General

Regional Anesthesia Strategies in Orthopedic Trauma

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Purpose

Orthopedic trauma patients have variable analgesic and anesthetic requirements dependent on injury pattern, severity, and comorbidities. Inadequate pain control can delay rehabilitation, prolong hospitalization, and contribute to chronic pain and opioid dependence. This review aims to summarize contemporary regional anesthesia (RA) strategies in orthopedic fracture care and highlight their indications, benefits, and limitations in the trauma setting.

Methods

A comprehensive literature search was conducted across PubMed, Google Scholar, and Web of Science to identify relevant studies on regional anesthesia techniques in orthopedic trauma. Search terms included "regional anesthesia," "peripheral nerve block," "orthopedic trauma," "fracture," "perioperative analgesia," and "multimodal analgesia." Following initial broad search, focused secondary searches were conducted for specific regional techniques. Review articles, randomized controlled trials, prospective and retrospective cohort studies, and landmark technique descriptions were all considered.

Results

Advances in ultrasound-guided regional anesthesia have significantly improved the precision, safety, and reliability of neuraxial and peripheral nerve block techniques. RA has been associated with superior early pain control, reduced opioid consumption, improved patient satisfaction, and facilitation of early mobilization when compared to systemic analgesia or general anesthesia alone. Although concerns persist regarding hemodynamic instability, masking of acute compartment syndrome, and peripheral nerve injury, current evidence supports the use of RA when appropriately indicated.

Conclusion

RA is an increasingly important component of multimodal analgesia in orthopedic trauma care. Familiarity with available techniques, anatomic considerations, and injury-specific applications allows orthopedic surgeons to collaborate effectively with anesthesia teams and optimize perioperative pain management. These strategies can improve functional recovery while minimizing opioid requirements.

INTRODUCTION

Injury and trauma remain among the leading causes of death in the United States.[1-3] Accidental trauma has increased in the last half-decade to account for more than 200,000 deaths and 41 million ED visits nationally.[4,5] Patients presenting acutely after trauma often require intensive, multifaceted treatment strategies requiring a broad expertise in managing trauma, emergency general surgery, and surgical critical care.[6] As a result, it is vital for surgeons to have a strong understanding of all aspects of the acute care process, including strategies in perioperative pain management and choice of anesthesia.

Effective perioperative pain management is essential to orthopedic trauma care. Inadequate analgesia is associated with poor rehabilitation, prolonged hospital stays, and lower patient satisfaction.[7] Poorly controlled pain can delay discharge, hinder physical therapy, and contribute to adverse outcomes in the acute postinjury period including predisposing the patient to chronic pain.[4,7,8] Orthopedic trauma patients additionally represent a heterogeneous population whose anesthetic and analgesic needs vary widely based on injury severity and type, as well as patient comorbidities. This makes the selection of optimal techniques challenging. However, multiple studies support the utilization of regional anesthesia (RA) as part of multimodal analgesic regimens.[4,7,8] Additionally, in the setting of the ongoing opioid crisis, RA offers an effective alternative that can reduce opioid reliance.[7,9] Advances in ultrasound-guided RA techniques have also significantly increased the safety and reliability of peripheral nerve blocks (PNBs). These innovations have made nerve localization more precise and reliable.[3,4]

Given these developments with anesthetic techniques and outcomes, orthopedic trauma surgeons must understand the capabilities and indications for various regional techniques. While trauma care often involves complex management with special attention to respiratory and hemodynamic compromise, RA remains a valuable component of the perioperative strategy. The benefits go beyond management of pain, with proper pain control through RA resulting in decreased incidence of DVT, blood loss, inflammatory response, and improved early mobilization.[3,4] As evidence grows across specific injury patterns, surgeons should understand the differing modalities, techniques, and approaches to optimize patient pain management and work in collaboration with their anesthesia colleagues.[10-15]

