

**ARROW® EZ-IO® INTRAOSSEOUS  
VASCULAR ACCESS SYSTEM**  
BIBLIOGRAPHY

**TITLE: FOUR YEARS OF EZ-IO SYSTEM IN THE PRE- AND IN-HOSPITAL EMERGENCY SETTING**

**Source:** Central European Journal of Medicine 2013;8(2):166-71. doi:10.2478/s11536-012-0125-6

**Authors:** Reinhardt L, Brenner T, Bernhard M, Knapp J, Sikinger M, Martin E, Helm M, Popp E

An observational study evaluating use of the EZ-IO Intraosseous Vascular Access System by two ground and one air based physician staffed EMS and at a German surgical university hospital between January 1, 2008 and December 31, 2011. The EZ-IO Intraosseous Vascular Access System was used to establish IO access 88 times in 87 patients; 83 insertions were performed in the EMS and 5 were performed in the hospital. The proximal tibia was the primary site used (97.7%) and the first attempt success rate was 94%. IO access was the first approach for vascular access in children compared to adults (38.9% vs. 86.2%). There were 5 failures attributed to missed insertions or extravasation and 2 for wrong needle length. There were no serious complications.

**TITLE: EZ-IO INTRAOSSEOUS DEVICE IMPLEMENTATION IN A PRE-HOSPITAL EMERGENCY SERVICE: A PROSPECTIVE STUDY AND REVIEW OF THE LITERATURE**

**Source:** Resuscitation 2013;84:440-5. <http://dx.doi.org/10.1016/j.resuscitation.2012.11.006>

**Authors:** Santos D, Carron PN, Yersin B, Pasquier M

An observational study evaluating use of the EZ-IO Intraosseous Vascular Access System in a Swiss pre-hospital EMS system between January 1, 2009 and December 31, 2011 and comparing those results to the literature. Sixty IO insertions were performed on 58 patients; the proximal tibia was used in all attempts except 1 attempt made in the proximal humerus. Overall success rate was 90%; the 6 failures were attributed to the inability to infuse, difficult needle insertion, and incorrect insertion site (tibial plateau). Some of the indications for IO access included cardiorespiratory arrest, major trauma, and shock; general anesthesia was successfully induced in 7 patients. Drugs infused are listed. There were no serious complications.

**TITLE: A MULTIJURISDICTIONAL EXPERIENCE WITH THE EZ-IO INTRAOSSEOUS DEVICE IN THE PREHOSPITAL SETTING**

**Source:** American Journal of Emergency Medicine 2013; <http://dx.doi.org/10.1016/j.ajem.2013.08.056>

**Authors:** Byars DV, Tsuchitani SN, Yates J, Knapp B

This letter to the editor describes a prospective, observational trial that evaluated use of the EZ-IO Intraosseous Vascular Access System in critically ill and injured patients (adult and pediatric) in a multijurisdictional prehospital setting; 9 EMS agencies were included. The 25 mm needle set was the only needle size allowed for the study. One-hundred-eleven EZ-IO Intraosseous Vascular Access System placements were performed by EMT-Intermediates and EMT-Paramedics with 96 successful placements (86.5%); the most common cause for failure reported by the author was thought to be patient obesity and inadequate needle length. Cardiac arrest patients made up 74.7% of the study population and the most common site accessed was the proximal tibia. Device operators rated the ease of use 7.87 using a 0 to 10 scale where 10=extremely easy.

**TITLE: PREHOSPITAL SEMIAUTOMATIC INTRAOSSEOUS PLACEMENT IN ADULTS**

**Source:** Prehospital Emergency Care 2012;16(1):173. doi:10.3109/10903127.2011.624676

**Authors:** Myers LA, Russi CS, Kolb L

This abstract presented at 2012 National Association of EMS Physicians (NAEMSP) scientific assembly described a retrospective study that evaluated success rates and features of prehospital IO needle placement in adults following implementation of the EZ-IO Intraosseous Vascular Access System over a 2 year period. First attempt success rate in 281 patients was 89.7%; overall placement success was achieved for 91.8%.

