue and then through the vein wall, but upon entry into the lumen of the vessel the nurse then scoops and sits with that needle – in order to be able to place the cannula of the IV needle within the lumen.

The tendency is, then, for the nurse to start out at a low angle of entry, since they end up at a low angle on the needle when it is in the canal. This low angle of entry can be a problem for the vein wall. Entering through a vein wall at a low angle disturbs more vein wall tissue than if you more directly penetrate the wall.





Leaning on the needle will –

- Bend the needle as it is inserted.
- Create more friction grab and drag as you enter the tissue, making it harder to insert the needle, and interfere with your ability to feel the "give" as you enter the vein.
- Actually depress the tissue of the arm.
- Result in a scooping insertion of the needle instead of a straight insertion.

All of the above will increase the discomfort for the patient.

Hard, Over Distended Veins vs. Natural Dilated Veins: We've touched upon this when we discussed the "too tight tourniquet", but let's approach it from a different direction now.

Let's actually experience the varying degrees of vein distention. Take a human arm that has a good antecubital vein and palpate –

- First without a tourniquet,
- then with a snug tourniquet,
- then with a slightly tight tourniquet, and
- then with a very tight tourniquet.

Did you notice the difference in the vessel itself? It should have gone from very soft and pliable all the way to "hard".

If you lean on a "hard" over distended vein as you insert the needle, the chances of your needle slipping off to the side of that vein or displacing that vein (pushing vein off to the side) are great. Make sure the vein is supple and pliable, and don't lean on the needle.

Repositioning the Needle Once In the Arm: When changing the needle position and direction while in the patient's arm, you must back the needle up (or out, so to speak) to the level of the bevel without exposing the bevel opening to air or without ending up with the bevel opening in the dermis. From this position only can you re-direct the needle.

Using the tissue flap, insert your needle to the right of the vein. Make sure you are the usual ½ inch in with the needle. Now, from this needle position, try pointing the needle in the direction of the vein (to your left). Did you see all the "tissue" move? Did you feel how much resistance there was with that movement? This is exactly what it would be like for the patient.

Now, back that needle up (out) to the level of the bevel. Now point to the left and insert to the vein. Much easier! There is no tissue displacement, and there is no pain with this movement because the tip and bevel of the needle are all that is really moving within that subcutaneous tissue, and the skin is not pulled or stretched like it would be with movement from a deeply inserted needle.

When you go to insert the needle into the vein, you will be using your support hand to support the TISSUE as you insert the needle into the vein. This is an important concept to look at closely because the current method has you anchor the vein.

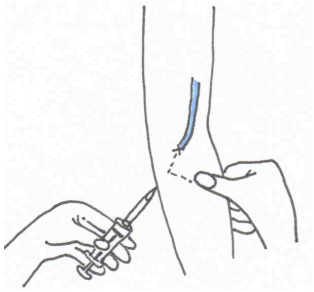
The Support Hand

Some out there teach a technique called "anchoring the vein". This is WRONG. That technique will either get you stuck, or tear the tissue as you insert the needle, or contaminate your needle (allowing organisms to march right down the needle and into that portal of entry the needle just created), or a combination of all three! The following description will clarify all of this for you and give you a better method for supporting the local tissue as you insert the needle.

The support hand is your NON-DOMINANT HAND, and it is going to "support" the nearby tissue while you are inserting the needle into the vein. The use of the support hand is described below, and technically speaking, it is actually the **thumb** that does the supporting.

To properly place the support thumb, tuck the four fingers to the patient's arm (not under the arm).

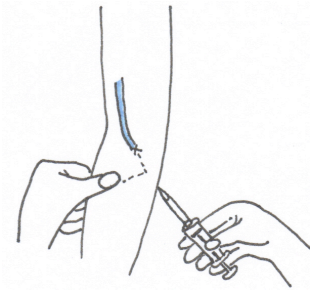
Once the four fingers are in place, and without leaning on them, bring the support thumb straight over and (barely) place it one inch down (same direction as vein) and one inch over from the intended insertion site.



"X" marks the insertion site.

Note the direction of the vein.

The broken line indicates one inch down, and one inch over.



Left Handed Nurse

Place your right thumb (support thumb) one inch down and one inch to the **RIGHT** of the intended site of needle insertion.

Right Handed Nurse

Place your left thumb (support thumb) one inch down and one inch to the **LEFT** of the intended site of needle insertion.

Just place your support thumb on the patient's arm, **barely** touching it.

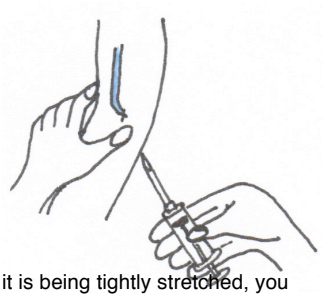
DO NOT APPLY PRESSURE! **DO NOT PULL ON THE TISSUE!**

Just place your support thumb on the patient's arm, **barely** touching it.
The purpose of the support thumb is to support the tissue only and only if it is necessary. If the needle does not want to glide easily into and through the tissue of the arm (because it is dry, or leathery, or dehydrated. . .), then you will need to **press** straight down with that support thumb, anchoring the tissue as you now proceed to advance the needle in.

