

AORN Guideline for Patients Receiving Local-Only Anesthesia
Evidence Table

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS SCORE
1	Lirk P., Picardi S. and Hollmann, M. W. Local anaesthetics: 10 essentials. 2014	Literature Review	n/a	n/a	n/a	n/a	The mechanism of action and access pathways of local anesthetics and their pharmacokinetics are increasingly understood and appreciated.	VA
2	Calatayud, Jesús, M.D.,D.D.S., Ph.D., González, Ángel, M.D., D.D.S., Ph.D. History of the development and evolution of local anesthesia since the coca leaf. <i>Anesthesiology</i> . 2003;98(6):1503-1508.	Expert Opinion	n/a	n/a	n/a	n/a	A review of the discovery and evolution of local anesthesia from the Spanish discovery of the coca leaf in America.	VA
3	Gordh T, M.D., Gordh, Torsten E.,M.D., Ph.D., Lindqvist K, M.Sc. Lidocaine: The origin of a modern local anesthetic. <i>Anesthesiology</i> . 2010;113(6):1433-1437. https://doi.org/10.1097/ALN.0b013e3181fcef48 . doi: 10.1097/ALN.0b013e3181fcef48.	Literature Review	n/a	n/a	n/a	n/a	Before the introduction of lidocaine, the choice of local anesthetics was limited. Lidocaine's onset was substantially faster and longer lasting than procaine.	VA
4	Volcheck G.W., Mertes, P. M. Local and general anesthetics immediate hypersensitivity reactions. 2014	Literature Review	n/a	n/a	n/a	n/a	Whether to test the local anesthetic causing the allergic reaction or an alternative agent depends on the expected future need of the specific local anesthetic. Testing the initial offending drug is preferred to make a definite diagnosis.	VA
5	Fathi R., Serota M. and Brown, M. Identifying and managing local anesthetic allergy in dermatologic surgery. 2016	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
6	Zhang, Jacques X., Gray, Jason, Lalonde, Donald H. and Carr, Nicholas. Digital Necrosis After Lidocaine and Epinephrine Injection in the Flexor Tendon Sheath Without Phentolamine Rescue. 2017	Case Report	n/a	n/a	n/a	n/a	Despite the evidence that low-dose digital epinephrine injections are generally safe, this case report demonstrates that unexpected outcomes (ie, digital necrosis) are possible. When using local anesthetic solutions containing epinephrine in the finger consider reversing epinephrine vasoconstriction with phentolamine before discharging a patient with a white fingertip.	VA

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7	Thomson C, Lalonde D, Denkler K, Feicht A. A critical look at the evidence for and against elective epinephrine use in the finger. <i>Plast Reconstr Surg.</i> 2007;119(1):260-266.	Literature Review	n/a	n/a	n/a	n/a	The evidence that created the dogma that adrenaline should not be injected into the fingers is clearly not valid. However, there is considerable valid evidence in the literature that supports the tenet that properly used adrenaline in the fingers is safe, and that it removes the need for a tourniquet and therefore removes the need for sedation and general anesthesia for many hand operations.	VA
8	Lalonde, D. H. Conceptual origins, current practice, and views of wide awake hand surgery. 2017	Literature Review	n/a	n/a	n/a	n/a	The wide awake approach is one of the few innovations that requires less instead of more in terms of resources and time.	VA
9	Mohd Rashid, Mohd Z., Sapuan, Jamari and Abdullah, Shalimar. A randomized controlled trial of trigger finger release under digital anesthesia with (WALANT) and without adrenaline. 2019	RCT	86 patients for trigger finger release	Local anesthesia	Control: 1% lidocaine and 8.4% sodium bicarbonate with arm tourniquet 10 minutes before the procedure. Intervention: 1% lidocaine with 1:100,000 epinephrine and 8.4% sodium bicarbonate given 30 minutes prior to the procedure.	Hemostasis score, surgical field visibility, onset and duration of anesthesia, pain score, duration of surgery, and potential side effects	Wide awake local anesthetic no tourniquet technique provides excellent surgical field visibility and is safe an don par with conventional methods but without the use of a tourniquet and its associated discomfort.	IB
10	Rhee, P. C. The Current and Possible Future Role of Wide-Awake Local Anesthesia No Tourniquet Hand Surgery in Military Health Care Delivery. 2019	Expert Opinion	n/a	n/a	n/a	n/a	Wide awake hand surgery has tremendous benefits and applicability in the various health care settings in military medicine.	VA
11	Tang J.B., Xing S.G., Ayhan E., Hediger S. and Huang, S. Impact of Wide-Awake Local Anesthesia No Tourniquet on Departmental Settings, Cost, Patient and Surgeon Satisfaction, and Beyond. 2019	Organizational Experience	502 patients having hand surgery	n/a	n/a	n/a	The Wide Awake Local Anesthetic No Tourniquet approach improves the surgeons' and patients' quality of life. The improved efficiency decreases the number of late afternoon or night surgeries.	VA

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12	Van Demark R.E., Becker H.A., Anderson M.C. and Smith, V. J. S. Wide-Awake Anesthesia in the In-Office Procedure Room: Lessons Learned. 2018	Organizational Experience	111 patients using wide awake anesthesia in the procedure room	n/a	n/a	n/a	The concurrent use of wide awake local anesthesia no tourniquet and minor field sterility has created a hand surgery practice that is cost effective for the patient and the facility and resulted in excellent patient outcomes and satisfaction.	VA
13	Rhee P.C., Fischer M.M., Rhee L.S., McMillan H. and Johnson, A. E. Cost Savings and Patient Experiences of a Clinic-Based, Wide-Awake Hand Surgery Program at a Military Medical Center: A Critical Analysis of the First 100 Procedures. 2017	Nonexperimental-prospective cohort study	100 consecutive hand surgery patients; 66 completed the survey	Wide awake local anesthesia not tourniquet	Costs in the OR ; costs in the ortho clinic	Costs, patient satisfaction and willingness to undergo the same technique in the future.	A clinic-based wide awake local anesthesia no tourniquet hand surgery program at a military medical center resulted in considerable cost savings for the health system.	IIIB
14	Caggiano N.M., Avery D.M. and Matullo, K. S. The effect of anesthesia type on nonsurgical operating room time. 2015	Nonexperimental-retrospective review	566 hand procedures	n/a	n/a	Non-surgical time for local, general, and Monitored anesthesia care	When appropriate, the choice of local anesthesia may facilitate rapid OR turnover and improve facility efficiency with lower costs.	IIIB
15	Kazmers N.H., Presson A.P., Xu Y., Howenstein A. and Tyser, A. R. Cost Implications of Varying the Surgical Technique, Surgical Setting, and Anesthesia Type for Carpal Tunnel Release Surgery. 2018	Nonexperimental-retrospective analysis	479 patients with diagnosis of carpal tunnel	Carpal tunnel surgery	Type of carpal tunnel release (ie, open, endoscopic), surgical setting (ie, OR, procedure room), anesthetic type (ie, general, local, Bier block, Monitored anesthesia care)	Direct surgical encounter costs	Performing open carpal tunnel release under local anesthesia in a procedure room significantly minimizes direct surgical encounter costs.	IIIB
16	Alter T.H., Warrender W.J., Liss F.E. and Ilyas, A. M. A Cost Analysis of Carpal Tunnel Release Surgery Performed Wide Awake versus under Sedation. 2018	Nonexperimental-retrospective comparison	n/a	n/a	n/a	n/a	Carpal tunnel release surgery performed with the wide awake local anesthesia technique offers significant reductions in costs for anesthesia services and PACU	IIIB
17	Rabinowitz J., Kelly T., Peterson A., Angermeier E. and Kokko, K. In-office wide-Awake hand surgery versus traditional surgery in the operating room: A comparison of clinical outcomes and healthcare costs at an academic institution. 2019	Nonexperimental-retrospective review	76 patients undergoing A-1 pulley release	Anesthesia types	Wide awake anesthesia in an office setting; monitored anesthesia care in an operating room	Patient's level of pain and anxiety before during and after the procedure; patient satisfaction	A1 pulley release performed with patients wide awake in an office setting led to higher patient satisfaction, decreased costs, and higher physician reimbursement than when performed in an OR with sedation.	IIIB

