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Pain Management in the Emergency Department: a Review Article on Options and Methods

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Abstract

Context: The aim of this review is to recognizing different methods of analgesia for emergency medicine physicians (EMPs) allows them to have various pain relief methods to reduce pain and to be able to use it according to the patient's condition and to improve the quality of their services.

Evidence acquisition: In this review article, the search engines and scientific databases of Google Scholar, Science Direct, PubMed, Medline, Scopus, and Cochrane for emergency pain management methods were reviewed. Among the findings, high quality articles were eventually selected from 2000 to 2018, and after reviewing them, we have conducted a comprehensive comparison of the usual methods of pain control in the emergency department (ED).

Results: For better understanding, the results are reported in to separate subheadings including "Parenteral agents" and "Regional blocks". Non-opioids analgesics such as nonsteroidal anti-inflammatory drugs (NSAIDs) and acetaminophen are commonly used in the treatment of acute pain. However, the relief of acute moderate to severe pain usually requires opioid agents. Considering the side effects of systemic drugs and the restrictions on the use of analgesics, especially opioids, regional blocks of pain as part of a multimodal analgesic strategy can be helpful.

Conclusion: This study was designed to investigate and identify the disadvantages and advantages of using each drug to be able to make the right choices in different clinical situations for patients while paying attention to the limitations of the use of these analgesic drugs.

Key words: Analgesics, Opioid; Anesthesia, Conduction; Emergency Service, Hospital; Pain Management

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CONTEXT

Pain is one of the main complaints of patients referred to the hospital and comprises almost 80% of the causes for referral to the emergency department (ED) (1, 2). Pain management in the emergency department is one of the quality-of-care indicators and can be used as a marker for assessing the care in the ED (3-7). Factors such as race, age, sex, ability to express pain, underlying illness, physician awareness, and fear of complications can prevent proper pain control in patients. Pain control should not be delayed while waiting for test results and paraclinical actions. The primary basis for pain relief is the administration of systemic analgesic agents such as narcotics or nonsteroidal anti-inflammatory drugs (NSAIDs) (8-10). The type of treatment regime should be chosen and administered in a way that, in addition to being able to improve several types of pain in the patient, have few side effects and do not interfere with other drugs (11). Studies have shown that patients whose primary pain is well managed and treated in the ED have a higher overall satisfaction with hospital services (12-14). However, there is an almost universal agreement about the inadequate treatment of pain in the ED (2, 15). As a result, recognizing different methods of analgesia and pain management for emergency medicine physicians (EMPs) allows them to have various pain relief methods to reduce pain and to be able to use it according to the patient's condition and to improve the quality of their services.

EVIDENCE ACQUISITION

In this review article, the search engines and scientific databases of Google Scholar, Science Direct, PubMed, Medline, Scopus, and Cochrane for "emergency pain management methods" were

reviewed. Among the findings, high quality articles were eventually selected from 2000 to 2018, and after performing critical appraisal, we have conducted a comprehensive comparison of the usual methods of pain control in the ED.

RESULTS

For better understanding, the results are reported in to separate subheadings including "Parenteral agents" and "Regional blocks".

Parenteral agents

- **Morphine**

Morphine is one of the main opioid agents due to its easier access in the hospital system in the treatment of patients with extremity trauma and moderate to severe pain (16, 17). The current recommendation for the treatment of acute pain in the ED is the use of the dose of bolus morphine initially, and then gradual titration to the desired analgesia (18, 19). Morphine has undesirable side effects, including sedation, nausea, hypothermia, and respiratory depression (20-31). Perhaps due to these side effects, most EMPs avoid administration of 7 to 10 mg of morphine in the initial bolus dose while two studies have shown that even 0.1 mg/kg of intravenous morphine is inadequate for pain relief (32-34). However, studies have shown that this drug can be used in patients without severe complications at standard doses for a long time (17). Also, for preventing of its abuse, the preparation and administration of this drug in hospitals has been controlled, which can delay its use (20). The study by Elsner et al. showed that although the achievement of favorable analgesia in the administration of subcutaneous morphine can be up to 24 minutes longer than intravenous (IV) use, there is no significant difference in analgesia derived from these two methods (35). However, due to the lack of the need for IV access in subcutaneous administration, this method can be useful in some cases (35).

- **Meperidine (Pethidine)**

Meperidine, like morphine, is one of the major opioids used in analgesia for admitted patients (36, 37); however, specialists suggest the use of morphine over meperidine due to less toxicity and greater efficacy (38-40). Morphine induces less nausea in parenteral use than meperidine (41). Also, several complications for this drug, even in regards to a cumulative dose, have been reported in young patients with normal renal function (40, 42, 43). It was assumed that, in contrast to meperidine, morphine causes more spasticity in the Oddi sphincter, so it is better not to use it in acute pancreatitis (44). Of course, there is no evidence to contraindicate the use of morphine for pancreatitis and gallbladder disease. Even Thompson suggests that morphine may be more beneficial than meperidine due to its prolonged analgesia and lower risk of seizures (45).

- **Fentanyl**

Fentanyl opioids are synthetic fat-soluble drugs that can remain in the body for up to 72 hours, depending on the type of administration (46).

Fentanyl is another opioid used in the ED, with an analgesic effect 100 times higher than morphine. IV fentanyl, compared with IV morphine, has a faster onset effect. However, its half-life is shorter, only around 30–60 minutes; therefore, it requires repeated doses for prolonged pain management (47, 48). The study of Parental et al. showed that IV fentanyl had no significant difference in reducing pain and side effects in comparison with IV morphine (47). Studies have shown that the use of fentanyl-based titration protocols in the ED can improve analgesia without increasing unwanted side effects (49, 50); consequently, it may be a good alternative to IV morphine (47). Studies have also shown that most patients prefer fentanyl to morphine due to fewer digestive tract complications (especially constipation) (46, 51-53).

Theoretically, the administration of IV opioid vs. the intranasal (IN) method due to the mechanism of drug absorption should have an onset of approximately 5 minutes faster. However, the results of some studies have shown that the analgesic effect of IV morphine is not significantly different from IN fentanyl (54). Due to the nature of the bioavailability of IN fentanyl and the absence of its passing through the liver and thus no effect of the first-pass liver metabolism, this drug can reach a therapeutic serum level within 2 minutes (55). In addition, due to the lack of a need for IV access, IN administration of fentanyl can be a better option than IV morphine in some instances (54).

- **Hydromorphone**

This semi-synthetic opioid is analogous to morphine and has a very similar chemical structure (56). In a study by Chang et al., it was found that, unlike morphine, EMPs are more comfortable using hydromorphone to control pain. This is probably due to the higher effectiveness of hydromorphone and therefore it is administered in a lower dose and this causes the physician to think there was a lower amount of prescribed opiate given to the patient (32). A recent Cochrane review also revealed that 32 studies had shown a positive effect of hydromorphone on acute pain relief (57).

