

# Intravenous and Intraosseous Access in Children

Matthew Hansen

## REFERENCES

1. Frascone RJ, Jensen J, Wewerka SS, Salzman JG: Use of the pediatric EZ-IO needle by emergency medical services providers. *Pediatr Emerg Care* 25: 329, 2009. [PMID: 19404222]
2. Levitan RM, Bortle CD, Snyder TA, et al: Use of a battery-operated needle driver for intraosseous access by novice users: skill acquisition with cadavers. *Ann Emerg Med* 54: 692, 2009. [PMID: 19643511]
3. Horton MA, Beamer C: Powered intraosseous insertion provides safe and effective vascular access for pediatric emergency patients. *Pediatr Emerg Care* 24: 347, 2008. [PMID: 18562874]
4. Hartholt KA, van Lieshout EMM, Thies WC, Patka P, Schipper IB: Intraosseous devices: a randomized controlled trial comparing three intraosseous devices. *Prehosp Emerg Care* 14: 6, 2010. [PMID: 19947861]
5. Shavit I, Hoffmann Y, Galbraith R, Waisman Y: Comparison of two mechanical intraosseous infusion devices: a pilot, randomized crossover trial. *Resuscitation* 80: 1029, 2009. [PMID: 19586701]
6. Leidel BA, Kirchhoff C, Braunstein V, et al: Comparison of two intraosseous access devices in adult patients under resuscitation in the emergency department: a prospective, randomized study. *Resuscitation* 81: 994, 2010. [PMID: 20434823]
7. Karapinar B, Cura A: Complications of central venous catheterization in critically ill children. *Pediatr Int* 49: 593, 2007. [PMID: 17875082]
8. Steele R, Irvin CB: Central line mechanical complication rate in emergency medicine patients. *Acad Emerg Med* 8: 204, 2001. [PMID: 11157303]
9. Von Hoff DD, Kuhn JG, Burris HA 3rd, Miller LJ: Does intraosseous equal intravenous? A pharmacokinetic study. *Am J Emerg Med* 26: 31, 2008. [PMID: 18082778]
10. Davidoff J, Fowler R, Gordon D, et al: Clinical evaluation of a novel intraosseous device for adults: prospective, 250-patient, multi-center trial. *JEMS* 30(Suppl): 20, 2005. [PMID: 16382512]
11. Moore GP, Pace SA, Busby W: Comparison of intraosseous, intramuscular, and intravenous administration of succinylcholine. *Pediatr Emerg Care* 5: 209, 1989. [PMID: 2602189]
12. Ummenhofer W, Frei FJ, Urwyler A, Drewe J: Are laboratory values in bone marrow aspirate predictable for venous blood in paediatric patients? *Resuscitation* 27: 123, 1994. [PMID: 8029533]
13. Hurren JS: Can blood taken from intraosseous cannulations be used for blood analysis? *Burns* 26: 727, 2000. [PMID: 11024606]
14. Brickman KR, Krupp K, Rega P, Alexander J, Guinness M: Typing and screening of blood from intraosseous access. *Ann Emerg Med* 21: 414, 1992. [PMID: 1554180]
15. Abdelmoneim T, Kissoon N, Johnson L, Fiallos M, Murphy S: Acid-base status of blood from intraosseous and mixed venous sites during prolonged cardiopulmonary resuscitation and drug infusions. *Crit Care Med* 27: 1923, 1999. [PMID: 10507619]
16. Fiorito BA, Mirza F, Doran TM, et al: Intraosseous access in the setting of pediatric critical care transport. *Pediatr Crit Care Med* 6: 50, 2005. [PMID: 15636659]
17. Nijssen-Jordan C: Emergency department utilization and success rates for intraosseous infusion in pediatric resuscitations. *CJEM* 2: 10, 2000. [PMID: 17637111]
18. Hansen M, Meckler G, Spiro D, Newgard C: Intraosseous line use, complications, and outcomes among a population-based cohort of children presenting to California hospitals. *Pediatr Emerg Care* 27: 928, 2011. [PMID: 21960092]