NEURAXIAL NERVE BLOCK

Neuraxial anesthesia can be administered through spinal, epidural, and combined spinal epidural (CSE) blockade.[16] Epidural catheters can deliver anesthetic agents as a continuous infusion, patient-controlled epidural analgesia (PCEA), or a combination of both.[4] Spinal anesthesia consists of a single-shot injection into the subarachnoid space, while epidural anesthesia involves an indwelling catheter for continuous infusion placed in the epidural space.[16] For acute cases, the single-shot spinal injection or CSE is preferred due to the speed of effect when compared to the epidural. While these techniques are frequently used in orthopedic surgery, their role in upper extremity trauma is often limited due to concerns about hemodynamic instability and undiagnosed concurrent injuries. Epidural and combined anesthesia are more commonly used perioperatively for lower extremity trauma injuries.[16] Combined spinal anesthesia consists of a spinal injection for rapid onset of surgical anesthesia, followed by placement of an epidural catheter for prolonging surgical anesthesia and better postoperative analgesia in patients with lower extremity injuries.[16] Continuous epidural analgesia is frequently employed in the post-operative setting for patients with rib fractures.[4] However, the general contraindications for neuraxial nerve blocks conflict with the presentation of most trauma patients. The foremost concern is their significant impact on hemodynamic stability. Still, other factors include patient cooperation, infection, coagulopathy, and increased intracranial pressure, all adding to the increasing popularity of other anesthetic techniques for this population.[4]

PARAVERTEBRAL BLOCK

The paravertebral block (PVB) is a valuable alternative to neuraxial techniques. It involves injecting local anesthetic adjacent to the vertebral body at the point where spinal nerves exit the intervertebral foramina, resulting in an ipsilateral somatic and sympathetic block that may span multiple vertebral levels above and below the site of injection.[4] The procedure can be performed easily at bedside and can be completed as a single-shot injection of 15 to 20 mL of local anesthetic or as a continuous infusion.[4,17] Paravertebral blocks are most effective in the setting of rib fractures, similar to epidural injections. While studies have shown similar outcomes in patients receiving epidural or PVB, each has its unique benefits.[18] In the ambulatory setting, PVB with a catheter can provide patients with long-term relief, allowing them to return to function sooner. For patients with multiple rib fractures, an epidural is more appropriate for wider coverage of pain relief.[4,17] One drawback of both epidurals and paravertebral blocks is potential contraindication to anticoagulants while the catheter is in place, as well as difficulty with placement in patients with a larger body habitus.

PERIPHERAL NERVE BLOCKS

Peripheral nerve blocks (PNB) can be applied to both upper and lower extremity injuries for increased precision and localization of relief. The choice of block is guided by the specific anatomic location and procedure.[4] (Table 1) PNBs carry similar contraindications to neuraxial blocks and should not be used in patients who are uncooperative or suffer from infection, concern for developing compartment syndrome, or existing peripheral neuropathy.[4] Improvements in ultrasound-guided techniques with the placement of these peripheral blocks have allowed for better visualization of anatomy and localization, resulting in high block success rates.[7]

SINGLE-SHOT VS CONTINUOUS PERIPHERAL NERVE BLOCKS

Peripheral nerve blocks may be administered either as a single injection or through a continuous peripheral nerve block (CPNB) catheter.[4] The decision between techniques should be based primarily on the anticipated duration and severity of pain. Single injection blocks provide relief for 12-24 hours and thus are less useful in patients with major trauma and significant analgesic requirement, or concern of rebound pain.[4,7] For the majority of trauma patients who will have severe and longstanding pain, a CPNB is the most appropriate modality as they can be used for days to weeks, depending on patient requirements.[4,7] For patients with multiple traumatic injuries, the simultaneous use of more than one catheter is also common.[4] However, the use of CPNBs comes with considerations. Their use requires

Table 1. Regional Technique by Injury Location[4,8,16]

