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Intraosseous Catheterization: An Often Underused, Life-Saving Tool

Intraosseous catheterization involves placing a needle into a bone.¹⁻⁴ This procedure should be considered when vascular access is not possible or cannot be performed in adequate time due to cardiac arrest, hypovolemic shock, patient anatomy, presence of skin wounds or thrombosis over proposed sites of intravenous catheterization, or very small patient size. The technique is technically simple to perform, requires no specialized equipment or tools, and can make the difference between life and death in small animals.

Contraindications

Relative contraindications include fracture of the proposed catheter site, bacterial infection or sepsis, skin wound or infection over the proposed site of catheterization, or pneumatic bone in avian species. In avian species, however, placement of a catheter into pneumatic bone can be used to facilitate administration of supplemental oxygen.⁴

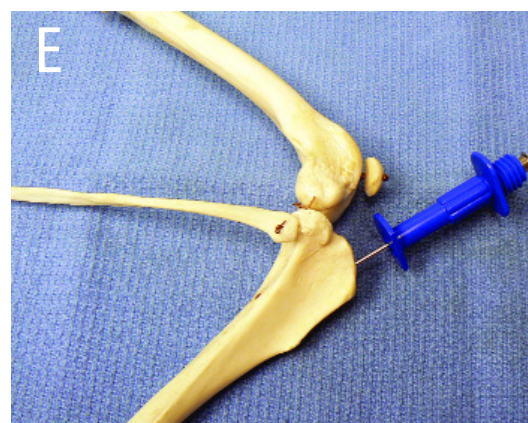
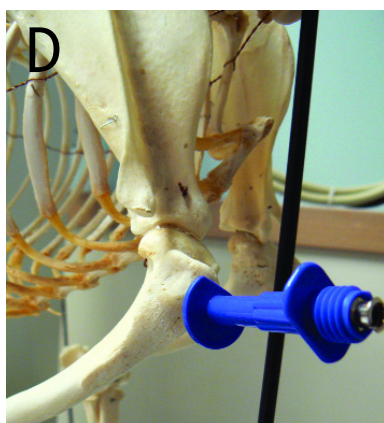
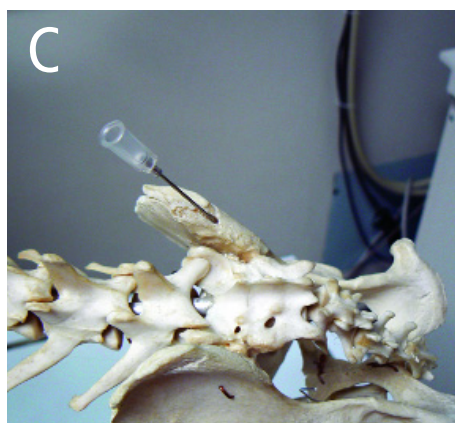
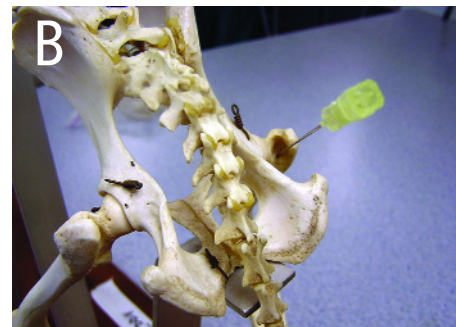
Rate of Infusion

Rate of fluid infusion is directly proportional to diameter of the needle, placement of the needle, whether bevel of the catheter is placed against the bony cortex, and whether needle is partially occluded with bony debris. Fluid can flow with gravity alone, at a maximum rate of 11 mL/min; however, this rate is much slower in extremely small patients. When the catheter is placed under 300 mmHg of pressure, flow can increase to 24 mL/min. In some cases, rapid infusion can increase patient discomfort.