Don't confuse **this** instruction with a concept that should never be employed call "anchoring the vein".

#1 One way they teach you to anchor the vein is to place your thumb over the vein itself, just inferior to the site that you intend to stick. And they teach you to **pull** (down) on the tissue, "anchoring the vein" right before you stick the needle in it.

What's wrong with this picture?



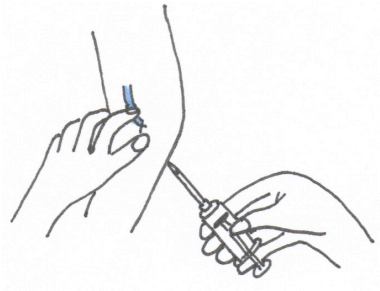
a) Stretching tissue stretches nerve endings. Stretched nerve endings cause pain signals to be sent to the brain. The patient immediately has an inherent sense of concern. Remember Fright and Flight Syndrome? Fear causes what?

b) If you introduce a sharp instrument into tissue while it is being tightly stretched, you will cause the tissue to tear. Albeit a tiny skin tear, it is still a tear and is not necessary. What is in skin? **NERVE ENDINGS!** That tear just caused more pain and more injury.

c) Once the needle is inserted, where is the needle with respect to that support thumb? The STERILE needle is either near or resting upon your NOT-sterile gloved thumb. This will contaminate your needle and set your patient up for an "acquired" infection - as organisms can march right down that needle and into the portal of entry you just created with your needle insertion.

#2 The second type of "anchoring the vein" commonly seen is when they have you place the support thumb on the vein beneath your intended insertion site and your support hand index finger on the vein above the site.

What's wrong with this picture?



The same thing that's wrong with the other one - only more exaggerated.

a) You will really tear the tissue as you insert the needle through that very tightly stretched skin.

b) Your index finger is in a great spot to get accidentally stuck!!!!

c) And, again, the gloved thumb can contaminate the needle.

#3 Finally, the third type of "anchoring the vein". There are some nurses who place their support thumb basically where I have instructed you to place it - one inch down and one inch over. **BUT** instead of pressing straight down (when necessary), they will automatically, and on every IV start, **PULL** the tissue to the side as they stick.

When you pull the tissue, **you pull the vein with it**, displacing the vein from its original position. There's an actual medical word to describe this DISPLACEMENT.

Phlebectopia.

It's true. It's in *Dorland's Medical Dictionary* 30th Edition, pg. 1423.

And when the nurse inserts the needle into that vein and there is no "back flash" of blood in that IV needle, that nurse then looks at the patient and, with disgust in his/her voice says to the patient "Your vein rolled". Like it was the patient's fault! But it's not the patient's fault AND the vein didn't roll. **Veins don't roll!**

In fact, there is no medical word for "rolling vein" in the medical dictionary. Why?

Because IT DOESN'T EXIST. **Veins don't roll!**

Veins Don't Roll

Anatomically and physiologically, it's not possible for a vein to "roll". Ask any anatomist and any physiologist.

Prove it to yourself by placing a long, skinny water balloon on the table. Have someone else place one finger at one end of the water balloon and another finger at the other end of the water balloon, and now place your finger on the water balloon and roll it.

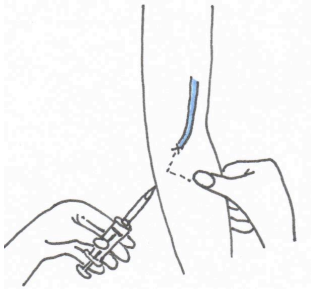
LOOK at it. The balloon twists on itself at the ends, doesn't it? Do you really think that this can happen to a vein? Did the water balloon roll and twist on itself all by itself? The answers are all NO! **Veins don't roll**

We, the nurses, displace the vein! When you pull the tissue to the side, you pull the vein with it, displacing it!

So, don't pull on the tissue. If you need to use the support thumb, press straight down, anchoring the tissue of the arm (not the vein).

Let's review. To properly place the support thumb, tuck the four fingers to the patient's arm (not under the arm).

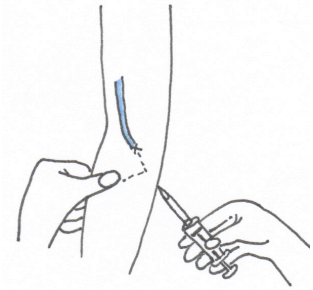
Once the four fingers are in place, and without leaning on them, bring the support thumb straight over and (barely) place it one inch down (same direction as vein) and one inch over from the intended insertion site. Press straight down with the support thumb (only when necessary) to anchor the tissue (not the vein).



"X" marks the insertion site.

Note the direction of the vein.

The broken line indicates one inch down, and one inch over.



Left Handed Nurse

Place your right thumb (support thumb) one inch down and one inch to the **RIGHT** of the intended site of needle insertion.

Right Handed Nurse

Place your left thumb (support thumb) one inch down and one inch to the **LEFT** of the intended site of needle insertion.