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18	Codding, Jason L., Bhat, Suneel B. and Ilyas, Asif M. An Economic Analysis of MAC Versus WALANT: A Trigger Finger Release Surgery Case Study. 2017	Nonexperimental-retrospective review	78 patients for trigger finger release	n/a	Wide awake local anesthesia no tourniquet (WALANT) versus monitored anesthesia care	n/a	The patients under WALANT trended toward less time in the OR, similar surgical times, and spent significantly less time in the PACU compared to monitored anesthesia care. The WALANT procedures saved at least \$105 per case.	IIIB
19	Kazmers, Nikolas H Stephens, Andrew R Presson, Angela P Yu, Ziji Tyser, Andrew R. Cost Implications of Varying the Surgical Setting and Anesthesia Type for Trigger Finger Release Surgery: [Article] 2019	Nonexperimental-retrospective cost analysis	210 patients undergoing unilateral trigger finger release	Anesthesia	Local only in the procedure room, local only in the OR, and monitored anesthesia care	Direct costs of the procedure	Performing trigger finger release in the procedure room setting under local only anesthesia minimizes the direct costs of the surgical procedure.	IIIB
20	Poggetti, A., Del Chiaro, A., Nicastro, M., Parchi, P., Piolanti, N. and Scaglione, M. A local anesthesia without tourniquet for distal fibula hardware removal after open reduction and internal fixation: the safe use of epinephrine in the foot. A randomized clinical study 2018	RCT	60 patients undergoing distal fibula plate removal	Type of anesthesia	Loco-regional anesthesia; wide awake local anesthesia no tourniquet	Patient pain level, number of hospital days,	The wide awake local anesthesia no tourniquet technique can be considered as a suitable option for distal fibula hardware removal in selected patients. The technique shows important clinical and economical advantages compared with traditional loco-regional anesthesia with a tourniquet.	IB
21	Saleem Z., Azhar M.J., Arain S.H. and Chohan, Z. A. Excision of dorsal wrist ganglia under local anesthesia with adrenaline without tourniquet, and with evacuation of the cyst during dissection for the ease and completeness of the excision. 2017	Nonexperimental	50 patients with dorsal wrist ganglion	Local anesthesia with epinephrine without tourniquet	n/a	Overall recurrence rate, scar tenderness, satisfaction with cosmetic appearance of the scar	The authors recommend using local anesthesia with epinephrine and not tourniquet for the removal of symptomatic ganglia.	IIIB
22	Barroso Rosa, Sergio, James, Dugal and Matthews, Brent D. Is knee arthroscopy under local anaesthetic a patient-friendly technique? A prospective controlled trial. 2016	Quasi-experimental-prospective controlled trial	82 patients undergoing knee arthroscopy	Anesthesia for knee arthroscopy	Local anesthesia versus general anesthesia	pain levels	Local anesthesia is a reliable option for knee arthroscopy. Local anesthesia resulted in decreased recovery time and postoperative pain with similar levels of patient satisfaction when compared to general anesthesia.	IIB

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23	Lalonde, D. H. Latest Advances in Wide Awake Hand Surgery. 2019	Literature Review	n/a	n/a	n/a	n/a	The reasons for the rapid rise in popularity of the wide awake technique include patient convenience, satisfaction, and safety. Surgeons achieve better results when they can see intraoperative active movement in tendon and fracture procedures.	VA
24	Van Demark R.E., Smith V.J.S. and Fiegen, A. Lean and Green Hand Surgery. 2018	Organizational Experience	1,099 hand cases	n/a	n/a	n/a	Eliminating excess and needless supplies will save both financial and environmental resources while maintaining quality care and patient satisfaction.	VA
25	Lalonde, D. Minimally invasive anesthesia in wide awake hand surgery. 2014	Literature Review	n/a	n/a	n/a	n/a	Tumescent minimally invasive local anesthesia is eliminating the need for sedation and proximal nerve blocks as well as their risks, costs, and inconvenience.	VA
26	Via, G. G., Esterle, A. R., Awan, H. M., Jain, S. A. and Goyal, K. S. Comparison of Local-Only Anesthesia Versus Sedation in Patients Undergoing Staged Bilateral Carpal Tunnel Release: a Randomized Trial 2019	RCT	31 patients requiring bilateral carpal tunnel release	Anesthesia	Local-only anesthesia / sedation	Patient satisfaction and patient anesthesia preference	Patients reported equal satisfaction scores with carpal tunnel release performed under local-only anesthesia or with sedation.	IB
27	Ruxasagulwong, Sompob, Kraissarin, Jirachart and Sananpanich, Kanit. Wide awake technique versus local anesthesia with tourniquet application for minor orthopedic hand surgery: a prospective clinical trial. 2015	RCT	60 patients undergoing surgery for common hand problems	Local anesthesia	Wide-awake with lidocaine with epinephrine with uninflated tourniquet wrap; Lidocaine and 250 mmHg tourniquet application	Patient pain score, surgical field bleeding, amount of bleeding, and any complications	The wide-awake technique offers better comfort for patients and less total blood loss while providing effective anesthesia and patient safety as the conventional method with a tourniquet.	IB
28	Diaz-Abele. Lidocaine with epinephrine versus bupivacaine with epinephrine. 2019	RCT	61 patients receiving carpal tunnel surgery	Local anesthetic	Short-lasting anesthetic (lidocaine)/ long-lasting anesthetic (Bupivacaine)	Patient pain levels over the first and second 24 hours; postoperative use of acetaminophen and opioids.	The use of the long-term anesthetic in wide awake carpal tunnel release decreases postoperative pain over the initial 12 hours after surgery.	IB

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29	Gunasagaran, J., Sean, E. S., Shivdas, S., Amir, S. and Ahmad, T. S. Perceived comfort during minor hand surgeries with wide awake local anaesthesia no tourniquet (WALANT) versus local anaesthesia (LA)/tourniquet 2017	RCT	40 patient having hand surgery	Hand surgery	Wide awake local anesthetic no tourniquet to local anesthetic with a tourniquet	Patient comfort, pre-op preparation time, OR time, and blood loss	Wide awake local anesthetic no tourniquet technique was associated with better patient comfort. The tourniquet was the main reason for discomfort during surgery. Wide awake local anesthetic no tourniquet technique is an alternative in minor hand surgeries for a bloodless surgical field without the discomfort of the tourniquet application.	IB
30	Kang, Sang-Woo, Park, Hye-Mi, Park, Ji-Kang, et al. Open cubital and carpal tunnel release using wide-awake technique: reduction of postoperative pain. 2019	Nonexperimental-retrospective review	62 patients for cubital and carpal tunnel surgery	Anesthesia	Wide awake local only no tourniquet (WALANT); local anesthesia round the incision under IV propofol sedation; general anesthesia	Patient pain and functional outcome	Cubital and carpal tunnel surgery using WALANT technique was comparable in function compared to other anesthesia methods and superior for pain relief.	IIIB
31	Orbach H., Rozen N. and Rubin, G. Open reduction and internal fixation of intra-articular distal radius fractures under wide-awake local anesthesia with no tourniquet. 2018	Quasi-experimental	5 patients with distal radius fractures	Local anesthesia	n/a	Patient pain level and bleeding	The wide awake local anesthetic no tourniquet technique is a simple and safe alternative to traditional anesthesia for open reduction and plating of distal radius fractures.	IIC
32	Huang Y.C., Hsu C.J., Renn J.H., et al. WALANT for distal radius fracture: open reduction with plating fixation via wide-awake local anesthesia with no tourniquet. 2018	Nonexperimental-retrospective study	24 patients with distal radius fracture	ORIF	n/a	n/a	Wide awake local anesthetic no tourniquet technique for distal radius fracture ORIF is a method to control blood loss by the effects of the local anesthetic mixed with hemostatic agents. Without the tourniquet the patient does not experience tourniquet pain. Without sedation, the patient can perform active range of motion to check impingement of the implants. It eliminates the need for post-operative examinations, post-operative recovery room care, and the side effects of sedation.	IIIB