- **Ketorolac**

In the United States and Europe, ketorolac injections are widely used as an injectable painkiller. It is commonly used because of the high analgesic power of ketorolac. In the control of acute pain, its analgesic effect is similar to injectable opioids such as morphine and pethidine (58). The absence of respiratory depression, the lack of dependence, and the long-lasting effect of relief are some of the most important advantages of ketorolac compared to injectable opioids. Also, ketorolac and injectable opioids have synergistic effects with each other and can reduce the necessary dose of opioids by simultaneous administration of injected ketorolac and opioids (59-61). Another study showed no significant difference in pain control with morphine or ketorolac. However, the simultaneous use of both reduces the need for rescue therapy. Complications were reduced in the morphine combined with ketorolac group (62). The results of the Victor study showed that pain relief after pethidine or ketorolac was significant, but the time to return to normal work after taking ketorolac was shorter (63).

- **Ibuprofen**

Many physicians believe that among the NSAIDs, ketorolac has more analgesic power than oral ibuprofen (64). However, a review of studies has shown that oral ibuprofen has a similar analgesic effect to parenteral ketorolac (65). On the other hand, studies have shown that ketorolac can cause significant bleeding after some surgical procedures such as post-tonsillectomy (66, 67). However, a Cochrane review showed that NSAIDs are not a significant factor in the incidence of bleeding (68). A study by Moss et al. showed that analgesia induced by injected ibuprofen not only reduced the need for opioid use in the opioid group but also reduced complications such as nausea (67). In contrast to the opiate and paracetamol drugs, ibuprofen has anti-inflammatory properties, which can play an essential role in limiting inflammatory cascades and reducing pain, especially after invasive procedures (67). It is clinically important to use this drug as an analgesic, especially in children, where the use of opiates can have more risks and complications (69).

- **Paracetamol**

Paracetamol is another medication that can be used in the ED that has fewer side effects and unwanted side effects than opioids and NSAIDs in therapeutic doses (70). Studies have shown that injected paracetamol can have similar analgesic effects to injectable NSAIDs in ED, as well to morphine in some painful procedures, such as wisdom tooth extraction (71-74). It is also frequently used after orthopedic surgeries (71, 75). According to Bektas et al., the analgesic effect of paracetamol may comparable with injected morphine in the treatment of renal colic (76). This drug can also be a good alternative to reduce the pain of patients undergoing heart surgery as compared with tramadol infusion (77). The other advantages of this drug is that it is easy to access and its cheapness in comparison with opiates (78, 79). Comparing paracetamol and NSAIDs and their combination, it has been shown that the addition of paracetamol to NSAIDs increases the effect of analgesia compared with the use of NSAIDs alone (70).

- **Ketamine**

Ketamine is another analgesic drug that has been used in clinical interventions for more than 30 years and can be administrated via IV, IN, intramuscular (IM), subcutaneous (SC), oral, rectal, transdermal, epidural and intrathecal routes (80-82). Clinical trials have shown that IN ketamine can have similar analgesic effects to IN fentanyl. Due to fewer complications, comparable duration of action, and ease of use can be a good choice for controlling pain in children (83-85). In particular, even after oral administration, it has an appropriate effect and few side effects in different age groups (86). Therefore, IN ketamine can be used in people who are contraindicated in taking fentanyl or other opioids (83). Ketamine can also be effective in preventing the immediate and delayed effects of hyperalgesia and acute tolerance effects due to the use of morphine and fentanyl (87).

- **Magnesium sulfate**

magnesium sulfate ($MgSO_4$) has various applications in the clinic, including the treatment of eclampsia and pre-eclampsia, hypokalemia, premature delivery, myocardial protection after ischemia, asthma crises, hemodynamic stability during intubation, and postoperative acute pain control (88-93). Several studies have indicated the analgesic effect of this drug, especially after surgery and shown it can reduce the need for fentanyl after therapeutic procedures (92, 94-97). It is also effective in increasing local analgesia when lidocaine is used and for relieving acute migraine attacks (98, 99).

Regional blocks

- **Femoral block**

In the elderly with a femoral bone fracture, using a block of nerve branches for analgesia can

significantly reduce the need for opioid use (100, 101). This analgesic technique, especially under ultrasound guidance, is easily carried out and lower compilations are associated (102). In addition, this method of analgesia in combat and disaster settings can be very suitable because it requires the use of a low dose of medication (103-105).

- **Hematoma block**

Distal radial fracture is the most common upper limb fracture in children and adults (106). Feeling a lot of pain during manual reduction, as well as a lot of stress and discomfort by the patient, can reduce the success of the intervention (107). Drug strategies to reduce pain during reduction include the use of short-acting benzodiazepines or propofol with or without opioids (108, 109). However, all of these medicines have their own side effects and limitations. Studies have shown that direct injection of analgesia into the fracture site, known as hematoma block, can be considered to be a more rapid and relatively less complicated method (110). The results of controlled trials in recent years have shown that hematoma blocks can have a strong effect on manual reduction of distal radial fractures and they involve fewer risks in comparison with systemic analgesics, a higher cost-effectiveness, and reductions in the time spent to achieve analgesia for interventions (107, 111-113).

- **Beir block**

Using IV regional anesthesia (IVRA) is a simple, reliable, and cost-effective method for local anesthesia for short-term procedures on limbs (114-116). Chan et al. acknowledged that this method is more beneficial and cost-effective compared to general anesthesia (117). Of course, some studies have reported the disadvantages associated with IVRA's analgesia. These include topical anesthetic toxicity, slow start of the sensory and motor block, poor muscle relaxation, tourniquet pain, and only short-term analgesia after the procedure, along with arrhythmia and cardiac arrest in the event of a human error, and possible neurological damage and compartment syndrome (118-123).

- **Axillary block**

In order to reduce the use of opioids, various methods of peripheral nerve blocking are used in upper limb procedures. The Instrascalene Brachial Plexus Block (ISB) is the most commonly used method for this purpose, because it can produce effective analgesia for 6 to 12 hours (124). However, this method is associated with a 100% probability of paralysis of the diaphragm and consequently, it is contraindicated in patients with underlying respiratory problems (125-127). In addition, this method can cause unwanted unilateral numbness and motor weakness (128). Price considered supra-scapular nerve blocks (SSNB) and axillary nerve blocks (ANB) as an alternative to ISB (129). However, studies by Pitombo et al. and Dhir et al. have shown that the efficacy of the ISB method is significantly greater than SSNB (130, 131). Checcucci et al. have shown that ANB can be an effective way to achieve analgesia but using ANB with SSNB has greater efficacy and patient satisfaction, and, if used correctly, can have fewer side effects than systemic analgesics (132).

- **Occipital block**

Studies have shown that large and small occipital nerve blocks can cause temporary headache relief (133, 134). Currently, the most effective treatment for cervicogenic headaches is blocking pain transfer through the greater occipital nerve (GON) and lesser occipital nerves (LON) (135). A study by Naja et al. showed that analgesia through the GON and LON blocks significantly reduced the need for the use of medications and systemic complications such as nausea, vomiting, appetite loss and recurrent pain (136). In the study by Ashkenazi and Young, GON block analgesia caused 89.5% relief of migraine in patients; the effect of this method on allodynia was also high and reported to be 100% (137). The success of this method for the relief of cluster headaches and drug-resistant cluster headaches has also been reported in some studies (138, 139).

