

Medication Administration

Intraosseous (IO) vascular access has experienced a resurgence in recent years due to significant advancements in IO technology. As a result, medication administration via the IO route has become more commonplace. This document addresses certain misperceptions regarding drug delivery via the IO route, and provides clinical validation that drug delivery time via the IO and central intravenous (IV) routes is essentially equivalent.



Equal Time with IO and IV

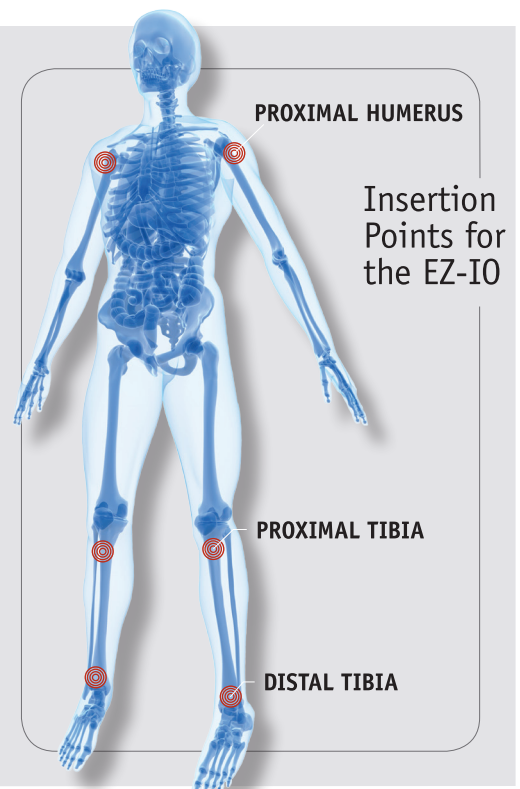
In 2008, a 25-patient clinical study was conducted that compared the pharmacokinetics of intraosseous access vs. intravenous administration using morphine sulfate in adults.¹ Results were statistically significant, showing NO difference between IO and IV administration of morphine for most pharmacokinetic parameters, including:

- maximum plasma concentration
- time to maximum plasma concentration
- area under plasma concentration-time curve.

CONCLUSION: Results support the bioequivalence of IO and IV administration of morphine in adults.

Based on relevant research and clinical practice, any medication delivered via peripheral IV can be administered safely via the IO route, including blood and blood products. For example, according to published literature, the following medications and fluids have been administered via the IO route:^{i,ii,iii,iv}

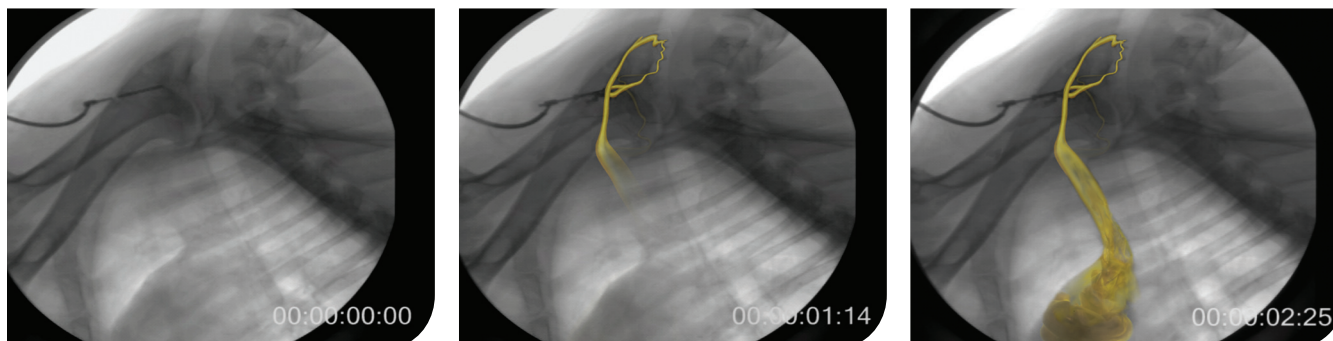
Medications	Diazoxide	Lorazepam	Succinylcholine
Adenosine	Digoxin	Magnesium sulfate	Thiamine
Aminophylline	Dobutamine	Mannitol	Thiopental
Amiodarone	Dopamine	Methylprednisolone	Vasopressin
Anesthetic agents	Ephedrine	Midazolam	Vecuronium
Antibiotics	Epinephrine	Morphine	
Antitoxins	Etomidate	Naloxone	Fluids
Atracurium besylate	Fentanyl	Pancuronium	Blood and blood products
Atropine	Furosemide	Phenobarbital	Colloids
Calcium chloride	Haloperidol	Phenytoin	Crystalloids
Calcium gluconate	Heparin	Potassium chloride	Dextrose solutions
Contrast media	Insulin	Promethazine	Lactated Ringer's solutions
Dexamethasone	Labetalol	Propranolol	Sodium chloride solutions
Dextrose 50%	Levarterenol	Rocuronium	
Diazepam	Lidocaine	Sodium bicarbonate	



