

Continuous peripheral nerve blocks in acute pain management

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Key points

- Continuous nerve blocks are useful for the management of postoperative and trauma pain in both the inpatient and ambulatory settings.
- Advantages of this technique include improved analgesia, early functional recovery and discharge from the hospital.
- Combined with thromboprophylaxis, this technique represents a safer alternative to epidural.
- The appropriate use of this technique does not increase the risk of falls.

Summary. The indications for continuous nerve blocks for the perioperative pain management in hospitalized and ambulatory patients have extended well beyond orthopaedics. These techniques are not only used to control pain in patients undergoing major upper and lower extremity surgery, but also to provide perioperative analgesia in patients undergoing abdominal, plastic, urological, gynaecological, thoracic, and trauma surgeries. Infusion regimens of local anaesthetics and supplements must take into consideration the condition of the patient before and after surgery, the nature and intensity of the surgical stress associated with the surgery, and the possible need for immediate functional recovery. Continuous nerve blocks have proved safe and effective in reducing opioid consumption and related side-effects, accelerating recovery, and in many patients reducing the length of hospital stay. Continuous nerve blocks provide a safer alternative to epidural analgesia in patients receiving thromboprophylaxis, especially with low molecular-weight heparin.

Keywords: acute pain; continuous nerve blocks; local anaesthetics; regional anaesthesia

Between 1 July, 2009 and 30 June, 2010, the UPMC (University of Pittsburgh Medical Center) Division of Regional Anesthesia and Acute Interventional Perioperative Pain Service performed more than 20 000 nerve blocks, including 5147 blocks performed with the use of ultrasound and 9287 continuous peripheral nerve blocks (CPNB's: 176 axillary for arm and hand surgery and interscalene for shoulder surgery; 1778 sciatic including 1475 gluteal blocks for total knee replacement and 303 popliteal blocks for foot and ankle surgery; 2143 femoral for total knee replacement and ACL repair; 1006 lumbar plexus for total hip replacement and 4184 paravertebral for thoracotomy, abdominal and pelvic surgery). This represents an increase of 21% from the previous year.

As early as 1946, Ansbro¹ proposed the use of a continuous supraclavicular nerve block technique to prolong the duration of analgesia and to optimize sensory block with minimal residual motor block. Today, these principles remain the basis of regional anaesthesia practice. Continuous peripheral nerve blocks are now mainly indicated for perioperative analgesia, whereas the vast majority of blocks performed for anaesthesia are single-shot blocks.

Historically, perineural catheters were placed for upper extremity blocks to allow prolonged infusion of local anaesthetic solutions.² Use of continuous peripheral nerve blocks for outpatient surgery^{3–11} has recently become a worldwide trend.

The indications for continuous nerve blocks include perioperative pain management, pain management after trauma,¹² and even chronic pain.¹³ Over the past 12 years,^{14–16} continuous nerve blocks have gained significant popularity for acute postoperative pain management after major orthopaedic and thoracic surgery, for both inpatients and outpatients, in adults and children, especially in the context of a multimodal approach to postoperative pain treatment.

There is also increasing interest in peripheral nerve blocks because of potential anti-inflammatory¹⁷ benefits and the concern over interactions of anticoagulants and central neuraxial techniques. However, recent guidelines on 'Regional anaesthesia in the patient receiving antithrombotic or thrombolytic therapy'¹⁸ have generated significant controversy.¹⁹

The aim of this review is to offer an updated overview about continuous peripheral nerve blocks as a useful tool in the treatment of acute postoperative pain after elective surgery, trauma, or both.