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STEP BY STEP INTRAOSSEOUS CATHETERIZATION

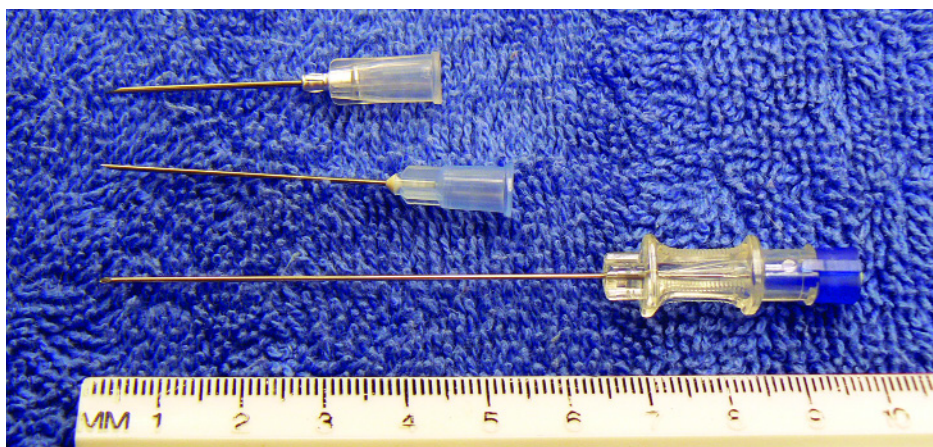
1 Locations for intraosseous catheter placement include the trochanteric fossa of the femur (A and B), the wing of the ileum (C), the proximal humerus (D), and the tibial tuberosity (E). The trochanteric fossa is easy to catheterize; the tibial tuberosity is an excellent place for catheterization of exotic species, including reptiles.



2 Supplies required include a clipper with clean blades, 4 × 4-cm gauze squares, antimicrobial soap and solution, local anesthetic, suture material, a T-set, and the catheter itself.

A variety of hypodermic needles or spinal needles can be used. In small or neonatal animals, 3/4- and 1 1/2-inch 22-gauge hypodermic needles or spinal needles (**shown**) can be used. Bone marrow needles can be used in large patients whose bones have already ossified; Smith Medical manufactures an intraosseous catheter that is appropriate for use in adult animals with ossified bones. Additionally, intraosseous drills (EZ-IO; vidacare.com) can be used to facilitate insertion of an intraosseous catheter in an ossified bone.

In smaller patients whose bones have not yet ossified, the shaft of the hypodermic needles can become clogged with bone debris during



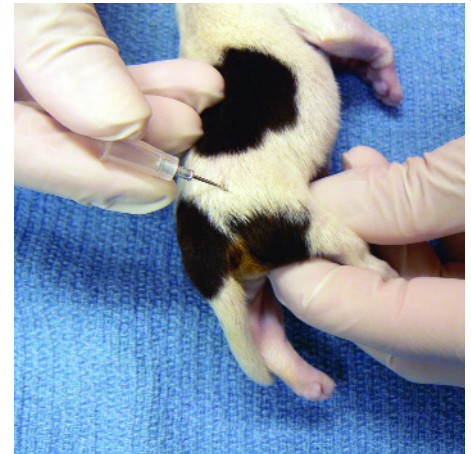
placement. You can avoid this by using a spinal needle with an outer needle and inner stylette, or you can place a piece of surgical wire in the shaft of the hypodermic needle to prevent clogging. If the needle does become clogged, you can simply remove the needle and replace it with an identical one through the hole that you have created.

PROCEDURE PEARL

Avoid clogging the needle with bony debris by using a spinal needle with outer needle and inner stylette or by placing a piece of surgical wire in the hypodermic needle shaft.

