| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 1 | Lawand J, Hantouly A, Bouri F, Muneer M, Farooq A, Hagert E. Complications and side effects of Wide-Awake Local Anaesthesia No Tourniquet (WALANT) in upper limb surgery: a systematic review and metaanalysis. Int Orthop. 2024;48(5):1257-1269. doi:10.1007/s00264-024-06104-9 | Systematic Review with Meta-Analysis | 15,595 WALANT patients | upper limb WALANT procedures | n/a | complications and side effects of WALANT upper limb procedures | WALANT has a low overall complication rate of 1.7%, with a significant reduction in complications when sodium bicarbonate is added to the anesthetic solution. The findings support the safety of WALANT in upper limb procedures. | IIIB |
| 2 | Schindelar L, Townsend CB, Ilyas AM, Matzon JL. The impact of intraoperative nursing care on perioperative complications during wideawake local anesthesia hand surgery. J Hand Surg Glob Online. 2022;4(6):385-388. doi:10.1016/j.jhsg.2021.12.006 | Nonexperimental | 1,771 patients who underwent wide awake hand surgery | n/a | n/a | perioperative complications | Limiting the nursing personnel for wide-awake local anesthesia hand surgeries could be an efficient way to cut procedural costs without compromising patient safety. | IIIB |
| 3 | Benze C, Spruce L, Groah L. Perioperative Nursing: Scope and Standards of Practice. AORN Inc;2021. Accessed October 3, 2025. https://www.aorn.org/guidelinesresources/clinicalresources/standardsofpractice | Position Statement | n/a | n/a | n/a | n/a | Provides the AORN position statement for the scope and standards of practice for perioperative nursing | IVB |
| 4 | Gitman M, Fettiplace MR, Weinberg GL, Neal JM, Barrington MJ. Local anesthetic systemic toxicity: a narrative literature review and clinical update on prevention, diagnosis, and management. Plast Reconstr Surg. 2019;144(3):783-795. doi:10.1097/PRS.0000000000005989 | Literature Review | n/a | n/a | n/a | n/a | All physicians who administer local anesthetics should be educated about systemic toxicity and contemporary management algorithms, including lipid emulsion therapy. | VA |
| 5 | Selmanoglu A, Güvenir H, Celik IK, et al. Immediate local anesthetic reactions and diagnostic test results in pediatric patients. Allergol Immunopathol (Madr). 2021;49(3):108-114. doi:10.15586/aei.v49i3.87 | Nonexperimental | 73 pediatric patients | n/a | n/a | Local anesthetic allergy prevalence in pediatric patients | The current literature provides limited information regarding local anesthetic allergies and diagnosis test results in pediatric patients. | IIIC |
| 6 | Guideline for medication safety. In: Guidelines for Perioperative Practice. AORN Inc; 2025:487-540. | Guideline | n/a | n/a | n/a | n/a | Provides evidence-based recommendations for medication safety for perioperative teams. | IVA |
| 7 | Nursing: Scope and Standards of Practice. 4th ed. American Nurses Association; 2021. | Consensus | n/a | n/a | n/a | n/a | Provides expert consensus on the scope and standards of nursing practice. | IVA |
| 8 | 2025-2026 Perianesthesia Nursing Standards, Practice Recommendations and Interpretive Statements. American Society of PeriAnesthesia Nurses (ASPAN); 2024. | Guideline | n/a | n/a | n/a | n/a | Provides ASPAN perianesthesia nursing standards, practice recommendations, and interpretive statements. | IVB |
| 9 | Label: INTRALIPID – i. v. fat emulsion emulsion. DailyMed. Accessed October 3, 2025. https://www.dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=a69c82da-15ba-4d4d-8d7f-871dc3981eb8 | Expert Opinion | n/a | n/a | n/a | n/a | Provides information about IV lipid emulsion administration and safety. | VB |
| 10 | Chang MT, Jitaroon K, Nguyen T, et al. Hemodynamic changes in patients undergoing office-based sinus procedures under local anesthesia. Int Forum Allergy Rhinol. 2020;10(1):114-120. doi:10.1002/alr.22460 | Nonexperimental | 25 patients undergoing office-ased sinus procedures under local anesthesia | n/a | n/a | Hemodynamics, pain, anxiety | Although patients appear to tolerate office procedures well, providers should recognize the potential for significant fluctuations in blood pressure during the procedure, especially in older patients. | IIIB |
| 11 | Smilowitz NR, Berger JS. Perioperative cardiovascular risk assessment and management for noncardiac surgery: a review. JAMA. 2020;324(3):279-290. doi:10.1001/jama.2020.7840 | Literature Review | n/a | n/a | n/a | n/a | A comprehensive history, physical examination, and assessment of functional capacity during daily life should be performed prior to noncardiac surgery to assess cardiovascular risk. Cardiovascular testing is rarely indicated in patients with a low risk of major adverse cardiovascular event but may be useful in patients with poor functional capacity undergoing high-risk surgery if test results would change therapy independent of the planned surgery. Perioperative medical therapy should be prescribed based on patient-specific risk. | VA |

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|---|---|---|---|---|---|---|---|---|
| 12 | Charipova K, Urits I, Viswanath O, Urman RD. Preoperative assessment and optimization of cognitive dysfunction and frailty in the ambulatory surgical patient. Curr Opin Anaesthesiol. 2020;33(6):732-739. doi:10.1097/ACO.0000000000000901 | Literature Review | n/a | n/a | n/a | n/a | The recognition of at-risk patients using standardized screening and the use of this assessment to guide perioperative monitoring and interventions is essential for optimizing outcomes for the complex ambulatory surgery patient. | VB |
| 13 | Mitchell M. Conscious surgery: influence of the environment on patient anxiety. J Adv Nurs. 2008;64(3):261-271. doi: 10.1111/j.1365-2648.2008.04769.x | Nonexperimental | 214 adult surgical patients from 4 day surgery centers | n/a | n/a | Level of anxiety | Providing information regarding the intraoperative experience may help reduce anxiety for the majority of patients. | IIIB |
| 14 | Mitchell M. Patient anxiety and conscious surgery. J Perioper Pract. 2009;19(6):168-173. doi: 10.1177/175045890901900601 | Nonexperimental | 214 adult surgical patients from 3 day surgery centers | n/a | n/a | overall level of anxiety | Focusing care on managing the intra-operative experience and providing anesthetic information prior to surgery may help limit anxiety and misapprehensions associated with conscious surgery. | IIIB |
| 15 | Guideline for information management. In: Guidelines for Perioperative Practice. AORN Inc; 2025:375-412. | Guideline | n/a | n/a | n/a | n/a | Provides evidence-based recommendations for information management for perioperative teams. | IVA |
| 16 | Statement on ASA Physical Status Classification System. American Society of Anesthesiologists. Accessed October 3, 2025. https://www.asahq.org/standardsand-guidelines/asaphysicalstatus-classificationsystem | Expert Opinion | n/a | n/a | n/a | n/a | The ASA Physical Status Classification System has been in use for over 60 years. The purpose of the system is to assess and communicate a patient's pre-anesthesia medical co-morbidities. The classification system alone does not predict the perioperative risks, but used with other factors (eg, type of surgery, frailty, level of deconditioning), it can be helpful in predicting perioperative risks. | VA |