Advantages of the use of continuous peripheral nerve blocks for the management of perioperative pain

It is well established that the quality of patient's immediate functional recovery after total knee and hip replacement is

directly related to the quality of the postoperative pain management.^{20–21} This is best illustrated in patients who underwent minimally invasive surgery.^{22–25} Continuous lumbar plexus block in combination with a multimodal approach has led to the feasibility of discharging patients home within 24 h after total hip replacement.^{25–26}

In addition to the humanitarian and economical aspects of effective pain management, the use of continuous nerve block provides better postoperative pain control than systemic patient-controlled analgesia (PCA),^{27–29} reduces the need for opioids and their related complications, allows earlier mobilization and functional recovery, shortens hospital stay and rehabilitation centre,^{7–8} and improves sleep.³ Most studies agree that opioid consumption is decreased by 40–70% when continuous nerve blocks are used when compared with PCA alone.

Another significant advantage of the use of continuous nerve blocks in the ambulatory patient is that this technique decreases the frequency of unanticipated admissions and re-admissions after same-day surgery and their associated costs.³⁰

Indications

Approaches and local anaesthetics

Several techniques have been proposed for the placement of perineural catheters. They include blind techniques as is the case with the placement of a catheter in the psoas compartment and the paravertebral space. Although paraesthesia was a predominant technique in the past, for the past 20 yr the use of neurostimulation represented the predominant approach with or without the use of a stimulating catheter.³¹ Recently, the use of ultrasound-guided techniques, alone or in combination with a neurostimulation approach, has been advocated (e.g. for femoral, gluteal, popliteal, upper extremity, and thoracic paravertebral blocks). Comparison of these techniques supports the concept that the use of an ultrasound-guided technique reduces the time necessary for the placement of the perineural catheter and reduces vascular punctures, need for opioids, and the volume of local anaesthetics.^{32–35}

Several local anaesthetics have been infused including bupivacaine, ropivacaine, levobupivacaine, and lidocaine. Use of lidocaine in orthopaedics has been limited as it does not produce a preferential sensory block.³⁶ Various concentrations, rates of infusion, and modes of administration have been described (continuous, patient-controlled, a combination of both, and bolus only).^{37–38} It is very difficult to advocate a single standard protocol for all patients that takes into consideration the site of infusion, the pharmacokinetics of local anaesthetic, type of surgery being performed, additional administration of analgesics, need for functional recovery in orthopaedic procedures, and expected length of stay in the hospital. For example, although ropivacaine is usually infused at a concentration of 0.2%, concentrations as low as 0.1% or as high as 0.5% have been proposed. Brodner and colleagues³⁹ demonstrated that 0.1%

ropivacaine was not effective and that 0.2% and 0.3% ropivacaine were required at a rate of 15 ml h⁻¹. It appears that the amount, not the concentration or infusion rate, represents the most important determinant.⁴⁰

The value of additives such as clonidine⁴¹ and morphine⁴² to continuous perineural infusions is controversial and has yet to be established.

The indications for continuous nerve blocks include major orthopaedic procedures, such as shoulder surgery, upper and lower extremity trauma, upper and lower extremity re-implantation procedures, shoulder, elbow, hip, knee and ankle arthroplasty, and prolonged upper and lower extremity physical therapy, plastic, breast, thoracic, urological, abdominal, pelvic surgery, and multiple rib fractures (Table 1).

Joint replacement

Total hip replacement

Several groups have demonstrated the safety and efficacy of continuous lumbar plexus block for perioperative management of total hip replacement.^{43–47} This technique has proved more effective than continuous femoral blocks and i.v. hydromorphone PCA.⁴⁸ Although continuous femoral nerve blocks have been proposed for the management of pain after total hip replacement,⁴⁹ evidence favours the use of lumbar plexus block.³⁵

Total knee replacement

Several continuous nerve block techniques have been proposed for the management of perioperative pain after total knee replacement including continuous femoral block and continuous lumbar plexus block.^{38–42} The use of sciatic nerve blocks has also been proposed.^{50–55} Combined continuous femoral and sciatic block represents an interesting alternative approach compared with an epidural block.^{53–54}

Total ankle replacement

Continuous sciatic block is indicated for the perioperative management of pain after total ankle replacement. Although the sciatic nerve can be approached at various levels according to patient anatomy and mobility, a lateral or a posterior popliteal approach is often used.

