

# REVIEWING THE “BIG THREE” INJECTION ROUTES

**Make sure you know  
how and why to inject  
drugs subcutaneously,  
intramuscularly, and  
intravenously.**

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YOUR PRACTICE IN AN AGE OF BURGEONING TECHNOLOGY, rising health care costs, and persistent fear of acquired immunodeficiency syndrome. So nothing you do can be taken for granted anymore—especially giving injections.

That's why you need to understand the advantages of the different injection routes. In this article, we'll focus on the

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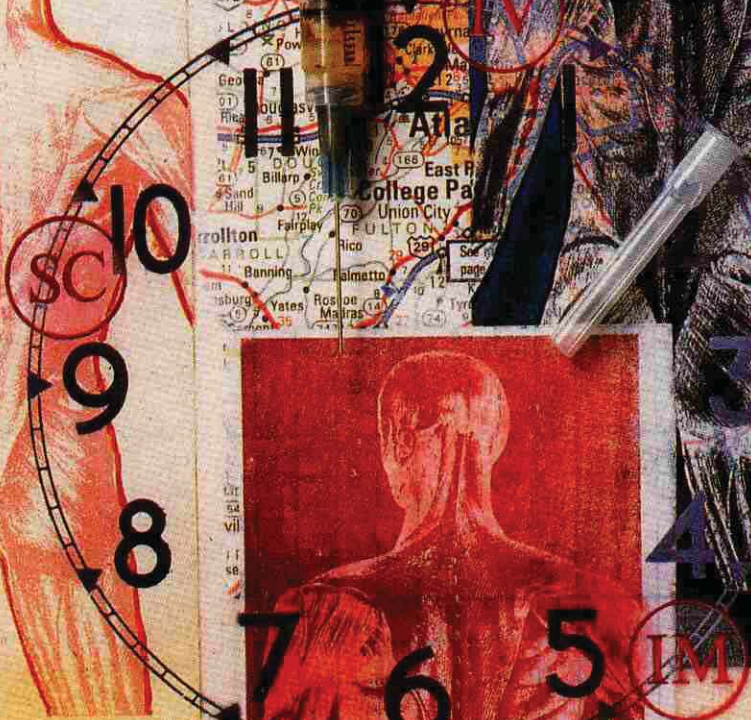
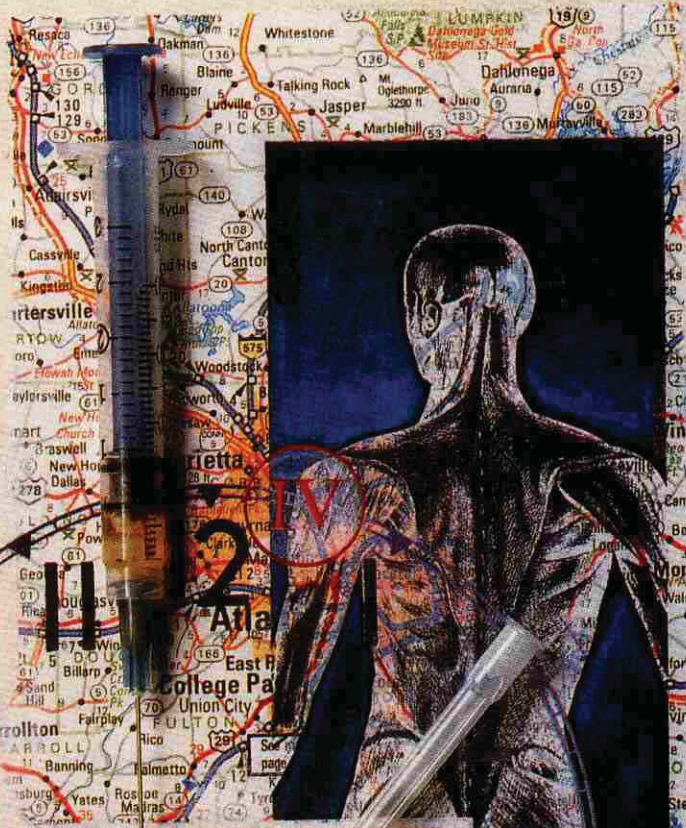
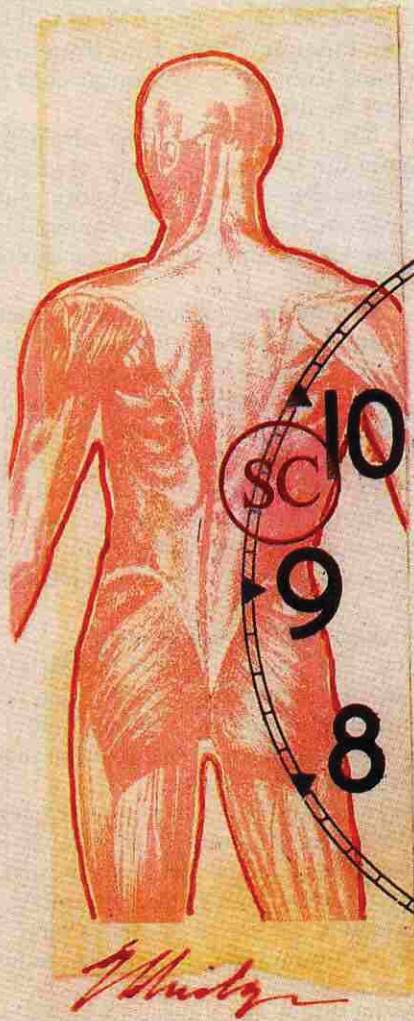
“big three”—subcutaneous (S.C.), intramuscular (I.M.), and intravenous (I.V.)—and offer you tips for using each.

