

# Local and Regional Anesthesia

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## REFERENCES

- Crystal CS, McArthur TJ, Harrison B: Anesthetic and procedural sedation techniques for wound management. *Emerg Med Clin North Am* 25: 41, 2007. [PMID: 17400072]
- Grabinsky A, Sharar SR: Regional anesthesia for acute traumatic injuries in the emergency room. *Expert Rev Neurother* 9: 1677, 2009. [PMID: 19903026]
- Wu JJ, Lollo L, Grabinsky A: Regional anesthesia in trauma medicine. *Anesthesiol Res Pract* 2011: 713281, 2011. [PMID: 22162684]
- Becker DE, Reed KL: Local anesthetics: review of pharmacological considerations. *Anesth Prog* 59: 90, 2012. [PMID: 22822998]
- French J, Sharp LM: Local anaesthetics. *Ann R Coll Surg Engl* 94: 76, 2012. [PMID: 22391358]
- Leone S, Di Cianni S, Casati A, Fanelli G: Pharmacology, toxicology, and clinical use of new long-acting local anesthetics, ropivacaine and levobupivacaine. *Acta Biomed* 79: 92, 2008. [PMID: 18788503]
- Drasner K: Local anesthetic systemic toxicity: a historical perspective. *Reg Anesth Pain Med* 35: 162, 2010. [PMID: 20216034]
- Zink W, Graf BM: The toxicity of local anesthetics: the place of ropivacaine and levobupivacaine. *Curr Opin Anaesthesiol* 21: 645, 2008. [PMID: 18784493]
- Kuthiala G, Chaudhary G: Ropivacaine: a review of its pharmacology and clinical use. *Indian J Anaesth* 55: 104, 2011. [PMID: 21712863]
- Butterworth JF 4th: Models and mechanisms of local anesthetic cardiac toxicity: a review. *Reg Anesth Pain Med* 35: 167, 2010. [PMID: 20301823]
- Wolfe JW, Butterworth JF: Local anesthetic systemic toxicity: update on mechanisms and treatment. *Curr Opin Anaesthesiol* 24: 561, 2011. [PMID: 21841477]
- Dillane D, Finucane BT: Local anesthetic systemic toxicity. *Can J Anaesth* 57: 368, 2010. [PMID: 20151342]
- Di Gregorio G, Neal JM, Rosenquist RW, Weinberg GL: Clinical presentation of local anesthetic systemic toxicity: a review of published cases, 1979 to 2009. *Reg Anesth Pain Med* 35: 181, 2010. [PMID: 20301824]
- Lönnqvist PA: Toxicity of local anesthetic drugs: a pediatric perspective. *Paediatr Anaesth* 22: 39, 2012. [PMID: 21672079]
- Lui KC, Chow YF: Safe use of local anaesthetics: prevention and management of systemic toxicity. *Hong Kong Med J* 16: 470, 2010. [PMID: 21135424]
- Mulroy MF, Hejtmanek MR: Prevention of local anesthetic systemic toxicity. *Reg Anesth Pain Med* 35: 177, 2010. [PMID: 20216035]
- Mercado P, Weinberg GL: Local anesthetic systemic toxicity: prevention and treatment. *Anesthesiol Clin* 29: 233, 2011. [PMID: 21620340]
- Yaddanapudi S: Prevention of local anesthetic systemic toxicity. *J Anaesthesiol Clin Pharmacol* 27: 438, 2011. [PMID: 22096273]
- Neal JM, Mulroy MF, Weinberg GL: American Society of Regional Anesthesia and Pain Medicine checklist for managing local anesthetic systemic toxicity: 2012 version. *Reg Anesth Pain Med* 37: 16, 2012. [PMID: 22189574]
- Ok SH, Hong JM, Lee SH, Sohn JT: Lipid emulsion for treating local anesthetic systemic toxicity. *Int J Med Sci* 15: 713, 2018. [PMID: 29910676]
- Rothschild L, Bern S, Oswald S, Weinberg G: Intravenous lipid emulsion in clinical toxicology. *Scand J Trauma Resusc Emerg Med* 18: 51, 2010. [PMID: 20923546]
- Morau D, Ahern S: Management of local anesthetic toxicity. *Int Anesthesiol Clin* 48: 117, 2010. [PMID: 20881531]
- Weinberg GL: Treatment of local anesthetic systemic toxicity (LAST). *Reg Anesth Pain Med* 35: 188, 2010. [PMID: 20216036]