Total shoulder replacement

Continuous interscalene block⁵⁶ represents the technique of choice in these cases.

Total elbow replacement

Continuous infraclavicular block⁵⁷ has been reported to provide effective perioperative analgesia for patients undergoing total elbow replacement.

Ambulatory surgery

The use of continuous nerve blocks in patients undergoing ambulatory (day case) procedures has expanded considerably in the past few years. Indications include major upper

Table 1 Indications for continuous nerve blocks in orthopaedic procedures and trauma

Surgical procedure/ trauma	Continuous block	Suggested infusion
Total shoulder arthroplasty, shoulder hemiarthroplasty, rotator cuff repair, shoulder arthrodesis, 'frozen' shoulder PT, biceps surgery, proximal humerus fractures	Interscalene	Initial bolus: 20 ml ropivacaine 0.5%; continuous infusion: 5–10 ml h ⁻¹ ropivacaine 0.2%
Distal humerus fractures, elbow arthroplasty, elbow arthrodesis, radius fractures and surgery, ulna fractures and surgery, wrist arthrodesis, re-implantation surgery, major upper limb trauma	Supraclavicular, infraclavicular, axillary	Initial bolus: 20 ml ropivacaine 0.5%; continuous infusion: 5–10 ml h ⁻¹ ropivacaine 0.2%
Unilateral: thoracotomy and major breast surgery (T4–5), rib fractures, nephrectomy (T7)	Thoracic paravertebral	Initial bolus: 15 ml per catheter ropivacaine 0.5%; continuous infusion: 5–10 ml h ⁻¹ ropivacaine 0.2% per catheter
Bilateral: laparotomy (T8), cystectomy (T10)		
Primary total hip arthroplasty, revision THA, femur fractures	Lumbar plexus	Initial bolus: 20 ml ropivacaine 0.2–0.5%; continuous infusion: 5–10 ml h ⁻¹ ropivacaine 0.2%;
Femur fractures, anterior cruciate ligament reconstruction, patella repair, total knee arthroplasty, knee active and passive PT	Femoral nerve	initial bolus: 20 ml ropivacaine 0.2–0.5%; continuous infusion: 5–10 ml h ⁻¹ ropivacaine 0.2%
Total knee arthroplasty, posterior cruciate ligament reconstruction	Femoral + sciatic (parasacral or gluteal or subgluteal approach)	Initial bolus (after foot dorsi-flexion has been checked): 6–12 ml ropivacaine 0.2%; continuous infusion: 3–8 ml h ⁻¹ ropivacaine 0.1–0.2%
Tibia fracture and surgery, fibula fracture and surgery, ankle fusion, subtalar fusion, total ankle arthroplasty, hallux valgus repair	Sciatic (anterior or gluteal or subgluteal or lateral popliteal approach)	Initial bolus (after foot active dorsi-flexion has been checked): 5–10 ml ropivacaine 0.2–0.5%; continuous infusion: 5–10 ml h ⁻¹ ropivacaine 0.1–0.2%
Ankle fusion; total ankle arthroplasty	Femoral or saphenous + sciatic	Initial bolus: 20 ml ropivacaine 0.2%; continuous infusion: 5–10 ml h ⁻¹ ropivacaine 0.1%

and lower extremity and breast surgery. Recently, the ability to perform joint replacement as an ambulatory procedure has created additional opportunities.

