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Review Article

Intraosseous Insights: Tips and Tricks

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Intraosseous (IO) infusion is not a new concept. The technique was actually first described in the early 1920s, but then it seemed to disappear for many years.[1] Although it never completely went away, we have seen an eye-opening resurgence of interest in IO access recently. An alternative to traditional intravenous access, IO access devices are now making a huge comeback for medical and trauma care across the life span. In cases in which there is an urgent need for medications and fluid resuscitation, whether in infants, children, or adults, and immediate intravenous access is not easily obtainable, intraosseous access should be considered as a first-line option.

EZ-IO Vascular Access System

The EZ-IO Power Driver (Teleflex, Wayne, PA) (Fig. 1) works with 3 lengths/colors of needles: 15 mm (pink), 25 mm (blue), and 45 mm (yellow).

As with so many aspects of emergency medical care, the immediate need for accurate and reliable decision making suggests that there should be an easy way to determine who gets what, whether that "what" is a dose of medication, an airway, immobilization method, or a vascular access device. But, first, a word of caution. Make sure that whatever method you use, it works. There is a critical difference between something that is easy to use or remember and something that provides actual correct information. The first might be useful, useless, or even dangerous. The second might help save a life!

For example, access to recognized sources of information, such as the Broselow-Luten (Armstrong Medical, Lincolnshire, IL) or Handtevy (Pediatric Emergency Standards, Davie, FL) systems, can work wonderfully with the appropriate level of practice and familiarity with the equipment. On the other hand, we often hear about (and worse yet) rely on shortcuts that should be forgotten or ignored rather remembered and used. So, if you see the pink and blue needle sets for the EZ-IO Power Driver, DO NOT think "pink is for peds" or even worse "pink is for little girls and blue is for little boys." Yes, we have actually heard those lines suggested as ways to remember which needle set to select. Please do not use those thoughts in your actual practice; they simply do not work! The pink/15-mm needle may not be long enough to hit what you are trying to hit in many pediatric cases, especially with the epidemic of pediatric obesity.

The following is what we recommend as an easy way to remember which IO needle set should be used for which patient population (Table 1):

The pink/15-mm needle is the shortest of the 3 lengths and is labeled for tiny tots that weigh at least 3 kg. If your patient is not at least 3 kg, be careful. IO access in babies smaller than 3 kg has been successfully performed with several types of devices for many years; however, per the EZ-IO manufacturer, this needle is considered "off-label" for that portion of tiny patients. In fact, many prehospital systems and hospitals are removing the pink needle from their resuscitation tool bag and just stocking the blue and yellow needles. The pink needle length is for use when there is very little tissue depth over the bone. This needle may be too short to access the tibia in an otherwise healthy, chubby 6-month old.

The blue/25-mm needle is your go-to needle for *just about all* proximal or distal tibial insertions. Simple and straightforward.

The yellow/45-mm needle can be used if you are unsure if the blue is long enough. Why the color yellow you may ask. Unofficial conversations with some of the original developers of the EZ-IO system lend some unique insights. What we heard was that when the colors for the 3 lengths of the needles were being selected, pink was thought to be for cute pink babies, blue for blue (or soon to be blue) patients, and yellow because body fat is yellow, so they made the longest needle yellow!

We like to remember that the yellow needle set is for "fat, femurs, fences, 40 (or more kg), or funny (actually humerus, but you get the idea)." The fat, femur, 40 kg, and funny (humerus) are pretty obvious, but how did "fences" get in the list? If you are "on the fence" as to whether your patient needs the blue or yellow needle, "go big or go home!" Use the yellow needle. If you are stuck on a desert island and could only pick 1 EZ-IO needle, choose the yellow needle. If the blue needle works, that is great, but at the end of the day, the needle needs to be long enough to hit what you are trying to hit.