- Neal JM, Bernards CM, Butterworth JF 4th, et al: ASRA practice advisory on local anesthetic systemic toxicity. *Reg Anesth Pain Med* 35: 152, 2010. [PMID: 20216033]
- Ciechanowicz S, Patil V: Lipid emulsion for local anesthetic systemic toxicity. *Anesthesiol Res Pract* 2012: 131784, 2012. [PMID: 21969824]
- Parry A: Management and treatment of local anaesthetic toxicity. *J Perioper Pract* 21: 404, 2011. [PMID: 22263318]
- Harvey M, Cave G, Chanwai G, Nicholson T: Successful resuscitation from bupivacaine-induced cardiovascular collapse with intravenous lipid emulsion following femoral nerve block in an emergency department. *Emerg Med Australas* 23: 209, 2011. [PMID: 21489169]
- Bern S, Akpa BS, Kuo I, Weinberg G: Lipid resuscitation: a life-saving antidote for local anesthetic toxicity. *Curr Pharm Biotechnol* 12: 313, 2011. [PMID: 21050161]
- Niemi G: Advantages and disadvantages of adrenaline in regional anaesthesia. *Best Pract Res Clin Anaesthesiol* 19: 229, 2005. [PMID: 15966495]
- Häfner HM, Röcken M, Breuninger H: Epinephrine-supplemented local anesthetics for ear and nose surgery: clinical use without complications in more than 10,000 surgical procedures. *J Dtsch Dermatol Ges* 3: 195, 2005. [PMID: 16372813]
- Thomson CJ, Lalonde DH, Denkler KA, Feicht AJ: A critical look at the evidence for and against elective epinephrine use in the finger. *Plast Reconstr Surg* 119: 260, 2007. [PMID: 17312559]
- Waterbrook AL, Germann CA, Southall JC: Is epinephrine harmful when used with anesthetics for digital nerve blocks? *Ann Emerg Med* 50: 472, 2007. [PMID: 17886362]
- Chowdhry S, Seidenstricker L, Cooney DS, Hazani R, Wilhelmi BJ: Do not use epinephrine in digital blocks: myth or truth? Part I. A retrospective review of 1111 cases. *Plast Reconstr Surg* 126: 2031, 2010. [PMID: 20697319]
- Lalonde DH, Lalonde JF: Discussion: do not use epinephrine in digital blocks: myth or truth? Part II. A retrospective review of 1111 cases. *Plast Reconstr Surg* 126: 2035, 2010. [PMID: 21124142]
- Muck AE, Bebartha VS, Borys DJ, Morgan DL: Six years of epinephrine digital injections: absence of significant local or systemic effects. *Ann Emerg Med* 56: 270, 2010. [PMID: 20346537]
- Pratap JN, Shankar RK, Goroszeniuk T: Co-injection of clonidine prolongs the anesthetic effect of lidocaine skin infiltration by a peripheral action. *Anesth Analg* 104: 982, 2007. [PMID: 17377118]
- McCartney CJ, Duggan E, Apatu E: Should we add clonidine to local anesthetic for peripheral nerve blockade? A qualitative systematic review of the literature. *Reg Anesth Pain Med* 32: 330, 2007. [PMID: 17720118]
- Pöpping DM, Elia N, Marret E, Wenk M, Tramèr MR: Clonidine as an adjuvant to local anesthetics for peripheral nerve and plexus blocks: a meta-analysis of randomized trials. *Anesthesiology* 111: 406, 2009. [PMID: 19602964]
- Zilinsky I, Bar-Meir E, Zaslansky R, et al: Ten commandments for minimal pain during administration of local anesthetics. *J Drugs Dermatol* 4: 212, 2005. [PMID: 15776779]
- Babamiri K, Nassab R: The evidence for reducing the pain of administration of local anesthesia and cosmetic injectables. *J Cosmet Dermatol* 9: 242, 2010. [PMID: 20883298]
- Baibergenova A, Murray CA: Techniques to minimize the pain of injected local anesthetic. *J Cutan Med Surg* 15: 250, 2011. [PMID: 21962183]
- Phillips JF, Yates AB, Deshazo RD: Approach to patients with suspected hypersensitivity to local anesthetics. *Am J Med Sci* 334: 190, 2007. [PMID: 17873533]
- Henderson S: Allergy to local anaesthetic agents used in dentistry—what are the signs, symptoms, alternative diagnoses and management options? *Dent Update* 38: 410, 2011. [PMID: 21905354]