- **Alveolar block**

The lower alveolar nerve block is the most common mandibular injection technique for analgesia in elective and emergency endodontic treatments. The study by Claffey et al. showed that analgesia using an inferior alveolar nerve block (IANB) with two lidocaine and articaine drugs did not have a significant difference (140, 141).

- **Intercostal nerve block**

Pain is the most common symptom of rib fractures, which can also reduce the respiratory effort and, consequently, reduce pulmonary compliance, atelectasis, and pneumonia (142). One of the appropriate anesthetic methods is an intercostal nerve block, which is an effective method that can increase lung compliance. Nevertheless, to reach the appropriate level of analgesia, it should be repeated every 4 to 6 hours, which can cause iatrogenic pneumothorax (143). This method is also used to relieve thoracotomy pain. However, the results have shown that its efficacy under the

best conditions is marginal and does not show a preference over a systemic narcotic (144). In addition, the usefulness of this method of analgesia in chronic pain syndrome has also been proven (145).

- **Periosteal Block**

In most patients, pain due to a fracture is induced by periosteal stimulation in the fracture site (146). Studies have shown that opioid receptors are present in the periosteum, and blocking them can have an analgesic effect (147-149). A study by Tageldin et al. showed that the use of a periosteal block in reduction of the distal radius fracture could be more effective than other analgesic methods, such as a hematoma block, neural network brachial block, or the use of systemic analgesics, and can have fewer side effects, a shorter hospital stay and greater patient satisfaction. Also, since the time and facilities needed to achieve the desired level of analgesia using this method are less than with other methods, it can be considered to be an effective action in initial emergency management (150).

Discussion

Non-opioids analgesics such as NSAIDS and acetaminophen are commonly used in the treatment of acute pain. However, the relief of acute moderate to severe pain usually requires opioid agents (151). The four primary parenteral opioids that are used in the treatment of acute pain in the ED are morphine, meperidine, fentanyl, and hydromorphone (32). Morphine and meperidine are the most common parenteral opioids used in the ED (152). Due to the short duration of action, fentanyl is primarily used for procedural sedation; hydromorphone is still not used extensively in the ED (32, 152).

NSAIDs are the other commonly used drugs, and although they are less effective during the first 10 minutes, they have an equal effect to opioids within 20–30 minutes and are well tolerated for short-term use (58, 153-155). Heldigit showed that pain control using NSAIDs is better than for morphine, and the need for rescue treatment and complications in NSAIDs is lower (156, 157). The anti-inflammatory effects of NSAIDs are due to inhibition of prostaglandins, which reduce the dilatation of the vessels, increase their permeability, increase diuretic effects on the kidneys, and increase pelvic pressure and the urine collection system (158). They also reduce swelling and inflammation and contractions of the ureter muscles. The gastrointestinal and renal side effects of NSAIDs have limited their use. However, their injectable generation such as ketorolac has minimized this complication (16).

Because of the side effects of systemic drugs and the restrictions on the use of analgesics, especially opioids, regional blocks of pain as part of a multimodal analgesic strategy, especially for fractures, joint reductions, complex lacerations, chest tube placement, and even paraphimosis reduction can be helpful (159-170).

With an increasing population and people's awareness and advancement of medical knowledge, selecting and proper use of pain killer medications are important. This is a great challenge for healthcare professionals because many patients in pain have complex conditions with multiple comorbidities and causes of pain.

Conclusions

This study was designed to investigate and identify the disadvantages and advantages of using each drug to be able to make the right choices in different clinical situations for patients while paying attention to the limitations of the use of these analgesic drugs.

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Authors' contribution

All authors passed four criteria for authorship contribution based on recommendations of the International Committee of Medical Journal Editors.

Conflict of interest

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References

1. Cordell WH, Keene KK, Giles BK, Jones JB, Jones JH, Brizendine EJ. The high prevalence of pain in emergency medical care. Am J Emerg Med. 2002;20(3):165-9.

2. Janati M, Kariman H, Memary E, Davarinezhad-Moghadam E, Arhami-Dolatabadi A. Educational Intervention Effect on Pain Management Quality in Emergency Department; a Clinical Audit. Adv J Emerg Med. 2018;2(2):e16.
3. Schull MJ, Morrison LJ, Vermeulen M, Redelmeier DA. Emergency department overcrowding and ambulance transport delays for patients with chest pain. CMAJ. 2003;168(3):277-83.
4. Gordon DB, Dahl JL, Miaskowski C, McCarberg B, Todd KH, Paice JA, et al. American pain society recommendations for improving the quality of acute and cancer pain management: American Pain Society Quality of Care Task Force. Arch Intern Med. 2005;165(14):1574-80.
5. Hwang U, Richardson LD, Sonuyi TO, Morrison RS. The effect of emergency department crowding on the management of pain in older adults with hip fracture. J Am Geriatr Soc. 2006;54(2):270-5.
6. Balbin JE, Nerenberg R, Baratloo A, Friedman BW. Intravenous fluids for migraine: a post hoc analysis of clinical trial data. Am J Emerg Med. 2016;34(4):713-6.
7. Baratloo A, Negida A, El Ashal G, Behnaz N. Intravenous caffeine for the treatment of acute migraine: a pilot study. J Caffeine Res. 2015;5(3):125-9.
8. Manthey DE, Nicks BA. Urologic stone disease. Emergency Medicine, 7th ed edited by Tintinalli JE, et al McGraw-Hill, New York, pp656. 2011.
9. Mortelmans LJ, Desruelles D, Baert JA, Hente KR, Tailly GG. Use of tramadol drip in controlling renal colic pain. J Endourol. 2006;20(12):1010-5.
10. Mirbaha S, Delavar-Kasmaei H, Shafiee E. Effectiveness of the Concurrent Intravenous Injection of Dexamethasone and Metoclopramide for Pain Management in Patients with Primary Headaches Presenting to Emergency Department. Adv J Emerg Med. 2017;1(1):e6.
11. Langford RM. Pain management today - what have we learned? Clin Rheumatol. 2006;25 Suppl 1:S2-8.
12. Todd KH, Ducharme J, Choiniere M, Crandall CS, Fosnocht DE, Homel P, et al. Pain in the emergency department: results of the pain and emergency medicine initiative (PEMI) multicenter study. J Pain. 2007;8(6):460-6.
13. Gordon DB, Pellino TA, Miaskowski C, McNeill JA, Paice JA, Laferriere D, et al. A 10-year review of quality improvement monitoring in pain management: recommendations for standardized outcome measures. Pain Manag Nurs. 2002;3(4):116-30.
14. Todd KH, Sloan EP, Chen C, Eder S, Wamstad K. Survey of pain etiology, management practices and patient satisfaction in two urban emergency departments. CJEM. 2002;4(4):252-6.
15. Rupp T, Delaney KA. Inadequate analgesia in emergency medicine. Ann Emerg Med. 2004;43(4):494-503.
16. Shaker S, Mosadegh R, Jalili F, Zavareh M. Comparison of intravenous morphine and ketorolac in renal colic patients admitted to Firoozgar and Hazrat Rasoul e Akram hospitals. J Anesthesiol Pain. 2016;7(2):40-8.
17. Hanks GW, Conno F, Cherny N, Hanna M, Kalso E, McQuay HJ, et al. Morphine and alternative opioids in cancer pain: the EAPC recommendations. Br J Cancer. 2001;84(5):587-93.
18. Paris P, Yealy D. Pain management. In: J M, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. St. Louis: Mosby; 2002. p. 2555-77.
19. Zimmer G. Acute pain management. In: Tintinalli J, Kelen G, Stapczynski J, editors. Emergency Medicine: A Comprehensive Study Guide. New York: McGraw-Hill; 2004. p. 257–64.
20. Craig M, Jeavons R, Probert J, Benger J. Randomised comparison of intravenous paracetamol and intravenous morphine for acute traumatic limb pain in the emergency department. Emerg Med J. 2012;29(1):37-9.
21. Raehal KM, Walker JK, Bohn LM. Morphine side effects in beta-arrestin 2 knockout mice. J Pharmacol Exp Ther. 2005;314(3):1195-201.