**TITLE: EFFICACY AND SAFETY OF THE EZ-IO™ INTRAOSSEOUS DEVICE: OUT-OF-HOSPITAL IMPLEMENTATION OF A MANAGEMENT ALGORITHM FOR DIFFICULT VASCULAR ACCESS**

**Source:** Resuscitation 2011;82(1):126-9

**Authors:** Gazin N, Auger H, Jabre P, Jaulin C, Lecarpentier E, Bertrand C, Margenet A, Combes X

This article describes an observational study to assess the safety and efficacy of the EZ-IO Intraosseous Vascular Access System when using a management algorithm for difficult vascular access in an out-of-hospital setting. Over a one-year period, the device was used in 30 cardiac arrest and 9 other cases. Overall success rate was 97% and first attempt success was 84%. There was one complication—transient local inflammation. Investigators concluded that the device is suitable as a first-line option for difficult vascular access in the out-of-hospital setting.

**TITLE: ALL ACCESS PASS: MASTERING THE USE OF IO DEVICES**

**Source:** Journal of Emergency Medical Services 2010;35(6):30,32

**Authors:** Gillum L

This article discusses training methodology and applies the concept to the implementation of the EZ-IO Intraosseous Vascular Access System in the Montgomery County Hospital District EMS, a participant in the EZ-IO Intraosseous Vascular Access System beta test.

## EZ-IO INTRAOSSEOUS VASCULAR ACCESS SYSTEM USE *continued*

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**TITLE:** 1,199 CASE SERIES: POWERED INTRAOSSEOUS INSERTION PROVIDES SAFE AND EFFECTIVE VASCULAR ACCESS FOR EMERGENCY PATIENTS

**Source:** Annals of Emergency Medicine 2008;52(4):S152

**Authors:** Fowler RL, Pierce A, Nazeer S, Philbeck TE, Miller LJ

Large retrospective study of patients for whom emergency vascular access was obtained using the EZ-IO Intraosseous Vascular Access System. Insertion success was 92% and within 10 seconds for 84% of the one-attempt successful cases. Complication rate was low (4.8%), none were serious, and extravasation was the most frequent (0.8%). The device was rated “easy to use” 72% of the time, and researchers concluded that the powered IO device is safe and effective for achieving vascular access in the resuscitation and stabilization of emergency patients.

*This study was sponsored by Teleflex Incorporated (Vidacare LLC).*

**TITLE:** STORIES BEHIND THE NUMBERS: IO EXPERIENCES IN PROVIDERS’ OWN WORDS

**Source:** Journal of Emergency Medical Services 2007;32:s30-1

**Authors:** Potyka JS, Gordon DJ

Qualitative study focuses on EMS caregivers’ experiences with the EZ-IO Intraosseous Vascular Access System and personal opinions. The study used a narrative approach to gain insight from EMS practitioners working with an IO access device under real field conditions.

**TITLE:** THE PORTLAND IO EXPERIENCE: RESULTS OF AN ADULT INTRAOSSEOUS INFUSION PROTOCOL

**Source:** Journal of Emergency Medical Services 2007;32:s27-8

**Authors:** Stouffer JA, Jui J, Acebo J, Hawks RW

The article describes a prospective observational study conducted by several EMS agencies in Portland, OR to determine the safety, efficacy and benefits of using the EZ-IO Intraosseous Vascular Access System in the prehospital environment. The IO device was successfully placed in 95% of the 280 cases. In 98% of the cases, placement was made within six seconds.

**TITLE:** FEASIBILITY OF BASIC EMERGENCY TECHNICIANS TO PERFORM SELECTED ADVANCED LIFE SUPPORT INTERVENTIONS

**Source:** Prehospital Emergency Care 2006;10(4):518-21

**Authors:** Guyette FX, Rittenberger JC, Platt T, Suffoletto B, Hostler D, Wang HE

Prospective observational study evaluating EMT-B ability to provide care in out-of-hospital cardiac arrests. Found that EMT-Bs were able to place the EZ-IO with a 94% success rate. Median time to placement was 72 seconds.