Removing the IV Needle

When it is time to remove that IV needle, follow the usual rules –

1. Swiftly remove the needle.
2. Immediately apply pressure to the site.
3. Instruct the patient to apply pressure to the site (for 3 full minutes).
4. Properly dispose of the needle system.
5. Check the venipuncture site to make sure that a clot has formed.
6. Apply (gently) a dressing to that site.

When it is time to remove that IV needle, pick up gauze pad or dry cotton ball and just place it over the insertion site.

DO NOT APPLY PRESSURE while the needle is in the arm, or you will cut the tissue as you remove the needle. Just place it there.

Then, in one continuous step, swiftly remove the needle, and then **immediately apply pressure**.

Pressure is what stops the bleeding at the vein site and the skin site. If you do not apply pressure, the sites will continue to leak and/or bleed, and this will result in bruising. Bruising is not necessary or acceptable. At this point, let's discuss the bruise.

The Bruise

I have yet to meet a patient who said "Oh, I'm so glad I got that bruise." Have you ever had a patient tell you that? No. In fact, almost every patient complains about the bruise that was left behind after their procedure, as if they needed or wanted a reminder that's going to last for a few days, or a few weeks, until that bruise resolves.

The bruise can be avoided, and understanding how the bruise occurs in the first place, will tell you exactly how to avoid bruising.

According to *Dorland's Illustrated Medical Dictionary, 30th Edition*.

bruise (brooz) contusion. (pg 256)

contusion [L. contusio, from contundere to bruise] an injury of a part without a break in the skin and with a subcutaneous hemorrhage. Called also a bruise. (pg 414)

injury [L. injuria; in **not** + jus **right**] harm or hurt; usually applied to damage inflicted on the body by an external force. …. (pg 934)

(Did you catch the words "not right" in the above definition and "inflicted on the body by an external force"?)

hemorrhage (hemo + rrhage) the escape of blood from the vessels; bleeding. …. (pg 834)

We are the "external force", and we did something "not right" that caused bleeding that resulted in bruising.

You must be thinking, "Of course there will be bleeding from the vessel, I just put a hole in it with the needle in order to do the procedure. So therefore, bleeding is unavoidable". **WRONG!!!**

Do you recall your FIRST AID instructions regarding "bleeding"? Now, don't go off assuming that we're referring to a massive arterial bleed. A bleed can be little or big, venous or arterial. So again, recalling the FIRST AID instructions - **How do you stop "bleeding"?**

APPLY PRESSURE!

That's right, apply pressure. Applying pressure stops the bleeding, instantly! Applying pressure, ***until a clot can form***, results in no bruising.

How long must you apply pressure? Assuming normal clotting time for your patient, pressure must be applied for **1-3 minutes**; the time that it takes for clot formation to occur. This time, of course, will be longer if your patient is on blood thinners or has some other blood disorder that interferes with clotting time.
This explains why some patients end up with multiple bruises all over the hands, wrists, and arms. When the repeat multiple sticks were occurring for that IV start, pressure was NOT applied to each site after each stick. The sites (skin and vein) continued to "bleed" and this resulted in the bruising.

Well, bruises are **injuries**, and they can be **avoided**. You first, and then your patient, must apply pressure to the site to stop the bleeding at both the skin level and the level of the vein, until clotting has occurred - before you move on to another next site.

How do you know for sure that enough time passed for the blood to clot? Observe the site. Lift the alcohol wipe up and count for 10 full seconds. If no blood rises to the skin surface, then it has clotted at the skin level and probably at the vein level, too.

DO NOT clean the site with that alcohol wipe to remove any smudge of blood left behind because this "cleaning" will move the tissue, tearing the clot apart, and the bleeding will startall over again.

Just leave the smudge of blood (if there is any), explain the "why" of it all to the patient, and leave the site alone.

Now you can apply the band aid, gently, so as not to disturb the clot.

MOCK IV PUSH

Place the patient on the bed. Place their arm in the proper position with that natural bend in the arm and the palm up.

Right Handed Nurse:

- Place all of your vein access tools on the left side of the patient's arm.
- Place your right hand on the patient's arm as if you had a needle in their arm.
- Spread the fingers of your left hand and place it over the tools on the left.

LOOK! Notice there is NOTHING to the right side of the patient's arm.
It's a brain thing!

Once the right hand inserts the needle into the patient's vein, your brain must stay focused on the needle. To accomplish this, you must keep all of your tools on the left hand side, or another way to state this is that NOTHING can be to the right of your right hand - this would mean that you have to cross over your right hand (with your left hand) to reach for tools. This act of crossing over your right hand causes two things to happen:

1) MOVEMENT - Your body executes a huge movement to reach over the right hand. Remember, there is a needle in the patient's arm, and any movement you cause will cause movement of the needle - OUCH!

2) As your left hand crosses over your right hand, your brain wants to go with the left hand (it now thinks that the left hand is the right hand, because it crossed mid brain). And if your brain (i.e. attention) is with the left hand, then who is in charge of the right hand with the needle in the patient's arm? No one! OUCH!