22. Javed RR, Dewey WL, Smith PA, Smith FL. PKC and PKA inhibitors reverse tolerance to morphine-induced hypothermia and supraspinal analgesia in mice. Eur J Pharmacol. 2004;492(2-3):149-57.
23. Zarrindast MR, Barghi-Lashkari S, Shafizadeh M. The possible cross-tolerance between morphine- and nicotine-induced hypothermia in mice. Pharmacol Biochem Behav. 2001;68(2):283-9.
24. Harkouk H, de Preville G, Benhamou D. [Hypothermia after intrathecal morphine for caesarean delivery: Another case report]. Ann Fr Anesth Reanim. 2013;32(1):53-5.
25. Hui CK, Huang CH, Lin CJ, Lau HP, Chan WH, Yeh HM. A randomised double-blind controlled study evaluating the hypothermic effect of 150 microg morphine during spinal anaesthesia for Caesarean section. Anaesthesia. 2006;61(1):29-31.
26. Koek W, France CP, Javors MA. Morphine-induced motor stimulation, motor incoordination, and hypothermia in adolescent and adult mice. Psychopharmacology. 2012;219(4):1027-37.
27. Ryan KF, Price JW, Warriner CB, Choi PT. Persistent hypothermia after intrathecal morphine: case report and literature review. Can J Anaesth. 2012;59(4):384-8.
28. Sayyid SS, Jabbour DG, Baraka AS. Hypothermia and excessive sweating following intrathecal morphine in a parturient undergoing cesarean delivery. Reg Anesth Pain Med. 2003;28(2):140-3.
29. Houshyar H, Cooper ZD, Woods JH. Paradoxical effects of chronic morphine treatment on the temperature and pituitary-adrenal responses to acute restraint stress: a chronic stress paradigm. J Neuroendocrinol. 2001;13(10):862-74.
30. Tzeng JI, Wang JJ, Ho ST, Tang CS, Liu YC, Lee SC. Dexamethasone for prophylaxis of nausea and vomiting after epidural morphine for post-Caesarean section analgesia: comparison of droperidol and saline. Br J Anaesth. 2000;85(6):865-8.
31. Harnett MJ, O'Rourke N, Walsh M, Carabuena JM, Segal S. Transdermal scopolamine for prevention of intrathecal morphine-induced nausea and vomiting after cesarean delivery. Anesth Analg. 2007;105(3):764-9.
32. Chang AK, Bijur PE, Meyer RH, Kenny MK, Solorzano C, Gallagher EJ. Safety and efficacy of hydromorphone as an analgesic alternative to morphine in acute pain: a randomized clinical trial. Ann Emerg Med. 2006;48(2):164-72.
33. Aubrun F, Monsel S, Langeron O, Coriat P, Riou B. Postoperative titration of intravenous morphine in the elderly patient. Anesthesiology. 2002;96(1):17-23.
34. Bijur PE, Kenny MK, Gallagher EJ. Intravenous morphine at 0.1 mg/kg is not effective for controlling severe acute pain in the majority of patients. Ann Emerg Med. 2005;46(4):362-7.
35. Elsner F, Radbruch L, Loick G, Gaertner J, Sabatowski R. Intravenous versus subcutaneous morphine titration in patients with persisting exacerbation of cancer pain. J Palliat Med. 2005;8(4):743-50.
36. Joranson DE, Ryan KM, Gilson AM, Dahl JL. Trends in medical use and abuse of opioid analgesics. JAMA. 2000;283(13):1710-4.
37. Wacker MS, Moniz CJ. Meperidine: second-line agent with first-line prescribing practices. Med Health R I. 2001;84(1):10-4.
38. Gordon DB, Jones HD, Goshman LM, Foley DK, Bland SE. A quality improvement approach to reducing use of meperidine. Jt Comm J Qual Improv. 2000;26(12):686-99.
39. Yasaei R, Saadabadi A. Meperidine. 2017. (https://www.ncbi.nlm.nih.gov/books/NBK470362)
40. Latta KS, Ginsberg B, Barkin RL. Meperidine: a critical review. Am J Ther. 2002;9(1):53-68.
41. Silverman ME, Shih RD, Allegra J. Morphine induces less nausea than meperidine when administered parenterally. J Emerg Med. 2004;27(3):241-3.
42. Hubbard GP, Wolfe KR. Meperidine misuse in a patient with sphincter of Oddi dysfunction. Ann Pharmacother. 2003;37(4):534-7.
43. Ezri T, Lurie S, Stein A, Evron S, Geva D. Postoperative nausea and vomiting: comparison of the effect of postoperative meperidine or morphine in gynecologic surgery patients. J Clin Anesth. 2002;14(4):262-6.