Medication Administration (Continued)

Proven, Effective Transport

The vasculature of bone marrow is a very dynamic part of the vascular system, even for patients in physiologic shock.ⁱⁱⁱ A common misperception regarding the intraosseous space is that it is a sluggish part of the venous system, and medications are sequestered or metabolized differently from those administered via the intravenous route. This is not the case. The dynamic nature of bone marrow vasculature has been validated by research, confirming that bone marrow architecture facilitates rapid transport of drugs to the central venous system and heart.



In the images above, a fluoroscopy video of an infusion at the proximal humerus clearly shows the effective drug delivery of EZ-IO to the heart in 2.25 seconds. (Images visually enhanced; contrast used in a caprine model for illustration. Results in humans may vary.) Please visit Vidacare.com to view the actual video.

RELEVANT FINDINGS SUPPORT EZ-IO

A number of research studies and other articles on IO access have been published in recent years. Each provides key insights that support and validate IO, and EZ-IO, as a viable alternative for medication administration.

2008: Von Hoff study key findingsⁱ

- Pharmacokinetic study of IO vs. IV administration of morphine sulfate
- No statistical differences were observed between IO and IV administration of morphine sulfate for time to maximum concentration and maximum plasma concentration
- Results support bioequivalence of IO and IV administration of morphine sulfate in adults

2005: Hoskins study key findingsⁱⁱⁱ

- Attempting vascular access can adversely delay drug therapy during CPR
- The IO route provides rapid access via non-collapsible vessels in bone marrow
- IO infusions effectively deliver drugs during CPR

2009: Wright study key findings^{iv}

- Research study of IO infusion of rFVIIa during hemorrhagic shock
- Systemic blood levels of rFVIIa increased rapidly following IO administration
- There was NO evidence of local or systemic toxicity following IO infusion
- The blood concentration of rFVIIa peaked immediately after end of IO infusion

BIBLIOGRAPHY

- i Von Hoff DD, Kuhn JG, Burris HA, Miller LJ. Does intraosseous equal intravenous? A pharmacokinetic study. *American Journal of Emergency Medicine* 2008;26:31-8.
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Paxton JH, Knuth TE, Klausner HA. Proximal humerus intraosseous infusion: a preferred emergency venous access. *The Journal of Trauma* 2009;67:606-11.
Davidoff J, Fowler R, Gordon D, et al. Clinical evaluation of a novel intraosseous device for adults: prospective, 250-patient, multi-center trial. *JEMS* 2005;30:s20-23.
- iii Hoskins S, Nascimento P, Espana J, Kramer G. Pharmacokinetics of intraosseous drug delivery during CPR. *Shock* 2005;23:35.
- iv Wright JK, Christy RJ, Tharp RV, Kalns JE. Evaluation of intraosseous delivery of factor VIIa during hemorrhagic shock in the pig. *Military Medicine* 2009;174:119-23.