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33	Huang Y.C., Chen C.Y., Lin K.C., Yang S.W., Tarng Y.W. and Chang, W. N. Comparison of wide-awake local anesthesia no tourniquet with general anesthesia with tourniquet for volar plating of distal radius fracture. 2019	Nonexperimental-retrospective study	62 patients with distal radius fractures treated with ORIF using a volar locking plate	ORIF	Wide awake local anesthetic no tourniquet to general anesthesia with a tourniquet	OR time, pain level post-op, length of hospitalization	Wide awake local anesthetic no tourniquet technique is a feasible and effective method for treating distal radius fractures through ORIF with a plate. Patients experience less pain and shorter hospitalization, although there could be more blood loss.	IIIB
34	Ahmad A.A., Yi L.M. and Ahmad, A. R. Plating of Distal Radius Fracture Using the Wide-Awake Anesthesia Technique. 2018	Case Report	n/a	n/a	n/a	n/a	The case report outlines the technique for wide awake local anesthesia no tourniquet method for use during repair of a distal radius fracture.	VB
35	Nakanishi, Yasuaki, Omokawa, Shohei, Kobata, et al. Ultrasound-guided Selective Sensory Nerve Block for Wide-awake Forearm Tendon Reconstruction 2015	Quasi-experimental	8 patients undergoing tendon transfer or tendon graft surgery of the forearm	Selective administration of ropivacaine to the sensory nerve branches and subfascial layers using ultrasound.	n/a	Active motion of the donor muscle, patient pain level	Ultrasound-guided selective sensory nerve block is a promising procedure for wide-awake forearm tendon surgery. The total amount of local anesthetic can be reduced with the use of ultrasound-guided injection to the sensory nerve, skin, subcutaneous tissue, fascia, and intrasosseous membrane of the forearm.	IIC
36	Li, Yi-Syuan, Chen, Chun-Yu, Lin, Kai-Cheng, Tarng, Yih-Wen, Hsu, Chien-Jen and Chang, Wei-Ning. Open reduction and internal fixation of ankle fracture using wide-awake local anaesthesia no tourniquet technique. 2019	Quasi-experimental	13 consecutive patients with ankle fractures	Wide awake local only no tourniquet technique	n/a	Patient pain level	Wide awake local only no tourniquet technique simplified surgical preparations and provided a safe and reliable method of ankle fracture management. The technique resulted in more satisfied patients and facilitated earlier recovery	IIIB
37	Liu B., Ng C.Y., Arshad M.S., Edwards D.S. and Hayton, M. J. Wide-Awake Wrist and Small Joints Arthroscopy of the Hand. 2019	Expert Opinion	n/a	n/a	n/a	n/a	Wide awake arthroscopy has given surgeons the ability to visualize both static and dynamic movements of a joint.	VA

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38	Hyatt B.T., Rhee, P. C. Wide-Awake Surgical Management of Hand Fractures: Technical Pearls and Advanced Rehabilitation. 2019	Literature Review	n/a	n/a	n/a	n/a	Local anesthesia with epinephrine is safe for the use in the finger and provides effective analgesia for common hand fractures. Benefits of this technique include decreased cost, avoiding general anesthesia or IV sedation, and the ability to perform intraoperative assessment of the fracture stability following stabilization.	VA
39	Ahmad A.A., Ikram, M. A. Plating of an isolated fracture of shaft of ulna under local anaesthesia and periosteal nerve block. 2017	Case Report	n/a	n/a	n/a	n/a	The wide awake local anesthesia no tourniquet method allowed the surgery to be performed as an outpatient with the added benefit of reduced cost compared to other types of anesthesia such as IV regional anesthesia.	VB
40	Ahmad, Amir A., Sabari, Shahril S., Ruslan, Shairil R., Abdullah, Shalimar and Ahmad, Abdul R. Wide-Awake Anesthesia for Olecranon Fracture Fixation. 2019	Case Report	n/a	n/a	n/a	n/a	The use of the wide-awake local anesthesia and no tourniquet for surgical fixation can be expanded beyond the hand and wrist. This is an option for patients at high risk of general anesthesia, producing similar surgical outcomes without intraoperative and	VB
41	Wolfe R.C., Spillars, A. Local Anesthetic Systemic Toxicity: Reviewing Updates From the American Society of Regional Anesthesia and Pain Medicine Practice Advisory. 2018	Expert Opinion	n/a	n/a	n/a	n/a	The updated practice advisory of the American Society of regional Anesthesia contains information about current knowledge on the mechanism of lipid emulsion reversal along with restructured guidance as it relates to prevention, detection, and treatment of local anesthetic systemic toxicity.	VA

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42	Gitman M., Fettiplace M.R., Weinberg G., Neal J.M. and Barrington, M. J. Local Anesthetic Systemic Toxicity: A Narrative Literature Review and Clinical Update on Prevention, Diagnosis and Management. 2019	Literature Review	n/a	n/a	n/a	n/a	All practitioners who administer local anesthetics should be educated regarding LAST and the contemporary management algorithms that include lipid emulsion therapy.	VA
43	McEvoy M.D., Thies K.C., Einav S., et al. Cardiac arrest in the operating room: Part 2-special situations in the perioperative period. 2018	Literature Review	n/a	n/a	n/a	n/a	The causes, logistics, and management of perioperative crises differ substantially from the American Heart Association ACLS guidelines.	VA
44	Waldinger R., Weinberg G. and Gitman, M. Local Anesthetic Toxicity in the Geriatric Population. 2019	Expert Opinion	n/a	n/a	n/a	n/a	Local anesthetic systemic toxicity continues to occur despite the use of less cardiotoxic formulations of local anesthetics and more common use of ultrasound guidance. The elderly appear to be at a disproportionately increased risk for toxicity owing to the presence of relevant comorbidities and decreased muscle mass. Elderly patients are at increased risk of local anesthetic systemic toxicity. When considering use of local anesthetics in older patients, special attention should be paid to the presence of systemic disease and muscle wasting. The safety of regional anesthesia and multi-modal analgesia among these at-risk patients will be improved by educating physicians and staff to recognize and manage local anesthetic systemic toxicity.	VA