| 17 | Sankar A, Johnson SR, Beattie WS, Tait G, Wijeysundera DN. Reliability of the American Society of Anesthesiologists physical status scale in clinical practice. Br J Anaesth. 2014;113(3):424-432. doi:10.1093/bja/aeu100 | Nonexperimental | 10,864 patients | n/a | n/a | inter-rater reliability of ASA-PS scoring | Consistent with its inherent subjectivity, the ASA-PS scale has moderate interrater reliability in clinical practice. It also demonstrates validity as a marker of patients' preoperative health status. | IIIB |
| 18 | Li G, Walco JP, Mueller DA, Wanderer JP, Freundlich RE. Reliability of the ASA Physical Status Classification System in predicting surgical morbidity: a retrospective analysis. J Med Syst. 2021;45(9):83. doi:10.1007/s10916-021-01758-z | Nonexperimental | 56,820 cases meeting inclusion criteria | n/a | n/a | Correlation between ASA physical status assignment and objective measures of overall illness, and prediction of 30-day postoperative mortality | The ASA Physical Status Classification System showed significant correlation with 27 of the 31 Elixhauser comorbidities and other demographic characteristics, demonstrating its reliability and potential ability to predict postoperative outcomes. | IIIA |
| 19 | Hackett NJ, De Oliveira GS, Jain UK, Kim JYS. ASA class is a reliable independent predictor of medical complications and mortality following surgery. Int J Surg. 2015;18:184-190. doi:10.1016/j.ijsu.2015.04.079 | Nonexperimental | 2,297,629 cases with ASA PS classification from the ACS NSQIP database | n/a | n/a | 30-day medical complications | ASA-PS has strong, independent associations with post-operative medical complications and mortality across procedures. This capability, along with its simplicity, makes it a valuable prognostic metric. | IIIA |
| 20 | Neal JM, Barrington MJ, Fettiplace MR, et al. The Third American Society of Regional Anesthesia and Pain Medicine Practice Advisory on Local Anesthetic Systemic Toxicity: Executive Summary 2017. Reg Anesth Pain Med. 2018;43(2):113-123. doi: 10.1097/AAP.0000000000000720 | Guideline | n/a | n/a | n/a | n/a | Provides practice advisory on local anesthetic systemic toxicity. | IVA |

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|---|---|---|---|---|---|---|---|---|
| 21 | Hasegawa T, Kanazawa T, Komazawa D, et al. Effect of intracordal injection under local anesthesia on vital signs in high-risk patients. Auris Nasus Larynx. 2022;49(3):445-453. doi:10.1016/j.anl.2021.09.002 | Nonexperimental | Retrospective chart review of 46 patients with unilateral vocal cord paralysis who underwent intracordal injection under topical local anesthesia | n/a | n/a | Changes in vital signs (heart rate, blood oxygen saturation, systolic blood pressure, diastolic blood pressure) before and after intracordal injection | Intracordal injection under local anesthesia may be safe for high-risk patients requiring blood pressure management after thoracic aortic disease surgery. | IIIB |
| 22 | Tantri A, Clark C, Huber P, et al. Anesthesia monitoring by registered nurses during cataract surgery: assessment of need for intraoperative anesthesia consultation. J Cataract Refract Surg. 2006;32(7):1115-1118. doi:10.1016/j.jcrs.2006.01.102 | Nonexperimental | 270 cataract patients | Use of the ASA classification | n/a | intraoperative anesthesia consultation | Monitoring of routine cataract surgery by RNs was associated with a low rate of intraoperative anesthesia consultation. The ASA classification is predictive of the need for intraoperative consultation. | IIIB |
| 23 | Guideline for team communication. In: Guidelines for Perioperative Practice. AORN Inc; 2025:1143-1178. | Guideline | n/a | n/a | n/a | n/a | Provides evidence-based recommendations for perioperative team communication. | IVA |
| 24 | Maamari JA, Wolfe RC. Perioperative management of local anesthetic allergies. J Perianesth Nurs. 2023;38(6):947-949. doi:10.1016/j.jopan.2023.09.001 | Literature Review | n/a | n/a | n/a | n/a | Allergy to local anesthetics is rare, although can produce significant issues including anaphylaxis. Perioperative clinicians should understand allergic symptoms and understand how to manage an allergic reaction. | VA |
| 25 | Franceschini F, Bottau P, Caimmi S, et al. Local anesthetic hypersensitivity reactions in pediatric patients: recognition and management. Discov Med. 2024;36(180):16-21. doi:10.24976/Discov.Med.202436180.2 | Literature Review | n/a | n/a | n/a | n/a | Local anesthetics rarely induce adverse events when used in recommended doses and with proper injection techniques. Immediate anaphylactic reactions to LA injections are rare but potentially life-threatening. A comprehensive report and specialist examination are crucial to prevent further episodes. Diagnosis should be based on history, medical records, skin, and challenge tests. | VB |
| 26 | Fathi R, Serota M, Brown M. Identifying and managing local anesthetic allergy in dermatologic surgery. Dermatol Surg. 2016;42(2):147-156. doi:10.1097/DSS.0000000000000596 | Expert Opinion | n/a | n/a | n/a | n/a | True Ig-E mediated anaphylaxis to local anesthetics is very rare. Surgeons should be aware of the symptoms of an anesthetic allergy and how to manage the allergic reactions. | VA |
| 27 | Standards for Basic Anesthetic Monitoring. American Society of Anesthesiologists. Accessed October 5, 2025. https://www.asahq.org/standardsand-practiceparameters/standardsfor-basicanestheticmonitoring | Consensus | n/a | n/a | n/a | n/a | Provides standards for basic anesthetic monitoring. | IVB |
| 28 | Standards for Nurse Anesthesia Practice. American Association of Nurse Anesthesiology. 2019. Accessed October 5, 2025. https://issuu.com/aanapublishing/docs/standards_for_nurse_anesthesia_practice_ 2.23?fr=sOGNhNjU2NDAxMjU | Guideline | n/a | n/a | n/a | n/a | The American Association of Nurse Anesthetists (AANA) Standards for Nurse Anesthesia Practice provide a foundation for Certified Registered Nurse Anesthetists (CRNAs) in all practice settings. These standards are intended to support the delivery of patient-centered, consistent, high-quality, and safe anesthesia care and assist the public in understanding the CRNA's role in anesthesia care. | IVA |
| 29 | Vasović DD, Karamarković M, Stojičić M, et al. Buffered versus nonbuffered local anesthetics and local pain scores in upper eyelid blepharoplasty: randomized controlled trial. Ophthalmic Plast Reconstr Surg. 2023;39(6):602-605. doi:10.1097/IOP.0000000000002442 | RCT | 288 patients undergoing blepharoplasty | Groups 1-9 with different combinations of local anesthetics | contralateral side of each group received 2% plain lidocaine | Pain scores measured using Wong-Baker Face Pain Rating Visual Analogue Scale | Buffered combinations of local anesthetics produce significantly lower pain scores compared with nonbuffered solutions, which could help surgeons select an appropriate combination of local anesthetics, particularly in patients with lower pain threshold and tolerance. | IB |

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|---|---|---|---|---|---|---|---|---|
