

Position Statement

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The Role of the Registered Nurse in the Use of Intraosseous Vascular Access Devices

Description

In the last decade, endorsements for the use of intraosseous (IO) vascular access devices in the emergency care setting have grown. The American Heart Association (AHA), the International Committee on Resuscitation, the European Resuscitation Council, the Infusion Nurses Society (INS), the National Association of EMS Physicians, and the American Association of Critical-Care Nurses are examples of international organizations that support the insertion of IO vascular access devices to reduce the time to first drug and fluid administration during resuscitation.¹ While peripheral venous structures remain the preferred route for vascular access, updated clinical practice recommendations and advances in available vascular access devices (VADs) have supported the skill evolution for the registered nurse (RN) to include the insertion of IO vascular access devices.²⁻⁴

The first documented use of IO vascular access devices in the clinical setting occurred during World War II for treating severely injured patients.⁵⁻⁷ In the mid-1980s, the use of IO vascular access devices for pediatric patients increased due to newer studies, advances in technology, simplicity of the procedure, and recommendations of the AHA.⁷ Furthermore, advances in IO vascular access devices, and evidence demonstrating clinical equivalence to peripheral intravenous (IV) access, have supported assertions that IO vascular access is safe, fast, and effective in both the pediatric and adult populations.^{2-4,8,9}

In 2016, the AHA *Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care* stated IO cannulation is appropriate for providing access to the non-collapsible venous plexus found in the bone marrow space, thus enabling drug delivery similar to that achieved by peripheral venous access.³ The Pediatric Advanced Cardiac Life Support Cardiac Arrest Algorithm from AHA now also supports IO vascular access as the initial vascular access in cases of cardiac arrest.^{4,10} Beyond its utility in the resuscitative setting, initiation of IO vascular access is considered appropriate even in nonemergent situations when IV access cannot be obtained and the patient would be compromised without the medications or solutions prescribed.^{1,11-14}

Emergency Nurses Association and Infusion Nurses Society Position

It is the position of the Emergency Nurses Association (ENA) and the Infusion Nurses Society (INS) that:

1. An RN trained in proper techniques may insert, maintain, assess and manage complications, and remove IO access devices.
2. IO access is considered as a first alternative when:
 - peripheral access cannot be obtained, or

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- attempts fail for any patients for whom vascular access is medically necessary.
3. Organizational policies and procedures, in accordance with state nurse practice acts, allow the expeditious establishment of IO access by a properly trained RN when indicated.
 4. Individual facilities maintain organizational policies and procedures for initial and ongoing competency validation and required documentation for RNs responsible in the use of IO access devices.

Background

IO vascular access requires either drilling or puncturing through the bone cortex and placing a hollow needle in the marrow cavity, within an abundant network of marrow vasculature that enables rapid transport of fluids and medications into the vascular system.¹² The IO space refers to the spongy, cancellous bone of the epiphysis and the medullary cavity of the diaphysis.¹⁵ Vessels within the IO space link to the central circulation through a series of canals connecting the IO vasculature with other major arteries and veins.¹⁵ Peripheral IV catheter use has demonstrated significant failure rates leading to decreased reliability.¹⁶ Because IO access has higher first attempt success rates, faster insertion times, and lower complication rates compared to peripheral IV catheters, the IO may be an appropriate first-line attempt in patients with known limited vascular access, acting as a bridge to more definitive vascular access.^{14-23,24,25}

Currently, IO vascular access can be established using 1 of 3 types of available devices. Manual devices are inserted using the hand-delivered force of the clinician to insert hollow steel needles with removable trocars. Impact-driven devices use a spring-loaded design for a needle to penetrate the bony cortex into the IO space. Powered drills or drivers are handheld, battery-operated devices that insert the needles using a high-speed rotary motion. Each device has advantages and disadvantages. Device selection is dependent on the individual facility's preference. Current evidence to guide device selection is limited and varies considerably across care environments.^{9,24,26} There is evidence suggesting powered drivers have faster insertion rates compared to both manual and impact drivers.²⁷ Additionally, evidence also suggests that impact-driven and powered drivers have faster times to insertion and higher success rates compared to manual devices.^{24,28} It is important that each organization determines the specific IO device for use and develops clear policies and procedures in accordance with the nursing scope of practice, to enable expeditious establishment of IO access by a properly trained RN when indicated.

An RN trained in proper techniques may insert, maintain, assess and manage complications, and remove IO access devices.²⁹ Site selection is primarily guided by patient age and patient condition. The proximal tibia is a widely preferred insertion location due to the flat surface area and accessibility. However, the proximal humerus is becoming an increasingly popular insertion site for IO devices.^{3,4,8,9,30} Evidence suggests the proximal humerus site may be superior for improved flow rates, drug delivery, decreased pain from infusions, and lower complication rates.^{9,12,23} It should be noted that a powered driver is typically required for humeral head access. The distal tibia, distal femur, iliac crest, and the sternum are

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additional sites, which may be considered for IO insertion.^{29,31} Site selection may be guided by contraindications for IO insertion. Infusions through IO devices may require additional assistance for fluid delivery such as an infusion pump or pressure bag.

Contraindications for IO insertion include fractures in the targeted bone at or above insertion site, absence of adequate anatomical landmarks, previous surgery involving the targeted bone, suspected site infection, local vascular compromise, compartment syndrome, and previous insertion attempt or IO access in the same bone within the last 48 hours.^{9,20,22,29,30,32-34} The U.S. Food and Drug Administration limits dwell time for IO access devices to 24 hours except in instances where alternative vascular access is not available or successfully established.^{14,18,22,30,34-37} In these cases, dwell time for specific devices may be extended for up to an additional 24 hours, not to exceed 48 hours total.³⁶

IO access placement may be confirmed by the following: the stability of the device in the bone, loss of resistance upon bone penetration, and achievement of adequate flow rates without signs of infiltration.^{3,4,29,32,33,35} The ability to aspirate bone marrow or blood may assist in confirmation but may not be present in some patients and should not be used as an indication of improper placement if other indications of proper placement are present.^{9,30,38} Complications of IO access include extravasation, compartment syndrome, fat and air embolism, and infection.^{9,12,37,39-43} In addition, it is essential to have explicit formal organizational policies and procedures in place that follow state nurse practice acts as they relate to the insertion, maintenance, and removal of IO access devices. Insertion site pain and/or infusion-related pain are commonly reported findings for patients with IO access.⁴¹ When appropriate, and based on individual organization policies and procedures, the use of lidocaine is recommended for acute treatment.^{44,45} However, a recent systematic review reports lack of evidence of its efficacy.⁹

Initial education and ongoing validation of competency focus on safe insertion, maintenance, ability to recognize complications, and removal of the IO device. Ongoing validation of clinical competency in IO access through demonstrated clinical competence and evaluation is recommended. It is important that trained RNs demonstrate the ability to provide appropriate care and maintenance of the IO device, including removal. Trained and competent RNs will have the ability to recognize and intervene for suspected complications associated with IO access.²⁹

Emergent and urgent clinical situations require quick and reliable vascular access. Delays in vascular access can have life-threatening consequences for patients.^{2-4,9,12,16, 17, 29} IO access is a rapid and effective route for infusions and medications when IV access is difficult to achieve. In the setting where vascular access is medically necessary, it is essential that IO access be considered as first alternative access when peripheral access cannot rapidly be obtained or insertion attempts fail.⁹ RNs trained in the insertion, care, and maintenance of IO devices contribute to life-sustaining outcomes in patient populations.

Resources

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