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45	El Boghdadly K., Pawa A. and Chin, K. J. Local anesthetic systemic toxicity: Current perspectives. 2018	Expert Opinion	n/a	n/a	n/a	n/a	LAST is a life-threatening adverse event, and recent advances in understanding the pathophysiological basis of the condition and its therapy will improve patient safety. It is imperative that practitioners who use local anesthetics in their clinical practice are cognizant of the mechanisms, risk factors, prevention, and therapeutic modalities.	VA
46	El Boghdadly K., Chin, K. J. Local anesthetic systemic toxicity: Continuing Professional Development. 2016	Expert Opinion	n/a	n/a	n/a	n/a	Local anesthetic systemic toxicity is a potentially lethal condition with varied manifestations, and anesthesiologists must understand its risks, prevention, and safe	VA
47	Jayanthi, R., Nasser, Ksga and Monica, K. Local Anesthetics Systemic Toxicity 2016	Case Report	n/a	n/a	n/a	n/a	Early recognition of symptoms, timely intervention, careful selection of patients, and safe practice procedures will help in prevention.	VC
48	Vasques F., Behr A.U., Weinberg G., Ori C. and Di Gregorio, G. A review of local anesthetic systemic toxicity cases since publication of the American society of regional anesthesia recommendations: To whom it may concern. 2015	Nonexperimental-retrospective review	67 cases of local anesthetic systemic toxicity (LAST)	n/a	n/a	Setting, clinical manifestations, and treatment	The unpredictability of LAST mandates mindful practice and establishing preventive measures that are available to reduce the incidence of LAST and vigilance to detect the signs of toxicity.	IIIB
49	Barrington, Michael J. B. S., F.A.N.Z.C.A., Kluger, Roman BS,F.A.N.Z.C.A., P.G.DipBiostat. Ultrasound Guidance Reduces the Risk of Local Anesthetic Systemic Toxicity Following Peripheral Nerve Blockade 2013	Nonexperimental-retrospective	n/a	n/a	n/a	n/a	Ultrasound guidance may improve safety as it is associated with a reduced risk of LAST following a peripheral nerve block.	IIIA

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50	Morwald E.E., Zubizarreta N., Cozowicz C., Poeran J. and Memtsoudis, S. G. Incidence of Local Anesthetic Systemic Toxicity in Orthopedic Patients Receiving Peripheral Nerve Blocks. 2017	Nonexperimental-retrospective cohort study	238,473 patients receiving peripheral nerve blocks	n/a	n/a	n/a	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
51	Liu, Spencer S., Ortolan, Sarah, Sandoval, Miguel V., et al. Cardiac Arrest and Seizures Caused by Local Anesthetic Systemic Toxicity After Peripheral Nerve Blocks: Should We Still Fear the Reaper?. 2016	Qualitative-retrospective analysis	80,661 peripheral nerve blocks	n/a	n/a	Incidence of cardiac arrest and seizures	Cardiac arrest and seizures are rare after peripheral nerve blocks. The increased use of ultrasound guidance may have improved the safety of peripheral nerve blocks.	IIIA
52	Rubin D.S., Matsumoto M.M., Weinberg G. and 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. 2018	Nonexperimental-retrospective study	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
53	Jenerowicz D., Polanska A., Glinska O., CzarneckaOperacz M. and Schwartz, R. A. Allergy to lidocaine injections: Comparison of patient history with skin testing in five patients. 2014	Case Report	n/a	n/a	n/a	n/a	Although rare the consequences of a true allergy to local anesthetics can have serious consequences. Diagnosis is crucial.	VA
54	Malinovsky, Jean-Marc, Chiriac, Anca M., Tacquard, Charles, Mertes, Paul M. and Demoly, Pascal. Allergy to local anesthetics: Reality or myth?. 2016	Literature Review	n/a	n/a	n/a	n/a	The incidence of allergic reactions to local anesthetics is low. Most cases involve a psychogenic reaction rather than an allergic reaction	VA
55	To, Derek, Kossintseva, Iren and de Gannes, Gillian. Lidocaine contact allergy is becoming more prevalent. 2014	Nonexperimental retrospective review	1,819 patients who underwent patch testing	n/a	n/a	Prevalence of allergic contact dermatitis(ACD) to local anesthetics	The proportion of ACD caused by lidocaine is higher than expected. This is secondary to an increase in over the counter medicaments containing lidocaine.	IIIB

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56	Guideline for medication safety. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc.; 2020.443-481.	Guideline	n/a	n/a	n/a	n/a	This document provides guidance to perioperative team members for developing, implementing, and evaluating safety precautions that may assist with decreasing medication errors throughout the six phases of the medication use process.	IVB
57	ANA. Nursing : scope and standards of practice. 2015	Position Statement	n/a	n/a	n/a	n/a	Scope of practice describes the services that a qualified health professional is deemed competent to perform, and permitted to undertake – in keeping with the terms of their professional license. The Nursing Scope and Standards of Practice describe the “who,” “what,” “where,” “when,” “why,” and “how” of nursing practice.	IVB
58	Standards of perioperative nursing. In: Perioperative standards and recommended practices. Denver, CO: AORN, Inc.; 2015:693-708. https://www.aorn.org/guidelines/clinical-resources/aorn-standards .	Guideline	n/a	n/a	n/a	n/a	The standards of perioperative nursing provide a mechanism to delineate the responsibilities of RNs engaged in practice in the perioperative setting. The standards of perioperative nursing are generic and apply to all RNs engaged in perioperative practice, regardless of clinical setting, practice setting, or educational preparation.	IVB
59	American Society of PeriAnesthesia Nurses. Perianesthesia nursing standards and practice recommendations. Cherry Hill, NJ: American Society of PeriAnesthesia Nurses; 2019/2020.	Guideline	n/a	n/a	n/a	n/a	The Perianesthesia practice standards provide a framework for the care of a diverse patient population in all Perianesthesia settings.	IVB

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60	Petersen, Carol,, AORN.,. Perioperative nursing data set : The perioperative nursing vocabulary. 3rd ed. Denver, CO: AORN, Inc.; 2011	Guideline	n/a	n/a	n/a	n/a	The Perioperative Nursing Data Set (PNDS) is the standardized nursing language developed and refined by AORN and recognized by the American Nurses Association to describe the nursing care, from preadmission to discharge, of patients undergoing operative or other invasive procedures. The PNDS enables nursing care to be documented in a standardized manner and allows the collection of reliable and valid comparable clinical data to evaluate the effectiveness of nurse-sensitive interventions and the relationship between these interventions and patient outcomes.	IVB
61	Liu, Wenwen, Yang, Xianrui, Li, Chunjie, et al. Adverse drug reactions to local anesthetics: a systematic review; Allergic reaction to mepivacaine in a child 2013	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Lidocaine and bupivacaine are the most used local anesthetics. Cardiovascular system reaction is not rare. Cardiac arrest is the most life threatening adverse reaction of the local anesthetics.	IIIB
62	Treasure T, Bennett J. Office-based anesthesia. Oral Maxillofac Surg Clin North Am. 2007;19(1):45-57.	Literature Review	n/a	n/a	n/a	n/a	Protocols for maintaining quality anesthetic care include appropriate facilities, equipment, personnel, and evaluations.	VB
63	Kost, Michael. Nursing considerations for procedural sedation and analgesia: This first in a two-part series reviews patient assessment, red flags, and pharmacologic agents 2019	Expert Opinion	n/a	n/a	n/a	n/a	An overview of patient assessment, red flags and medications for procedural sedation.	VA