**TITLE:** POWERED INTRAOSSEOUS ACCESS IN THE PREHOSPITAL SETTING: MCHD EMS PUTS THE EZ-IO TO THE TEST

**Source:** Journal of Emergency Medical Services 2005;30:s24-6

**Authors:** Gillum L, Kovar J

Observational study of initial use of the EZ-IO Intraosseous Vascular Access System in 125 patients by EMS providers. Found 94% success rate for insertion and infusion into the IO space. No complications reported.

**TITLE:** CLINICAL EVALUATION OF A NOVEL INTRAOSSEOUS DEVICE FOR ADULTS: PROSPECTIVE, 250-PATIENT, MULTI-CENTER TRIAL

**Source:** Journal of Emergency Medical Services 2005;30(10):s20-23

**Authors:** Davidoff J, Fowler R, Gordon D, Klein G, Kovar J, Lozano M, Potyka J, Racht E, Saussy J, Swanson E, Yamada R, Miller L

Observational study evaluating use of the EZ-IO Intraosseous Vascular Access System. Found 97% success rate for insertion and infusion into the IO space by paramedics, nurses, physicians and other EMS personnel in using the device for emergency vascular access. No serious complications reported.

*This study was sponsored by Teleflex Incorporated (Vidacare LLC).*

## EZ-IO INTRAOSSEOUS VASCULAR ACCESS SYSTEM COMPARATIVE STUDIES

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**TITLE:** OPTIONS FOR INTRAVASCULAR ACCESS DURING RESUSCITATION OF ADULTS

**Source:** Emergency Nurse 2012;20(1):24-8

**Authors:** Cairney K, Ibrahim M

This article discusses how IO access can be used to improve advanced life support therapy. The EZ-IO Intraosseous Vascular Access System is described in this article; published comparative studies between other IO devices and peripheral IV access are cited, leading the author to conclude the EZ-IO Intraosseous Vascular Access System is user friendly, and establishes intravascular access more quickly and more often on first attempt than other devices.

**TITLE: THE INTRODUCTION OF A SEMIAUTOMATED (EZ-IO) DEVICE IN PEDIATRIC PREHOSPITAL CARE REPLACING A MANUAL INTRAOSSEOUS (IO) DEVICE IMPROVES THE SUCCESS RATE FOR ATTEMPTS AT VASCULAR ACCESS**

**Source:** Prehospital Emergency Care 2011;15(1):110

**Authors:** Myers LA, Russi CS, Arteaga GM

This abstract describes a 93 patient study presented at the 2011 National Association of EMS Physicians Annual Conference that examined the characteristics of pediatric patients receiving IO infusions and the primary EMS clinical impressions, success rates, and subsequent treatments delivered via manual IO needle vs. the powered EZ-IO Intraosseous Vascular Access System. Investigators concluded that for the pediatric cohort use of the powered device offered a marginally higher first-attempt success rate compared to the manual device, and that the rate of IO access utilization by EMS more than tripled after adoption of the powered device.

**TITLE: TACTILE FEEDBACK COMPARISON OF THREE TYPES OF INTRAOSSEOUS ACCESS DEVICES FOR NEEDLE INSERTION ACCURACY**

**Source:** Annals of Emergency Medicine 2010;56(3):S133

**Authors:** Miller L, Philbeck T, Bolleter S, Garcia G

This abstract, presented at the 2010 American College of Emergency Physicians (ACEP) Research Forum, describes a study designed to determine the relative precision of intraosseous needle placement using only tactile feedback. The study also assessed the ability to access simulated osteoporotic bone without damage using the 3 methods. Investigators concluded that, using tactile feedback only, rotary power may allow precise IO catheter placement with greater success and confidence than manual or hammer-assisted devices. Powered insertion may facilitate penetration into fragile bone without damage.