Injury Location	Suggested Regional Anesthetic Technique
Clavicle	Superficial cervical plexus Interscalene
Rib	Thoracic Epidural Paravertebral Intercostal Nerve Erector Spinae Plane Serratus Anterior Plane
Shoulder	Interscalene Supraclavicular
Upper Arm Lower Arm Hand	Supraclavicular Infraclavicular Axillary Bier Block
Pelvis	Lumbar Epidural
Femoral Neck	Lumbar Plexus Femoral Nerve Fascia Iliaca Pericapsular Nerve Group (PENG)
Femoral Shaft	Femoral Nerve Fascia Iliaca Lateral Femoral Cutaneous Nerve
Knee	Femoral Nerve Sciatic Nerve Saphenous Nerve
Patella	Femoral Nerve
Ankle	Femoral Nerve Ankle Block Sciatic Nerve Saphenous Nerve Bier Block
Foot	Ankle Block Sciatic Nerve Saphenous Nerve Bier Block

strong outpatient monitoring and trained personnel to ensure safe management and removal.[7] Reported complications include catheter migration or dislodgement, malfunction, leakage, and infection.[7,17,19,20] In institutions without established outpatient catheter monitoring programs, single-injection blocks, possibly augmented with adjuvant medications to prolong duration, may represent a safer, more resource-conscious alternative.[7]

UPPER EXTREMITY INJURY

Most upper extremity trauma procedures can be performed with RA in the form of a brachial plexus block. The specific approach can be modulated based on the location of injury.[4,8] For shoulder injuries, brachial plexus blocks with the interscalene or supraclavicular approach, superior trunk, suprascapular nerve, or axillary nerve blocks are indicated.[4,7] For more distal injuries, brachial plexus blocks with the supraclavicular, infraclavicular, and axillary approaches should be used.[4] These techniques provide satisfactory anesthesia and superior pain relief in the first 24 hours when measured by visual analog scale (VAS), reduce opioid requirement, and decrease discharge time for upper arm procedures, when compared to general anesthesia alone.[8,21-23] There is less clear evidence for the use of single-shot anesthesia compared to continuous catheter-based techniques. For upper arm surgery, continuous catheter-based blocks have been found to have superior pain relief to single-shot anesthesia, with multiple studies reporting lower VAS scores and opioid consumption.[24] There is less evidence that shows any superiority between the two for procedures below the elbow.[8] In addition to the above approaches, an intercostobrachial block can be utilized for tourniquet pain for longer procedures.

INTERSCALENE

Interscalene blocks (ISB) are completed by injecting local anesthetic near the C5 and C6 nerve roots between the anterior and middle scalene muscles, reliably blocking the suprascapular, musculocutaneous, axillary, lateral pectoral, and supraclavicular nerves.[7] The wide coverage makes the block a strong option for most shoulder procedures. The primary concern with this approach is the risk of concomitant blockade of the ipsilateral phrenic nerve.[7] This can potentially result in hemi-diaphragmatic paresis with up to 30 percent reduction in pulmonary function which is especially concerning in patients with existing respiratory complications.[4,7,25] As a result, this approach should also be avoided in heavily sedated patients, patients with pre-existing pulmonary conditions, or patients with low pulmonary reserves such as the morbidly obese. Additionally, this approach blocks partial motor function to the distal hand, a side-effect that can be distressing to patients if they are not properly counselled on it.

DIAPHRAGM SPARING BLOCKS

The superior trunk block (STB) has arisen as an alternative to ISB in patients with respiratory concerns. The approach deposits anesthetic medication at the brachial plexus at a more inferolateral location than the ISB approach, reliably targeting C5–C6 nerve fibers with less risk of affecting the phrenic nerve.[7,26] In a randomized trial of 126 patients, the superior trunk block provided equivalent surgical anesthesia while significantly lowering hemi-diaphragmatic paralysis rates.[27] Due to this and the added sparing of motor function of the distal hand, this technique has emerged as an attractive alternative to interscalene blocks for shoulder surgery.