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64	Neal J.M., Barrington M.J., Fettiplace M.R., et al. The Third American Society of Regional Anesthesia and Pain Medicine Practice Advisory on Local Anesthetic Systemic Toxicity: Executive Summary 2017. 2018	Guideline	n/a	n/a	n/a	n/a	The interim update summarizes recent scientific findings that contribute to our understanding of the mechanisms that lead to lipid emulsion reversal of local anesthetic systemic toxicity (LAST) including rapid partitioning, direct inotropy, and post-conditioning. There is a lower frequency of LAST however it is still occurring.	IVA
65	ASRA. Checklist for Treatment of Local Anesthetic Systemic Toxicity	Expert Opinion	n/a	n/a	n/a	n/a	ASRA provides guidance for the treatment of local anesthetic systemic toxicity	VA
66	ASA physical status classification system. American Society of Anesthesiologists; 2014.	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	VA
67	Tantri A, Clark C, Huber P, et al. Anesthesia monitoring by registered nurses during cataract surgery: Assessment of need for intraoperative anesthesia consultation. Journal of Cataract & Refractive Surgery. 2006;32(7):1115-1118.	Nonexperimental-retrospective review	270 cataract patients	Use of the ASA classification	n/a	n/a	Monitoring of routine cataract surgery by RNs was associated with a low rate of intraoperative anesthesia consultation. The ASA classification appears to be predictive of the need for intraoperative consultation.	IIIB
68	Mitchell M. Patient anxiety and conscious surgery. J PERIOPER PRACT. 2009;19(6):168-173. [Nonexperimental		n/a	n/a		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

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69	Mitchell M. Conscious surgery: influence of the environment on patient anxiety. J Adv Nurs. 2008;64(3):261-271.	Nonexperimental	214 adult surgical patients	n/a	n/a	Level of anxiety	Providing information regarding the intraoperative experience may help reduce anxiety for the majority of patients.	IIIB
70	El Hachem, May, Carnevale, Claudia, Diociaiuti, Andrea, et al. Local anesthesia in pediatric dermatologic surgery: Evaluation of a patient-centered approach 2018	Nonexperimental	388 questionnaires administered to pediatric patients and their parents for younger children	n/a	n/a	Fear, pain, surgery-related distress, surgical team-patient and family relationship, and global satisfaction	Specific measures for therapeutic pediatric patient education may be helpful in limiting discomfort, anxiety, and pain perception linked to procedures performed under local anesthesia. Further controlled studies are needed to assess the benefits of specific therapeutic education measures.	IIIB
71	Informed consent for anesthesia care: Policy and practice considerations. Park Ridge, IL: AANA Inc; 2017.	Position Statement	n/a	n/a	n/a	n/a	This document summarizes the ethical and legal concepts of informed consent for anesthesia, describes the elements of informed consent, and provides recommendations for engaging in the informed consent process for anesthesia services. It serves as a resource document for anesthesia professionals, healthcare professionals, and healthcare facilities for development of anesthesia informed consent policy and practice considerations.	IVB
72	Davis-Evans Chassidy. Alleviating anxiety and preventing panic attacks in the surgical patient. AORN J. 2013;97(3): 355-363.	Literature Review	n/a	n/a	n/a	n/a	Perioperative nurses should implement all available strategies to decrease surgical patients' anxiety including communication, humor, and music. Strategies should be individualized.	VB
73	Failure to monitor local anesthesia pt. before discharge. Case on point: Messer v. Martin, 2004 WL 1171736 N.W.2d -WI(2004) 2004	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

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74	ASA. Standards for Basic Anesthetic Monitoring [2015]	Guideline	n/a	n/a	n/a	n/a	The basics of anesthesia monitoring for all general, regional, and monitored anesthesia care procedures is discussed.	IVB
75	Standards for nurse anesthesia practice. . 2019:1-4.	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
76	Kruger, Grant H., Shanks, Amy, Kheterpal, Sachin, et al. Influence of non-invasive blood pressure measurement intervals on the occurrence of intra-operative hypotension. 2018	Nonexperimental-retrospective	5.7 million non-invasive blood pressure measurements associated with 139,509 general anesthesia cases	n/a	n/a	n/a	Intervals of greater than 6 and 10 minutes are associated with a fourfold increase in the propensity of an undetected transition into hypotension. Data support current ASA monitoring guideline.	IIIA
77	Buck, David, Kreeger, Renee and Spaeth, James. Case discussion and root cause analysis: bupivacaine overdose in an infant leading to ventricular tachycardia. 2014	Case Report	n/a	n/a	n/a	n/a	An overdose of bupivacaine was administered to an 11 month old infant due to the failure of the surgeon, anesthesiologist, and scrub tech to communicate about the maximum dosage of local anesthetic before the medication was prepared.	VA
78	Garcia-Rodriguez, Laura, Spiegel, Jeffrey H. Are surgeons overdosing patients with lidocaine?. 2018	Expert Opinion	n/a	n/a	n/a	n/a	For patient safety, it is important for communication between team members of all local anesthetics administered to the patient.	VA

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79	Khatri KP, Rothschild L, Oswald S, Weinberg G, eds. Current concepts in the management of systemic local anesthetic toxicity. ; 2010; No. 28.	Expert Opinion	n/a	n/a	n/a	n/a	Patient factors can reduce the threshold to LAST so that even normally safe serum concentrations of local anesthetic can lead to symptoms of clinical instability.	VA
80	Petrar S., Montemurro, T. Total local anesthetic administered is integral to the syndrome of local anesthetic systemic toxicity. 2014	Expert Opinion	n/a	n/a	n/a	n/a	Maximum dose calculation of local anesthetics should include patient factors such as weight, hepatic and renal function.	VA
81	Tanawuttiwat T, Thisayakorn P, Viles-Gonzalez JF. LAST (Local Anesthetic Systemic Toxicity) but not least: systemic lidocaine toxicity during cardiac intervention. J Invasive Cardiol. 2014;26(1):E13-E15.	Case Report	n/a	n/a	n/a	n/a	This case report emphasized the importance of adjusting the dose of the local anesthetic with advance heart failure; and discussed risk factors, preventive measures, and treatment.	VB
82	AAGBI Safety Guideline: Management of Severe Local Anaesthetic Toxicity 2010	Guideline	n/a	n/a	n/a	n/a	A chart detailing the immediate treatment of local anesthetic systemic toxicity.	IVB
83	Japanese Society of Anesthesiologists. Practical guide for the management of systemic toxicity caused by local anesthetics. 2019	Guideline	n/a	n/a	n/a	n/a	The guideline was created to generate a shared awareness of the prevention, diagnosis and treatment of local systematic toxicity among all medical professional who perform nerve blocks.	IVB
84	Byrne K, Engelbrecht C. Toxicity of local anaesthetic agents. Trends Anaesth Crit Care. 2013;3(1):25-30.	Literature Review	n/a	n/a	n/a	n/a	LAST still occurs despite improvement injection techniques. Lipid emulsion injection is a treatment but still in its infancy.	VB
85	Gitman M., Barrington, M. J. Local Anesthetic Systemic Toxicity: A Review of Recent Case Reports and Registries. 2018	Case Report	n/a	n/a	n/a	n/a	Publication of case reports and non-peer-reviewed cases submitted to lipid registries confirms that LAST continues to occur. The approximate incidence of LAST after peripheral regional anesthesia is 3 cases per 10,000.	VA