#### **Slower absorption from the S.C. route**

The S.C. injection route, which has been around since the 1860s, makes use of adipose and connective tissue under the skin and above skeletal muscles to promote systemic drug action. The best sites yield a 1-inch (2.5-cm) fat fold when pinched and have relatively few sensory nerve endings. Several factors determine how well the medication is absorbed from the site you've chosen: the patient's cardiovascular and fluid status, physical build, condition of subcutaneous tissue, and your injection skills.

Absorption from an S.C. injection occurs by relatively slow diffusion into the capillaries—the rate is 1 to 2 ml per hour per injection site. So when a drug is given S.C. rather than I.M., initial







blood concentrations of the drug will be lower but the drug's effects will last longer.

Because of its high potency, however, epinephrine is usually effective when given S.C. for an acute allergic reaction. If it's accidentally injected I.M., it could cause life-threatening hypertension and arrhythmias.

Be aware that the S.C. route's slow absorption rate, as well as the drug's effects, could markedly—and dangerously—increase if the patient exercises, warms, or elevates the site after an injection. For example, an insulin-dependent diabetic patient could develop acute hypoglycemia from previously unabsorbed insulin if he goes for a 2-mile jog.

#### **Potential dangers**

Speaking of insulin, it's the drug most commonly injected S.C. But the route is also appropriate for many other drugs that are watery, not cytotoxic, nonirritating, and well-absorbed from adipose and connective tissue. Keep in mind that technique is important when injecting these drugs—the patient could have a dangerous response if you mistakenly inject certain drugs (such as insulin) I.M. instead of S.C.

To prevent subcutaneous tissue damage, irritating or concentrated drugs are usually given I.M. An irritating solution that's mistakenly given S.C. can cause tissue ischemia and necrosis. Also, concentrated drug solutions injected S.C. can cause sterile abscesses.

You're probably careful to rotate sites when your patient needs repeated S.C. injections. But current research shows a strict rotation schedule isn't always necessary. You can use a site until the patient complains of discomfort, you notice pitting or lumping from lipodystrophy, or the drug—such as insulin—doesn't seem to be working (indicating poor absorption from the site).

Sterile and nonsterile abscesses, cysts, granulomas, and nodules are common among drug abusers who inject suspensions made from capsules and tablets. These immune reactions can be caused by injecting irritating solutions, solutions containing invisible microcrystals (such as talc and cellulose found in oral dosage forms), or more than 1 ml of a drug per site. Overusing a site can also cause these problems.

#### **Advantages of I.M. injections**

Properly administered, an I.M. injection deposits medication under the muscle

fascia below the fatty subcutaneous layer. This skeletal muscle has fewer pain-sensing nerves than the subcutaneous tissue. A larger volume of drug (up to 5 ml) can be injected I.M. because fluid spreads rapidly among the muscle's elastic fibers; it's also absorbed into the bloodstream more quickly. So you'll usually choose an I.M. site over an S.C. site when you're giving an irritating drug or when you want a more rapid onset of action or a stronger pharmacologic effect.

Make sure you aspirate the plunger before injecting a drug I.M. so that you don't mistakenly give it I.V. If you see blood flashback in the syringe, don't inject the drug.

The I.M. route has some advantages over the I.V. route. It can be used for potent drugs that aren't cytotoxic, plus aqueous suspensions and solutions in vegetable oil that could cause emboli if given I.V.

In some cases, though, the I.V. route is replacing I.M. injections. Giving narcotics I.V. using a microcomputer pump, for example, spares the patient repeated I.M. injections, which could irritate the site and result in erratic absorption. Besides eliminating those problems, I.V. administration delivers an exact dose directly into the bloodstream, so the onset of action is faster and more predictable.

#### **Comparing I.M. injection sites**

The I.M. injection site you choose will depend on the volume of the drug, how irritating it is, the patient's age, and muscle condition. Here's what you should know about these sites.