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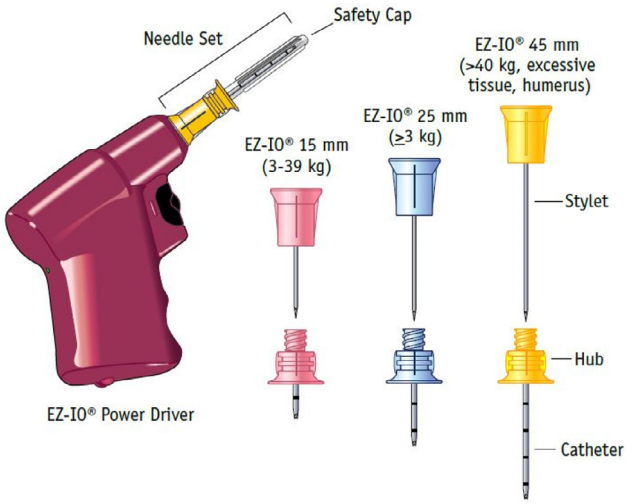

Figure 1. EZ-IO Power Driver and Needle Sets: description. (Reprinted with permission from Teleflex [www.teleflex.com].)

Table 1
Ways to Remember Which EZ-IO Needle to Use

Color	Length	Ways to Remember
Pink	15 mm	Do not use it unless you have a little baby (but at least 3 kg)
Blue	25 mm	Blue for blue patients
Yellow	45 mm	Yellow for fat, femurs/fences, 40 kg, & humerus
Red	Any length	STOP—ONLY FOR TRAINING PURPOSES

Last, but certainly not least, if you see red, STOP right there. There are red training needles for each of the lengths (15 mm, 25 mm, and 45 mm). This is easy to remember; red means stop. When you see a red EZ-IO needle, if you are not in a simulation situation, you should go no further. These are ONLY for training purposes; they are not sterile, and therefore intended for patient use.

Whatever length needle you pick, it is crucial to make sure it is long enough to hit what you are trying to hit (ie, the medullary space) (Fig. 2). All EZ-IO needles have black lines on the needles to help you determine if the needle selected is long enough. You must be able to see at least 1 of the black lines when the needle makes contact with the outside of the bone. If you cannot see at least 1 black line, do not engage the driver. You will not be able to hit what you are trying to hit.

To confirm that you have the right length needle hitting the right spot, Figures 3-5 reflect what we call the Goldilocks rule.

The following are informal insights from a very experienced IO educator/transport nurse:

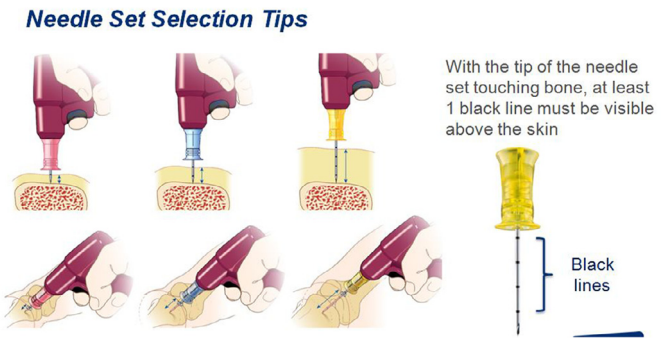

Figure 2. Needle set selection tips. (Reprinted with permission from Teleflex [www.teleflex.com].)

Figure 3. Too short; the needle is "buried" or "countersunk" into the skin. (Reprinted with permission from Oliver Boryszewski, CCEMT-P, NRP, EMT-P.)

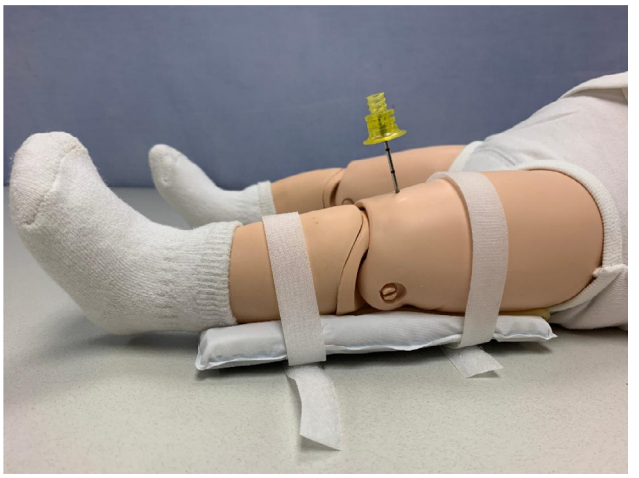

Figure 4. Too long; the needle is in the right spot, but the "flag pole" is easily dislodged. (Reprinted with permission from Oliver Boryszewski, CCEMT-P, NRP, EMT-P.)