- Bartfield JM, Jandreau SW, Raccio-Robak N: Randomized trial of diphenhydramine versus benzyl alcohol with epinephrine as an alternative to lidocaine local anesthesia. *Ann Emerg Med* 32: 650, 1998. [PMID: 9832659]
- Bartfield JM, May-Wheeling HE, Raccio-Robak N, Lai SY: Benzyl alcohol with epinephrine as an alternative to lidocaine with epinephrine. *J Emerg Med* 21: 375, 2001. [PMID: 11728763]
- Pavlidakey PG, Brodell EE, Helms SE: Diphenhydramine as an alternative local anesthetic agent. *J Clin Aesthet Dermatol* 2: 37, 2009. [PMID: 20725573]
- Kaweski S: Plastic Surgery Educational Foundation Technology Assessment Committee. Topical anesthetic creams. *Plast Reconstr Surg* 121: 2161, 2008. [PMID: 18520909]
- Gaufberg SV, Walta MJ, Workman TP: Expanding the use of topical anesthesia in wound management: sequential layered application of topical lidocaine with epinephrine. *Am J Emerg Med* 25: 379, 2007. [PMID: 17499653]
- Little C, Kelly OJ, Jenkins MG, Murphy D, McCarron P: The use of topical anaesthesia during repair of minor lacerations in Departments of Emergency Medicine: a literature review. *Int Emerg Nurs* 17: 99, 2009. [PMID: 19341995]
- Eidelman A, Weiss JM, Baldwin CL, Enu IK, McNicol ED, Carr DB: Topical anaesthetics for repair of dermal laceration. *Cochrane Database Syst Rev* 6: CD005364, 2011. [PMID: 21678347]
- Arendts G, Stevens M, Fry M: Topical anaesthesia and intravenous cannulation success in paediatric patients: a randomized double-blind trial. *Br J Anaesth* 100: 521, 2008. [PMID: 18292082]
- Valdovinos NC, Reddin C, Bernard C, Shafer B, Tanabe P: The use of topical anesthesia during intravenous catheter insertion in adults: a comparison of pain scores using LMX-4 versus placebo. *J Emerg Nurs* 35: 299, 2009. [PMID: 19591723]
- Newbury C, Herd DW: Amethocaine versus EMLA for successful intravenous cannulation in a children's emergency department: a randomised controlled study. *Emerg Med J* 26: 487, 2009. [PMID: 19546268]
- Herd DW, Newbury C, Brown PM: Cost benefit analysis of amethocaine (Ametop) compared with EMLA for intravenous cannulation in a children's emergency department. *Emerg Med J* 27: 456, 2010. [PMID: 20562142]
- Poonai N, Alawi K, Rieder M, Lynch T, Lim R: A comparison of amethocaine and liposomal lidocaine cream as a pain reliever before venipuncture in children: a randomized control trial. *Pediatr Emerg Care* 28: 104, 2012. [PMID: 22270502]
- Vandamme E, Lemoine S, van der Gucht A, de Cock P, van de Voorde P: LAT gel for laceration repair in the emergency department: not only for children? *Eur J Emerg Med* 24: 55, 2017. [PMID: 26214220]
- Scott NB: Wound infiltration for surgery. *Anaesthesia* 65(Suppl 1): 67, 2010. [PMID: 20377548]
- Mutalik S: How to make local anesthesia less painful. *J Cutan Aesthet Surg* 1: 37, 2008. [PMID: 20300343]
- Day JJ, Kent CF, Burnham RS: Can topical anesthetic reduce the pain associated with diagnostic blocks of the lumbosacral spine? *Pain Med* 9: 675, 2008. [PMID: 18564999]
- McNaughton C, Zhou C, Robert L, Storrow A, Kennedy R: A randomized, crossover comparison of injected buffered lidocaine, lidocaine cream, and no analgesia for peripheral intravenous cannula insertion. *Ann Emerg Med* 54: 214, 2009. [PMID: 19217695]
- Sultan J: Towards evidence-based emergency medicine: best BETs from the Manchester Royal Infirmary. The effect of warming local anaesthetics on pain of infiltration. *Emerg Med J* 24: 791, 2007. [PMID: 17954843]