Indications for Intraosseous Catheter Placement

- Extremely small body size
- Patient anatomy (eg, very short limbs)
- Exotic species
- Vascular collapse
 - Hypotension
 - Severe dehydration
 - Hypovolemic shock
 - Hypothermia
- Inaccessible IV catheter site
 - Wounds, edema, or infection over proposed sites
 - Thrombosis of vessels
 - Obesity

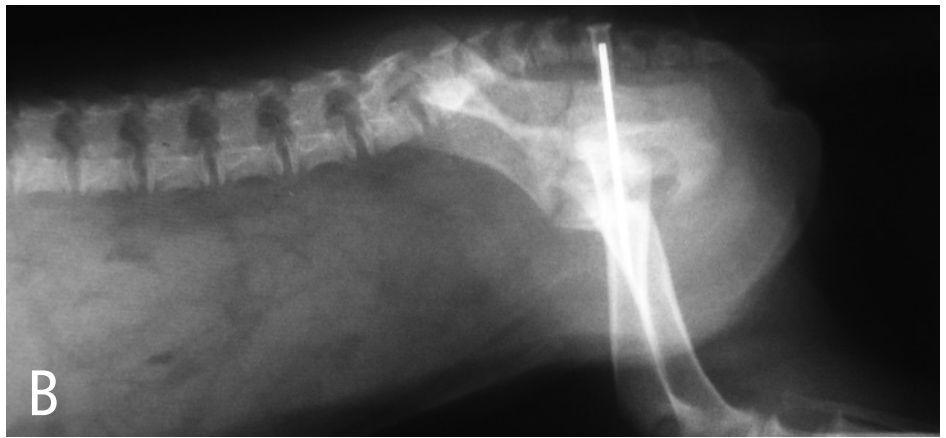


3 Clip and aseptically scrub the site of proposed catheter placement. A small amount of local anesthetic can be administered to the level of the periosteum to decrease discomfort associated with catheter placement.

A cadaver specimen was used to demonstrate the steps in this article; no aseptic preparation was needed.

4 Adduct the stifle so that it is pushed toward ventral midline and the trochanteric fossa is rotated laterally. This positioning helps decrease the risk of impaling the sciatic nerve. In smaller patients, the stifle can be held with your fingers or in the palm of your hand to provide support to push against during placement.

5 Push the tip of needle through the skin, and with a simultaneous pushing and twisting motion, push needle into the groove in the intertrochanteric fossa, through the periosteum, and into the shaft of the femur. You will feel resistance as the needle passes through the bone, then less resistance as it enters the shaft of the femur.



6 Once the needle is in place, you should be able to push the hub of the needle back and forth and move the leg (A). Aspiration of bone marrow also confirms placement. However, it is recommended that you check placement with radiographs (B and C).

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7 Insert a T-port into the hub of the catheter and flush the catheter with saline. Heparinized saline can be used in larger animals. However, nonheparinized saline should be used for very small animals to prevent coagulopathies. You should feel little resistance when flushing the catheter.



PROCEDURE PEARL
If fluid does not flow freely, rotate the needle 90 to 180 degrees; the bevel of the needle may be lodged against the wall of the cortex, thus causing an occlusion.

8 Secure the catheter in place. One method of doing so is to place a stay suture through the skin near the catheter hub, then suture the tubing of the T-port to the stay suture. A second method includes placing a piece of butterfly tape around the line of the T-port close to the catheter hub, then securing the butterfly tape to the skin with 2 sutures or surgical staples. Bandages can be cumbersome and become easily contaminated in very small patients, such as neonates or pocket pets.



Contraindications for Intraosseous Catheter Placement

- Skin wound and/or infection over proposed catheter site
- Fracture of bone intended for catheterization
- Pneumatic bones
- Sepsis
- Metabolic bone disease

9 The catheter is now ready for use. Crystalloid and colloid fluids, blood products (including whole blood), drugs, and parenteral nutrition can be administered, even at very fast rates,^{5,6} when necessary, through an intraosseous catheter. However, as mentioned earlier, rapid infusion rates can cause discomfort in some patients. ■



Potential Complications of Intraosseous Catheter Placement

- Osteomyelitis
- Damage to epiphysis
- Fluid leakage into subcutaneous tissues
- Edema

PROCEDURE PEARL
Nonheparinized saline should be used for very small animals to prevent coagulopathies.

See Aids & Resources, back page, for references, contacts, and appendices.
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