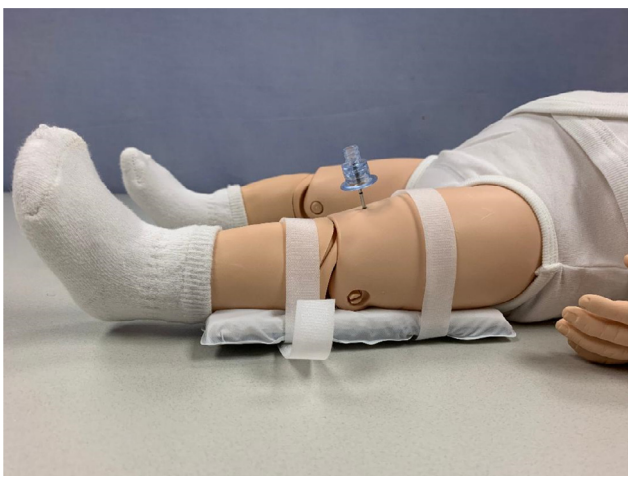

Figure 5. "Just right"; needle is in the right spot, not buried into the skin and not imitating a "flag pole." (Reprinted with permission from Oliver Boryszewski, CCEMT-P, NRP, EMT-P.)

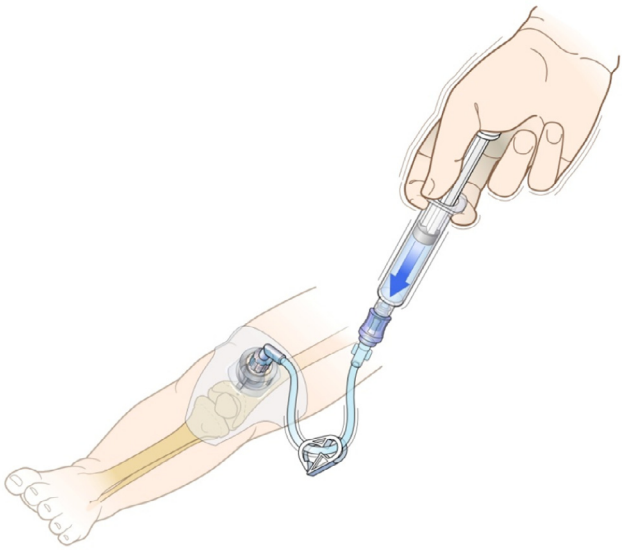

Figure 6. Pediatric femur IO access with stabilizer dressing. (Reprinted with permission from Teleflex [www.teleflex.com].)

Remember that for pediatric use, the blue needle is appropriate for most kids; but when the needle hits the bone, if no black lines are visible, then use a different site or needle length! You should slowly drive the needle inward until you feel a loss of resistance, then STOP (on adults, you can drive the needle to the hub). The best way to do this is to gently drive the needle in with your eyes CLOSED. Suggesting this may freak out clinicians until they try it a few times on a bone model or chicken bone. Obtaining IO access is a tactile skill, not a visual skill. Often when clinicians are driving the needle inward, especially in little ones, they are understandably nervous. They use it like a drill and cannot help but continue to push because they want the needle in, and the procedure over, as quickly as possible. Driving the needle inward with your eyes closed and relying just on the tactile feel of the loss of resistance, reminds clinicians NOT to push. Let the driver do the work and drive into the bone. Once you feel the loss of resistance, then simply lift your finger off the trigger. Once in place, using a stabilizer dressing is crucial to ensure the needle stays in the right spot (Fig. 6).

Every year, there is more and more medical research to review and remember in order to keep our patients safe and ensure that the best patient care possible is delivered. To help remember all this important information, memory tricks can be invaluable. Obtaining EZ-IO access really does involve more than just aiming a needle at a bone. It is essential to pick the right site, the right needle, and insert to the right depth to ensure the needle is in the right spot. Your patients, from babies to big people, deserve nothing less!

Reference

1. Drinker C, Drinker K, Lund C. The circulation in the mammalian bone marrow. *Am J Physiol*. 1922;61:1–92.