



Regional Anesthesia for Surgical Procedures and Acute Pain Management

Practice Considerations

Introduction

The use of regional anesthesia techniques in clinical practice has gained increasing popularity as part of surgical and acute pain management. As patients undergo surgical procedures, their recovery period may be characterized by acute postoperative pain. Research suggests that postoperative pain continues to be undertreated.¹⁻³ Acute pain management services provided by anesthesia professionals can aid patients in their recovery and increase patient satisfaction. Pain management services must be patient-centered. Key elements of patient-centered surgical and acute pain management services include patient engagement and education to address the patient's specific needs and include them in their plan for management of their pain.

Purpose

The purpose of these practice considerations is to highlight the contribution of regional anesthesia for surgical and acute pain management services.

Background

Regional Anesthesia

Regional anesthesia is used to desensitize a specific part of the body to a painful stimulus. It is classified into six sites of placement of local anesthetic: topical or surface anesthesia, local infiltration, peripheral nerve block, intravenous regional anesthesia, epidural anesthesia, and spinal (subarachnoid) anesthesia.⁴ Regional anesthesia techniques may include, but are not limited to, spinal, epidural, peripheral nerve blocks, upper and lower extremity blocks, airway blocks, and transversus abdominis plane (TAP) blocks. Regional anesthesia techniques may be used alone, or in combination with other anesthetic techniques, to provide anesthesia and analgesia for a variety of surgical and obstetrical procedures as well as for chronic pain management. Using regional anesthesia in combination with other anesthetic techniques can minimize side effects of an individual anesthetic technique, maximize benefits, and offer the patient options in the selection of anesthesia and analgesia.⁵ Regional anesthetic techniques may also be used for diagnostic and therapeutic procedures.

CRNA Scope of Practice

Regional anesthesia education and skill development are core elements of nurse anesthesia educational programs. The Council on Accreditation of Nurse Anesthesia Educational Programs (COA) specifies the didactic and clinical experience requirements necessary to develop regional anesthesia core competencies.⁶ These core competencies are the foundation of the CRNA regional anesthesia scope of practice.⁷ CRNAs practice in accordance with their professional scope of practice, federal and state law, and facility policy. As the provider integrates new technologies and techniques into their practice, they acquire and demonstrate the necessary knowledge, skills and abilities.⁸ As professionals, CRNAs engage in life-long learning and strive to provide safety and excellence in all aspects of patient-centered anesthesia care, including regional anesthesia.

Patient Populations

Regional anesthesia, used alone or as part of the perioperative multi-modal acute pain management plan, may be used in neonatal, pediatric, adult, and geriatric populations. Patient-specific circumstances and health status are considered as part of the overall assessment and evaluation of the patient.

Regional anesthesia used in combination with general anesthesia continues to grow in pediatric anesthesia practice. Recent studies have described the use of ultrasound-guided epidural injections, nerve blocks, and other regional techniques in the pediatric population.⁹⁻¹² Many factors make the assessment of pain unique in the pediatric population. Cognitive, behavioral, and psychosocial factors influence the pediatric patient's pain experience.¹³ Developmentally appropriate pain assessment tools are available.

Geriatric patients have age-related limitations and comorbidities which may increase their risk for surgery and anesthesia. In addition to physical and sensory changes, elderly patients may experience cognitive changes in the perioperative period. Treatment and recovery may be delayed when the geriatric patient is faced with a change in routine, environment, health and/or limited social support.¹⁴ Incorporating regional anesthesia techniques can be an effective option to reduce post-surgical complications for the elderly.¹⁵⁻¹⁷

Patient Assessment and Evaluation

Standard I of the *Standards for Nurse Anesthesia Practice* states that CRNAs “perform and document a thorough preanesthesia assessment and evaluation.”¹⁸ During the preanesthesia assessment, the patient health status is reviewed and evaluated to determine the patient's readiness for anesthesia and to develop the patient-specific perioperative plan of care. The patient assessment and evaluation involve a review of the following: the patient's medications; allergies; medical, surgical, and anesthetic history; psychosocial health; and issues related to respiratory, cardiovascular, renal, hepatic, gastrointestinal, neurologic, endocrine, musculoskeletal, and hematologic systems.¹⁹