   You can prove this for yourself. Place an alcohol wipe on the right side of your patient's arm. Pick up your needle/syringe system, cap off, bevel up, support thumb down, and place your needle tip to a marked site on the arm. Just point the needle there and leave it - DO NOT stick them – just pretend you have inserted the needle into the vein. Now reach over with your left hand to get the alcohol wipe - and stay put. From that position, look at your needle point - Did it move? I rest my case. Put all of your tools back to the "start" position.

Left Handed Nurse:

- Place all of your vein access tools on the right side of the patient's arm.
- Place your left hand on the patient's arm as if you had a needle in their arm.
- Spread the fingers of your right hand and place it over the tools on the right.

LOOK! Notice there is NOTHING to the left side of the patient's arm.
It's a Brain Thing!

Once the left hand inserts the needle into the patient's vein, your brain must stay focused on the needle. To accomplish this, you must keep all of your tools on the right hand side, or another way to state this is that NOTHING can be to the left of your left hand - this would mean that you have to cross over your left hand (with your right hand) to reach for tools. This act of crossing over your left hand causes two things to happen:

1) MOVEMENT - Your body executes a huge movement to reach over the left hand. Remember, there is a needle in the patient's arm and any movement you cause will cause movement of the needle - OUCH!

2) As your right hand crosses over your left hand, your brain wants to go with the right hand (it now thinks that the right hand is the left hand, because it crossed mid brain).And if your brain (i.e. attention) is with the right hand, then who is in charge of the left hand with the needle in the patient's arm? No one! OUCH!

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Let's do a mock infusion.

1. Collect and count your tools, and place them on the correct side.
2. Prepare the needle/syringe system, and make sure you have a sterile needle.
3. Apply the tourniquet.
4. Apply the support hand glove.
5. Clean your palpating finger and the region with alcohol, and leave it WET.
6. Palpate for a vein: locate it, palpate it, dilate it, grade it, landmark it, line up with it.
7. Apply the dominant hand glove.
8. Pick up the needle/syringe, twist the colored cap off.
9. Position the needle bevel up.
10. Support thumb down.
11. Pretend to (swiftly) insert the needle into the vein and visualize the back flash of blood. From here on out . . .

    KEEP YOUR EYES ON THE NEEDLE.
12. Using peripheral vision, gently release the tourniquet.
13. Slowly infuse the contrast.
14. Using peripheral vision, pick up the alcohol wipe, place it over the site, swiftly remove the needle, and immediately apply pressure.
15. Have the patient apply pressure.
16. Now you are free to safely recap the needle, unload it and pretend to dispose of it into the sharps container at your dominant side foot.
17. Ask the patient if they are allergic to band aids or tape; if not, check for clotting and apply the band aid.
18. Clean up your area.

Repeat this over and over again. Practice on both arms of your patient. Turn them around and do the other arm - #1 for practice, #2 because both arms aren't the same, #3 to discover that you don't have to move all of your tools to the "other side" - they remain in their correct position, just the patient's position changes.

This mock blood IV push truly reflects the real event almost in its entirety. You should **really** be palpating for a vein, locating the vein, palpating the vein to dilate it, grading the vein, determining the vein's direction and lining up with it, determining the vein's depth so you can start thinking about the angle of entry of the needle and where on the vein to insert the needle, and then running through the IV push process as if you are really doing it. The only thing you **do not** do "for real" with the mock IV push is stick the patient. We're not ready for this yet. There are a few more details that must be covered.
But this is the logic behind the mock IV push. The skill part of the vein access process remains consistent from test to test to test . . . the technique for locating the vein and grading it, the use of the tools, and the order described are consistent **every time**. This "skill" part does not change.

The part that does change is the patient - and **every one** is different. In fact, remember that even both arms on the same patient are different. Just take the **facts** that you were taught about locating a vein, and **apply these facts** to each patient, to each arm, to each IV push.

Maximize your success percentages by nailing the one thing that you do have control over - the vein access process:

THE VEIN ACCESS PROCESS IS THE ONE CONSTANT

PART FOUR

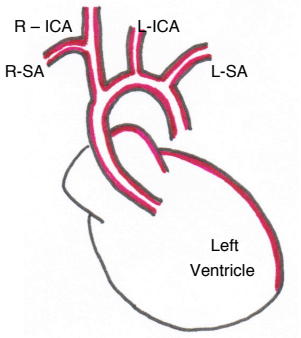
SPECIAL A&P AS RELATED TO THE IV

Venous Blood Return

****

How does blood move around the body? The answer most often given by lay people and health care professionals alike is that the **heart** contracts and moves the blood around the body.

But the physiological truth is that the heart just pumps blood **UP** and **out of the heart**. The contribution that the pumping makes to circulating blood is very little.



Left ventricle contracts.

Forcing blood **UP** and out of the left ventricle at a blood pressure of 120/80 mm Hg (just enough pressure to travel the distance from your LV to your brain).

UP and out the aortic arch.
UP to the brain - thru the R-ICA and L-ICA.
UP to the right and left shoulders to the right subclavian artery (off the R-ICA) and the left subclavian artery.

And then, two other mechanisms take over from there to move blood around the body.

GRAVITY and **MOVEMENT**

As you know, GRAVITY takes everything **DOWN**. This includes blood in the body as well.