| 30 | Hockett D, Kress L, Mac Donald R, Krenzischek DA, Maheshwari A. Effectiveness of buffered lidocaine for local anesthesia during liver biopsy. Gastroenterol Nurs. 2021;44(3):172-176. doi:10.1097/SGA.0000000000000542 | RCT | 199 patients presenting for percutaneous liver biopsy using local anesthesia | lidocaine buffered with sodium bicarbonate | lidocaine alone | Preprocedure anxiety and pain, postprocedure pain, change in pain scores | Using sodium bicarbonate with lidocaine significantly decreased pain sensation at the injection site when used for deep visceral anesthesia during percutaneous liver biopsy. | IB |
| 31 | Kim H, Hwang K. Onset, duration, and pain score obtained using lidocaine mixed with epinephrine and bicarbonate in plastic surgery. J Craniofac Surg. 2020;31(7):1986-1990. doi:10.1097/SCS.0000000000006627 | Literature Review | n/a | n/a | n/a | n/a | The review analyzed the effects of lidocaine mixed with epinephrine and bicarbonate in plastic surgery. Alkalization of lidocaine with sodium bicarbonate significantly reduced the pain score. | VB |
| 32 | Vent A, Surber C, Graf Johansen NT, et al. Buffered lidocaine 1%/ epinephrine 1: 100, 000 with sodium bicarbonate (sodium hydrogen carbonate) in a 3: 1 ratio is less painful than a 9: 1 ratio: a doubleblind, randomized, placebocontrolled, crossover trial. J Am Acad Dermatol. 2020;83(1):159-165. doi:10.1016/j.jaad.2019.09.088 | RCT | 48 participants | 3:1 Lido/Epi:NaHCO3 mixture, 9:1 Lido/Epi:NaHCO3 mixture, Unbuffered Lido/Epi | NaCl 0.9% placebo | Pain during infiltration, effectiveness of anesthesia | Lido/Epi-NaHCO3 mixtures effectively reduce burning pain during infiltration. The 3:1 mixing ratio is significantly less painful than the 9:1 ratio. Reported findings are of high practical relevance, given the extensive use of local anesthesia today. | IB |
| 33 | Liu HM, Wu TJ, Liou CM, Chiu WK, Kang YN, Chen C. Patient comfort with various local infiltration anesthetics for minor oculoplastic surgery: a systematic review and network metaanalysis. J Plast Reconstr Aesthet Surg. 2022;75(9):3473-3484. doi:10.1016/j.bjps.2022.06.058 | Systematic Review with Meta-Analysis | 11 RCTs of 521 patients | Bicarbonate- buffered lidocaine with epinephrine, prilocaine with felypressin, and lidocaine with epinephrine | Various anesthetics with adjuvants | Injection pain measured using the visual analog scale (VAS) or preference question, operative bleeding, complications | Bicarbonate- buffered lidocaine with epinephrine may be the optimal anesthetic solution for local infiltration in minor oculoplastic surgeries due to reduced injection pain, operative bleeding, and postoperative swelling. | IB |
| 34 | Baker SD, Lee JY, White RP, et al. Doubleblind, randomized clinical trial comparing one percent buffered versus two percent unbuffered lidocaine injections in children. Pediatr Dent. 2021;43(2):88-94. | RCT | 25 children ages 10 to 12 years old | 3mL buffered 1% lidocaine (including 0.3 mL of 8.4 percent sodium bicarbonate) with epinephrine | 3mL unbuffered 2% lidocaine with epinephrine | Mean blood lidocaine levels (15 minutes post-injection), timing of clinical signs onset, response to pain on injection, and duration of anesthesia | The buffered local anesthetic formulation showed equal effectiveness with a double-concentration unbuffered formulation while resulting in lower mean blood lidocaine levels-an important gain for the prevention of anesthetic toxicity. | IB |
| 35 | Shekhar S, Suprabha BS, Shenoy R, Rao A, Rao A. Effect of active and passive distraction techniques while administering local anaesthesia on the dental anxiety, behaviour and pain levels of children: a randomised controlled trial. Eur Arch Paediatr Dent. 2022;23(3):417-427. doi:10.1007/s40368-022-00698-7 | RCT | 123 children aged 8-12 years undergoing inferior alveolar nerve block for dental treatment | Group 1: Stress ball, Group 2: Audio-visual eyeglasses | Control group (basic behavior guidance without distraction) | Dental anxiety measured using modified child dental anxiety scale and pulse rate, behavior rated using Venham's scale, and pain measured by self-reporting and observational scales | Use of active stress ball distraction or passive audio-visual eyeglasses during local anesthesia administration decreased dental anxiety but did not result in a significant improvement in the dental anxiety, behavior and pain levels when compared to basic behavior guidance without distraction. | IB |
| 36 | Acar K, Ersöz H. Effect of guided imagery on patient comfort, vital signs, pain, anxiety, and satisfaction in cancer patients undergoing port catheterization with local anesthesia: a prospective randomized controlled study. Cancer Nurs. 2024;47(2):93-99. doi:10.1097/NCC.0000000000001194 | RCT | 80 patients with cancer undergoing port catheterization with local anesthesia | standard treatment and nursing care, as well as a guided imagery intervention once before and once during the procedure | standard treatment and nursing care | Pain, anxiety, satisfaction, comfort, respiratory rate, heart rate, blood pressure | Guided imagery applied during a port catheterization procedure performed under local anesthesia decreased patients' pain score and anxiety level, increased patient satisfaction and comfort, and had a positive effect on respiratory and heart rate. Therefore, guided imagery can be a useful and low-cost complementary therapy for patients receiving local anesthesia. | IB |

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|---|---|---|---|---|---|---|---|---|
| 37 | Tezcan B, Ademoğlu D, Can M, et al. A randomized clinical trial on the effect of hypnosis on anxiety and pain in rigid cystoscopy patients. J Endourol. 2021;35(1):47-53. doi:10.1089/end.2020.0101 | RCT | 90 male patients ASA I and ASA II undergoing rigid cystoscopy for the first time/single cysto center, Turkey | Hypnosis Group underwent cystoscopy with hypnotic communication as an adjuvant approach for periprocedural analgesia and anxiety | Standard Care Group underwent cystoscopy with routine local anesthesia and lubrication | Visual analog scale (VAS) for pain, State-Trait Anxiety Inventory (STAI) for anxiety, hemodynamic parameters, urologist satisfaction | Hypnosis as an adjunct therapy to local anesthesia during rigid cystoscopy significantly reduces pain and anxiety, provides more stable hemodynamic conditions, shortens procedure duration, and thus appears attractive for pain and anxiety management. | IB |
| 38 | Pathak PD, Lakade LS, Patil KV, Shah PP, Patel AR, Davalbhakta RN. Clinical evaluation of feasibility and effectiveness using a virtual reality device during local anesthesia and extractions in pediatric patients. Eur Arch Paediatr Dent. 2023;24(3):379-386. doi:10.1007/s40368-023-00801-6 | RCT | 30 healthy children between the ages of 6 and 12 who required mandibular primary molar extraction | Study group (n = 15), standard care and use of a VR device | Control group (n = 15), standard care | Pre- and post-extraction anxiety levels measured by Venham's picture test (VPT) and heart rate, pain and behavior evaluated by Wong-Bakers Faces pain rating scale (WBS) and FLACC Scale respectively | The use of a virtual reality device in children can reduce anxiety during primary molar extractions. Virtual reality devices might be an adjunct to high-quality dental care and to other behavior management methods. | IB |