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86	Ozer A.B., Erhan, O. L. Systemic toxicity to local anesthesia in an infant undergoing circumcision. 2014	Case Report	n/a	n/a	n/a	n/a	All precautions should be used during the application of local anesthetic in pediatric patients including proper indication, monitoring of the patient, establishment of venous access, readiness to do CPR in the event of toxicity. The maximum local anesthesia dose should be considered.	VA
87	Aydin, G. Unexpected local anesthesia toxicity during the ultrasonography-guided peripheral nerve block. 2018	Case Report	n/a	n/a	n/a	n/a	Performing ultrasonography-guided nerve blocks, slow and divided doses of drug administration, and negative aspiration are critical to preventing local anesthetic systemic toxicity. Conversion to general anesthesia and administration of lipid solution are effective and life-saving methods to prevent the progression of the toxicity symptoms.	VB
88	Kien, Nguyen T., Giang, Nguyen T., Van Manh, Bui, et al. Successful intralipid-emulsion treatment of local anesthetic systemic toxicity following ultrasound-guided brachial plexus block: case report. 2019	Case Report	n/a	n/a	n/a	n/a	The complication of local anesthetic systemic toxicity could be successfully treated with IV lipid emulsion.	VA
89	Eizaga Rebollar, Ramon, Garcia Palacios, Maria V., Morales Guerrero, Javier and Torres Morera, Luis M. Lipid rescue in children: The prompt decision. 2016	Case Report	n/a	n/a	n/a	n/a	Standardized measures for prevention of local anesthetic systemic toxicity in every single regional block, such as using safer local anesthetics, not exceeding the maximum dose, fractionating the dose injection, and performing an aspiration test. Full availability of lipid emulsion and its pediatric protocol of prompt use in all surgical area. "Fast-track" lipid rescue as soon as local anesthetic systemic toxicity is detected.	VA

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90	Najafi, Nadia, Veyckemans, Francis, Du Maine, Christine, et al. Systemic Toxicity Following the Use of 1% Ropivacaine for Pediatric Penile Nerve Block 2016	Case Report	n/a	n/a	n/a	n/a	Local anesthetic systemic toxicity as a result of dorsal penile nerve block has not been described in the literature. We suggest avoiding the use of 1% ropivacaine for pediatric ropivacaine.	VB
91	Shenoy, Usha, Paul, John and Antony, Deepu. Lipid resuscitation in pediatric patients - need for caution?. 2014	Case Report	n/a	n/a	n/a	n/a	The prompt recovery from bupivacaine toxicity is attributed to early detection, early administration of intravenous lipid emulsion, prevention of hypoxia and respiratory acidosis.	VA
92	Nicholas E., Thornton, M. D. Lidocaine Toxicity During Attempted Epistaxis Cautery. 2016	Case Report	n/a	n/a	n/a	n/a	Report of a 19 year old patient with epistaxis. After intranasal packing with lidocaine, the patient experienced symptoms of lidocaine toxicity. The authors theorized that intranasal absorption may be rapid due to the rich vascular supply. The patient's symptoms resolved after intravenous lipid emulsion.	VB
93	Musielak, Matthew, McCall, John. Lipid Rescue in a Pediatric Burn Patient 2016	Case Report	n/a	n/a	n/a	n/a	Surgeon judgement must be used when weighing the risks and benefits of pain control with a local anesthetic during skin harvesting following a burn versus potential cardiac effects with local anesthetics.	VA
94	Hoda, Syed, O'Brien, Jennifer and Gamble, Jonathan. Intractable seizures in a toddler after application of an over-the-counter local anesthetic cream. 2016	Case Report	n/a	n/a	n/a	n/a	The child had tonic-clonic seizures after topical application of an over the counter lidocaine cream. Topical anesthetics used appropriately are safe, In appropriate use can result in potentially life-threatening outcomes. Application of topical creams over burn area increase systemic absorption.	VA

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95	Mittal, Saurabh, Mohan, Anant and Madan, Karan. Ventricular Tachycardia and Cardiovascular Collapse following Flexible Bronchoscopy: Lidocaine Cardiotoxicity. 2018	Case Report	n/a	n/a	n/a	n/a	A patient experienced ventricular tachycardia (VT) following a flexible bronchoscopy with local anesthetic. The authors attribute the occurrence of VT to lidocaine toxicity.	VA
96	Bacon B., Silvertown N., Katz M., et al. Local Anesthetic Systemic Toxicity Induced Cardiac Arrest After Topicalization for Transesophageal Echocardiography and Subsequent Treatment With Extracorporeal Cardiopulmonary Resuscitation. 2019	Case Report	n/a	n/a	n/a	n/a	Patient experienced cardiac arrest secondary to LAST from 3,800 mg of topical lidocaine prior to Transesophageal echocardiography.	VA
97	Whiteman, David M., Kushins, Stephen I. Successful Resuscitation With Intralipid After Marcaine Overdose. 2014	Case Report	n/a	n/a	n/a	n/a	A case report of a patient who experienced cardiac arrest after combination abdominoplasty-mastopexy when her intramuscular pain pump failed, resulting in an accidental overdose of bupivacaine. The patient was successfully resuscitated with Intralipid 20% infusion in combination with evacuation of the local anesthetic.	VA
98	Di Gregorio G, Neal JM, Rosenquist RW, Weinberg GL.	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
99	Wolfe JW, Butterworth JF. Local anesthetic systemic toxicity: update on mechanisms and treatment. Curr Opin Anaesthesiol. 2011;24(5):561-566.	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

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100	Valencia, Marta I. B., Silva, Juan F. V. Protocol and importance of using the kit for local anesthetic systemic toxicity[white star] 2013	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 potential fatal consequences of LAST requires immediately available treatment.	VA
101	Gosselin S, Hoegberg LCG, Hoffman RS, et al. Evidence-based recommendations on the use of intravenous lipid emulsion therapy in poisoning. Clin Toxicol. 2016;54(10):899-923. https://doi.org/10.1080/15563650.2016.1214275 . doi: 10.1080/15563650.2016.1214275.	Systematic Review	n/a	n/a	n/a	n/a	Clinical recommendations regarding the use of intralipid emulsion in poisoning were only possible in a small number of cases and were based mainly on very low quality of evidence, balance of expected risks and benefits, adverse effects, and related costs and resources. The workgroup emphasizes that dose-finding and controlled studies reflecting human poisoning scenarios are required to advance knowledge of limitations, indications, adverse effects, effectiveness, and best regimen for treatment.	IIIB
102	Lavonas Eric J., Drennan Ian R., Andrea G, et al. Part 10: Special circumstances of resuscitation. Circulation. 2015;132(18):S501-S518. https://doi.org/10.1161/CIR.0000000000000264 . doi: 10.1161/CIR.0000000000000264.	Guideline	n/a	n/a	n/a	n/a	There are case reports of the return of spontaneous circulation in patients with prolonged cardiac arrest unresponsive to standard ACLS measures after the administration of lipid emulsion for LAST.	IVA
103	Fettiplace, Michael R., Weinberg, Guy. Past, Present, and Future of Lipid Resuscitation Therapy 2015	Literature Review	n/a	n/a	n/a	n/a	The review discusses the past, present, and future of lipid resuscitation therapy with a focus on understanding the mechanism and directions that the field is moving form a clinical and research perspective.	VA