44. Panda M, Desbiens N, Doshi N, Sheldon S. Determinants of prescribing meperidine compared to morphine in hospitalized patients. Pain. 2004;110(1-2):337-42.
45. Thompson DR. Narcotic analgesic effects on the sphincter of Oddi: a review of the data and therapeutic implications in treating pancreatitis. Am J Gastroenterol. 2001;96(4):1266-72.
46. Allan L, Hays H, Jensen NH, de Waroux BL, Bolt M, Donald R, et al. Randomised crossover trial of transdermal fentanyl and sustained release oral morphine for treating chronic non-cancer pain. BMJ. 2001;322(7295):1154-8.
47. Patanwala AE, Keim SM, Erstad BL. Intravenous opioids for severe acute pain in the emergency department. Ann Pharmacother. 2010;44(11):1800-9.
48. Russo A, Grieco DL, Bevilacqua F, Anzellotti GM, Scarano A, Scambia G, et al. Continuous intravenous analgesia with fentanyl or morphine after gynecological surgery: a cohort study. J Anesth. 2017;31(1):51-7.
49. Curtis KM, Henriques HF, Fanciullo G, Reynolds CM, Suber F. A fentanyl-based pain management protocol provides early analgesia for adult trauma patients. J Trauma. 2007;63(4):819-26.
50. Soares LG, Martins M, Uchoa R. Intravenous fentanyl for cancer pain: a "fast titration" protocol for the emergency room. J Pain Symptom Manage. 2003;26(3):876-81.
51. Radbruch L, Sabatowski R, Loick G, Kulbe C, Kasper M, Grond S, et al. Constipation and the use of laxatives: a comparison between transdermal fentanyl and oral morphine. Palliat Med. 2000;14(2):111-9.
52. Clark AJ, Ahmedzai SH, Allan LG, Camacho F, Horbay GL, Richarz U, et al. Efficacy and safety of transdermal fentanyl and sustained-release oral morphine in patients with cancer and chronic non-cancer pain. Curr Med Res Opin. 2004;20(9):1419-28.
53. Staats PS, Markowitz J, Schein J. Incidence of constipation associated with long-acting opioid therapy: a comparative study. South Med J. 2004;97(2):129-34.
54. Borland M, Jacobs I, King B, O'Brien D. A randomized controlled trial comparing intranasal fentanyl to intravenous morphine for managing acute pain in children in the emergency department. Ann Emerg Med. 2007;49(3):335-40.
55. Borland ML, Bergesio R, Pascoe EM, Turner S, Woodger S. Intranasal fentanyl is an equivalent analgesic to oral morphine in paediatric burns patients for dressing changes: a randomised double blind crossover study. Burns. 2005;31(7):831-7.
56. Armstrong SC, Cozza KL. Pharmacokinetic drug interactions of morphine, codeine, and their derivatives: theory and clinical reality, part I. Psychosomatics. 2003;44(2):167-71.
57. Quigley C, Wiffen P. A systematic review of hydromorphone in acute and chronic pain. J Pain Symptom Manage. 2003;25(2):169-78.
58. Baratloo A, Amiri M, Forouzanfar MM, Hasani S, Fouda S, Negida A. Efficacy measurement of ketorolac in reducing the severity of headache. J Emerg Practice Trauma. 2016;2(1):21-4.
59. Forrest JB, Camu F, Greer IA, Kehlet H, Abdalla M, Bonnet F, et al. Ketorolac, diclofenac, and ketoprofen are equally safe for pain relief after major surgery. Br J Anaesth. 2002;88(2):227-33.
60. Baratloo A, Bafarani SA, Forouzanfar MM, Hashemi B, Friedman BW, Abdalvand A. Intravenous caffeine versus intravenous ketorolac for the management of moderate to severe migraine headache. Bangladesh J Pharmacol. 2016;11(2):428-32.
61. Abdolrazaghnejad A, Banaie M. Fentanyl-midazolam vs. midazolam-ketamine regarding patient sedation analgesia for emergency orthopedic procedures. Bangladesh J Pharmacol. 2017;12(2):30-2017.
62. Ghuman J, Vadera R. Ketorolac and morphine for analgesia in acute renal colic: is this combination more effective than monotherapy? CJEM. 2008;10(1):66-8.
63. Wood VM, Christenson JM, Innes GD, Lesperance M, McKnight D. The NARC (nonsteroidal anti-inflammatory in renal colic) trial. Single-dose intravenous ketorolac versus titrated intravenous meperidine in acute renal colic: a randomized clinical trial. CJEM. 2000;2(2):83-9.

64. Arora S, Wagner JG, Herbert M. Myth: parenteral ketorolac provides more effective analgesia than oral ibuprofen. CJEM. 2007;9(1):30-2.
65. Bookstaver PB, Miller AD, Rudisill CN, Norris LB. Intravenous ibuprofen: the first injectable product for the treatment of pain and fever. J Pain Res. 2010;3:67-79.
66. Archer S, Rosenfeld R, Mitchell R, Baugh R. Clinical Practice Guideline: Tonsillectomy in Children. Otolaryngol Head Neck Surg. 2010;143(2_suppl):P12-P.
67. Moss JR, Watcha MF, Bendel LP, McCarthy DL, Witham SL, Glover CD. A multicenter, randomized, double-blind placebo-controlled, single dose trial of the safety and efficacy of intravenous ibuprofen for treatment of pain in pediatric patients undergoing tonsillectomy. Paediatr Anaesth. 2014;24(5):483-9.
68. Lewis SR, Nicholson A, Cardwell ME, Siviter G, Smith AF. Nonsteroidal anti-inflammatory drugs and perioperative bleeding in paediatric tonsillectomy. Cochrane Database Syst Rev. 2013(7):Cd003591.
69. Food U, Administration D. FDA Drug Safety Communication: safety review update of codeine use in children; new boxed warning and contraindication on use after tonsillectomy and/or adenoidectomy. 2014.
70. Hyllested M, Jones S, Pedersen J, Kehlet H. Comparative effect of paracetamol, NSAIDs or their combination in postoperative pain management: a qualitative review. 2002. (https://www.ncbi.nlm.nih.gov/books/NBK69262)
71. Zhou TJ, Tang J, White PF. Propacetamol versus ketorolac for treatment of acute postoperative pain after total hip or knee replacement. Anesth Analg. 2001;92(6):1569-75.
72. Dejonckheere M, Desjeux L, Deneu S, Ewalenko P. Intravenous tramadol compared to propacetamol for postoperative analgesia following thyroidectomy. Acta Anaesthesiol Belg. 2001;52(1):29-33.
73. Hernandez-Palazon J, Tortosa JA, Martinez-Lage JF, Perez-Flores D. Intravenous administration of propacetamol reduces morphine consumption after spinal fusion surgery. Anesth Analg. 2001;92(6):1473-6.
74. Van Aken H, Thys L, Veekman L, Buerkle H. Assessing analgesia in single and repeated administrations of propacetamol for postoperative pain: comparison with morphine after dental surgery. Anesth Analg. 2004;98(1):159-65, table of contents.
75. Sinatra RS, Jahr JS, Reynolds LW, Viscusi ER, Groudine SB, Payen-Champenois C. Efficacy and safety of single and repeated administration of 1 gram intravenous acetaminophen injection (paracetamol) for pain management after major orthopedic surgery. Anesthesiology. 2005;102(4):822-31.
76. Bektas F, Eken C, Karadeniz O, Goksu E, Cubuk M, Cete Y. Intravenous paracetamol or morphine for the treatment of renal colic: a randomized, placebo-controlled trial. Ann Emerg Med. 2009;54(4):568-74.
77. Cattabriga I, Pacini D, Lamazza G, Talarico F, Di Bartolomeo R, Grillone G, et al. Intravenous paracetamol as adjunctive treatment for postoperative pain after cardiac surgery: a double blind randomized controlled trial. Eur J Cardiothorac Surg. 2007;32(3):527-31.
78. Remy C, Marret E, Bonnet F. Effects of acetaminophen on morphine side-effects and consumption after major surgery: meta-analysis of randomized controlled trials. Br J Anaesth. 2005;94(4):505-13.
79. Romsing J, Moiniche S, Dahl JB. Rectal and parenteral paracetamol, and paracetamol in combination with NSAIDs, for postoperative analgesia. Br J Anaesth. 2002;88(2):215-26.
80. Hocking G, Cousins MJ. Ketamine in chronic pain management: an evidence-based review. Anesth Analg. 2003;97(6):1730-9.
81. Azevedo VM, Lauretti GR, Pereira NL, Reis MP. Transdermal ketamine as an adjuvant for postoperative analgesia after abdominal gynecological surgery using lidocaine epidural blockade. Anesth Analg. 2000;91(6):1479-82.
82. Mohammadshahi A, Abdolrazaghnejad A, Nikzamir H, Safaie A. Intranasal Ketamine Administration for Narcotic Dose Decrement in Patients Suffering from Acute Limb Trauma in Emergency Department: a Double-Blind Randomized Placebo-Controlled Trial. Adv J Emerg Med. 2018;2(3):e30.