Let's follow a drop of blood as it leaves the left ventricle of the heart –

> The left ventricle contracted with a pressure of 120/80 mm Hg and propelled blood **UP** and out of the heart – UP to the head and shoulders. From there, everything else went **DOWN** the aortic arch to the rest of the body. How? By **GRAVITY** (mostly).

Think about this for a second. The only arterial blood going **up** is the blood that goes **up** the aortic arch, **up** to the brain and **up** a short distance through the left subclavian to the left arm and **up** the internal carotid to the right subclavian for the right arm. That's a short distance to go, and the pressure of the blood as it leaves the left ventricle is

forceful enough to take the arterial blood in an upward direction to the head (**against gravity**). But the rest of the body is "south of the heart" (so to speak), and the arterial blood travels through these narrow lumen arteries with the help of **gravity** to the rest of the body.

Now that drop of arterial blood is at its final destination –in this case, the big toe - where it becomes a drop of venous blood that needs to return to the heart.

What moves venous blood, and how does venous blood return to the heart? How does a drop of blood get from my big toe back to my heart? Remember, gravity takes blood **down**.

There are two ways that the drop of venous blood can get back to the heart -

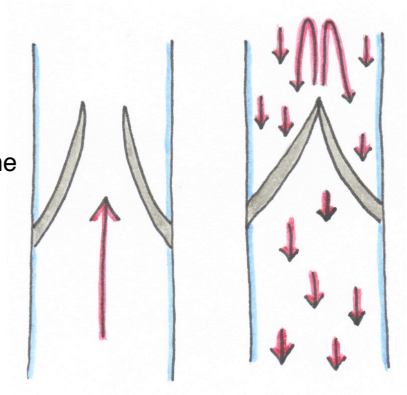
1. **Hang upside down** and let **gravity** bring it back.

   (That's not practical – You can't "live" like that! But, it would work!)

   OR

2. **MOVE!** That's right. It is **MOVEMENT**, the contracting of skeletal muscles, that causes a squeezing of the veins. This "milks" the blood along, up the legs and back to the heart. It does the same for all the venous blood everywhere in the body. (Except in the brain. Since the brain is higher than the heart – when standing, anyway – **gravity** brings the brain's venous blood back to the heart.)

Then what happens when you stop moving? Does that drop of blood in your thigh fall all the way back to your foot?



It would, except **veins have valves**. So when the blood starts to fall down, the little valves close (or open, depending on how you look at it) and hold the blood in place until you start moving again.

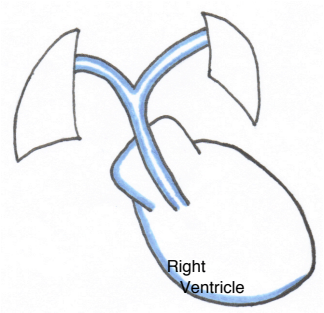
So, leg veins have oodles of valves because the legs are long, and they aren't always moving. But arm veins have very few valves because they are not as long, and we are constantly moving them, and therefore, the blood.

Note: Valves can become incompetent, failing to hold the blood in place, if you permanently injure the vein wall with over distention (varicosing the vein). The valves are attached to the wall of the vein, and if the wall is all stretched out, then the valve leaflets cannot touch each other and close appropriately. (And this will lead to more varicosing, more valve incompetence, more injury of the vein, and impaired venous blood return, and therefore, edema.) So, be careful with that tourniquet (SNUG, not tight).

So, the drop of venous blood in my big toe comes back to my heart by **MOVEMENT** – the contracting of skeletal muscles which squeeze the vein, milking the blood along, held in place with the help of valves – all the way back to my right ventricle.

The right ventricle then contracts at a pressure of 40 mm Hg (a fraction of the left ventricle pressure) to send the blood to the lungs.

(It requires less mm Hg pressure as compared to the left ventricle because the distance from the right ventricle to the lungs is much shorter than the distance from the left ventricle to the brain.)



What does this have to do with you, the RN, and the IV? It affects the movement of venous blood **AND THE FLUIDS/MEDS YOU ARE INFUSING**.

After you have placed your IV needle and released that tourniquet and started "running" the fluids or meds in – you need to tell your patient to

MOVE THAT ARM!

That's right. They must MOVE that arm and cause those skeletal muscles to contract so that the venous blood will be "milked" along and the infusing IV fluids along with the blood.

If you don't tell them to MOVE that arm, the infusing fluids will accumulate in that segment of vein, OVER distending the vein, stretching and THINNING that vein wall (venule wall and venous part of the capillary bed wall) and this will result in extravasation of those IV fluids out into the extravascular tissue.

Now you have an **INFILTRATION** (or your patient does, anyway).

That's right. That is one way that an infiltrate can occur. We'll describe the rest shortly.

Movement moves venous blood (and the IV fluids you are infusing!)

You now know
1. vein anatomy, neuroanatomy, physiology and neurophysiology
2. the Fright and Flight story,
3. thinning of the vein wall and the consequences thereof.
4. the Venous Blood Return story.

Now it's time to relate all of this to the IV and the story of the infiltrate.