62. Hogan ME, vanderVaart S, Perampaladas K, Machado M, Einarson TR, Taddio A: Systematic review and meta-analysis of the effect of warming local anesthetics on injection pain. *Ann Emerg Med* 58: 86, 2011. [PMID: 21316812]
63. Sultan J: Review of variable quality trials finds that warming local anaesthetic to body temperature reduces self-reported pain of infiltration by 11 mm on a 100 mm rating scale. *Evid Based Nurs* 15: 127, 2012. [PMID: 22561145]
64. Stoecker WV, Malters JM, Xu J, Pikka J: Tripod vibration anesthesia. *Dermatol Online J* 14: 20, 2008. [PMID: 18319037]
65. Nanitsos E, Vartuli R, Forte A, Dennison PJ, Peck CC: The effect of vibration on pain during local anaesthesia injections. *Aust Dent J* 54: 94, 2009. [PMID: 19473149]
66. Mustoe TA, Buck DW II, Lalonde DH: The safe management of anesthesia, sedation, and pain in plastic surgery. *Plast Reconstr Surg* 126: e165, 2010. [PMID: 20885206]
67. Strazar R, Leynes PG, Lalonde DH: Minimizing the pain of local anesthesia injection. *Plast Reconstr Surg* 132: 675, 2013. [PMID: 23985640]
68. Martires KJ, Malbasa CL, Bordeaux JS: A randomized controlled crossover trial: lidocaine injected at a 90-degree angle causes less pain than lidocaine injected at a 45-degree angle. *J Am Acad Dermatol* 65: 1231, 2011. [PMID: 22082846]
69. Candiotti K, Rodriguez Y, Koyyalamudi P, Curia L, Arheart KL, Birnbach DJ: The effect of needle bevel position on pain for subcutaneous lidocaine injection. *J Perianesth Nurs* 24: 241, 2009. [PMID: 19647661]
70. Soueid A, Richard B: Ethyl chloride as a cryoanalgesic in pediatrics for venipuncture. *Pediatr Emerg Care* 23: 380, 2007. [PMID: 17572521]
71. Hartstein BH, Barry JD: Mitigation of pain during intravenous catheter placement using a topical skin coolant in the emergency department. *Emerg Med J* 25: 257, 2008. [PMID: 18434455]
72. Hijazi R, Taylor D, Richardson J: Effect of topical alkane vapocoolant spray on pain with intravenous cannulation in patients in emergency departments: randomised double-blind placebo-controlled trial. *BMJ* 338: b215, 2009. [PMID: 19208703]
73. Aminabadi NA, Farahani RM: The effect of pre-cooling the injection site on pediatric pain perception during the administration of local anesthesia. *J Contemp Dent Pract* 10: 43, 2009. [PMID: 19430625]
74. Page DE, Taylor DM: Vapocoolant spray vs subcutaneous lidocaine injection for reducing the pain of intravenous cannulation: a randomized, controlled, clinical trial. *Br J Anaesth* 105: 519, 2010. [PMID: 20682573]
75. Crystal CS, Blankenship RB: Local anesthetics and peripheral nerve blocks in the emergency department. *Emerg Med Clin North Am* 23: 477, 2005. [PMID: 15829393]
76. Herring AA, Stone MB, Nagdev AD: Ultrasound-guided abdominal wall nerve blocks in the ED. *Am J Emerg Med* 30: 759, 2012. [PMID: 21570238]
77. Herring A, Price DD, Nagdev A, Simon B: Superior cluneal nerve block for treatment of buttock abscesses in the emergency department. *J Emerg Med* 39, 83, 2010. [PMID: 19926437]
78. Barrington MJ, Watts SA, Gledhill SR, et al: Preliminary results of the Australasian Regional Anaesthesia Collaboration: a prospective audit of more than 7000 peripheral nerve and plexus blocks for neurologic and other complications. *Reg Anesth Pain Med* 34: 534, 2009. [PMID: 19916206]
79. Jeng CL, Torriillo TM, Rosenblatt MA: Complications of peripheral nerve blocks. *Br J Anaesth* 105(Suppl 1): i97, 2010. [PMID: 21148659]
80. Cobbald A, Money T: Regional anaesthesia: back to basics. *J Perioper Pract* 20: 288, 2010. [PMID: 20860189]