83. Graudins A, Meek R, Egerton-Warburton D, Oakley E, Seith R. The PICHFORK (Pain in Children Fentanyl or Ketamine) trial: a randomized controlled trial comparing intranasal ketamine and fentanyl for the relief of moderate to severe pain in children with limb injuries. Ann Emerg Med. 2015;65(3):248-54.e1.
84. Yeaman F, Oakley E, Meek R, Graudins A. Sub-dissociative dose intranasal ketamine for limb injury pain in children in the emergency department: a pilot study. Emerg Med Australas. 2013;25(2):161-7.
85. Herd DW, Anderson BJ, Keene NA, Holford NH. Investigating the pharmacodynamics of ketamine in children. Paediatr Anaesth. 2008;18(1):36-42.
86. Bredlau AL, McDermott MP, Adams HR, Dworkin RH, Venuto C, Fisher SG, et al. Oral ketamine for children with chronic pain: a pilot phase 1 study. J Pediatr. 2013;163(1):194-200.e1.
87. Laulin JP, Maurette P, Corcuff JB, Rivat C, Chauvin M, Simonnet G. The role of ketamine in preventing fentanyl-induced hyperalgesia and subsequent acute morphine tolerance. Anesth Analg. 2002;94(5):1263-9, table of contents.
88. Poggi SH, Ghidini A. Short delay of delivery to allow corticosteroid administration in a case of preterm antepartum eclampsia. Obstet Gynecol. 2003;101(5 Pt 2):1075-8.
89. Schouten JW. Neuroprotection in traumatic brain injury: a complex struggle against the biology of nature. Curr Opin Crit Care. 2007;13(2):134-42.
90. Ozcan PE, Tugrul S, Senturk NM, Uludag E, Cakar N, Telci L, et al. Role of magnesium sulfate in postoperative pain management for patients undergoing thoracotomy. J Cardiothorac Vasc Anesth. 2007;21(6):827-31.
91. Arcioni R, Palmisani S, Tigano S, Santorsola C, Sauli V, Romano S, et al. Combined intrathecal and epidural magnesium sulfate supplementation of spinal anesthesia to reduce post-operative analgesic requirements: a prospective, randomized, double-blind, controlled trial in patients undergoing major orthopedic surgery. Acta Anaesthesiol Scand. 2007;51(4):482-9.
92. Unlugenc H, Gunduz M, Ozalevli M, Akman H. A comparative study on the analgesic effect of tramadol, tramadol plus magnesium, and tramadol plus ketamine for postoperative pain management after major abdominal surgery. Acta Anaesthesiol Scand. 2002;46(8):1025-30.
93. Baratloo A, Mirbaha S, Delavar Kasmaei H, Payandemehr P, Elmaraezy A, Negida A. Intravenous caffeine citrate vs. magnesium sulfate for reducing pain in patients with acute migraine headache; a prospective quasi-experimental study. Korean J Pain. 2017;30(3):176-82.
94. McCartney CJ, Sinha A, Katz J. A qualitative systematic review of the role of N-methyl-D-aspartate receptor antagonists in preventive analgesia. Anesth Analg. 2004;98(5):1385-400, table of contents.
95. Ferasatkish R, Dabbagh A, Alavi M, Mollasadeghi G, Hydarpur E, Moghadam AA, et al. Effect of magnesium sulfate on extubation time and acute pain in coronary artery bypass surgery. Acta Anaesthesiol Scand. 2008;52(10):1348-52.
96. Buvanendran A, McCarthy RJ, Kroin JS, Leong W, Perry P, Tuman KJ. Intrathecal magnesium prolongs fentanyl analgesia: a prospective, randomized, controlled trial. Anesth Analg. 2002;95(3):661-6, table of contents.
97. Ryu JH, Kang MH, Park KS, Do SH. Effects of magnesium sulphate on intraoperative anaesthetic requirements and postoperative analgesia in gynaecology patients receiving total intravenous anaesthesia. Br J Anaesth. 2008;100(3):397-403.
98. Turan A, Memis D, Karamanlioglu B, Guler T, Pamukcu Z. Intravenous regional anesthesia using lidocaine and magnesium. Anesth Analg. 2005;100(4):1189-92.
99. Demirkaya S, Vural O, Dora B, Topcuoglu MA. Efficacy of intravenous magnesium sulfate in the treatment of acute migraine attacks. Headache. 2001;41(2):171-7.
100. Beaudoin FL, Haran JP, Liebmann O. A comparison of ultrasound-guided three-in-one femoral nerve block versus parenteral opioids alone for analgesia in emergency department patients with hip fractures: a randomized controlled trial. Acad Emerg Med. 2013;20(6):584-91.