Regional anesthesia may pose additional risks for patients with certain pre-existing conditions. Increased risk of nerve injury should be considered in patients with conditions such as diabetes, multiple sclerosis, nutritional deficiencies, alcoholism, hypothyroidism, Guillain-Barre Syndrome, ulnar neuropathy, carpal tunnel syndrome, vascular disease, proximal nerve root compression, spinal canal stenosis or previous physical injury or trauma.^{20,21}

The morbidly obese patient requires careful planning to mitigate challenges related to equipment, supplies, positioning, identification of landmarks, and prevention of catheter dislodgement.²²⁻²⁴ These factors may potentially lead to complications and increase block failure.²⁴ The obese patient may also be at increased risk of obstructive sleep apnea. The diagnosis or identification of risk of obstructive sleep apnea may require additional perioperative assessment and planning. The use of regional anesthesia has been associated with lower complication rates than general anesthesia in patients with obstructive sleep apnea when opioids are minimized or eliminated from the plan of care.²⁵

Prior to regional anesthesia, the patient is assessed for infection at the site of the block, history of headaches or backaches, chronic neurologic disorders, local anesthetic allergy, venous thromboembolism, and current or recent antithrombotic or thrombolytic therapy.^{26,27} These conditions may signify additional considerations or a contraindication for the regional block procedure. Consultation with other clinicians may be considered prior to proceeding with the block administration.²⁶

Thromboprophylaxis management regimes vary. The patient-specific therapy and coagulation status should be considered and optimized at the time of spinal or epidural needle/catheter placement and monitored during the period of epidural catheterization and prior to catheter removal.²⁷ The American Society of Regional Anesthesia and Pain Medicine's (ASRA's) Practice Advisory, *Regional Anesthesia in*

the Patient Receiving Antithrombotic or Thrombolytic Therapy, provides specific guidance regarding regional anesthesia administration for patients on thromboprophylactic therapy.²⁷

Patient-Specific Perioperative Treatment Plan

Standard III of the *Standards for Nurse Anesthesia Practice* states that CRNAs “formulate a patient-specific plan for anesthesia care.”¹⁸ The patient’s expectation of the surgical and post-operative pain experience is a key factor in the development of the plan. A preemptive, often multi-modal, approach to acute pain management has been shown to be advantageous in a wide array of surgical specialties.²⁸⁻³⁵ The type and duration of the surgical procedure, patient comorbidities, and postoperative physical therapy plan should be taken into consideration. Studies have demonstrated that preemptive analgesia may improve the patient’s postoperative acute pain experience, minimize the transition to a chronic pain state and have a positive, long-term effect.^{28,30,36,37}

Patient Engagement

An important aspect of developing a patient-specific anesthesia or acute pain management treatment plan is patient engagement. A patient-centered discussion about anesthesia techniques for surgery and pain management ideally takes place during the first patient visit with the clinician and continues throughout the course of the delivery of healthcare services to the patient.³⁸ Studies have shown that preoperative patient communication and education can have an impact on patient anxiety and knowledge levels, help reduce use of postoperative pain medication, increase self-efficacy,³⁹ alter behavior after discharge, influence postoperative recovery, increase patient satisfaction, and reduce hospital readmission.⁴⁰

Two-way communication is important for the clinician to understand the patient’s prior experiences and expectations of post-operative pain and pain management. Patient and family knowledge and understanding of healthcare can vary. Certain patients may have limited understanding of their condition or the healthcare process while others are more involved in healthcare decision-making. Health literacy is defined by the Institute of Medicine as “the degree to which individuals have the capacity to obtain, process, and understand basic health information as services needed to make appropriate health decisions.”⁴¹ Assessment of the patient’s health literacy level supports two-way communication to discuss the patient’s questions related to their anesthetic and pain control options.