81. Greensmith JE, Murray WB: Complications of regional anesthesia. *Curr Opin Anaesthesiol* 19: 531, 2006. [PMID: 16960487]
82. De Tran QH, Muñoz L, Russo G, Finlayson RJ: Ultrasonography and stimulating perineural catheters for nerve blocks: a review of the evidence. *Can J Anaesth* 55: 447, 2008. [PMID: 18591703]
83. Koscielniak-Nielsen ZJ: Ultrasound-guided peripheral nerve blocks: what are the benefits? *Acta Anaesthesiol Scand* 52: 727, 2008. [PMID: 18477070]
84. Marhofer P, Harrop-Griffiths W, Kettner SC, Kirchmair L: Fifteen years of ultrasound guidance in regional anaesthesia: part 1. *Br J Anaesth* 104: 538, 2010. [PMID: 20364022]
85. Marhofer P, Harrop-Griffiths W, Willschke H, Kirchmair L: Fifteen years of ultrasound guidance in regional anaesthesia: part 2—recent developments in block techniques. *Br J Anaesth* 104: 673, 2010. [PMID: 20418267]
86. Dillane D, Tsui BC: From basic concepts to emerging technologies in regional anaesthesia. *Curr Opin Anaesthesiol* 23: 643, 2010. [PMID: 20689412]
87. Wu TS, Hatch N, Barr L, Roque PJ: Advanced ultrasound procedures. *Crit Care Clin* 30: 305, 2014. [PMID: 24606778]
88. Neal JM: Ultrasound-guided regional anesthesia and patient safety: an evidence-based analysis. *Reg Anesth Pain Med* 35(2 Suppl): S59, 2010. [PMID: 20216027]
89. Neal JM, Brull R, Chan VW, et al: The ASRA evidence-based medicine assessment of ultrasound-guided regional anesthesia and pain medicine: executive summary. *Reg Anesth Pain Med* 35(2 Suppl.): S1, 2012. Erratum in: *Reg Anesth Pain Med* 35: 325, 2010. [PMID: 20216019]
90. Antonakakis JG, Ting PH, Sites B: Ultrasound-guided regional anesthesia for peripheral nerve blocks: an evidence-based outcome review. *Anesthesiol Clin* 29: 179, 2011. [PMID: 21620337]
91. Liu SS: Evidence basis for ultrasound-guided block characteristics onset, quality, and duration. *Reg Anesth Pain Med* 41: 205, 2016. [PMID: 26244287]
92. Kang SN: Digital nerve blocks. *Br J Hosp Med (Lond)* 68: M30, 2007. [PMID: 17370711]
93. Alhelail M, Al-Salamah M, Al-Mulhim M, Al-Hamid S: Comparison of bupivacaine and lidocaine with epinephrine for digital nerve blocks. *Emerg Med J* 26: 347, 2009. [PMID: 19386869]
94. Yin ZG, Zhang JB, Kan SL, Wang P: A comparison of traditional digital blocks and single subcutaneous palmar injection blocks at the base of the finger and a meta-analysis of the digital block trials. *J Hand Surg [Br]* 31: 547, 2006. [PMID: 16930788]
95. Okur OM, Şener A, Kavaklı HŞ, et al: Two injection digital block versus single subcutaneous palmar injection block for finger lacerations. *Eur J Trauma Emerg Surg* 43: 863, 2017. [PMID: 27709248]
96. Cummings AJ, Tisol WB, Meyer LE: Modified transthecal digital block versus traditional digital block for anesthesia of the finger. *J Hand Surg Am* 29: 44, 2004. [PMID: 14751102]
97. Waitayawinyu T, Dodds SD, Niempoog S: Dose effectiveness of transthecal digital block. *J Hand Surg Am* 34: 458, 2009. [PMID: 19258143]
98. Ahmad M: Efficacy of digital anesthesia: comparison of two techniques. *World J Plast Surg* 6: 351, 2017. [PMID: 29218285]
99. Antevy PM, Zuckerbraun NS, Saladino RA, Pitetti RD: Evaluation of a transthecal digital nerve block in the injured pediatric patient. *Pediatr Emerg Care* 26: 177, 2010. [PMID: 20179662]
100. Stone MB, Muresanu M: Ultrasound-guided ulnar nerve block in the management of digital abscess and hand cellulitis. *Acad Emerg Med* 17: E3, 2010. [PMID: 19891674]