The IV, The Infiltrate, The Venous Blood Return Story & What Nurses Should Know About Them

****

The venous blood return story will tell you -

- that a nurse must tell the patient to MOVE that IV arm
- because that will cause skeletal muscles to contract
- that will cause a squeezing of the veins
- that will "milk" the blood (and infusing fluids/med) around the body
- that will deliver the meds to their target organ/system sooner, (rather than later)
- that will minimize that hospital stay to the minimum number of days possible
- that will increase your profit margin

Here's what will happen if you DON'T tell the patient to move that IV arm -

- the vein (the long skinny water balloon) will begin to **swell** at that particular segment (*because bloods and fluids only MOVE with movement or gravity)*
- causing the vein to distend and the wall to become thinner, and thinner and thinner
- causing a backing up of fluids in that vein distal to that segment
- causing the venule behind it to distend and the venule wall to thin,
- causing a backing up of fluids behind that segment into the venous part of the capillary bed
- causing those capillary bed walls to super thin
- and **all of these thin walls** begin to LEAK – fluids extravasating across the vessel walls – this is called an **INFILTRATE!**

If the antibiotics you are infusing (for that pneumonia) are going into the subcutaneous tissue, instead of to the lungs, YOU will get -

- delayed treatment
- prolonged stay
- eating up of your DRG allotment for the ailment
- a new ailment to attend to with (the infiltration)
- new treatment for that ailment and associated sequelae
- potential for morbidity and may be even mortality
- etc., etc., etc.

How does the fluid leak (extravasate) out of the vein and infiltrate into the subcutaneous tissue?

1. From the hole in the vein wall that the needle created .
2. From the multiple holes in the vein wall that you created with the multiple sticks.
3. From the thinned vein, venule and venous part of the capillary bed walls that occurs when the blood is "pooling", collecting in the non-moving arm, with additional increase in fluids from the infusing IV - all over filling, over distending and over stretching the venous system wall.
4. From using too large of a needle.
5. From needle placement in the extravascular tissue (SQ) instead of in the intravascular space.
6. Osmostic pressure changes.

Let's explain these in some detail.

1. From the hole in the vein that the needle created. **Why?**

   a. It leaks from this site because the pressure of the blood (venous BP), in that segment of vein, was **too high** when the needle was inserted, and the internal pressure of that venous blood caused a "blow out" injury (thanks CSI for so vividly describing the "blow out" injury) of that vein wall, making the hole bigger than what it needed to be and bigger than what it would have been. **Why or how?**

   Because you had the tourniquet on *soooooo* tight that you stopped the flow (return) of venous blood beyond the point of the tourniquet **AND** you had the patient "milking their hand" which also increased blood flow to that segment, increasing the quantity of blood, and more blood means higher blood pressure - and no where for this increased amount of blood to go (because you have the tourniquet on *soooooooo* tight - that, when you stuck the needle into the vein, that increased blood pressure vented itself **OUT** through the hole that you just created with the needle. Now the vein wall isn't snug against your needle, but loose and leaking.

Even when you release that "too tight tourniquet", the vein insertion site is still injured and bigger than what it would have been (bigger than just the size of the needle tip) and is now a loose fit around the needle, not a nice snug fit that it would have been.

And the patient's blood and the fluids you are infusing leak from that loose fit, that stretched out, blown out hole. That's one cause of an infiltrate at the (vein) site of needle insertion.

b. It can leak from the vein site if the needle was inserted bevel **DOWN** instead of bevel up. The needle cuts a hole the size of the bevel when it is inserted bevel down. Compare the size of the tip of the needle to the size of the bevel opening. HUGE DIFFERENCE!

Now add all of that just described in the previous section (a) to this bevel down story and you now have an even bigger hole and a bigger infiltrate (bigger leakage into the surrounding tissue). Not to mention the increased amount of pain you caused the patient by going in bevel down. (A hole the size of the bevel disturbed more nerve cells than a hole the size of the tip of a needle.)

2. From the multiple holes in the vein wall. **How and why?**

If you weren't successful in getting into the vein on the first insertion, chances are you maneuvered that needle around attempting to locate the vein (by continual sticking), and/or withdrawal of the needle and a frank repeat of a needle re-insertion into that same region.

Unbeknownst to you, you may have actually already been in the vein but there wasn't any blood there, so you had no "flashback of blood" and no idea that you were IN. **Why?**

Maybe you smacked, flicked or slapped the site as you started your effort to locate the vein. This activity causes vasoCONSTRICTION of the vein. That means NO BLOOD THERE NOW, not in that segment of vein anyway. Maybe it was the multiple sticks that caused pain and fear and vasoconstriction. Maybe it was a "too tight tourniquet", making a tight fist, and slapping the site and . . . that caused vasoconstriction. Whatever the reason for the vasoconstriction, there was no blood there and you continued to stick thinking that you had just not hit the vein yet.