| 39 | Pina M, Cusano A, LeVasseur MR, OlivieriOrtiz R, Ferreira J, Parrino A. Wide awake local anesthesia no tourniquet technique in hand surgery: the patient experience. Hand (N Y). 2023;18(4):655-661. doi:10.1177/15589447211058838 | Nonexperimental | 128 patients who underwent WALANT surgery | n/a | n/a | Patient satisfaction, overall experience, anxiety and pain levels, postoperative SANE scores | WALANT hand surgery was generally well tolerated with excellent surgical outcomes. Patients reported ease of preparation for surgery, faster recovery, and lack of anesthetic side effects as the main benefits of wide-awake surgery. Combination use of lidocaine and bupivacaine may be better than lidocaine alone with respect to pain control in the initial recovery period. | IIIC |
| 40 | Agani Z, Ahmedi J, Ademi Abdyli R, et al. The changes in levels of blood cortisol, glucose, and oxygen saturation in type 2 diabetic patients during tooth extraction. Clin Exp Dent Res. 2022;8(6):1449-1455. doi:10.1002/cre2.641 | Quasi-experimental | 40 patients with Type II diabetes | 20 patients receiving lidocaine with additional adrenaline | 20 patients receiving lidocaine only | Changes in blood cortisol, glucose, and oxygen saturation levels; systolic and diastolic blood pressure; arterial pulse; sensitivity to pain through the Visual Analog Scale (VAS) | Diabetic patients require a more cautious approach when undergoing teeth extractions despite it being a routine procedure. | IIB |
| 41 | Guideline for complementary care. In: Guidelines for Perioperative Practice. AORN Inc; 2025:31-78. | Guideline | n/a | n/a | n/a | n/a | Provides evidence-based recommendations for complementary care for the perioperative patient. | IVA |
| 42 | Greene BHC, Lalonde DH, Seal SKF. Incidence of the “adrenaline rush” and vasovagal response with local anesthetic injection. Plast Reconstr Surg Glob Open. 2021;9(6):e3659. doi:10.1097/GOX.0000000000003659 | Nonexperimental | 387 patients | n/a | n/a | adrenaline rush feeling and vasovagal response to epinephrine | Patients run a low risk of feeling an adrenaline rush or vasovagal reaction when injected with lidocaine and epinephrine. Routinely advising patients that the adrenaline rush can happen, and that this is not an allergic reaction can be helpful to allay fear of the unknown and to prevent false allergy beliefs. Injecting patients lying down may decrease the incidence of vasovagal reactions by increasing cerebral blood flow with the advantage of gravity. | IIIB |

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|---|---|---|---|---|---|---|---|---|
| 43 | 2024-2025 Targeted Medication Safety Best Practices for Hospitals. Institute for Safe Medication Practices. Accessed October 5, 2025. https://www.ismp.org/guidelines/bestpractices-hospitals | Consensus | n/a | n/a | n/a | n/a | Provides medication safety best practices for hospitals. | IVA |
| 44 | Bajwa MS, Bashir MM, Bajwa MH, et al. How long to wait after local infiltration anaesthesia: systematic review. BJS Open. 2023;7(5):zrad. doi:10.1093/bjsopen/zrad089 | Systematic Review | 24 studies with a total of 1013 participants | n/a | n/a | Onset of analgesia and onset of stable hypoperfusion | The literature suggests that around 2 minutes are required for most patients to achieve complete analgesia in all sites and with all anesthesia concentrations. | IIIB |
| 45 | Marra G, Zhuang J, Marquis A, et al. Pain in men undergoing transperineal freehand multiparametric magnetic resonance imaging fusion targeted biopsies under local anesthesia: outcomes and predictors from a multicenter study of 1, 008 patients. J Urol. 2020;204(6):1209-1215. doi:10.1097/JU.0000000000001234 | Nonexperimental | 1,008 men undergoing transperineal fusion biopsies | n/a | n/a | Pain scores and factors associated with severe pain, pain influence on clinically significant prostate cancer target cores detection | Transperineal fusion biopsies under local anesthesia result in moderate pain. Pain does not influence clinically significant prostate cancer target detection. Patient anxiety predicts pain. A numeric rating scale-based anxiety assessment may be used to identify those at higher risk for experiencing severe pain in men undergoing transperineal fusion biopsies. | IIIB |
| 46 | Gökçek E, Akelma H, Kaydu A. Cardiac arrest after trigger point injection. Agri. 2019;31(4):216-217. doi:10.14744/agri.2019.15045 | Case Report | 36-year-old female | n/a | n/a | n/a | Considering the frequency of office-based pain procedures, it is important to recognize the potential serious complications associated with procedures frequently thought to be benign. | VB |
| 47 | Kyosaka Y, Owatari T, Inokoshi M, Kubota K, Inoue M, Minakuchi S. Cardiovascular comparison of 2 types of local anesthesia with vasoconstrictor in older adults: a crossover study. Anesth Prog. 2019;66(3):133-140. doi:10.2344/anpr-66-02-04 | RCT | 22 participants aged over 65 years | Participants administered 3% prilocaine with 0.03 IU/mL felypressin (P + FP) for the other dental extraction | Participants administered 2% lidocaine with 1:80,000 adrenaline (L + AD) for one dental extraction | Blood pressure and heart rate recorded immediately, 5, and 10 minutes after local anesthetic administration | In older adults, P + FP administration increased the systolic and diastolic blood pressures. L + AD administration increased the heart rate and decreased the diastolic blood pressure. | IC |
| 48 | Jermolajevaite J, Razlevice I, Gurskis V, Grinkeviciute DE, Lukosiene L, Macas A. Local anesthetic systemic toxicity following inadvertent intravenous levobupivacaine infusion in infants: a case report. Medicina (Kaunas). 2023;59(5):981. doi:10.3390/medicina59050981 | Case Report | 1.5-month-old patient/Lithuania | n/a | n/a | n/a | Prevention of medication errors is critical. Early recognition and immediate CPR along with targeted treatment for LAST can lead to positive outcomes. | VB |
| 49 | Mock ND, Griggs KM, Mileto LA. Local anesthetic systemic toxicity during labor, birth, and immediate postpartum: clinical review. MCN Am J Matern Child Nurs. 2021;46(6):330-338. doi:10.1097/NMC.0000000000000765 | Literature Review | n/a | n/a | n/a | n/a | Interdisciplinary collaboration is the most effective strategy for developing safeguards and policies for anesthetic complications in maternity care. Such policies should address lipid emulsion accessibility and a LAST treatment plan specific to the maternal patient. | VA |
| 50 | ISMP Guidelines for Safe Medication Use in Perioperative and Procedural Settings. 2022. ECRI. Accessed October 5, 2025. https://online.ecri.org/hubfs/ISMP/Resources/ISMP_Perioperative_Guidelines.pdf | Consensus | n/a | n/a | n/a | n/a | Provides medication safety best practices for the perioperative and procedural settings. | IVB |