101. Ünlüer EE, Karagöz A, Ünlüer S, Oyar O, Özgürbüz U: Ultrasound-guided ulnar nerve block for boxer fractures. *Am J Emerg Med* 34: 1726, 2016. [PMID: 27342969]
102. Redborg KE, Antonakakis JG, Beach ML, Chinn CD, Sites BD: Ultrasound improves success rate of a tibial nerve block at the ankle. *Reg Anesth Pain Med* 34: 256, 2009. [PMID: 19587626]
103. Redborgf KE, Sites BD, Chinn CD, et al: Ultrasound improves success rate of a sural nerve block at the ankle. *Reg Anesth Pain Med* 34: 24, 2009. [PMID: 19258984]
104. Lacroix G, Meaudre E, Prunet B, et al: Appreciation of the role of regional anesthesia in managing facial wounds in the emergency unit. *Ann Fr Anesth Reanim* 29: 3, 2010. [PMID: 20080377]
105. Ingvaldsen CA, Tonseth KA: Auricular haematoma. *Tidsskr Nor Laegeforen* 137: 105, 2017. [PMID: 28127072]
106. Karmakar MK, Ho AM: Acute pain management of patients with multiple fractured ribs. *J Trauma* 54: 615, 2003. [PMID: 12634549]
107. Ho AM, Karmakar MK, Critchley LA: Acute pain management of patients with multiple fractured ribs: a focus on regional techniques. *Curr Opin Crit Care* 17: 323, 2011. [PMID: 21716105]
108. Stone MB, Carnell J, Fischer JW, Herring AA, Nagdev A: Ultrasound-guided intercostal nerve block for traumatic pneumothorax requiring tube thoracostomy. *Am J Emerg Med* 29: 697.e1, 2011. [PMID: 20708889]
109. Lee HJ, Park HS, Moon HI, Yoon SY: Effect of ultrasound-guided intercostal nerve block versus fluoroscopy-guided epidural nerve block in patients with thoracic herpes zoster: a comparative study. *J Ultrasound Med* 38: 725, 2019. [PMID: 30244489]
110. Osinowo OA, Zahrani M, Softah A: Effect of intercostal nerve block with 0.5% bupivacaine on peak expiratory flow rate and arterial oxygen saturation in rib fractures. *J Trauma* 56: 345, 2004. [PMID: 14960978]
111. Shanti CM, Carlin AM, Tyburski JG: Incidence of pneumothorax from intercostal nerve block for analgesia in rib fractures. *J Trauma* 51: 536, 2001. [PMID: 11535906]
112. De Tran QH, Clemente A, Finlayson RJ: A review of approaches and techniques for lower extremity nerve blocks. *Can J Anaesth* 54: 922, 2007. [PMID: 17975239]
113. Muttu CE, Jensen EJ, Manka MA Jr, et al: Femoral nerve block for diaphyseal and distal femoral fractures in the emergency department. *J Bone Joint Surg Am* 89: 2599, 2007. [PMID: 18056490]
114. Martin B, Ali B: Towards evidence based emergency medicine: best BETs from the Manchester Royal Infirmary. Regional nerve block in fractured neck of femur. *Emerg Med J* 19: 144, 2002. [PMID: 11904267]
115. Beaudoin FL, Nagdev A, Merchant RC, Becker BM: Ultrasound-guided femoral nerve blocks in elderly patients with hip fractures. *Am J Emerg Med* 28: 76, 2010. [PMID: 20006206]
116. Ritcey B, Pageau P, Woo MY, Perry JJ: Regional nerve blocks for hip and femoral neck fractures in the emergency department: a systematic review. *CJEM* 18: 37, 2016. [PMID: 26330019]
117. Ketelaars R, Stollman JT, van Eeten E, Eikendal T, Bruhn J, van Geffen GJ: Emergency physician-performed ultrasound-guided nerve blocks in proximal femoral fractures provide safe and effective pain relief: a prospective observational study in The Netherlands. *Int J Emerg Med* 11: 12, 2018. [PMID: 29500558]
118. Winnie AP, Ramamurthy S, Durrani Z: The inguinal paravascular technic of lumbar plexus anesthesia: the "3-in-1 block." *Anesth Analg* 52: 989, 1973. [PMID: 4796576]
119. Williams R, Saha B: Best evidence topic report. Ultrasound placement of needle in three-in-one nerve block. *Emerg Med J* 23: 401, 2006. [PMID: 16627849]