*This research was sponsored by Teleflex Incorporated (Vidacare LLC).*

**TITLE: COMPARISON OF INTRAVENOUS AND INTRAOSSEOUS ACCESS BY PRE-HOSPITAL MEDICAL EMERGENCY PERSONNEL WITH AND WITHOUT CBRN PROTECTIVE EQUIPMENT**

**Source:** Resuscitation 2010;81(1):65-8

**Authors:** Lamhaut L, Dagrón C, Apriotesei R, Gouvernaire J, Elie C, Marx JS, Télion C, Vivien B, Carli P

Training study with nurses and physicians comparing EZ-IO Intraosseous Vascular Access System to IV lines under Hazmat conditions. IO access procedure significantly shorter.

**TITLE: EMERGENCY INTRAOSSEOUS ACCESS IN A HELICOPTER EMERGENCY MEDICAL SERVICE: A RETROSPECTIVE STUDY. SCANDINAVIAN JOURNAL OF TRAUMA**

**Source:** Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine 2010;18:52. doi:10.1186/1757-7241-18-52.

**Authors:** Sunde GA, Heradstveit BE, Vikenes BH, Heltne JK

This article describes a longitudinal study of intraosseous vascular access in pre-hospital emergency medicine handled by helicopter emergency medical services. Of the 78 IO insertion attempts made on 70 patients, overall success rates were 50% using manual needles, 55% using the Bone Injection Gun, and 96% using the EZ-IO Intraosseous Vascular Access System. Investigators concluded that newer IO techniques may enable faster and more reliable vascular access; and that all emergency services should be familiar with IO techniques.

**TITLE: FAST OR EASY? COMPARING TWO ADULT IO INFUSION DEVICES**

**Source:** JEMS.com 2008; [http://www.jems.com/news\\_and\\_articles/articles/Fast\\_or\\_Easy.html](http://www.jems.com/news_and_articles/articles/Fast_or_Easy.html). Accessed 01/24/2008

**Authors:** Pointer JE, Vultaggio D, Schnepf R, Kleveno A

This article describes an observational study in which two intraosseous devices were compared: the FAST1® and the EZ-IO Intraosseous Vascular Access System. For the 117 patients on which the FAST1 was used, there was an 84% success; compared to a 97% success rate for the EZ-IO Intraosseous Vascular Access System (n=71).

**TITLE: CONSECUTIVE FIELD TRIALS USING TWO DIFFERENT INTRAOSSEOUS DEVICES**

**Source:** Prehospital Emergency Care 2007;11:164-71

**Authors:** Frascione RJ, Jensen JP, Kaye K, Salzman JG

This article describes authors' evaluation of provider performance using two IO devices; the FAST1 and the EZ-IO Intraosseous Vascular Access System. Of 89 insertions with each device, success rate for 72% for the FAST1 and 87% for the EZ-IO Intraosseous Vascular Access System, a significant difference (p=0.009). The time to fluid insertion for the EZ-IO Intraosseous Vascular Access System was also faster (p=0.02). Authors noted that the EZ-IO Intraosseous Vascular Access System is unique and much more useful than the FAST1.

*This study was sponsored by Teleflex Incorporated (Vidacare LLC).*

**TITLE: TRENDS IN THE USAGE OF INTRAOSSEOUS ACCESS IN THE PREHOSPITAL SETTING**

**Source:** Prehospital Emergency Care 2007;11(1):130

**Authors:** Mathew N, McGinnis-Hainsworth D, Megargel R, Cleary A, O'Connor R

In this study, presented at the National Association of EMS Physicians (NAEMSP) 2007 annual meeting, authors compared the success rate of conventional IO access with the EZ-IO Intraosseous Vascular Access System during 245 cases in the prehospital setting. They concluded that using the EZ-IO Intraosseous Vascular Access System results in a statistically significant increase in IO access success rate, compared to conventional IO methods.

## GENERAL IO ACCESS

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**TITLE:    INTRAOSSEOUS ACCESS IN THE PREHOSPITAL SETTING: LITERATURE REVIEW.**

**Source:**   Prehospital Disaster Medicine 2012;27(5):468-72. doi:10.1017/S1049023X12001124.

**Authors:**   Olaussen A, Williams B

A literature review of articles describing intraosseous vascular access devices used in the pre-hospital setting. Twenty articles met the inclusion criteria and described the manual devices, BIG, Fast-1 and the EZ-IO Intraosseous Vascular Access System. The authors concluded that the literature suggests that semiautomatic IO devices may be more effective than manual devices.