Suprascapular blocks are another option for shoulder procedures in patients with respiratory concerns. The technique targets the nerve either under the posterior belly of the omohyoid muscle as it branches from the superior trunk, at the suprascapular notch, or within the supraspinous fossa.[7] When combined with an axillary nerve block, studies have shown decreased incidence of hand motor function and dyspnea in addition to superior pain control when compared to ISB.[28,29] Thus, this approach is another valuable diaphragm-sparing option for shoulder injury.

SUPRACLAVICULAR

The supraclavicular block is commonly utilized for procedures of the hand, forearm, elbow, and arm. The injection targets the brachial plexus just above the clavicle by injecting local anesthetic between the anterior and middle scalene muscles at the first rib- level.[7,16] The C5–C7 distribution to the shoulder, lateral arm, and forearm, as well as C8–T1 distribution to the hand and medial forearm, are impacted. Since the plexus branches are densely packed here, the block produces overlapping upper limb- anesthesia. However, the proximal medial upper arm (T2) is supplied by the intercostobrachial nerve and may require separate blockade.[16] While some shoulder involvement does occur, the block does not provide enough coverage to be reliably used for shoulder procedures. While the risk of diaphragmatic paresis is lower due to the approach, respiratory complications are still possible due to the potential for iatrogenic pneumothorax.[4] Spread of the local anesthetic in this densely packed region can also lead to the risk of Horner syndrome or hoarseness due to the impact of the cervical sympathetic chain or recurrent laryngeal nerve.

INFRACLAVICULAR

This approach has similar indications to the supraclavicular block. Local anesthetic is injected around the axillary artery below the clavicle, targeting all three cords of the brachial plexus before they branch into the axillary and musculocutaneous nerves.[16] While it requires a deeper injection, this approach is ideal for trauma patients with cervical spine-precautions as it does not require any manipulation of the head or neck during placement.[4,16] There are similar concerns with this approach for pneumothorax with injection, and Horner's syndrome and hoarseness with the spread of anesthetic. However, these are less likely, and the primary obstacle for the infraclavicular block is achieving adequate needle depth. Despite these concerns, infraclavicular blocks have demonstrated clear advantages in reduction of opioid consumption, shorter hospital stays, decreased post-operative nausea, and faster return to function in orthopedic trauma populations.[16,30]

AXILLARY

Axillary brachial plexus blocks provide similar coverage and analgesic relief as other brachial plexus blocks. However, they are generally avoided in acute trauma as they require abduction and movement of the injured limb, which can exacerbate pain or compromise fracture alignment.[4] Thus, they are best utilized for injuries at the elbow and below, or as an adjunctive intervention. Axillary blocks have been frequently studied as complements to other diaphragm-sparing- techniques to broaden shoulder analgesia.[7,28,31] The approach targets the median, ulnar, radial, and musculocutaneous nerves as they run around the axillary artery. The patient's injured arm must be abducted to 90 degrees before each nerve is identified under ultrasound guidance.[16] While this block has demonstrated superior analgesia compared to general anesthesia in upper limb- trauma, it carries specific risks.[21] Hematoma formation and intravascular injection are both low risk concerns due to the proximity of the injection to the axillary vessels. In isolation, however, axillary blocks fail to cover all branches necessary for shoulder surgery, limiting their use as a primary anesthetic.[7]

BIER BLOCK

This technique is also referred to as intravenous regional anesthesia (IVRA) and provides rapid analgesic effect for both upper and lower extremity procedures. This block is indicated for brief procedures of the forearm, wrist, and hand in the upper extremity, and lower leg, foot, and ankle in the lower extremity.[32] The block is performed by first placing an IV as close to the injury or surgical site as possible. Then, the limb is exsanguinated through the use of an Esmarch and pneumatic tourniquet applied proximally. Once the cuff is inflated, local anesthetic is injected into the IV to allow infiltration into the limb, with the cuff preventing systemic circulation further into the body. Contraindications for this technique include history of DVT or thrombophlebitis of the limb, uncontrolled hypertension, or open and severe injuries. Difficulty body habitus, history of neuropathy, and procedure length longer than two hours are relative contraindications as well.[33] Thus, the Bier block provides a valuable anesthesia technique for less severe trauma due to its ease of technique, safety, and rapid action.