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104	Fettiplace, Michael R., Akpa, Belinda S., Ripper, Richard, et al. Resuscitation with lipid emulsion: dose-dependent recovery from cardiac pharmacotoxicity requires a cardiostimulant effect 2014	RCT	Laboratory animals	Lipid emulsion injection following nonlethal dose of bupivacaine	Four randomized treatments-30% IV lipid emulsion, 20% IV lipid emulsion, IV saline, or no treatment	Recovery from bupivacaine toxicity	IV lipid emulsion accelerates cardiovascular recovery from bupivacaine toxicity in a dose-dependent manner. The animals treated with 30% lipid emulsion elicited the fastest hemodynamic recovery.	IIC
105	Fettiplace, Michael R., Ripper, Richard, Lis, Kinga, Feinstein, Douglas L., Rubinstein, Israel and Weinberg, Guy. Intraosseous lipid emulsion: an effective alternative to IV delivery in emergency situations 2014	RCT	25 laboratory animals	Lipid emulsion infusion	Four randomized treatments- intraosseous lipid emulsion, intraosseous saline, IV lipid emulsion, and no treatment	Recovery of hemodynamic variables following IV bupivacaine injection	Intraosseous infusion of lipid emulsion rapidly reversed bupivacaine induced cardiac toxicity.	IC
106	Gonca, Ersoz, Catli, Duygu. The Effects of Lidocaine with Epinephrine on Bupivacaine-Induced Cardiotoxicity. 2018	Nonexperimental-controlled trial with no randomization	24 lab animals	Injection of bupivacaine	No lidocaine with epinephrine, 1 mg/kg of lidocaine with epinephrine, 3 mg/kg of lidocaine with epinephrine, 6 mg/kg of lidocaine with epinephrine	Duration of asystole and reduction of mean arterial blood pressure	Lidocaine with epinephrine has a protective effect against bupivacaine cardiotoxicity. The simultaneous application of lidocaine with epinephrine and bupivacaine may reduce the risk of cardiotoxicity to bupivacaine.	IIC
107	Hayaran, Nitin, Sardana, Rashi, Nandinie, Hamse and Jain, Aruna. Unusual presentation of local anesthetic toxicity. 2017	Case Report	n/a	n/a	n/a	n/a	Report of a 19 year old male patient who had two episodes of unconsciousness after injection of lidocaine for dental procedures. Lipid emulsion was used for treatment.	VA
108	Marwick PC, Levin AI, Coetzee AR. Recurrence of cardiotoxicity after lipid rescue from bupivacaine-induced cardiac arrest. Anesth Analg. 2009;108(4):1344-1346.	Case Report	n/a	n/a	n/a	n/a	The case study suggests that LAST may recur after initial lipid rescue.	VA
109	Batinac T, Sotosek Tokmadzic V, Peharda V, Brajac I. Adverse reactions and alleged allergy to local anesthetics: Analysis of 331 patients. J Dermatol. 2013;40(7):522-527.	Nonexperimental-retrospective	n/a	n/a	n/a	n/a	Allergic reactions to local anesthetics are rare.	IIIA
110	Bhole MV, Manson AL, Seneviratne SL, Misbah SA. IgE-mediated allergy to local anaesthetics: separating fact from perception: a UK perspective. Br J Anaesth. 2012;108(6):903-911.	Literature Review	n/a	n/a	n/a	n/a	Intravenous lipid emulsion 20% should be available whenever patients receive large doses of local anesthetics.	VA

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111	Fuzier R, Lapeyre-Mestre M, Mertes PM, et al. Immediate- and delayed-type allergic reactions to amide local anesthetics: clinical features and skin testing. <i>Pharmacoepidemiol Drug Saf.</i> 2009;18(7):595-601.	Nonexperimental-retrospective	n/a	n/a	n/a	n/a	Cutaneous symptoms are main feature but more serious symptoms may occur. Intradermal reaction and challenge tests with several local anesthetics are helpful in identification	IIIC
112	Harboe T, Guttormsen AB, Aarebrot S, Dybendal T, Irgens A, Florvaag E. Suspected allergy to local anaesthetics: follow-up in 135 cases. <i>Acta Anaesthesiol Scand.</i> 2010;54(5):536-542.	Nonexperimental-retrospective	n/a	n/a	n/a	n/a	Reactions to local anesthetics are rarely an IgE-mediated allergy. Other allergens should be tested.	IIIB
113	Grzanka A, Misiolek H, Filipowska A, Miśkiewicz-Orczyk K, Jarzab J. Adverse effects of local anaesthetics—allergy, toxic reactions or hypersensitivity. <i>Anestezjol Intens Ter.</i> 2010;42(4):175-178.	Nonexperimental	32 patients with a suspected local anesthetic allergy	n/a	n/a	Local anesthetic allergy	True allergic reactions to local anesthetics are rare; most are hypersensitivity. Any adverse event requires review of history, and testing of immediate and late allergic reactions to local anesthetics as well as latex and preservatives.	IIIB
114	Kvisselgaard A.D., Kroigaard M., Mosbech H.F. and Garvey, L. H. No cases of perioperative allergy to local anaesthetics in the Danish Anaesthesia Allergy Centre. 2017	Nonexperimental-retrospective review	162 patients with suspected local anesthetic allergy	Allergy testing-prick testing, intradermal test and subcutaneous	n/a	Allergic reaction to local anesthetics	No patients were diagnosed with an allergy to local anesthetics from 2004-2013.	IIIA
115	Kvisselgaard A.D., Mosbech H.F., Fransson S. and Garvey, L. H. Risk of Immediate-Type Allergy to Local Anesthetics Is Overestimated-Results from 5 Years of Provocation Testing in a Danish Allergy Clinic. 2018	Nonexperimental-retrospective	164 patients with suspected local anesthetic allergy	n/a	n/a	n/a	None of the 164 patients with suspected immediate-type allergy to local anesthetics reacted on provocation. Other potential allergens should be considered.	IIIA
116	Brinca, Ana, Cabral, Rita and Goncalo, Margarida. Contact allergy to local anaesthetics-value of patch testing with a caine mix in the baseline series. 2013	Nonexperimental-retrospective review	2736 patch tests for contact allergy to local anesthetics	Patch testing with 7 local anesthetics	n/a	Allergic reaction to local anesthetics	Almost 70% of the allergic reactions to local anesthetics would have been missed if only benzocaine was used as a screening allergen. The authors recommend replacing benzocaine with a local anesthetic mixture for the baseline patch testing.	IIIA

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117	Trautmann, Axel, Stoevesandt, Johanna. Differential diagnosis of late-type reactions to injected local anaesthetics: Inflammation at the injection site is the only indicator of allergic hypersensitivity. 2019	Nonexperimental-retrospective review	202 patients reporting symptoms with an onset at least 1 hour after local anesthetic injection	n/a	n/a	Local effects (eg, erythema, swelling); systemic effects (eg exacerbation of asthma, loss of consciousness)	Late-type LA allergy commonly causes inflammatory skin reactions confined to the injection site. Local anesthetics are highly unlikely to trigger delayed systemic symptoms such as urticaria.	IIIB
118	Yilmaz I., Ozdemir S.K., Aydin O. and Celik, G. E. Local anesthetics allergy: Who should be tested?. 2018	Nonexperimental/Observational	228 patients referred for local anesthetic allergy testing	n/a	n/a	n/a	Patients with a prior history of local anesthetic hypersensitivity should undergo local anesthetic testing. Allergists and the physicians administering local anesthesia should collaborate. Prior records related to the undesired effects of local anesthetics should be kept and given to the patients.	IIIB
119	Trautmann A., Goebeler M. and Stoevesandt, J. Twenty Years' Experience with Anaphylaxis-Like Reactions to Local Anesthetics: Genuine Allergy is Rare. 2018	Nonexperimental-retrospective review	402 patients referred to the allergy clinic for diagnostic workup for local anesthetic-induced immediate type reactions	n/a	n/a	Allergic reactions following intradermal testing and provocative challenge.	Skin testing and provocative local anesthetic challenge are useful to exclude local anesthetic allergy.	IIIB
120	Kvisselgaard, Ask D. B. S., Melchior, Birgitte B., Kroigaard, Mogens and Garvey, Lene H. Lidocaine as a Rare and Hidden Allergen in the Perioperative Setting: A Case Report 2019	Case Report	n/a	n/a	n/a	n/a	This case illustrates that lidocaine may be a "hidden allergen" in the perioperative setting and should always be considered a potential culprit in cases of suspected perioperative hypersensitivity. The case also demonstrates that suspected perioperative hypersensitivity requires highly specialized investigation and close collaboration between allergists and anesthesiologists.	VA