**TITLE:    A BUILDING BLOCK STRATEGY FOR OPTIMIZING OUTCOMES FROM OUT OF HOSPITAL CARDIAC ARREST**

**Source:**    Circulation 2009;120:S1470-a

**Authors:**   Ornato JP, Peberdy MA, Kurz MC

In this 1,598 patient case series, investigators studied the effects of "...serial standard of care changes...in the EMS system over time." They concluded that IO access is an essential component for a proven algorithm for the management of out of hospital cardiac arrest (OOH-CA).

**TITLE:    POTENTIAL REDUCTION IN TIME TO DRUG ADMINISTRATION IF VASCULAR ACCESS PRECEDED INTUBATION DURING OUT-OF-HOSPITAL CARDIAC ARREST**

**Source:**    Prehospital Emergency Care 2009;13(1):133

**Authors:**   Menegazzi JJ, LaCoverly AC, Negron DI, Condle JP, Callaway CW

This abstract describes a retrospective study to determine the time from EMS dispatch to IV or IO drug delivery, time savings to drug delivery if vascular access preceded intubation, the internal validity of that point estimate using matched cases in which IV/IO was performed first, and the theoretical increase in rate of return to spontaneous circulation. Investigators concluded that time from dispatch to IV/IO delivery could be reduced by 4 minutes if vascular access preceded intubation and could potentially double ROSC.

**TITLE:    INTRAOSSEOUS LINE PLACEMENT DOES NOT IMPROVE OUTCOME IN ADULTS WITH OUT-OF-HOSPITAL CARDIAC ARREST**

**Source:**    Prehospital Emergency Care 2009;13(1):102

**Authors:**   Schutt RC, Bowman B, Cevik C, Essa N, Lee ML, Macedo J, Mowrey B, Ratcliff T, Whitworth RL, Phy M

This abstract describes a small study designed to determine if IO line placement improves outcome in adult patients with out-of-hospital cardiac arrest. This 165 patient study did not demonstrate improved survival.

**TITLE:    INTRAOSSEOUS DRUG ADMINISTRATION IN CHILDREN AND ADULTS DURING CARDIOPULMONARY RESUSCITATION**

**Source:**    The Annals of Pharmacotherapy 2007;41(10):1679-86

**Authors:**   Buck ML, Wiggins BS, Sesler JM

This article reviews and assesses the literature on the use of IO drug administration during cardiopulmonary resuscitation. It addresses the risks and benefits of using IO access in adults and children. The article describes the FDA-cleared devices available for use including the FAST1, Waismed Bone Injection Gun and the EZ-IO Intraosseous Vascular Access System.

**TITLE:    THE ROLE OF INTRAOSSEOUS VASCULAR ACCESS IN THE OUT-OF-HOSPITAL ENVIRONMENT (RESOURCE DOCUMENT TO NAEMSP POSITION STATEMENT)**

**Source:**    Prehospital Emergency Care 2007;11(1):63-6

**Authors:**   Fowler R, Gallagher JV, Isaacs SM, Ossman E, Pepe P, Wayne M

Article calls for action by all EMS medical directors to consider and use the intraosseous route for adult patients requiring immediate vascular access. Also, provides the supporting documentation to a position statement by the National Association of EMS Physicians which calls for greater awareness of the advantages and benefits gained from using IO access. Includes excellent description of EZ-IO Intraosseous Vascular Access System and IO devices.

**TITLE:    INTRAOSSEOUS INFUSION: NOT JUST FOR KIDS ANYMORE**

**Source:**    Emergency Medical Services; March 2005

**Authors:**   DeBoer S, Seaver M, Morissette C

Article describes intraosseous access for adults and pediatrics. Describes and discusses IO devices available including Jamshidi, Bone Injection Gun, FAST1, and the EZ-IO Intraosseous Vascular Access System.