| 51 | Ahmad H, Shami HB, Jan SN, Tayab Z, Bashir MM. Pain relief durations of different concentrations of lidocaine in wide awake hand surgery: a prospective randomised clinical trial. J Coll Physicians Surg Pak. 2023;33(7):727-731. doi:10.29271/jcpsp.2023.07.727 | RCT | 90 patients (30 in each group) | Group A (0.1% lidocaine) | Group B (0.2% lidocaine), Group C (0.3% lidocaine) | Duration of analgesia in minutes, pain measured using the Visual Analogue Scale | Adequate analgesia was recorded with all 3 lidocaine concentrations. The greatest pain-free duration was observed in the 0.3% lidocaine group. | IB |
| 52 | Byrne K, Engelbrecht C. Toxicity of local anaesthetic agents. Trends Anaesth Crit Care. 2013;3(1):25-30. doi:10.1016/j.tacc.2012.11.002 | Literature Review | n/a | n/a | n/a | n/a | LAST still occurs despite improvement injection techniques. Lipid emulsion injection is a treatment but requires further research. | VB |

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|---|---|---|---|---|---|---|---|---|
| 53 | Rubin DS, Matsumoto MM, Weinberg G, Roth S. Local anesthetic systemic toxicity in total joint arthroplasty: incidence and risk factors in the United States from the National Inpatient Sample 1998-2013. Reg Anesth Pain Med. 2018;43(2):131-137. doi:10.1097/AAP.0000000000000684 | Nonexperimental | 710,327 discharged patients from total having total joint procedures with a peripheral nerve block. | n/a | n/a | Incidence of Local anesthetic systemic toxicity (LAST) | In this study of a large nationally representative database, the authors identified an estimated LAST incidence of 1.4 per1000 peripheral nerve blocks and documented major LAST complications were present in 0.22 per 1000 peripheral nerve blocks. There is a trend of decreasing incidence. | IIIA |
| 54 | Tsai YF, Lin YC, Hsieh PH, et al. Incidence of local anesthetic systemic toxicity in patients receiving bupivacaine infiltration analgesia for total joint arthroplasty under general anesthesia: a retrospective single-center study. BMC Anesthesiol. 2024;24(1):422. doi:10.1186/s12871-024-02816-y | Nonexperimental | 1267 patients receiving LIA with bupivacaine for THA (n=873) and TKA (n=394)/single center, China | n/a | n/a | LAST incidences by severity, patient demographics, surgical and anesthesia details, recovery profiles | LIA was associated with a significantly higher risk of LAST in the THA group than in the TKA group. Exploring strategies to reduce the incidence of LIA-induced LAST is essential to improve perioperative patient safety. | IIIB |
| 55 | Mörwald EE, Zubizarreta N, Cozowicz C, Poeran J, Memtsoudis SG. Incidence of local anesthetic systemic toxicity in orthopedic patients receiving peripheral nerve blocks. Reg Anesth Pain Med. 2017;42(4):442-445. doi:10.1097/AAP.0000000000000544 | Nonexperimental | 238,473 patients who received peripheral nerve blocks | n/a | n/a | local anesthetic systemic toxicity | The incidence of local anesthetic systemic toxicity is low but should be considered clinically significant. Appropriate resources and awareness to identify and treat local anesthetic systemic toxicity should be available wherever regional anesthesia is performed. | IIIB |
| 56 | Waldinger R, Weinberg G, Gitman M. Local anesthetic toxicity in the geriatric population. Drugs Aging. 2020; 37(1): 1-9. doi:10.1007/s40266-019-00718-0 | Literature Review | n/a | n/a | n/a | n/a | Elderly patients are at increased risk of local anesthetic systemic toxicity. Special attention should be paid to the presence of systemic disease and muscle wasting when considering the use of local anesthetics in older patients. Educating physicians and staff to recognize and manage local anesthetic systemic toxicity will improve the safety of regional anesthesia and multi-modal analgesia among these at-risk patients. | VA |
| 57 | State Operations Manual Appendix A – Survey Protocol, Regulations and Interpretive Guidelines for Hospitals. Rev. 220; 04-19-24. Centers for Medicare & Medicaid Services. Accessed October 5, 2025. https://www.cms.gov/regulations-and-guidance/guidance/manuals/downloads/som107ap_a_hospitals.pdf | Regulatory | n/a | n/a | n/a | n/a | Provides regulatory requirements for hospitals. | n/a |
| 58 | Hunter OO, Kim TE, Mariano ER, Harrison TK. Care of the patient with a peripheral nerve block. J Perianesth Nurs. 2019;34(1):16-26. doi:10.1016/j.jopan.2018.01.006 | Expert Opinion | n/a | n/a | n/a | n/a | Perianesthesia nurses play a major role in anticipating and mitigating risks and carefully monitoring patients for potential complications related to peripheral nerve blocks. These include compartment syndrome, local anesthetic systemic toxicity, thermal injuries, falls, and fractures. The nurse's responsibility in discharge education after a peripheral nerve block is also discussed. | VA |
| 59 | Failure to monitor local anesthesia pt. before discharge. Case on point: Messer v. Martin, 2004 WL 1171736 N.W.2d -WI(2004). Nurs Law Regan Rep. 2004;45(1):2. | Case Report | n/a | n/a | n/a | n/a | Patient was discharged after a local procedure and fainted in the elevator. Vital signs were not taken after the procedure and before discharge. | VB |
| 60 | State Operations Manual Appendix L – Guidance for Surveyors: Ambulatory Surgical Centers. Rev. 215, 07-21-23. Accessed October 5, 2025. Centers for Medicare & Medicaid Services. https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/Downloads/som107ap_l_ambulatory.pdf | Regulatory | n/a | n/a | n/a | n/a | Provides regulatory requirements for ambulatory surgical centers. | n/a |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 61 | Greig PR, Zolger D, Onwochei DN, Thurley N, Higham H, Desai N. Cognitive aids in the management of clinical emergencies: a systematic review. Anaesthesia. 2023;78(3):343-355. doi:10.1111/anae.15939 | Systematic Review with Meta-Analysis | 13 RCTs | cognitive aids | standard care | completeness of care, incidence of errors, accuracy of care | The use of a cognitive aid increased the completeness of care delivered, reducing the incidence of errors and increasing the rate of correctly performed steps in emergencies. It is also important that cognitive aids be tested before their deployment and appropriate training in their use is provided. | IA |
| 62 | Checklist for Treatment of Local Anesthetic Systemic Toxicity (LAST) ASRA Pain Medicine. November 1, 2020. Accessed October 5, 2025. https://asra.com/news-publications/asra-updates/bloglanding/guidelines/2020/11/01/checklist-for-treatment-of-localanestheticsystemic-toxicity | Consensus | n/a | n/a | n/a | n/a | Provides an evidence-based treatment algorithm for local anesthetic systemic toxicity. | IVA |
| 63 | Local anesthetic systemic toxicity (LAST). In: Operating Room Crisis Checklists: Management of Adult Emergencies. Ariadne Labs. September 2024. Accessed October 5, 2025. https://www.ariadnelabs.org/wpcontent/uploads/2024/09/ORCC-Package-Updated-Sept-2024-Final.pdf - Draft | Consensus | n/a | n/a | n/a | n/a | Provides a local anesthetic systemic toxicity crisis checklist. | IVA |
| 64 | Local anesthetic toxicity. In: Stanford Anesthesia Cognitive Aid Program, Emergency Manual: Cognitive Aids for Perioperative Crises. Version 4; 2021. Standford Medicine. Accessed October 5, 2025. https://web.stanford.edu/dept/anesthesia/em/SEM_interactive.pdf | Consensus | n/a | n/a | n/a | n/a | Provides a local anesthetic systemic toxicity cognitive aid. | IVA |