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121	Dickison, Philippa, Smith, Saxon D. Biting down on the truth: A case of a delayed hypersensitivity reaction to lidocaine. 2019	Case Report	n/a	n/a	n/a	n/a	Local aesthetic Allergy is a challenging diagnosis to make. The prevalence of delayed contact allergy to lidocaine is increasing. This may be secondary to the availability of lidocaine in over the counter products.	VA
122	Vega, Francisco, Argiz, Laura, Bazire, Raphaelle, Las Heras, Paloma and Blanco, Carlos. Delayed urticaria due to bupivacaine: A new presentation of local anesthetic allergy. 2016	Case Report	Patient who developed generalized urticaria 2 days after GI surgery.	n/a	n/a	n/a	Final diagnosis was delayed urticaria due to bupivacaine with morphological data suggestive of urticarial vasculitis.	VA
123	Russo, Paul A. J., Banovic, Tatjana, Wiese, Michael D., Whyte, Andrew F. and Smith, William B. Systemic allergy to EDTA in local anesthetic and radiocontrast media. 2014	Case Report	n/a	n/a	n/a	n/a	Through allergy testing, a patient's allergic reaction to a local anesthetic was the preservative EDTA not the lidocaine.	VA
124	McGarry, David P., Kim, Yoon M., Casselman, Jason, et al. Ocular desensitization in the face of local anesthetic hypersensitivity. 2017	Case Report	n/a	n/a	n/a	n/a	True hypersensitivity to local ester and amide anesthetics is extremely rare. This is the first documented case of successful ocular bupivacaine desensitization in a patient with suspected local anesthetic hypersensitivity.	VA
125	Presman B., Vindigni V. and ToccoTussardi, I. Immediate reaction to lidocaine with periorbital edema during upper blepharoplasty. 2016	Case Report	n/a	n/a	n/a	n/a	A patient presented with periorbital edema following local anesthesia injection. Patients should be informed about the possibility of recurrence of an adverse reaction to local anesthetic.	VB
126	Kumar, Annapurna. Diffuse epithelial keratopathy following a single instillation of topical lignocaine: the damaging drop. 2016	Case Report	n/a	n/a	n/a	n/a	Clinically significant epithelial keratopathy can occur following a single topical instillation of 4% lidocaine. Authors recommend cautious and judicious use of the drops.	VB
127	Halabi-Tawil, Maya, Kechichian, Elio and Tomb, Roland. An unusual complication of minor surgery: contact dermatitis caused by injected lidocaine. 2016	Case Report	n/a	n/a	n/a	n/a	The case report highlights that allergic contact dermatitis caused by lidocaine can occur not only after topical use but subcutaneous injection.	VB

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128	Dominguez Ortega J., Phillips Angles E., Gonzalez Munoz M., Heredia R., Fiandor A. and Quirce, S. Allergy to several local anesthetics from the amide group. 2016	Case Report	n/a	n/a	n/a	n/a	Cross-reactivity among amide-type local anesthetics is rare. In patients with hypersensitivity to one of them, tolerance to other drugs from this group should be confirmed with a	VB
129	Al Dosary K., Al Qahtani A. and Alangari, A. Anaphylaxis to lidocaine with tolerance to articaine in a 12 year old girl. 2014	Case Report	n/a	n/a	n/a	n/a	To the authors' knowledge, this is the first report of a patient who is allergic to lidocaine and tolerant to	VB
130	Barash, Mark, Reich, Keith A. and Rademaker, Dennis. Lidocaine-induced methemoglobinemia: a clinical reminder 2015	Literature Review	n/a	n/a	n/a	n/a	Methemoglobinemia is a potentially fatal condition that is generally rare but must be part of the differential diagnosis for any patient exhibiting clinical signs of hypoxia, cyanosis, or depressed pulse oximetry readings or who has been exposed to a substance with strong oxidative	VA
131	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.	Nonexperimental-retrospective review	28,478 patients undergoing transesophageal echocardiography	Use of topical lidocaine and/ or benzocaine	Patients with and without methemoglobinemia	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
132	Shamriz, Oded, Cohen-Glickman, Inbal, Reif, Shimon and Shteyer, Eyal. Methemoglobinemia induced by lidocaine-prilocaine cream 2014	Case Report	n/a	n/a	n/a	n/a	Lidocaine-prilocaine cream has been implicated as a cause of methemoglobinemia. The cream is not risk -free and the medical community should be alert to this possible complication.	VA
133	Larson, Austin, Stidham, Timothy, Banerji, Shireen and Kaufman, Jon. Seizures and Methemoglobinemia in an Infant After Excessive EMLA Application 2013	Case Report	n/a	n/a	n/a	n/a	Case report of an infant with extensive vascular malformations treated with EMLA cream who developed seizures and methemoglobinemia from lidocaine and prilocaine.	VA

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134	Brown C., Bowling, M. Methemoglobinemia in bronchoscopy a case series and a review of the literature. 2013	Nonexperimental- case series	11 cases of methemoglobinemia after bronchoscopy using topical anesthetics	n/a	n/a	n/a	Using topical anesthetic during bronchoscopy appears to be relatively safe. In this series there were no fatalities from methemoglobinemia. Methemoglobinemia should be suspected in patients who develop hypoxia or cyanosis after the bronchoscopy. CO2 oximetry can confirm the diagnosis.	IIIC
135	ASA. Guidelines for Ambulatory Anesthesia and Surgery [2018]	Guideline	n/a	n/a	n/a	n/a	The guideline applies to all care involving anesthesia personnel in an ambulatory setting.	IVB
136	CMS. State Operations Manual Appendix A: Survey Protocol, Regulations and Interpretive Guidelines for Hospitals 2018	Regulatory	n/a	n/a	n/a	n/a		
137	CMS. State Operations Manual Appendix L: Guidance for Surveyors: Ambulatory Surgical Centers 2015	Regulatory	n/a	n/a	n/a	n/a		
138	Sagir, Afrin, Goyal, Rakhee. An assessment of the awareness of local anesthetic systemic toxicity among multi-specialty postgraduate residents. 2015	Qualitative-cross sectional questionnaire-based study	200 postgraduate residents of various specialties	n/a	n/a	n/a	Based on the survey results, there is a definite need to raise awareness of detection and treatment of local anesthetic toxicity among all medical practitioners who regularly use local anesthetics.	IIIB
139	Barrington, Michael J., Weinberg, Guy L. and Neal, Joseph M. A call to all readers: educating all surgeons on preventing and treatment of local anaesthetic systemic toxicity 2016	Expert Opinion	n/a	n/a	n/a	n/a	Learning to recognize and manage LAST will improve patient safety. Prevention is key and successful treatment of severe LAST may require advance cardiac life support and lipid emulsion therapy. All practitioners who administer local anesthetics need to know and consider the potential risks of LAST	VA
140	Urfalioglu A., Urfalioglu S. and Oksuz, G. The knowledge of eye physicians on local anesthetic toxicity and intravenous lipid treatment: Questionnaire study. 2017	Qualitative	104 ophthalmologists	n/a	n/a	Knowledge of local anesthetic systemic toxicity and IV lipid emulsion treatment	There should be compulsory training programs for ophthalmologists regarding local anesthetic systemic toxicity and lipid emulsion treatment.	IIIB

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141	AORN. Position Statement on Perioperative Registered Nurse Circulator Dedicated to Every Patient Undergoing an Operative or Other Invasive Procedure 2019	Position Statement	n/a	n/a	n/a	n/a	At a minimum, one perioperative RN circulator should be dedicated to each patient undergoing an operative or other invasive procedure and should be present during that patient's entire intraoperative experience.	IVB