- The *dorsogluteal* site may be the most dangerous: An injection given too low or too close to the buttocks crease could permanently damage the sciatic nerve or puncture the superior gluteal artery.
- The *ventrogluteal* site (gluteus medius and minimus) lacks major nerves or blood vessels and has dense muscles. It's a better choice for debilitated patients and a safe alternative to the dorsogluteal site.
- The *vastus lateralis* site, which is also free from major nerves and blood vessels, is usually well-developed in adults and walking children, and it's easily accessible. However, it does have a number of small nerve endings, so many patients complain of pain after the injection.
- The *deltoid* site has a small muscle mass, so you can't give more than 2 ml of medication in a single injection. It's close to the radial nerve and the deep brachial artery. But it provides easy ac-

**Research now shows that a strict rotation schedule for insulin injections isn't always necessary.**



## A CLOSER LOOK AT THE BIG THREE ROUTES

| Route | Site   | Needle   | Volume range (ml)   | Onset and duration of action   |
|-------|--|--|---|--|
| S.C.  | Fat pads at the lateral abdomen, scapulae, hips, below beltline, lateral arms above the elbow  | 25-27 gauge, 1/2-1 in (1.3-2.5 cm)   | 0.1-1   | Onset: minutes (epinephrine, for example) to hours<br>Duration: hours to weeks |
| I.M.  | • Deltoid  | 22-25 gauge, 1-1 1/2 in (2.5-3.8 cm)   | 0.1-2   | Onset: less than 1 hr<br>Duration: hours to weeks                              |
|       | • Dorsogluteal (gluteus maximus)   | 20-23 gauge, 1 1/2-3 in (3.8-7.6 cm)   | 0.1-5   | Same as deltoid  |
|       | • Ventrogluteal (gluteus medius and minimus)   | Same as dorsogluteal   | Same as dorsogluteal  | Same as deltoid  |
|       | • Vastus lateralis (outer mid thigh)   | Adults: 20-23 gauge, 1 1/2-2 in (3.8-5.1 cm); children, infants: 23-26 gauge, 1 1/2 in (3.8 cm)  | Adults: 0.1-5; children, infants: 0.1-1   | Same as deltoid  |
| I.V.  | Basilic and cephalic veins in the forearm for adults and children; basilic, cephalic, marginal, scalp, and small saphenous veins for infants | Needles for adults and children: 16-23 gauge, 1-1 1/2 in (2.5-3.8 cm); catheters for adults and children: 16-22 gauge, 2-12 in (5.1-30.48 cm); needles for infants: 23-25 gauge, 5/8-1 in (1.6-2.5 cm) | For adults and children, 0.1-1,000/hr (children are at the lower end); for infants, 0.1-10/hr | Onset: instant<br>Duration: seconds to hours                                   |

### 9 STEPS TO REDUCING THE PAIN OF I.M. INJECTIONS

1. Encourage the patient to relax the muscle you'll be injecting; injecting into a tense muscle causes more bleeding and pain.

The following techniques will relax the appropriate muscles. For *gluteal injections*, the patient should lie facedown, stand with his toes pointed inward, or lie on his side with the upper leg drawn up in front of the lower one. For a *vastus lateralis injection*, the patient's toes should point in so the hip rotates internally. And for a *deltoid injection*, the patient should flex his elbow and support the lower arm.

2. Avoid especially sensitive areas. When you choose an injection site, roll the muscle mass with your fingers and watch for twitching, an indication that the area is too sensitive.

3. If the patient is very apprehensive, numb the site briefly by holding ice on it or by spraying an anesthetic coolant on it before you've applied an antiseptic.

4. Wait until the antiseptic is dry. Wet antiseptic could cling to the needle and cause pain when you insert the needle.

5. After you draw up the drug, change needles. A needle's point and bevel can be dulled when you puncture the drug vial's stopper, and dull needles hurt. By changing needles, you eliminate another source of pain: medication that clings to the outside of the needle when you draw medication out of the vial or ampule.

6. Insert the needle smoothly and rapidly to minimize puncture pain. As you're doing so, try to distract the patient's attention.