Patient education is a key aspect of quality healthcare services.⁴⁰ A collaborative patient-clinician relationship has been associated with patient agreement with treatment recommendations, greater self-efficacy, and increased clinician empathy. It is also a predictor of patient satisfaction and adherence to treatment recommendations.⁴² Patient engagement and education can also take on a multidisciplinary approach. Numerous clinicians aid in the patient’s care before, during, and after surgery or a procedure. Patient education about their pain and pain management is reinforced throughout the healthcare delivery process using a variety of educational approaches (e.g., verbal engagement, written materials).⁴³

Patient education about regional anesthesia for surgery and acute postoperative pain management may occur in conjunction with the preanesthesia assessment and informed consent. Before regional anesthesia is administered, the procedure, risks, and potential complications should be discussed with the patient, and informed consent is obtained.^{44,45} For additional guidance on the informed consent process, refer to AANA’s *Informed Consent in Anesthesia*.⁴⁴

Block Placement

Block placement may occur in various locations. Regardless of the physical location where the block placement will occur, appropriate monitors, oxygen, supplies, equipment, and support staff should be available to the anesthesia professional. Preparation for the administration of regional techniques requires the immediate availability of emergency equipment, supplies, and drugs (e.g., intravenous lipid emulsion^{46,47}) in case emergency treatment is required.⁵

Local anesthetics may be used alone, or in combination with other drugs, to provide regional anesthesia.^{5,26,45} The pharmacokinetics of local anesthetic drugs vary in onset (e.g., slow, moderate, rapid) and duration.^{4,5,26,45} Therefore, the local anesthetic selected for the injection should be appropriate for the patient, type of block being performed, surgical procedure, and the postoperative physical therapy plan.

A review of patient's anatomy to identify nerves and other important structures is performed prior to the injection of medication for the block.⁴⁵ Identification of nerves and anatomy may be performed using conventional anatomic landmark-guided techniques and/or a peripheral nerve stimulator. With advancements in technology, anesthesia professionals may also integrate image-guided technology, such as ultrasound and fluoroscopy, to aid in identification and documentation of the injection site.

Infection may occur as a complication of a regional anesthesia technique. Meticulous aseptic technique is critical in the administration of regional anesthesia and the prevention of infection. The AANA's *Infection Control Guide for Certified Registered Nurse Anesthetists* details evidence-based recommendations for regional anesthesia administration.⁴⁸ Specific to regional anesthesia, these recommendations detail topics such as hand hygiene, standard precautions, skin preparation, sterile preparation of drugs, sterile draping, and proper technique specific for the block or technology being used.

As with any procedure, regional anesthesia techniques are not without risk. Regional block placement after the patient is heavily sedated or after the induction of general anesthesia may increase the risk of postoperative neurologic complications.⁴⁹ Patients who are under heavy sedation or general anesthesia are not able to respond to a painful stimulus or communicate with their anesthesia professional during the injection.^{20,49} The anesthesia professional considers and discusses with the patient, the risk and benefit of block placement with sedation or under general anesthesia.

Intraoperative Management

Standard IV of the *Standards for Nurse Anesthesia Practice* indicates that CRNAs “implement and adjust the anesthesia care plan based on the patient’s physiologic status. Continuously assess the patient’s response to the anesthetic, surgical intervention, or procedure. Intervene as required to maintain the patient in optimal physiologic condition.”¹⁸ Additionally, Standard V calls for CRNAs to “monitor, evaluate, and document the patient’s physiologic condition as appropriate for the type of anesthesia and specific patient needs.”¹⁸

When regional anesthetic techniques are used preemptively, as the sole anesthetic technique, or in conjunction with a general anesthetic, the anesthesia professional implements and adjusts the patient-specific treatment plan and monitors the patients throughout the entirety of anesthetic administration. The CRNA attends to the patient “continuously until the responsibility of care has been accepted by another anesthesia professional.”¹⁸

Postoperative Management

In making the determination to transfer the patient to the postanesthesia care unit (PACU), the CRNA should “evaluate the patient’s status and determine when it is safe to transfer the responsibility of care.”¹⁸ The CRNA reports “the patient’s condition, including all essential information, and transfer the responsibility of care to another qualified healthcare provider in a manner that assures continuity of care and patient safety.”¹⁸ In the PACU, postoperatively, and after discharge, patients are assessed for potential side effects and complications of regional anesthesia. These may include, but are not limited to, hypotension, nausea and vomiting, back pain, voiding difficulty, weakness, postdural puncture headache, neuraxial hematoma or abscess, palsies, paralysis or meningitis.^{50,51} Prior to discharge, patients are provided instructions on signs and symptoms to be aware of and who to contact with concerns.