| 65 | Hepner DL, Arriaga AF, Cooper JB, et al. Operating room crisis checklists and emergency manuals. Anesthesiology. 2017;127(2):384-392. doi:10.1097/ALN.0000000000001731. | Literature Review | n/a | n/a | n/a | n/a | Effective training and implementation strategies can lead to a perioperative culture that trains for and encourages appropriately using cognitive aids in conjunction with good teamwork and judgment and thus further reduces preventable perioperative adverse events. | VA |
| 66 | White A, Rougeau C, Gilbert T, Hughes E. Local anesthetic systemic toxicity: ensuring sustained nursing knowledge in a high-volume outpatient surgery center. J Perianesth Nurs. 2024;39(5):722-728. doi:10.1016/j.jopan.2023.12.007 | Organizational Experience | n/a | n/a | n/a | n/a | Standardizing LAST care in accordance with evidence-based guidance is critical to patient safety due to its infrequent occurrence. Nurses should consider implementing simulation supplemented with multimodal education and system changes to support sustained knowledge. | VA |
| 67 | Valencia MIB, Silva JFV. Protocol and importance of using the kit for local anesthetic systemic toxicity. Rev Colomb Anesthesiol. 2013;41(4):274-279. doi:10.1016/j.rcae.2013.09.001 | Expert Opinion | n/a | n/a | n/a | n/a | The increasing use of peripheral nerve blocks may result in more frequent cases of local anesthetic systemic toxicity (LAST). The potentially fatal consequences of LAST require immediately available treatment. | VA |
| 68 | Tkach L, Baillie L, Newby J, et al. Assessing CRNA knowledge of local anesthetic systemic toxicity treatment. AANA J. 2023;91(5):385-390. | Nonexperimental | 184 respondents | n/a | n/a | knowledge of LAST treatment | Implementing cognitive aids can help bridge knowledge gaps and ensure critical steps are not missed. Further studies examining the use of cognitive aids to improve CRNA knowledge of LAST management may be beneficial in the future. | IIIB |
| 69 | Neal JM, Neal EJ, Weinberg GL. American Society of Regional Anesthesia and Pain Medicine Local Anesthetic Systemic Toxicity checklist: 2020 version. Reg Anesth Pain Med. 2021;46(1):81-82. doi:10.1136/rapm-2020-101986 | Consensus | n/a | n/a | n/a | n/a | Provides ASRA treatment algorithm for local anesthetic systemic toxicity (LAST). | IVA |
| 70 | Ağaçkiran I, Özdamar Y, İlhan B, Aksu NM. Bupivacaine-induced systemic toxicity in a hair transplantation procedure. Dermatol Surg. 2021;47(4):573-574. doi:10.1097/DSS.0000000000002383 | Case Report | Patient admitted to ED after diagnosis of LAST | n/a | n/a | n/a | Patient admitted to ED after diagnosis of LAST during hair transplant procedure in a nonequipped medical center with bupivacaine injection. Tonic-clonic seizure activity was first symptom. | VB |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 71 | Hays H. Emergency medicine case study on local anesthetic systemic toxicity. Adv Emerg Nurs J. 2024;46(3):234-240. doi:10.1097/TME.0000000000000529 | Case Report | A 55-year-old female who experienced LAST following an outpatient procedure | n/a | n/a | n/a | Emergency nurse practitioners should be knowledgeable about local anesthetic systemic toxicity, including steps for resuscitation, pharmacologic treatment, risk assessment, clinical manifestations, and deviations from routine advanced resuscitative guidelines. | VB |
| 72 | American College of Medical Toxicology. ACMT Position Statement: Guidance for the Use of Intravenous Lipid Emulsion. J Med Toxicol. 2017;13(1):124-125. doi:10.1007/s13181-016-0550-z | Position Statement | n/a | n/a | n/a | n/a | Provides ACMT position for the guidance for the use of intravenous lipid emulsion. | IVA |
| 73 | Di Paolo M, Maiese A, Scatena A, et al. Fat overload syndrome following intravenous lipid emulsion administration as antidote in suspected anesthetic intoxication: insights from a clinical and forensic case experience. Clin Ter. 2024;175(4):211-215. doi:10.7417/CT.2024.5065 | Case Report | 1 patient with suspected bupivacaine intoxication, treated with lipid emulsion | n/a | n/a | n/a | The case report emphasizes the critical importance of healthcare professionals understanding the risks associated with using intravenous lipid emulsion (ILE) as an antidote. Adequate monitoring and evaluation of such sentinel events can help in developing specific clinical risk management protocols to reduce patient risk and healthcare costs. | VA |
| 74 | SchweitzerChaput A, Callot D, Bouazza N, et al. Local anesthetics systemic toxicity in children: analysis of the French pharmacovigilance database. BMC Pediatr. 2023;23(1):321. doi:10.1186/s12887-023-04126-7 | Nonexperimental | 64 LAST cases out of 512 cases retrieved | n/a | n/a | Neurological and cardiac signs, life-threatening outcomes | LAST in children appear to be a rare event. Neurological and cardiac signs were the most frequently reported reactions. LAST in children can be life-threatening, even at therapeutic doses. Although a fatal outcome may anecdotally occur, the vast majority of patients recovered after appropriate medical care. | IIIB |
| 75 | Torrie AM, Dunitz J, Brookman JC. Apparent reversal of a successful peripheral neural blockade with intravenous lipid emulsion after treatment for local anesthetic systemic toxicity: a case report. A A Pract. 2020;14(13):e01336. doi:10.1213/XAA.0000000000001336 | Case Report | Patient treated for LAST with ILE | n/a | n/a | n/a | Intravenous lipid emulsion (ILE) was successfully used to treat local anesthetic systemic toxicity (LAST), however resulted in complete reversal of a previously successful peripheral nerve block. | VB |
| 76 | Gola W, Bialka S, Zajac M, Misiolek H. Cardiac arrest after small doses ropivacaine: local anesthetic systemic toxicity in the course of continuous femoral nerve blockade. Int J Environ Res Public Health. 2022;19(19):12223. doi:10.3390/ijerph191912223 | Case Report | 74-year-old patient | n/a | n/a | n/a | Systemic toxicity of local anesthetics is a serious and potentially fatal complication in clinical practice. Proper supervision and a developed procedure for managing local anesthetic systemic toxicity are crucial. | VB |
| 77 | Estifan Kasabji G, Lucas Álvarez C, Fernández Ibán R. Convulsive crisis by local anesthetic during the placement of CVC: a purpose of a case. Nefrologia (Engl Ed). 2020;40(4):474-475. doi:10.1016/j.nefro.2019.09.002 | Case Report | 42-year-old female undergoing CVC placement with local anesthetic | n/a | n/a | n/a | After receiving locally injected lidocaine, the patient experienced anasocoria, seizures, and cardiovascular symptoms of toxicity. | VB |
| 78 | Nunes Silva M, Ferro A, Fragata I. Lidocaine-induced central nervous system toxicity during implantable cardioverter defibrillator placement – a case report and literature review. Rev Port Cardiol. 2023;42(5):483.e1-483.e4. doi:10.1016/j.repc.2020.07.025 | Case Report | 53-year-old female | n/a | n/a | n/a | The case aims to raise awareness of the risks and symptoms of local anesthetic toxicity, educate regarding the site of administration and dose of anesthetic delivery as independent risk factors for systemic toxicity, and highlight the use of intravenous lipid emulsion as an antidote. | VB |