LOWER EXTREMITY INJURY

Lower extremity trauma can be managed with neuraxial, as discussed previously, or peripheral nerve blockade techniques. PNBs provide effective analgesia across multiple injury patterns in the lower limb while minimizing the need for patient positioning or limb manipulation.[4,16] While their use has increased, PNBs are still commonly used as adjuncts to general or neuraxial anesthesia.[8,16] Although general versus regional anesthesia decisions are largely dependent on injury severity, randomized trials consistently show superior post-operative pain control with regional techniques.[8] PNBs improve patient satisfaction and reduce pain scores in the first 24 hours post-operatively compared with systemic analgesia.[8,12,14] The ability to localize anesthetic delivery results in many differing approach options for patients. Lumbar plexus blocks can be used for injuries to the acetabulum, femoral neck and shaft, and knee joint. Femur and lower leg fractures are best treated with a femoral block with either a supportive femoral nerve or fascia iliaca approach. Distally, procedures involving the knee, ankle, and foot can be managed with sciatic or saphenous nerve blocks through multiple approaches, depending on the specific injury. Finally, foot surgeries can also be managed with a regional ankle block.

LUMBAR PLEXUS

Lumbar plexus blocks are useful for hip, femoral neck and shaft, and knee procedures. With this block, the femoral, obturator, and lateral femoral cutaneous nerves are all covered.[16] This technique is particularly valuable after open reduction and internal fixation of acetabular fractures, achieving a 60 percent reduction in morphine requirements with continuous infusion.[4,34] Although the ability to cover multiple nerve distributions with a single block is beneficial, the approach is technically challenging and carries a higher risk of complications, including inadvertent epidural spread with high neuraxial blockade and local anesthetic-systemic toxicity.[16] The block can be augmented with other RA techniques for more comprehensive coverage of the lower limb.[35]

SCIATIC NERVE

The sciatic nerve may be blocked through several different approaches, including anterior, transgluteal, subgluteal, and popliteal techniques. These blocks are used either as primary anesthesia or adjunctive analgesia for procedures of the posterior knee, hamstrings, foot and ankle.[4,16] The nerve arises from the L4-S3 branches of the lumbar plexus and splits into the tibial and common peroneal nerves at the level of the popliteal fossa. This technique provides complete motor and sensory blockade below the knee. However, the medial aspect of the knee is unaffected, as it receives innervation from the saphenous nerve.[16] The approach should be determined based on patient positioning and surgical requirements. The sciatic nerve can be targeted with the anterior approach through the proximal medial thigh, transgluteal approach through the posterior buttock, subgluteal approach through the gluteal crease, or the popliteal approach through the popliteal fossa.[16,35] In addition to common risks with all PNBs, additional complications with sciatic blocks include the formation of heel ulcers and difficulty in assessing sciatic nerve injury post-operatively.[16,35]

FEMORAL NERVE

The femoral nerve block remains one of the most widely performed blocks for lower extremity- orthopedic procedures.[35] The nerve arises from the L2-L4 branches of the lumbar plexus and provides sensory innervation to the anterior thigh and medial aspects of the calf, foot, and ankle, as well as motor innervation to the quadriceps, sartorius, and pectineus muscles. The blockade reliably covers the anterior thigh, knee, medial calf, ankle, and foot. Indications for this technique include procedures in those sensory distributions as well as knee arthroplasty, arthroscopy, and femoral neck fractures, with local infiltration anesthesia as a potential beneficial adjunct.[3,16,35] This technique also benefits from a relatively easy placement process, as the needle only traverses skin and adipose tissue in the inguinal region, making it much more convenient for patients and providers alike.[16] Outcomes with inclusion of this block in these injury patterns are reportedly superior to other techniques and decrease morphine consumption.[4,35,36] However, with this technique, there is the potential for quadriceps weakness in the post-operative period, resulting in decreased patient mobility and increased fall risk.