Patients may require continuous peripheral nerve blocks to manage their acute pain in the postoperative period. Continuous nerve blocks are valuable tools in the management of postoperative pain. They have been shown to be safe and effective, especially when combined with a multi-modal approach to pain management.⁵² The placement of long-acting regional anesthesia blocks may reduce pain, control sympathetic nervous system activity, and improve ventilation.⁵³ Patient controlled analgesia (PCA) and patient controlled epidural analgesia (PCEA) pumps may be used in postoperative pain management and allow the patient to self-administer small doses of narcotics.

Safety

Insufficient analgesia or drug-related side effects may impede the course of a patient's postoperative recovery. Incorporating regional techniques for preemptive analgesia has been associated with reduced postoperative pain,^{10,54-58} decreased incidence of postoperative nausea and vomiting,^{31,32,55,59,60} lower doses required of postoperative pain medications (e.g., opioids),^{11,32-35,55,56,58-60} shorter PACU stay,^{34,60} shorter hospital stays,^{31,32,34,57} increased ability to begin rehabilitation,^{31,32} shorter time to resuming normal activities,^{34,61} improved visual analog scale pain scores,^{30,32,34,35} and increased patient satisfaction.^{57,59,62} The use of regional anesthesia has also been associated with a reduced incidence of post-surgical pain three to twelve months after surgery.^{61,63,64} Regional anesthesia may positively impact long-term healing and immune function.^{65,66}

Local anesthetic systemic toxicity (LAST) is an adverse event which may occur during the administration of local anesthetics. The major risk of LAST is cardiac arrest. The pharmacologic treatment of LAST differs from other cardiac arrest scenarios.⁶⁷ It is recommended that the *Checklist for Treatment of Local Anesthetic Systemic Toxicity* and 20 percent lipid emulsion are immediately available when regional anesthesia is placed.^{47,67} The checklist below was developed by ASRA and provides guidance for the treatment of LAST.⁶⁷

- Get Help**
- Initial Focus**
 - Airway management:** ventilate with 100% oxygen
 - Seizure suppression:** benzodiazepines are preferred; **AVOID propofol** in patients having signs of cardiovascular instability
 - Alert** the nearest facility having cardiopulmonary bypass capability
- Management of Cardiac Arrhythmias**
 - Basic and Advanced Cardiac Life Support (ACLS)** will require adjustment of medications and perhaps prolonged effort
 - AVOID vasopressin, calcium channel blockers, beta blockers, or local anesthetic**
 - REDUCE individual epinephrine doses to <1 mcg/kg**
- Lipid Emulsion (20%) Therapy** (values in parenthesis are for 70kg patient)
 - Bolus 1.5 mL/kg** (lean body mass) intravenously over 1 minute (~100mL)
 - Continuous infusion 0.25 mL/kg/min** (~18 mL/min; adjust by roller clamp)
 - Repeat bolus once or twice for persistent cardiovascular collapse
 - Double the infusion rate to 0.5 mL/kg/min if blood pressure remains low
 - Continue infusion** for at least 10 minutes after attaining circulatory stability
 - Recommended upper limit: Approximately 10 mL/kg lipid emulsion over the first 30 minutes
- Post LAST events at www.lipidrescue.org and report use of lipid to www.lipidregistry.org.**