| 79 | Basta MN. Local anaesthetic systemic toxicity complicating intraoperative intercostal nerve blocks: what do clinicians need to know to prevent similar occurrence? J Perioper Pract. 2023;33(12):390-395. doi:10.1177/17504589231180769 | Case Report | LAST after intraoperative nerve block with liposomal bupivacaine and bupivacaine in a patient undergoing VATS/general anesthesia | n/a | n/a | n/a | This case illustrates the importance of awareness regarding the prevention, diagnosis and treatment of local anesthetic systemic toxicity among medical professionals who administer local anesthetics. | VB |

| REFERENCE # | CITATION | EVIDENCE TYPE | SAMPLE SIZE/ POPULATION | INTERVENTION(S) | CONTROL/ COMPARISON | OUTCOME MEASURE(S) | CONCLUSION(S) | CONSENSUS SCORE |
|---|---|---|---|---|---|---|---|---|
| 80 | Gabrieli A, Barberi C, Compostella C, et al. Local anesthetic systemic toxicity joint management in the prehospital environment: a case report. Air Med J. 2024;43(3):256-258. doi:10.1016/j.amj.2024.01.009 | Case Report | Single case report of LAST in a dental ambulatory center, Italy | n/a | n/a | n/a | Effective communication among different components of the regional health care system led to fast lipid emulsion retrieval en route and on-site toxicity resolution. Establishing protocols to facilitate antidote retrieval, training focused on toxidromes recognition, and improved communication skills among different professionals involved in prehospital emergency medicine may improve response. | VC |
| 81 | Yawata S, Imamachi N, Sakura S, Yamamoto H, Saito Y. Local anesthetic systemic toxicity of levobupivacaine in erector spinae plane block. Korean J Anesthesiol. 2021;74(3):271-272. doi:10.4097/kja.20560 | Case Report | 50-year-old male, erector spinae plane block LAST | n/a | n/a | n/a | Care must be taken when performing bilateral ESPB because large volumes of local anesthetics are used. Best practice might include using ropivacaine rather than levobupivacaine and reducing the dose of local anesthetics as much as possible. | VC |
| 82 | Aditya A, Amar P, Chander A, Goel N, Jain K, Samra T. Ropivacaine induced systemic toxicity in a patient with phacomatosis pigmentokeratotica. Indian J Pharmacol. 2021;53(2):153-156. doi:10.4103/ijp.IJP_521_20 | Case Report | 22-year-old male with PPK who developed LAST after regional block with ropivacaine | n/a | n/a | n/a | This case report highlights successful resuscitation of a patient with Phacomatosis pigmentokeratotica after the development of CNS toxicity secondary to the administration of ropivacaine in ultrasound-guided combined lumbar plexus and sciatic nerve block. Some high-risk patient profiles should be vigilantly monitored to minimize the incidence of LAST. | VC |
| 83 | Bacon B, Silverton N, Katz M, et al. Local anesthetic systemic toxicity induced cardiac arrest after topicalization for transesophageal echocardiography and subsequent treatment with extracorporeal cardiopulmonary resuscitation. J Cardiothorac Vasc Anesth. 2019;33(1):162-165. doi:10.1053/j.jvca.2018.01.044 | Case Report | 76-year-old female who experienced LAST after oropharyngeal topical anesthesia with lidocaine prior to TEE and subsequent treatment with ECMO | n/a | n/a | n/a | Although reports of LAST are rare, the profound refractory cardiac arrest associated with significant toxicity may not respond to first-line therapies, and extracorporeal cardiopulmonary resuscitation may be required in severe cases. | VA |
| 84 | 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. 2010;35(2):181-187. doi:10.1097/aap.0b013e3181d2310b | Literature Review | n/a | n/a | n/a | n/a | Need for development of a prospective, global registry of LAST for educating practitioners & optimizing management of LAST. | VA |
| 85 | Wolfe JW, Butterworth JF. Local anesthetic systemic toxicity: update on mechanisms and treatment. Curr Opin Anaesthesiol. 2011;24(5):561-566. doi:10.1097/ACO.0b013e32834a9394 | Literature Review | n/a | n/a | n/a | n/a | There is mixed evidence as to the mechanisms of LAST, but it is likely local anesthetic cardiotoxicity arises from a blockade of sodium channels. Treatment includes ventilation, oxygenation, chest compressions, lipid emulsion therapy. | VB |
| 86 | Lavonas EJ, Akpunonu PD, Arens AM, et al. 2023 American Heart Association Focused Update on the Management of Patients with Cardiac Arrest or Life Threatening Toxicity Due to Poisoning: An Update to the American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2023;148(16):e149-e184. doi:10.1161/CIR.0000000000001161 | Guideline | n/a | n/a | n/a | n/a | Provides evidence-based recommendations for the management of patients with cardiac arrest or life-threatening toxicity due to poisoning. | IVA |
| 87 | Lee SH, Kim S, Sohn JT. Lipid emulsion treatment for local anesthetic systemic toxicity in pediatric patients: a systematic review. Medicine (Baltimore). 2024;103(11):e37534. doi:10.1097/MD.0000000000037534 | Literature Review | n/a | n/a | n/a | n/a | The findings reveal that lipid emulsion (LE) is effective in treating pediatric local anesthetic systemic toxicity (LAST). | VA |

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|---|---|---|---|---|---|---|---|---|
| 88 | Barradas Lopes J, Reis Ferreira A, Sousa MJ, Cadinha S. Anaphylactic shock to lidocaine: a rare case with evaluation of cross-reactivity between local anesthetics. J Investig Allergol Clin Immunol. 2021;31(5):449-450. doi:10.18176/jiaci.0658 | Case Report | 43-year-old male | n/a | n/a | n/a | Case report of allergic reaction to intranasal lidocaine. | |
| 89 | Rosa Duque JS, Chong PC, Lau YL, Ho MH. Cross-reactivity pattern of a rare presentation of generalized delayed-type hypersensitivity to local anaesthetics. Asian Pac J Allergy Immunol. 2019;37(3):179-182. doi:10.12932/AP-040218-0251 | Case Report | 7-year-old female | n/a | n/a | n/a | A 7-year-old female developed angioedema and a generalized, erythematous rash several hours after receiving lignocaine with adrenaline, confirming the first known case of generalized delayed-type hypersensitivity to local anesthetics with cross-reactivity to bupivacaine but not chloroprocaine. | VC |
| 90 | Sanan N, Lee J, Baxter C, Jeskey J, Hostoffer R. Delayed and protracted allergic reaction to oral lidocaine. Ann Allergy Asthma Immunol. 2019;123(4):413-414. doi:10.1016/j.anai.2019.03.004 | Case Report | Patient who experienced allergic reaction to lidocaine | n/a | n/a | n/a | Oral viscous lidocaine allergy report. | VC |
| 91 | Ishii T, Miyoshi H, Kubo T, Tsutsumi YM, Horikawa YT, Tanaka H. Delayed nonimmune anaphylaxis caused by ropivacaine for preoperative nerve blocks: a case report. A A Pract. 2023;17(11):e01727.doi:10.1213/XAA.0000000000001727 | Case Report | 70-year-old male | n/a | n/a | n/a | Anaphylaxis can be caused by medications even hours after their administration, and all administered drugs should be suspected of potentially causing anaphylaxis. | VB |
| 92 | Jiang Y, Yang F, Yao J, Xu C. Delayed urticaria owing to ropivacaine: a rare occurrence of local anesthetic allergy in a 11-year-old child. Minerva Anestesiol. 2023;89(10):945-946. doi:10.23736/S0375-9393.23.17352-4 | Case Report | 11-year-old child | n/a | n/a | n/a | Patient with observed urticaria around local anesthetic injection during lap appendectomy. | VC |