101. Newton-Brown E, Fitzgerald L, Mitra B. Audit improves emergency department triage, assessment, multi-modal analgesia and nerve block use in the management of pain in older people with neck of femur fracture. Australas Emerg Nurs J. 2014;17(4):176-83.
102. Johnson B, Herring A, Shah S, Krosin M, Mantuani D, Nagdev A. Door-to-block time: prioritizing acute pain management for femoral fractures in the ED. Am J Emerg Med. 2014;32(7):801-3.
103. Buckenmaier CC, McKnight GM, Winkley JV, Bleckner LL, Shannon C, Klein SM, et al. Continuous peripheral nerve block for battlefield anesthesia and evacuation. Reg Anesth Pain Med. 2005;30(2):202-5.
104. Lippert SC, Nagdev A, Stone MB, Herring A, Norris R. Pain control in disaster settings: a role for ultrasound-guided nerve blocks. Ann Emerg Med. 2013;61(6):690-6.
105. Malchow RJ. Ultrasonography for advanced regional anesthesia and acute pain management in a combat environment. US Army Med Dep J. 2009:64-6.
106. Alluri RK, Hill JR, Ghiassi A. Distal Radius Fractures: Approaches, Indications, and Techniques. J Hand Surg Am. 2016;41(8):845-54.
107. 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. 2018;13(1):62.
108. Godwin SA, Burton JH, Gerardo CJ, Hatten BW, Mace SE, Silvers SM, et al. Clinical policy: procedural sedation and analgesia in the emergency department. Ann Emerg Med. 2014;63(2):247-58.e18.
109. Nejati A, Moharari RS, Ashraf H, Labaf A, Golshani K. Ketamine/propofol versus midazolam/fentanyl for procedural sedation and analgesia in the emergency department: a randomized, prospective, double-blind trial. Acad Emerg Med. 2011;18(8):800-6.
110. Ogunlade SO, Omololu AB, Alonge TO, Salawu SA, Bamgboye EA. Haematoma block in reduction of distal radial fractures. West Afr J Med. 2002;21(4):282-5.
111. Fathi M, Moezzi M, Abbasi S, Farsi D, Zare MA, Hafezimoghadam P. Ultrasound-guided hematoma block in distal radial fracture reduction: a randomised clinical trial. Emerg Med J. 2015;32(6):474-7.
112. Bear DM, Friel NA, Lupo CL, Pitetti R, Ward WT. Hematoma block versus sedation for the reduction of distal radius fractures in children. J Hand Surg Am. 2015;40(1):57-61.
113. Myderrizi N, Mema B. The hematoma block an effective alternative for fracture reduction in distal radius fractures. Med Arh. 2011;65(4):239-42.
114. Choyce A, Peng P. A systematic review of adjuncts for intravenous regional anesthesia for surgical procedures. Can J Anaesth. 2002;49(1):32-45.
115. Yurtlu S, Hanci V, Kargi E, Erdogan G, Koksal BG, Gul S, et al. The analgesic effect of dexketoprofen when added to lidocaine for intravenous regional anaesthesia: a prospective, randomized, placebo-controlled study. J Int Med Res. 2011;39(5):1923-31.
116. Handoll HH, Madhok R, Dodds C. Anaesthesia for treating distal radial fracture in adults. The Cochrane Database Syst Rev. 2002(3):Cd003320.
117. Chan VW, Peng PW, Kaszas Z, Middleton WJ, Muni R, Anastakis DG, et al. A comparative study of general anesthesia, intravenous regional anesthesia, and axillary block for outpatient hand surgery: clinical outcome and cost analysis. Anesth Analg. 2001;93(5):1181-4.
118. Sorensen AM, Dalsgaard J, Hansen TB. Local anaesthesia versus intravenous regional anaesthesia in endoscopic carpal tunnel release: a randomized controlled trial. J Hand Surg Eur Vol. 2013;38(5):481-4.
119. Memis D, Turan A, Karamanlioglu B, Pamukcu Z, Kurt I. Adding dexmedetomidine to lidocaine for intravenous regional anesthesia. Anesth Analg. 2004;98(3):835-40.
120. Cladis FP, Litman RS. Transient cardiovascular toxicity with unintentional intravascular injection of 3% 2-chloroprocaine in a 2-month-old infant. Anesthesiology. 2004;100(1):181-3.

121. Marsch SC, Sluga M, Studer W, Barandun J, Scharplatz D, Ummenhofer W. 0.5% versus 1.0% 2-chloroprocaine for intravenous regional anesthesia: a prospective, randomized, double-blind trial. Anesth Analg. 2004;98(6):1789-93.
122. Horlocker TT, Hebl JR, Gali B, Jankowski CJ, Burkle CM, Berry DJ, et al. Anesthetic, patient, and surgical risk factors for neurologic complications after prolonged total tourniquet time during total knee arthroplasty. Anesth Analg. 2006;102(3):950-5.
123. Guay J. Adverse events associated with intravenous regional anesthesia (Bier block): a systematic review of complications. J Clin Anesth. 2009;21(8):585-94.
124. Abdallah FW, Halpern SH, Aoyama K, Brull R. Will the Real Benefits of Single-Shot Interscalene Block Please Stand Up? A Systematic Review and Meta-Analysis. Anesth Analg. 2015;120(5):1114-29.
125. Verelst P, van Zundert A. Respiratory impact of analgesic strategies for shoulder surgery. Reg Anesth Pain Med. 2013;38(1):50-3.
126. Bergmann L, Martini S, Kesselmeier M, Armbruster W, Notheisen T, Adamzik M, et al. Phrenic nerve block caused by interscalene brachial plexus block: breathing effects of different sites of injection. BMC Anesthesiol. 2016;16(1):45.
127. Kessler J, Schafhalter-Zoppoth I, Gray AT. An ultrasound study of the phrenic nerve in the posterior cervical triangle: implications for the interscalene brachial plexus block. Reg Anesth Pain Med. 2008;33(6):545-50.
128. Shin HJ, Na HS, Oh AY, Hwang JW, Kim BG, Park HP, et al. A prospective, randomized and controlled study of interscalene brachial plexus block for arthroscopic shoulder surgery: A comparison of C5 and conventional approach, a CONSORT-compliant article. Medicine. 2016;95(37):e4921.
129. Price DJ. The shoulder block: a new alternative to interscalene brachial plexus blockade for the control of postoperative shoulder pain. Anaesth Intensive Care. 2007;35(4):575-81.
130. Pitombo PF, Meira Barros R, Matos MA, Pinheiro Modolo NS. Selective suprascapular and axillary nerve block provides adequate analgesia and minimal motor block. Comparison with interscalene block. Braz J Anesthesiol. 2013;63(1):45-51.
131. Dhir S, Sondekoppam RV, Sharma R, Ganapathy S, Athwal GS. A Comparison of Combined Suprascapular and Axillary Nerve Blocks to Interscalene Nerve Block for Analgesia in Arthroscopic Shoulder Surgery: An Equivalence Study. Reg Anesth Pain Med. 2016;41(5):564-71.
132. Checcucci G, Allegra A, Bigazzi P, Gianesello L, Ceruso M, Gritti G. A new technique for regional anesthesia for arthroscopic shoulder surgery based on a suprascapular nerve block and an axillary nerve block: an evaluation of the first results. Arthroscopy. 2008;24(6):689-96.
133. Biondi DM. Cervicogenic headache: diagnostic evaluation and treatment strategies. Curr Pain Headache Rep. 2001;5(4):361-8.
134. Biondi DM. Cervicogenic headache: a review of diagnostic and treatment strategies. J Am Osteopath Assoc. 2005;105(4 Suppl 2):16s-22s.
135. Grimshaw DN. Cervicogenic headache: manual and manipulative therapies. Curr Pain Headache Rep. 2001;5(4):369-75.
136. Naja ZM, El-Rajab M, Al-Tannir MA, Ziade FM, Tawfik OM. Occipital nerve blockade for cervicogenic headache: a double-blind randomized controlled clinical trial. Pain Pract. 2006;6(2):89-95.
137. Ashkenazi A, Young WB. The effects of greater occipital nerve block and trigger point injection on brush allodynia and pain in migraine. Headache. 2005;45(4):350-4.
138. Peres MF, Stiles MA, Siow HC, Rozen TD, Young WB, Silberstein SD. Greater occipital nerve blockade for cluster headache. Cephalalgia. 2002;22(7):520-2.
139. Magis D, Allena M, Bolla M, De Pasqua V, Remacle JM, Schoenen J. Occipital nerve stimulation for drug-resistant chronic cluster headache: a prospective pilot study. Lancet Neurol. 2007;6(4):314-21.
140. Claffey E, Reader A, Nusstein J, Beck M, Weaver J. Anesthetic efficacy of articaine for inferior alveolar nerve blocks in patients with irreversible pulpitis. J Endod. 2004;30(8):568-71.