When the vein finally dilated and filled, and you finally saw a "flashback" of blood, and you released the tourniquet and their hand from the fist, and started running the fluids in..... the multiple holes in the vein wall started to LEAK. Now you have an infiltrate

3. **Thinning** of the vein wall, the venule wall and the venous part of the capillary bed wall. **Why and how?**

   a. A tourniquet applied too tightly stops the flow of blood at that point; this will cause the filling vein to distend. And, as it is filling and distending (getting bigger), the wall is stretching and thinning. And just before is reaches the point of rupture (the wall, that is), it is *sooooo* thin that it starts **LEAKING** (vein walls, venule walls and capillary bed walls).

How do you think ankle edema occurs? How do you think hemorrhoid leaks? These all leak serum. This leakage is called an extravasate, an infiltrate, or edema. They are all the same - the serum part of the blood! (The cells won't leak through the wall - that's why the exudate is clear and not red or bloody.) Serum is that "stuff" that oozes from that abrasion when you scrape your knee - that forms a scab...)

   b. Infusing fluids without instructing the patient to **MOVE** that extremity results in a distention of that segment of vein BECAUSE without movement **the venous blood doesn't move** (and, therefore, **ACCUMULATES**) and the fluids that are being infused are not moving (and, therefore, **ACCUMULATES**) and this accumulation of fluid, in one spot, distends the vein, thinning the wall, that results in leakage.

   As that segment of vein overdistends, then the remainder of that vein **inferior** to that segment are affected (as well as the venule and the venous part of the capillary bed – they also superfill with blood, thinning their walls, and causing leakage as well).

   c. The needle occupied the **entire lumen**, causing the blood behind the needle to pool.

   d. The needle was either never in the vein, or managed somehow to back out of the vein after placement and/or after the fluids started running - now the IV fluids are being infused directly into the subcutaneous tissue (extravascularly).

   e. Osmotic pressure changes can cause a shift in fluids from intravascular to extravascular and vice versa. So this really isn't an infiltration. We aren't going to discuss this physiological explanation for fluid extravasation here because:

   f. It is a very scientific explanation, too vast and too complicated to cover in one paragraph here, and

g. This is a physiological causative factor for fluid shift (not really infiltration) and one that **we** did not (necessarily) influence or cause. But this kind of "leakage" won't occur just at the IV site. In fact, this kind of abnormal extravasation occurs throughout the body: at all capillary bed levels (i.e. nephrons in the kidneys, alveoli in the lungs, *regular* capillary beds in the circulatory system).

So in summary, the first 5 explanations are mechanical in nature and ones that **WE** caused. The sixth explanation is physiological in nature, and WE probably did not cause this. The things that WE cause, we can change. See the following examples.

Example #1

The nurse and patient are ready for the IV insertion. The nurse positions the arm of the patient.

What the nurse does . . .	***What the nurse should do . .***
The nurse starts LOOKing for a vein in the hand.	*The nurse should **palpate** that hand vein which would tell the nurse that that hand vein would not tolerate the stick.*
The nurse has been taught to "start low and work your way up, if you have to". So, the nurse LOOKs for a hand vein and SEEs one.	*The nurse should immediately feel for a more firm vein (a segment of vein with a thicker vein wall).*
The nurse places a really tight tourniquet **2 inches** above the site where she intends to stick, at the wrist.	*The nurse should always place the tourniquet over the belly of the biceps muscle (no matter where the needle insertion site is on that extremity). Also the tourniquet should be SNUG, not tight because that close to the site will cause a huge over distention of the vein – and all the problems that go with that.*
The nurse has the patient "milk the hand". The vein is really full now.	*The nurse should not have the patient "milk the hand" because this causes skeletal muscles to contract which causes venous blood to move to engorge that segment of vein with blood increasing the blood pressure in that vein, over distending the vein, thinning the vein wall thinner than what nature intended for it to be.*

The nurse sticks, and the vein "blows", and now the nurse sees a huge hematoma. The nurse immediately releases the tourniquet, removes the needle, and places a band aid (immediately) over the site.	*The nurse should never have stuck that vein. Of course that vein wall ruptured. It was so thin, and the quantity of blood and the blood pressure were so. . . high, that it all created that "blow out injury. To avoid further bleeding and **bruising**, the nurse should have applied pressure to the site for the appropriate amount of time and then apply the band aid.*
The nurse moves on to the other hand.	*The nurse should always palpate, **grade the vein**, and move to a site with a "**healthy**" vein, insuring a successful stick.*

The other hand usually fails as well, and the nurse moves up the arm to the wrist. Typically, a patient gets stuck 2 to 3 times, or sometimes more for that IV start – mostly because the vein choice was a bad one – the vein did not tolerate the stick. And, the nurse misses higher up because they can't SEE veins. Using this new technique for locating, dilating, and grading the veins will improve the rates for successful first stick attempts.

Example #2

The nurse and the patient are ready of the IV insertion. The nurse positions the arm.