| 93 | Cefalu JN, Joshi TV, Spalitta MJ, et al. Methemoglobinemia in the operating room and intensive care unit: early recognition, pathophysiology, and management. Adv Ther. 2020;37(5):1714-1723. doi:10.1007/s12325-020-01282-5 | Literature Review | n/a | n/a | n/a | n/a | The review describes the causes of methemoglobinemia, recommends sensitive diagnostic tests, and provides guidance for rapid detection and treatment. CO-oximetry is more effective than standard pulse oximetry for detecting methemoglobinemia, and treatments include intravenous administration of methylene blue, ascorbic acid, and riboflavin. Methylene blue is used for cases that are secondary to drug exposure. | VA |
| 94 | Arslan D, Yıldız G, Şahin MO. The incidence of methemoglobinemia due to prilocaine use in circumcision. J Urologic Surg. 2019;6(1):38-41. doi:10.4274/jus.galenos.2018.2217 | Nonexperimental | 2,431 patients who received prilocaine for circumcision | n/a | n/a | methemoglobinemia | Determining the causative factor for methemoglobinemia and undertaking early and effective application of methylene blue or ascorbic acid can be lifesaving. | IIIC |
| 95 | Tackett N, Mathews T, Mentzer C, Morrow C, Thurston B, Lombardozzi K. Acquired methemoglobinemia in the surgical intensive care unit. Am Surg. 2023;89(9):3959-3961. doi:10.1177/00031348231173959 | Case Report | 2 patients with acquired methemoglobinemia in the surgical intensive care unit | n/a | n/a | n/a | High clinical suspicion for methemoglobinemia is warranted if the patient develops cyanosis or a decreased oxygen saturation unresponsive to supplemental oxygen when another etiology is not identifiable. Prompt treatment with intravenous methylene blue can be highly effective. | VC |
| 96 | Lerner RP, Lee E. EMLA-induced methemoglobinemia after laser-assisted hair removal procedure. Am J Emerg Med. 2019;37(11):2119.e1-2119.e2. doi:10.1016/j.ajem.2019.158415 | Case Report | A 23-year-old female | n/a | n/a | n/a | A 23-year-old female developed methemoglobinemia as a rare but significant complication of the application of EMLA local anesthetic before a laser-assisted hair removal procedure. Methemoglobinemia could occur after the application of EMLA | VB |
| 97 | Kane GC, Hoehn SM, Behrenbeck TR, Mulvagh SL. Benzocaine-induced methemoglobinemia based on the Mayo Clinic experience from 28 478 transesophageal echocardiograms: incidence, outcomes, and predisposing factors. Arch Intern Med. 2007;167(18):1977-1982. doi:10.1001/archinte.167.18.1977 | Nonexperimental | 28,478 patients undergoing transesophageal echocardiography | n/a | n/a | Development of methemoglobinemia | The incidence of methemoglobinemia is rare with 1 case per 1499 procedures. Methemoglobinemia can have a good outcome if recognized and treated promptly. | IIIA |

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|---|---|---|---|---|---|---|---|---|
| 98 | Krishnaprabhu S, Das JM. Reevaluating the epinephrine myth: a comprehensive review. Indian J Pharmacol. 2024;56(3):206-213. doi:10.4103/ijp.ijp_308_23 | Literature Review | n/a | n/a | n/a | n/a | The use of epinephrine in local anesthesia offers significant advantages and is generally safe for acral areas. However, the risk of necrosis cannot be entirely eliminated, particularly in patients with compromised vascular function. Adhering to proper guidelines and selecting suitable patients can help mitigate the risk. Phentolamine serves as a potential rescue agent if vascular compromise occurs. Precautionary measures must be taken when using this combination in high-risk patients. | VB |
| 99 | Arp AS, Multani JK, Yen RW, Brooks BM, Brooks BM, Brooks BM. The anesthetic effects of lidocaine with epinephrine in digital nerve blocks: a systematic review. J Am Podiatr Med Assoc. 2023;113(4):21-066. doi:10.7547/21-066 | Systematic Review | 7 RCTs studying patients undergoing digital nerve block with lidocaine/epi | lidocaine with epinephrine digital nerve block | lidocaine plain digital nerve block | Duration of anesthesia, onset of anesthesia, and complications | In adults, the use of lidocaine with epinephrine 1:80,000 to 1:1,000,000 (1-12.5 microg/mL) for DNB yields a longer duration of anesthetic effect and seems to be as safe as plain lidocaine in healthy adults. Several studies had some concern for bias, and additional studies are warranted. | IA |
| 100 | Hurwitz EE, Simon M, Vinta SR, et al. Adding examples to the ASA-Physical Status Classification improves correct assignment to patients. Anesthesiology. 2017;126(4)614-622. doi:10.1097/ALN.0000000000001541 | Nonexperimental | 889 clinician participants (anesthesia providers and non-anesthesia providers) | n/a | n/a | Accuracy of assigning ASA-PS score | The addition of examples to the definitions of the ASA-Physical Status Classification System increases the correct assignment of patients by anesthesia-trained and nonanesthesia-trained clinicians. | IIIB |
| 101 | Bevil KM, Klesius LL, Chambers T, Borden SB. Educating perioperative nurses about local anesthetic systemic toxicity using high-fidelity simulation. Pain Manag Nurs. 2020;21(3):271-275. doi:10.1016/j.pmn.2019.09.007 | Quasi-experimental | 13 nurses from the preoperative, post-anesthesia, and block nursing teams | simulation | n/a | Test scores, self-efficacy, ability to handle crisis scenarios | Experiential learning often results in significant knowledge acquisition and retention. Participants in this study improved their test scores regarding LAST and increased their sense of self-efficacy and ability to handle crisis scenarios after taking part in a high-fidelity simulation. | IIB |
| 102 | AORN Position Statement on Perioperative Registered Nurse Circulator Dedicated to Every Patient Undergoing an Operative or Other Invasive Procedure. AORN Inc; 2019. Accessed October 5, 2025. https://www.aorn.org/docs/defaultsource/guidelinesresources/positionstatements/personnelstaffing/posstat_rn_circulator.pdf?sfvrsn=642bbf4b_1 | Position Statement | n/a | n/a | n/a | n/a | Provides the AORN position statement regarding a perioperative registered nurse circulator dedicated to every patient undergoing an operative or other invasive procedure. | IVB |
| 103 | Cheng A, Magid DJ, Auerbach M, et al. Part 6: Resuscitation Education Science: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2020;142(16 suppl 2):S551-S579. doi:10.1161/CIR.0000000000000903 | Guideline | n/a | n/a | n/a | n/a | Provides recommendations for cardiopulmonary resuscitation and emergency cardiovascular care. | IVA |
| 104 | Lockey A, Lin Y, Cheng A. Impact of adult advanced cardiac life support course participation on patient outcomes – a systematic review and meta-analysis. Resuscitation. 2018;129:48-54. doi:10.1016/j.resuscitation.2018.05.034 | Systematic Review with Meta-Analysis | 8 observational studies | adult advanced cardiac life support course | n/a | Return of spontaneous circulation, survival to discharge, survival to 30 days, survival to 1 year | The advanced life support courses have a positive impact upon return of spontaneous circulation and survival to hospital discharge. The data also implies a positive impact upon survival to 30 days of adult cardiac arrest patients. | IIIA |