## THERAPEUTIC HYPOTHERMIA VIA IO ROUTE

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**TITLE: INFUSING CHILLED SALINE VIA THE INTRAOSSEOUS ROUTE IS EQUIVALENT TO INFUSION VIA THE INTRAVENOUS ROUTE IN REDUCING THE CORE TEMPERATURE IN SWINE**

**Source:** Prehospital Emergency Care 2012;16(1):152. doi:10.3109/10903127.2011.624676

**Authors:** Miller L, Montez DF, Philbeck TE, Puga TA, Morgan J

This abstract presented at the 2012 National Association of EMS Physicians (NAEMSP) scientific assembly described a randomized, cross-over study in which 8 swine were administered chilled saline via IV and IO routes to determine if the two routes were equivalent. The results suggested no clinical or statistical difference between IV and IO routes for infusion of chilled saline for therapeutic hypothermia.

*This study was sponsored by Teleflex Incorporated (Vidacare LLC).*

**TITLE: THE FEASIBILITY OF INDUCING MILD THERAPEUTIC HYPOTHERMIA AFTER CARDIAC RESUSCITATION USING ICED SALINE INFUSION VIA AN INTRAOSSEOUS NEEDLE**

**Source:** Resuscitation 2010;81:82-6

**Authors:** Mader TJ, Walterscheid JK, Kellogg AR, Lodding CC

In this study, using a swine model, investigators concluded that mild therapeutic hypothermia can be effectively induced after successful resuscitation of prolonged ventricular fibrillation through infusion of chilled saline via the IO catheter.

**TITLE: EFFICIENT PREHOSPITAL INDUCTION OF THERAPEUTIC HYPOTHERMIA VIA INTRAOSSEOUS INFUSION**

**Source:** Resuscitation 2010;81(2):262-3

**Authors:** Truhlar A, Skulec R, Rozsival P, Cerny V

This letter to the editor describes the first case reported in the clinical literature in which therapeutic hypothermia was administered using the intraosseous route. The patient, a 2-year-old boy who was found submerged in a cesspool and had been asystolic for 5-10 minutes, survived without neurological complications.

**TITLE: INDUCED COOLING BY EMS (ICE): YEAR ONE IN RALEIGH/WAKE COUNTY.**

**Source:** Journal of Emergency Medical Services 2007;32:s13-5.

**Authors:** Myers BJ, Lewis R

This article describes the experience of the Wake County (NC) EMS System in inducing hypothermia for patients with return of spontaneous circulation after cardiac arrest. Authors describe their use of the EZ-IO® Intraosseous Vascular Access System for the administration of chilled saline with 414 placements and an overall success rate of 94%.

## IO INFUSION PAIN MITIGATION, FLOW RATES AND INSERTION SITES

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**TITLE: A MAGNETIC RESONANCE IMAGING STUDY TO DEFINE OPTIMAL NEEDLE LENGTH FOR HUMERAL HEAD IO DEVICES**

**Source:** Journal of Special Operations Medicine 2012;12(2):77-82

**Authors:** Rush S, Bremer J, Foresto C, Rubin AM, Anderson PI

This article describes a retrospective study in which 50 consecutive MRI images were evaluated of the humerus for the purpose of determining the optimal needle length necessary for successful proximal humerus IO insertion. Results showed the cortical thickness was 4mm in all cases and that an IO needle length ranging between 40-50mm should be used via the anterior approach. The EZ-IO Intraosseous Vascular Access System is specifically discussed in relation to the proximal humerus IO insertion site and a 24 patient post mortem review of the EZ-IO Intraosseous Vascular Access System placed in the proximal humerus is discussed.

**TITLE: PARAMEDICS SUCCESSFULLY PERFORM HUMERAL EZ-IO INTRAOSSEOUS ACCESS IN ADULT OUT-OF-HOSPITAL CARDIAC ARREST PATIENTS**

**Source:** American Journal of Emergency Medicine 2012;30:1095-9. doi:10.1016/j.ajem.2011.07.010

**Authors:** Wampler D, Schwartz D, Shumaker J, Bolleter S, Beckett R, Manifold C

This study conducted by the San Antonio Fire Department evaluated the first-attempt success rate for humeral EZ-IO Intraosseous Vascular Access System placement by paramedics in prehospital adult cardiac arrest patients. Humeral placement was attempted in 247 cardiac arrest patients; first attempt placement success rate was 91%. Authors concluded that humeral IO access placement is a reliable method for vascular access in this patient population.