What the nurse does . . .	*What the nurse should do . .*
The nurse starts LOOKing for a vein, and this time, SEEs one on the wrist.	*The nurse should **palpate** that wrist vein will tell the nurse that the more superior segment of that vein is "healthier" than the lower (inferior) segment.*
The nurse places a tight tourniquet on the forearm, **2 inches** above the intended site.	*The nurse should always place the tourniquet at the belly of the biceps, **SNUG**, not tight.*
The nurse smacks, or flicks the vein, and starts feeling and looking at the vein. Now the nurse can't feel it or see it (but it must be there.....it just was).	*The nurse should never smack or flick the vein because this causes pain, and and pain will cause that segment of the vein to **constrict**. Remember Fright and Flight!*

The nurse inserts the needle, NO blood return!	*The nurse should not insert the needle. because vasoconstriction just occurred and the blood's NOT THERE!*
The nurse continues to maneuver the needle around, and (not realizing it) is sticking the vein 3, 4, or more times. . . the nurse even backs out from that site and resticks nearby - thinking they just missed it (somehow).	*The nurse does not continue to move the needle around because this can potentially place multiple holes in the vein wall (each time they reposition the needle) - causing a "watering can" effect in the vein wall.*
Getting no where quick, the nurse decides to call for "the one" nurse on the floor who usually gets it when no one else does to try their hand at this IV.	*Remember Fright and Flight – the nurse should wait because after the vein constricts, it will dilate – big.*
Now the new nurse SEEs a huge vessel when she walks in and instantly places the IV needle and SEEs instant blood return. SUCCESS!	*Again, the nurse should wait for vasodilatation to occur. (It occurred right before the new nurse came into the room. It was easy for this nurse to locate a huge vein - right? Because this nurse was set up for success.)*
The fluids are now infusing. And the patient is **not** moving that arm or hand one bit - either because the nurse said "don't disturb that thing, we don't want to have to do that again", or because the patient is thinking "I'm not moving a muscle, because I don't want to have to go through that again". (In any case, no one told the patient to **move** their arm.)	*The nurse should instruct the patient to move that arm. BECAUSE the only way venous blood moves around the body is with **MOVEMENT**. And now the fluids are infusing, and there are a few extra holes in that vein wall, the patient needs to move that arm to keep the infusing fluids and the venous blood from pooling in that segment of the vein.*

The increasing fluids (pooling) in that one segment of vein can now fill, over distend, over stretch, and thin the vein wall . . .

AND THE IV FLUIDS AND THE LIQUID PART OF BLOOD (the serum)
START LEAKING, EXTRAVASATING, and **INFILTRATING**
ACROSS THE VEIN WALL,INTO THE SUBCUTANEOUS TISSUE,

along with the contribution of fluids leaking through the multiple holes . . . etc.

It is this lack of scientific knowledge that sets the nurse up for failure with these IVs. And, of course, it sets the patient up for all kinds of problems, too.

Avoid the infiltrate:
1. Apply a snug tourniquet to the belly of the biceps OR don't apply one at all.
2. Pick a healthy vein for the IV site.
3. Landmark the site so you know where to stick
4. Bevel up, 35°- 45° angle of entry with that needle.
5. Once the fluids are running, have the patient MOVE that arm.

Neurovascular Anomalies

****

I'll never forget the first time I experienced a vein shrinking beneath my finger. That's right. My sense of touch detected this once huge vein getting smaller. How on earth does that happen? Can this happen?

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".

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 blood draw 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 venipuncture or vein access. 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 then vasodilatation.

Yes, that vein will dilate - it will **SUPER DILATE**. That's the time to stick it – **without 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 - NO tourniquet and do NOT re-palpate - **gently** swipe clean only the site you intend to stick (because the entire antecubital region should still be sterile from your previous prep) and insert the needle . . . you should get blood 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 phlebotomist (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 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.

Dorland's Medical Dictionary definitions pertinent to this story.

neurovascular (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.

vasoneuropathy (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 my books. 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 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!

Note from the Author

Hopefully this anatomy, physiology, other sciences education, and the application of this information to the skill will make you better at vein access than you were before you read this book.

This book should have answered a lot of questions for you. It should have taken the mystery out of vein access. It should improve your skill level.

If this information and instruction worked for you, please write a review on the Barnes and Noble web site (www.bn.com). Just go to the website and in the search box for books, key in the name of this book – and in that section "write a review". Please tell others how this information helped you.

We have other texts and other articles available. Please check out the last page of this book for that information.

Glossary

****

adventitia – the outermost covering of a structure or organ

allergy – hypersensitivity to a substance

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

axillary – pertaining to the armpit

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

contaminate – to make impure or unclean

contraindications – an indication against the use of a particular substance or treatment

dilatation – expansion of an organ or vessel

displacement – removal from the normal or usual position or place

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

gravity – the force that attracts an object to the center of the Earth

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

hemolysis – the destruction of red blood cells causing the release of hemoglobin into the surrounding fluid

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

interphalangeal – in a joint between two bones of a finger

intima – the innermost coating of a structure or blood vessel

intravenous (IV) – within or into a vein

invert – to turn upside down

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

lancet – a small surgical knife with a sharp point that has two edges

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

mastectomy – surgical removal of the breast

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

non-sterile – not free of living microorganisms

OSHA – Occupational Safety and Health Administration

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

Pavlovian Response – a conditioned response due to training or repetition

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

sterile – free from living organisms

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

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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 and for providing me with the "Order of the Draw" poster.
(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 sense of touch 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 this 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!

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 the 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!!!

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