141. Tortamano IP, Siviero M, Costa CG, Buscariolo IA, Armonia PL. A comparison of the anesthetic efficacy of articaine and lidocaine in patients with irreversible pulpitis. J Endod. 2009;35(2):165-8.
142. Truitt MS, Murry J, Amos J, Lorenzo M, Mangram A, Dunn E, et al. Continuous intercostal nerve blockade for rib fractures: ready for primetime? J Trauma. 2011;71(6):1548-52.
143. Shanti CM, Carlin AM, Tyburski JG. Incidence of pneumothorax from intercostal nerve block for analgesia in rib fractures. J Trauma. 2001;51(3):536-9.
144. Silomon M, Claus T, Huwer H, Biedler A, Larsen R, Molter G. Interpleural analgesia does not influence postthoracotomy pain. Anesth Analg. 2000;91(1):44-50.
145. Doi K, Nikai T, Sakura S, Saito Y. Intercostal nerve block with 5% tetracaine for chronic pain syndromes. J Clin Anesth. 2002;14(1):39-41.
146. Jansen H, Frey SP, Doht S, Fehske K, Meffert RH. Medium-term results after complex intra-articular fractures of the tibial plateau. J Orthop Sci. 2013;18(4):569-77.
147. Bergstrom J, Ahmed M, Li J, Ahmad T, Kreicbergs A, Spetea M. Opioid peptides and receptors in joint tissues: study in the rat. J Orthop Res. 2006;24(6):1193-9.
148. Mach DB, Rogers SD, Sabino MC, Luger NM, Schwei MJ, Pomonis JD, et al. Origins of skeletal pain: sensory and sympathetic innervation of the mouse femur. Neuroscience. 2002;113(1):155-66.
149. Gajda M, Litwin JA, Cichocki T, Timmermans JP, Adriaensen D. Development of sensory innervation in rat tibia: co-localization of CGRP and substance P with growth-associated protein 43 (GAP-43). J Anat. 2005;207(2):135-44.
150. Tageldin ME, Alrashid M, Khoriati AA, Gadikoppula S, Atkinson HD. Periosteal nerve blocks for distal radius and ulna fracture manipulation--the technique and early results. J Orthop Surg Res. 2015;10:134.
151. Alford DP, Compton P, Samet JH. Acute pain management for patients receiving maintenance methadone or buprenorphine therapy. Ann Intern Med. 2006;144(2):127-34.
152. Middleton K, Hing E. National Hospital Ambulatory Medical Care Survey: 2003 outpatient department summary. Adv Data. 2005(366):1-36.
153. Reza KB, Safarinezhad M, Markazi MN, Valimanesh H, Abd EM. The comparison of the efficacy of common pain management in acute renal colic. Ann Military Health Sci Res. 2004;2(3):381-6.
154. Boureau F, Legallicier P, Kabir-Ahmadi M. Tramadol in post-herpetic neuralgia: a randomized, double-blind, placebo-controlled trial. Pain. 2003;104(1-2):323-31.
155. Milsom I, Minic M, Dawood MY, Akin MD, Spann J, Niland NF, et al. Comparison of the efficacy and safety of nonprescription doses of naproxen and naproxen sodium with ibuprofen, acetaminophen, and placebo in the treatment of primary dysmenorrhea: a pooled analysis of five studies. Clin Ther. 2002;24(9):1384-400.
156. Holdgate A, Oh CM. Is there a role for antimuscarinics in renal colic? A randomized controlled trial. J Urol. 2005;174(2):572-5.
157. Holdgate A, Pollock T. Systematic review of the relative efficacy of non-steroidal anti-inflammatory drugs and opioids in the treatment of acute renal colic. BMJ. 2004;328(7453):1401.
158. Aganovic D, Prcic A, Kulovac B, Hadziosmanovic O. Clinical decision making in renal pain management. Acta Inform Med. 2012;20(1):18-21.
159. Food U, Administration D. FDA issues Public Health Advisory recommending limited use of Cox-2 inhibitors: agency requires evaluation of prevention studies involving Cox-2 selective agents. FDA Talk Paper, 2004. 2005.
160. Clattenburg E, Herring A, Hahn C, Johnson B, Nagdev A. ED ultrasound-guided posterior tibial nerve blocks for calcaneal fracture analagesia. Am J Emerg Med. 2016;34(6):1183.e1-3.
161. Frenkel O, Herring AA, Fischer J, Carnell J, Nagdev A. Supracondylar radial nerve block for treatment of distal radius fractures in the emergency department. J Emerg Med. 2011;41(4):386-8.
162. Dickman E, Pushkar I, Likourezos A, Todd K, Hwang U, Akhter S, et al. Ultrasound-guided nerve blocks for intracapsular and extracapsular hip fractures. Am J Emerg Med. 2016;34(3):586-9.

163. Abdolrazaghnejad A, Banaie M, Safdari M. Ultrasonography in Emergency Department; a Diagnostic Tool for Better Examination and Decision-Making. Adv J Emerg Med. 2018;2(1):e7.
164. Herring AA, Stone MB, Frenkel O, Chipman A, Nagdev AD. The ultrasound-guided superficial cervical plexus block for anesthesia and analgesia in emergency care settings. Am J Emerg Med. 2012;30(7):1263-7.
165. Blaivas M, Adhikari S, Lander L. A prospective comparison of procedural sedation and ultrasound-guided interscalene nerve block for shoulder reduction in the emergency department. Acad Emerg Med. 2011;18(9):922-7.
166. Tezel O, Kaldirim U, Bilgic S, Deniz S, Eyi YE, Ozyurek S, et al. A comparison of suprascapular nerve block and procedural sedation analgesia in shoulder dislocation reduction. Am J Emerg Med. 2014;32(6):549-52.
167. Herring AA, Stone MB, Fischer J, Frenkel O, Chiles K, Teismann N, et al. Ultrasound-guided distal popliteal sciatic nerve block for ED anesthesia. Am J Emerg Med. 2011;29(6):697.e3-5.
168. Flores S, Herring AA. Ultrasound-guided Greater Auricular Nerve Block for Emergency Department Ear Laceration and Ear Abscess Drainage. J Emerg Med. 2016;50(4):651-5.
169. 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. 2011;29(6):697.e1-2.
170. Flores S, Herring AA. Ultrasound-guided dorsal penile nerve block for ED paraphimosis reduction. The Am J Emerg Med. 2015;33(6):863.e3-5.