FASCIA ILIACA COMPARTMENT

This technique has similar indications and coverage to the femoral block but provides analgesia by targeting both the femoral nerve and the lateral femoral cutaneous nerve through a single injection beneath the fascia iliaca.[16] The technique relies on injection into the fascial plane at the level of the inguinal crease, spreading anesthetic medication laterally toward the anterior superior iliac spine and medially toward the femoral nerve. It is frequently performed in the emergency department for patients with hip fractures and has been shown to significantly reduce opioid requirements.[16,37] Due to the low risk of complication and ease of technique, performance of this block by emergency department staff should be encouraged.[38] The block has similar drawbacks to femoral nerve blocks, as clinicians must monitor patients for quadriceps weakness and the risk of falls, as well as systemic toxicity from larger anesthetic volumes.

PERICAPSULAR NERVE GROUP BLOCK

PENG blocks are a relatively newer intervention for hip fracture patients that targets articular branches of the anterior hip capsule.[39,40] The anterior hip capsule is innervated by the articular branches of the obturator, accessory obturator, and femoral nerves. The injection is placed between the myofascial plane between the superior pubic ramus and the psoas muscle.[39] This approach offers a valuable option for effective and localized pain relief while avoiding the muscular blockade effect found in several other lower extremity approaches. Studies have reported similar to superior analgesic effects of PENG blocks and femoral nerve blocks in post-operative opioid consumption and patient-reported pain.[39,41] Multiple studies have found improved post-operative mobility, reflecting the benefit of the motor sparing with this approach.[41-43]

SAPHENOUS NERVE

The saphenous nerve block is indicated for a variety of lower extremity procedures and is frequently recommended in conjunction with a sciatic block to provide total coverage for the lower leg.[4] The nerve provides purely sensory anesthesia to the medial leg, ankle, and foot and is targeted through an ultrasound-guided injection in the adductor canal beneath the sartorius muscle. When used alone, it offers motor-sparing analgesia ideal for procedures on the medial knee, ankle, or foot.[4] The varying approaches include the adductor canal, the femoral triangle, the medial femoral condyle, or the tibial tuberosity, and allow flexibility based on surgical site and patient positioning.[4] However, the block does not address the posterior knee capsule, and high anesthetic volumes may risk unintended femoral nerve spread, resulting in quadriceps weakness.

ANKLE BLOCK

The ankle block delivers motor-sparing anesthesia to the foot by blocking peripheral nerves at the level of the ankle. The saphenous nerve comes off the femoral nerve, and the sural, posterior tibial, superficial peroneal, and deep peroneal nerves come off the sciatic nerve around the medial and lateral malleoli.[16] The technique is performed using surface landmarks alone or with optional ultrasound for greater accuracy and provides rapid analgesia for forefoot and midfoot surgery as well as acute fracture and soft tissue injury. Although slightly less opioid-sparing than a popliteal block, its simplicity and minimal need for repositioning make it ideal for certain emergent situations and can be easily performed by the surgeon perioperatively.[16]

RISKS AND CONCERNS

Regional anesthesia exists with risks and contraindications that are further complicated by the delicate nature of trauma patients. These patients often present with preexisting hemodynamic instability, significant comorbidities, or active coagulopathy. An uncooperative patient complicates block placement and primary evaluation, and obtunded patients require general anesthesia in order to secure and protect the airway.[4] Regional techniques also carry the risk of masking the escalating pain of compartment syndrome, increasing the risk of infection or hematoma, and presenting an opportunity for iatrogenic injury during placement.