Numerous factors influence the severity and likelihood of LAST, including patient risk factors, concurrent medications, type and location of block, local anesthetic used, total local anesthetic dose,

timeliness of detection, and adequacy of treatment.⁴⁷ The classic description of LAST is of a progressive excitation then depression of the central nervous system and cardiovascular system. Case reports suggest that seizure is the most common presenting symptom.⁴⁷ Twenty percent of the cases reported the classic prodromal symptoms of auditory changes, metallic taste and agitation.^{46,47} These symptoms are followed by unexpected cardiovascular manifestations of excitation (e.g., tachycardia, ventricular arrhythmia, and hypertension) then depression (e.g., bradycardia, conduction block, asystole, and cardiac depression).⁴⁶ Vigilance should be heightened in patients with underlying cardiac, neurologic, pulmonary, renal, hepatic, or metabolic disease.⁴⁷ Manifestations of LAST typically appear one to five minutes after the injection of local anesthetic. The onset may be as early as 30 seconds or as late as 60 minutes.⁴⁷ It is important to note that LAST cardiac arrests are often resistant to standard resuscitation measures.⁴⁶

Detailed guidance documents, such as the *ASRA Practice Advisory on Local Anesthetic Systemic Toxicity*⁴⁷ and *Checklist for Treatment of Local Anesthetic Systemic Toxicity*,⁶⁷ are available on ASRA's website.

Neurologic injuries may result from a regional anesthetic injection or block. Many peripheral nerve injuries may be very mild and not identified. Nerve injuries may not manifest symptoms until several days into the postoperative period.⁴⁹ Potential causes of perioperative nerve injuries are direct nerve trauma from the needle or catheter, direct toxicity of the local anesthetic or adjuvant drugs, decrease in neuronal blood flow, improper patient positioning, or tourniquet pressure.^{21,49,68} A high percentage of neurological injuries improve by four to six weeks postoperatively.²⁰ After a year, 99 percent of neurologic injuries may resolve.²⁰ Although the risk of nerve injuries cannot be completely mitigated, knowledge of risk factors, mechanisms of nerve injuries, patient comorbidities, and implementation of preventive strategies may decrease the probability of a nerve injury occurring.⁴⁹ Patient safety is optimized when the patient is provided education and information to reference after discharge and how to report or seek treatment for potential neurologic injury symptoms.

Technology

Innovations in the use of technology for guided regional anesthesia techniques have improved the safety and quality (e.g., block onset, block duration) of the nerve block.^{12,69-71} Peripheral nerve stimulators and image-guided technology, such as ultrasound and fluoroscopy, may improve regional anesthesia safety and accuracy.^{12,69,72-77} As the use of image-guided technologies is integrated into clinical practice, proficiency is developed through education, training, and experience.⁷⁵ When new techniques and technologies are added to practice, it is valuable to develop specific quality metrics to identify opportunities for additional education and practice modifications to improve outcomes.

Settings

Regional anesthesia use is not limited to the hospital setting. Due to the clinical value of regional anesthesia, it continues to be used safely and effectively in ambulatory⁷⁸⁻⁸⁰ and office-based^{45,81-83} settings. Klein et al. conducted a literature review analyzing peripheral nerve block use in the ambulatory setting and found support for peripheral nerve block use. The literature cited improved postoperative analgesia, opioid sparing, and fewer opioid-related side effects when compared to general anesthesia and parenteral analgesia.⁸⁰ In a retrospective chart review, Hausman et al. demonstrated that providing spinal and peripheral nerve blocks in an orthopedic surgery office does not increase the amount of office-based operating room time and is not associated with increased morbidity.⁸² Ambulatory and office-based facilities have requisite policies, equipment and staff present in the facility to maintain patient safety, assure necessary monitoring, and address emergencies. For additional guidance, refer to the AANA's *Standards for Office Based Anesthesia Practice*.⁸⁴

Conclusion

Anesthesia care is evolving due to many influences. Advancements in less invasive procedures, technology, shorter-acting anesthetics, and a demand for affordable healthcare and increased efficiency

have impacted the delivery of anesthesia services.⁸⁵ Hallmarks of patient-centered anesthesia care provided by CRNAs include vigilance, professionalism, and promotion of patient safety. CRNAs add value to the patient experience by providing regional anesthesia as part of a patient-centered surgical and acute pain management service.

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