19. Blumberg SM, Gorni M, Crain EF: Intraosseous infusion: a review of methods and novel devices. *Pediatr Emerg Care* 24: 50, 2008. [PMID: 18212613]
20. Claudet I, Baunin C, Laporte-Turpin E, et al: Long-term effects on tibial growth after intraosseous infusion: a prospective, radiographic analysis. *Pediatr Emerg Care* 19: 397, 2003. [PMID: 19561750]
21. Doniger SJ, Ishimine P, Fox JC, Kanegaye JT: Randomized controlled trial of ultrasound-guided peripheral intraosseous catheter placement versus traditional techniques in difficult-access pediatric patients. *Pediatr Emerg Care* 25: 154, 2009. [PMID: 19262420]
22. Bair AE, Rose JS, Vance CW, Andrade-Brown E, Kuppermann N: Ultrasound-assisted peripheral venous access in young children: a randomized controlled trial and pilot feasibility study. *West J Emerg Med* 9: 219, 2008. [PMID: 19561750]
23. Janik JE, Conlon SJ, Janik JS: Percutaneous central access in patients younger than 5 years: size does matter. *J Pediatr Surg* 39: 1252, 2004. [PMID: 15300539]
24. Eisen LA, Narasimhan M, Berger JS, et al: Mechanical complications of central venous catheters. *J Intensive Care Med* 21: 40, 2006. [PMID: 16698743]
25. Lukish J, Valladares E, Rodriguez C, et al: Classical positioning decreases subclavian vein cross-sectional area in children. *J Trauma* 53: 272, 2002. [PMID: 12169933]
26. Skippen P, Kissoon N: Ultrasound guidance for central vascular access in the pediatric emergency department. *Pediatr Emerg Care* 23: 203, 2007. [PMID: 17413442]
27. Verghese ST, Nath A, Zenger D, et al: The effects of the simulated Valsalva maneuver, liver compression, and/or Trendelenburg position on the cross-sectional area of the internal jugular vein in infants and young children. *Anesth Analg* 94: 250, 2002. [PMID: 11812678]
28. Hopkins JW, Warkentine F, Gracely E, Kim IK: The anatomic relationship between the common femoral artery and common femoral vein in frog leg position versus straight leg position in pediatric patients. *Acad Emerg Med* 16: 579, 2009. [PMID: 19519804]
29. Suk EH, Lee K-Y, Kweon TD, Jang Y-H, Bai SJ: Ultrasonographic evaluation of the femoral vein in anaesthetised infants and young children. *Anesthesia* 65: 895, 2010. [PMID: 20645949]
30. Warkentine FH, Clyde Pierce M, Lorenz D, Kim IK: The anatomic relationship of femoral vein to femoral artery in euvolemic pediatric patients by ultrasonography: implications for pediatric femoral central venous access. *Acad Emerg Med* 15: 426, 2008. [PMID: 18439197]
31. Iwashima S, Ishikawa T, Ohzeki T: Ultrasound-guided versus landmark-guided femoral vein access in pediatric cardiac catheterization. *Pediatr Cardiol* 29: 339, 2008. [PMID: 17851631]
32. Green C, Yohannan MD: Umbilical arterial and venous catheters: placement, use, and complications. *Neonatal Netw* 17: 23, 1998. [PMID: 9832755]
33. Yiğiter M, Arda IS, Hiçsönmez A: Hepatic laceration because of malpositioning of the umbilical vein catheter: case report and literature review. *J Pediatr Surg* 43: E39, 2008. [PMID: 18485935]

## USEFUL WEB RESOURCES

WaisMed: BIG® Bone Injection Gun—[http://www.waismed.com/PR\\_PediBIG.html](http://www.waismed.com/PR_PediBIG.html)  
Vidacare: EZ-10® Infusion System—<http://www.vidacare.com/ez-io/index.html>