COMPARTMENT SYNDROME

Acute compartment syndrome (ACS) develops when rising intra-compartmental pressures result in compromise of circulation and development of ischemia and necrosis if unrecognized.[4,44] However, the risk of obscuring the evaluation of acute compartment syndrome following the use of regional anesthesia is not well described.[4,17] Nerve blocks in trauma patients have previously been avoided over the concern that sensory blockade could mask the clinical finding of pain out of proportion and delay diagnosis.[4,17] However, these clinical signs have demonstrated poor sensitivity (11%–19%) despite high specificity (97%–98%) in lower-leg injuries.[45] In sedated or neurologically impaired patients, who cannot reliably report discomfort, the usefulness of these signs is further diminished. To best mitigate the risk of ACS, rigorous patient surveillance and objective measurement for evaluation of trauma patients should be encouraged. Surgeons and anesthesiologists should monitor analgesic consumption, watch for breakthrough pain, and employ compartment pressure monitoring in high-risk scenarios.[17] While there may be some concern, no research has conclusively demonstrated an increase in missed ACS or related complications attributable to regional anesthesia.[46]

POLYTRAUMA

Patients suffering from polytrauma form another high-risk population for which RA techniques may be less appropriate. In these patients, the primary goals in the acute setting are immediate resuscitation and hemodynamic stabilization, followed by perioperative pain management that allows for monitoring of post-traumatic complications such as compartment syndrome.[47] High-energy injuries such as tibial and femoral shaft fractures, bicondylar tibial plateau fractures, and high-energy upper extremity injuries increase the concern for ACS in this population.[48] Additionally, due to the need for mobility, patient comorbidity, and multiple injury sites, systemic approaches thus may be more practical for these patients.[8]

PERIPHERAL NERVE INJURY

Peripheral nerve injury represents another significant, but rare, concern associated with regional anesthesia. Multiple studies demonstrate low incidence rates. Capdevila et al found that transient adverse neurologic symptoms occurred in between 0 to 1.4% of interscalene catheter placements, 0.4 to 0.5% of femoral catheters, and 0 to 1% of sciatic catheters, with permanent neurologic deficits reported in fewer than 0.1% of cases.[19] Further, while perioperative nerve injury was more likely in patients with comorbidities such as diabetes, hypertension, or tobacco use, lasting deficits beyond six weeks reportedly occurred in 0.2% of patients, with most recovering spontaneously within three months.[4,19,49] Barrington et al described a nerve injury-rate of 0.4 per 1,000 blocks, most of which were subclinical and attributable to a combination of surgical and patient-related factors rather than the block itself.[50] While rare, the risk for iatrogenic injury is still present. Factors that increase risk in these procedures include intrafascicular injection under high pressure and preexisting neuropathy.[16] To mitigate risk, ultrasound guidance should be utilized to aid in needle visualization and anesthetic spread. Despite these concerns, current evidence supports the safety of regional anesthesia when performed with attention to technique and patient selection. Modern advances in training, technique, and monitoring continue to drive down complication rates of this type.[8]

SUMMARY

Trauma patients represent some of the most complex patients for health care providers, with their demands requiring careful planning across multiple sub-specialties. While the benefits of regional anesthesia in elective orthopedics are well established, trauma patients face additional challenges. These patients' injury patterns come with severe, multifocal, and prolonged pain that can impede rehabilitation, delay discharge, and develop into chronic pain syndromes if not appropriately managed. In the perioperative window, overuse of systemic opioids carries its own risk. RA techniques have been proven across multiple injury patterns to have equivalent to superior outcomes in the orthopedic trauma population, when compared to opioids or general anesthesia alone. Certain risks do exist with specific approaches and techniques, and the decision to utilize RA should balance consideration of patient factors, trauma severity, and injury location against the documented benefits. In extremely acute trauma cases, RA alone is not an option as patients will require general anesthesia for intubation and maintenance of their airway, and hemodynamic control. Additionally, pre-operative coordination between anesthesia and surgical staff is vital to discuss block or catheter location against surgical approach and sterile field requirements. Education on the analgesic options available to surgeons treating complex trauma patients emphasizes close collaboration between all members of the acute care team and allows for better clinical decision-making in these emergent situations.

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CONFLICTS OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

ETHICS STATEMENT

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