*This study was sponsored by Teleflex Incorporated (Vidacare LLC).*

**TITLE: INTRAOSSEOUS VERSUS INTRAVENOUS VASCULAR ACCESS DURING OUT-OF-HOSPITAL CARDIAC ARREST: A RANDOMIZED CONTROLLED TRIAL**

**Source:** Annals of Emergency Medicine 2011;58(6):509-16

**Authors:** Reades R, Studnek JR, Vandeventer S, Garrett J

The objective of this study was to determine the frequency of first-attempt success of humeral IO, tibial IO, and peripheral IV (PIV) insertions during out-of-hospital cardiac arrest. Patients were randomized to receive one of the 3 methods. There were 182 patients enrolled, 64 were assigned to tibial IO, 51 to humeral IO and 67 to PIV. Of all patients 130 (71%) were successful on first attempt with 17 (9%) needles dislodged. First attempt success within the treatment groups was 91% for tibial IO, 51% for humeral IO, and 43% for PIV.



**TITLE: HURTS SO GOOD; EASING IO PAIN AND PRESSURE**

**Source:** Journal of Emergency Medical Services 2010;35(9):58-69

**Authors:** Philbeck TE, Miller LJ, Montez D, Puga T

This article describes two studies designed to compare lidocaine's effect on pain during fluid infusion through the tibial and humeral IO routes and to determine infusion flow rates. Authors concluded that, for adequate IO infusion rates with minimal and tolerable pain, 40 mg of preservative-free lidocaine may be needed; followed by a rapid normal saline syringe flush of at least 10mL and another 20 mg of lidocaine. Additional dosing and flushing may be required. For less overall pain due to IO infusion, and greater infusion flow rates, the proximal humerus should be strongly considered, using a longer IO needle set.

*This study was sponsored by Teleflex Incorporated (Vidacare LLC).*

**TITLE: INTRAOSSEOUS PRESSURE INFUSION COMPARISON USING A RAPID INFUSION DEVICE AND A PRESSURE BAG IN A SWINE MODEL**

**Source:** Annals of Emergency Medicine 2010;56(3):S26

**Authors:** Lairret JR, Bebart V, Lairret K, Kacproicz R, Johnson R, Pltotti R, Bolleter S, Cowart J

In an abstract presented at the 2010 American College of Emergency Physicians (ACEP) Research Forum, investigators describe a swine study designed to compare IO infusion rates using the Belmont FMS 2000 rapid infusion device and a pressure bag through the proximal tibia and proximal humerus. Investigators concluded that infusion rates were highest using the pressure bag via the proximal humerus.

## PEDIATRICS

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**TITLE: USE OF THE PEDIATRIC EZ-IO NEEDLE BY EMERGENCY MEDICAL SERVICES PROVIDERS**

**Source:** Pediatric Emergency Care 2009;25(5):329-32

**Authors:** Frascone RJ, Jensen J, Wewerka SS, Salzman JG

Prospective study of 246 EMS providers at 14 EMS agencies. Reports successful IO needle placement in 95% of cases (18 of 19).

**TITLE: POWERED INTRAOSSEOUS INSERTION PROVIDES SAFE AND EFFECTIVE VASCULAR ACCESS FOR PEDIATRIC EMERGENCY PATIENTS**

**Source:** Pediatric Emergency Care 2008;24(6):347-50

**Authors:** Horton MA, Beamer C

A retrospective clinical study was conducted to demonstrate the safety and effectiveness of the EZ-IO Intraosseous Vascular Access System for pediatric patients. For the 95 eligible patients in the study, successful insertion and infusion was achieved in 94% of the patients. Insertion time was 10 seconds or less in 77% of the one-attempt successful cases reporting time to insertion. There were 4 minor complications (4%), but none significant. The results of this study support the use of the EZ-IO Intraosseous Vascular Access System for children in emergency situations. The complication rate suggests that the powered IO device is safe and effective for the resuscitation and stabilization of pediatric patients.