120. Reid N, Stella J, Ryan M, Ragg M: Use of ultrasound to facilitate accurate femoral nerve block in the emergency department. *Emerg Med Australas* 21: 124, 2009. [PMID: 19422409]
121. Elkhodair S, Mortazavi J, Chester A, Pereira M: Single fascia iliaca compartment block for pain relief in patients with fractured neck of femur in the emergency department: a pilot study. *Eur J Emerg Med* 18: 340, 2011. [PMID: 21422933]
122. Haines L, Dickman E, Ayzazyan S, et al: Ultrasound-guided fascia iliaca compartment block for hip fractures in the emergency department. *J Emerg Med* 43: 692, 2012. [PMID: 22494596]
123. Cooper AL, Nagree Y, Goudie A, Watson PR, Arendts G: Ultrasound-guided femoral nerve blocks are not superior to ultrasound-guided fascia iliaca blocks for fractured neck of femur. *Emerg Med Australas* 2018 September 9. [Epub ahead of print] [PMID: 30198199]
124. Handoll HH, Madhok R, Dodds C: Anaesthesia for treating distal radial fracture in adults. *Cochrane Database Syst Rev* 3: CD003320, 2002. [PMID: 12137688]
125. Myderrizi N, Mema B: The hematoma block an effective alternative for fracture reduction in distal radius fractures. *Med Arh* 65: 239, 2011. [PMID: 21950232]
126. Ross A, Catanzariti AR, Medicino RW: The hematoma block: a simple, effective

- technique for closed reduction of ankle fracture dislocations. *J Foot Ankle Surg* 50: 507, 2011. [PMID: 21708343]
127. Tseng PT, Leu TH, Chen YW, Chen YP: Hematoma block or procedural sedation and analgesia, which is the most effective method of anesthesia in reduction of displaced distal radius fracture? *J Orthop Surg Res* 13: 62, 2018. [PMID: 29580286]
128. McCormick LM, Baynard T, Williams BR, Vang S, Xi M, Lafferty P: Intra-articular hematoma block compared to procedural sedation for closed reduction of ankle fractures. *Foot Ankle Int* 39: 1162, 2018. [PMID: 29860875]
129. Orbach H, Rozen N, Rinat B, Rubin G: Hematoma block for distal radius fractures - prospective, randomized comparison of two different volumes of lidocaine. *J Int Med Res* 46: 4535, 2018. [PMID: 30259769]
130. Mohr B: Safety and effectiveness of intravenous regional anesthesia (Bier block) for outpatient management of forearm trauma. *CJEM* 8: 247, 2006. [PMID: 17324303]
131. Fauteux-Lamarre E, Burstein B, Cheng A1, Bretholz A: Reduced Length of Stay and Adverse Events Using Bier Block for Forearm Fracture Reduction in the Pediatric Emergency Department. *Pediatr Emerg Care* 35: 58, 2019. [PMID: 27918376]
132. Ahmad M, Saynor G: Best evidence topic report. Fasting before prilocaine Biers' block. *Emerg Med J* 22: 558, 2005. [PMID: 16046756]
133. Guay J: Adverse events associated with intravenous regional anesthesia (Bier block): a systematic review of complications. *J Clin Anesth* 21: 585, 2009. [PMID: 20122591]
134. Akram M, Farooqi FM, Irshad M, Faraz Ul Hassan S, Awais SM: Role of addition of Dexamethasone and Ketorolac to lignocaine intravenous regional anesthesia (Bier's Block) to improve tourniquet tolerance and post-operative analgesia in hand and forearm surgery. *J Pak Med Assoc* 65(11 Suppl 3): S128, 2015. [PMID: 26878503]
135. Honarmand A, Safavi M, Nemat K, Oghab P: The efficacy of different doses of Midazolam added to Lidocaine for upper extremity Bier block on the sensory and motor block characteristics and postoperative pain. *J Res Pharm Pract* 4: 160, 2015. [PMID: 26312256]
136. Kumar A, Sharma D, Datta B: Addition of ketamine or dexmedetomidine to lignocaine in intravenous regional anesthesia: a randomized controlled study. *J Anaesthesiol Clin Pharmacol* 28: 501, 2012. [PMID: 23225933]