7. If the needle is properly placed, inject the drug slowly to avoid creating high pressure in the muscle.

8. Withdraw the needle smoothly and rapidly.

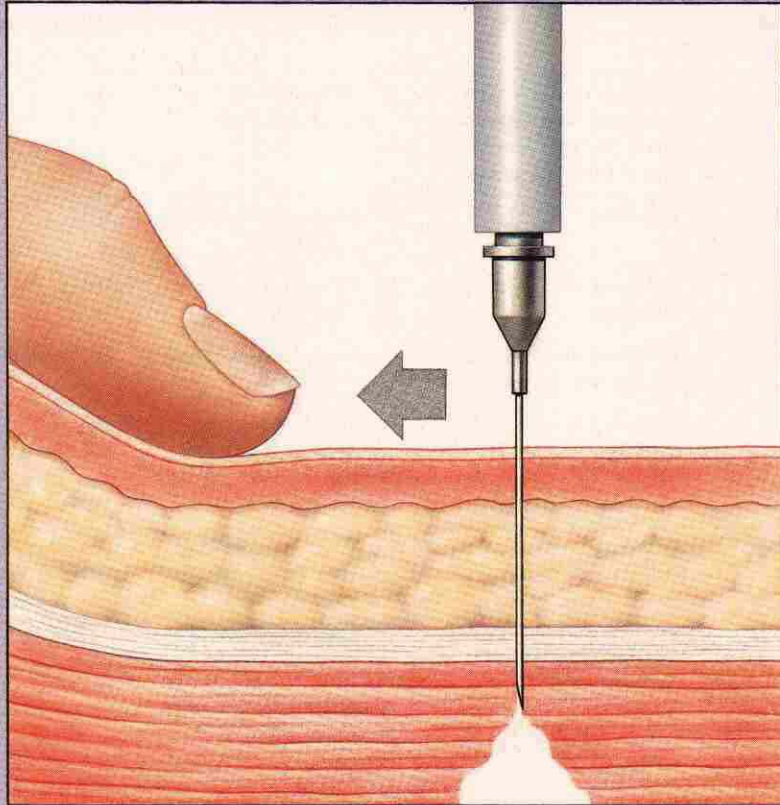
9. Unless contraindicated by the medication (iron dextran, for example), gently massage the relaxed muscle to distribute the drug better and increase absorption. This helps reduce pain caused by tissue stretching from a large-volume injection. (Lightly exercising the injected muscle does the same thing.)



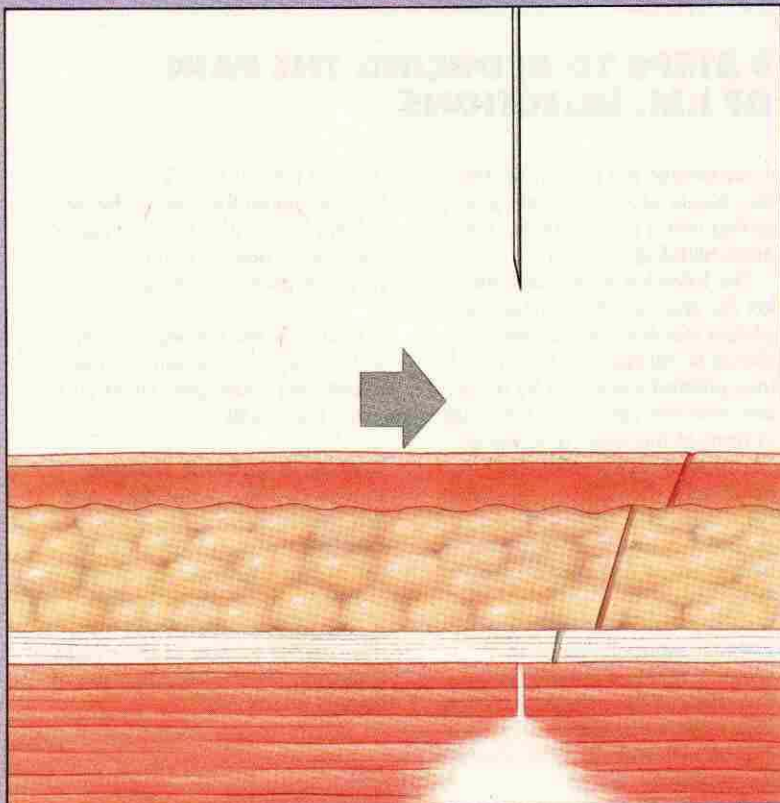
## GIVING A Z-TRACK INJECTION

The Z-track method was designed to administer I.M. drugs that can stain clothing or irritate tissue because it seals the medication in the muscle and prevents leakage. But you can use it for other I.M. drugs too. Here's how.

- Clean the site with antiseptic and allow it to dry.
- Displace the skin and subcutaneous tissue laterally at least 1 inch over the target muscle (thigh, gluteus, or any muscle mass large enough for a deep I.M. injection).
- Insert the needle at a 90-degree angle up to the hub.
- Aspirate to be sure the needle isn't in a blood vessel.
- Inject the medication slowly.
- Wait 10 seconds, then withdraw the needle slowly.
- Release the retracted tissue to create a leakproof zigzag path.
- Don't massage the injection site. Otherwise, the medication could leak back along the zigzag path. This would cause irritation, and the patient wouldn't get the intended dose of medication.



Displace the skin and subcutaneous tissue laterally.



Release the displaced tissue to create a zigzag path.

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