## IO BLOOD FOR LABORATORY ANALYSIS

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**TITLE: INTRAOSSEOUS BLOOD CORRELATES WITH VENOUS BLOOD IN HEALTHY SUBJECTS USING POINT-OF-CARE ANALYZERS**

**Source:** Annals of Emergency Medicine 2013;62(4S):S40

**Authors:** Montez DF, Puga TA, Garcia MR, Miller LJ, Davlantes C, Saussy JM, Philbeck TE, Jr.

A clinical study evaluating the relationship between IO blood and peripheral venous blood lactate levels analyzed using the i-STAT point-of-care analyzer in healthy volunteers. Results showed IO blood lactate levels were comparable to venous blood lactate levels with a positive statistical correlation.

*This study was sponsored by Teleflex Incorporated (Vidacare LLC).*

**TITLE: ANALYSIS OF BLOOD GAS, ELECTROLYTES AND GLUCOSE FROM INTRAOSSEOUS SAMPLES USING AN I-STAT POINT-OF-CARE ANALYSER**

**Source:** Resuscitation 2013; <http://dx.doi.org/10.1016/j.resuscitation.2013.12.002>

**Authors:** Veldhoen ES, de Vooght KMK, Sliker MG, Versluys AB, Turner NMB

A prospective study comparing IO and venous laboratory values obtained from a point-of-care analyzer (i-STAT) in 20 children. IO blood specimens were collected from the iliac crest; 2 ml were discarded before the sample was collected for analysis. Results showed differences between venous and IO samples were clinically acceptable for pH, base excess, sodium, ionized calcium and glucose in hemodynamically stable patients. Authors concluded that analysis of IO samples with a bedside point-of-care analyzer is feasible and in emergency situations may be useful to guide treatment.

## EZ-IO® INTRAOSSEOUS VASCULAR ACCESS SYSTEM USE WITH PERSONAL PROTECTIVE EQUIPMENT

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**TITLE: INTRAOSSEOUS LINE PLACEMENT FOR ANTIDOTE INJECTION BY FIRST RESPONDERS AND RECEIVERS WEARING PERSONAL PROTECTIVE EQUIPMENT**

**Source:** American Journal of Emergency Medicine 2011;29(4):373- 81.doi:10.1016/j.ajem.2009.10.009

**Authors:** Borron SW, Arias JC, Bauer CR, Philbeck T, Hass P, Lawson W, Montez D, Fernandez M, Jung I, Gordon DJ

This article describes an animal trial that assessed the ability of protected, experienced first responders and limited-experience first receivers to place IO lines for antidote administration using the EZ-IO Intraosseous Vascular Access System device. First responders placed IO lines successfully in 100% of cases, and first receivers placed IO lines successfully in 91% of the cases. Investigators concluded that IO lines may facilitate earlier administration of antidotes to hazardous material victims.

*This study was sponsored by Teleflex Incorporated (Vidacare LLC).*

**TITLE: IO VERSUS IV ACCESS WHILE WEARING PERSONAL PROTECTIVE EQUIPMENT IN A HAZMAT SCENARIO**

**Source:** Prehospital Emergency Care 2007;11(4):467-72

**Authors:** Suyama J, Knutsen CC, Northington WE, Hahn M, Hostler D

Article describes a controlled study in which the time difference between IV and IO access was compared while providers and simulated patients (mannequins) were wearing personal protective equipment (PPE). Twenty-two EMT-P providers measured the times to skin access, vascular access and fluid infusion in three scenarios: no PPE for providers or mannequins; providers only in PPE; and both providers and mannequins in PPE. In all scenarios, there was a statistically significant difference in vascular access and fluid infusion time, in favor of the EZ-IO Intraosseous Vascular Access System. Investigators concluded that, overall, the EZ-IO Intraosseous Vascular Access System provides vascular access and fluid more quickly than standard IV access, and that donning PPE does not hinder providers' use of the EZ-IO Intraosseous Vascular Access System.