Upper extremity surgery

For major shoulder surgeries many favour continuous interscalene block.^{58–59} Ultrasound-guided continuous posterior interscalene block provided superior postoperative analgesia, minimized supplemental opioid requirements, and improved sleep quality when compared with a single-injection ropivacaine interscalene block after shoulder surgery.⁶⁰

For major surgeries below the shoulder, supraclavicular, infraclavicular,⁶¹ or axillary approaches⁶² are safe and effective for intra-operative anaesthesia, especially with the advent of ultrasound guidance. The infraclavicular approach to brachial plexus catheterization allows longer stability of in-dwelling catheters with less patient discomfort. Tunnelling supraclavicular and axillary blocks subcutaneously helps prevent catheter dislocation.⁶³

Lower extremity surgery

Indications for lower extremity continuous nerve blocks vary according to the procedure.⁶⁴ In most cases, patients are discharged home with only one perineural catheter: either a femoral³⁴ or lumbar plexus catheter after surgery of the thigh, knee, or both or a popliteal sciatic catheter^{65–66} after foot and ankle surgery.

Thoracic, abdominal, pelvic, and urological surgery

Continuous paravertebral blocks have been shown to be highly effective for postoperative pain management in patients undergoing breast, thoracic, abdominal, pelvic, and urological surgery.^{67–71} Use of a continuous technique has been shown to be superior to single blocks in patients undergoing thoracic surgery.⁷² Continuous paravertebral nerve blocks provided better pain at rest and during coughing, less opioid consumption, superior pulmonary function, and were associated with less nausea and hypotension than epidural analgesia.^{73–76} Contraindications to thoracic epidural analgesia such as thromboprophylaxis do not preclude the use of a paravertebral block. For thoracic and breast surgery, a unilateral paravertebral catheter is placed at the level of T4. Other indications for a unilateral paravertebral catheter include complete or partial nephrectomy (T8) or liver surgery (T6) with a lateral surgical approach. Bilateral placement of paravertebral catheters is used to satisfy the surgical requirement in cases involving colon resection, abdominal debulking, pancreatectomy, liver resection, cystectomy, and hysterectomy with node dissection at levels T8–T10 depending on the indications.

Trauma

Continuous nerve blocks represent an interesting alternative in managing pain in the trauma patient.^{77–79} Trauma patients often require multiple perineural catheters to

provide optimal long-lasting analgesia. Continuous nerve block techniques have been successfully used in military medical care for treating soldiers wounded in combat.

Before performing blocks in trauma patients, it is important to perform a complete neurological examination to document sensory impairments, motor impairments, or both. A pre-existing neurological injury does not represent an absolute contraindication to performing a block, but documentation can provide important medico-legal evidence for future discussion regarding the origin of a nerve injury.

Upper extremity trauma

The choice of the type of continuous nerve blocks being performed depends on the location of the injury and the expected duration of the infusion.^{12 80} Interscalene, supraclavicular, and axillary catheters are difficult to be maintained in place for more than a couple of days. If necessary one can tunnel the catheter in order to keep it in place and reduce the risk of infection. In trauma patients, the sympathetomy associated with the use of continuous nerve blocks is probably beneficial for revascularization, and re-implantation procedures, or in cases where blood flow is compromised.

Patients with upper humerus fractures can develop compression syndromes, a condition considered to be an emergency as it can lead to an irreversible injury of the radial nerve. If a continuous brachial plexus block is performed to provide analgesia for an upper humerus fracture, the rate of infusion should be kept as low as possible to provide sensory but no motor block. If pain that had been controlled should suddenly increase, an orthopaedic consult should be obtained to rule out compression syndrome. An increase in the rate of infusion might control the pain but would not facilitate early diagnosis of compression syndrome.

Lower extremity trauma

Regional anaesthesia of the lower extremity usually includes lumbar plexus block and sacral plexus block at different sites. These nerve block procedures are superior to morphine PCA in providing analgesia for lower extremity trauma,^{81 82} and are considered safer than epidural, as many of these patients receive thromboprophylaxis with low molecular-weight heparin.

Depending on the site of injury, either lumbar plexus/femoral or sacral plexus/sciatic blocks or both might be required to provide adequate analgesia. For example, acetabular or femoral neck injury might require only a lumbar plexus block, whereas knee/patellar injuries and ankle injuries require both femoral and sciatic nerve blocks.

When a continuous sciatic block is performed to control the pain of a patient with a tibial plateau fracture, one should provide a sensory block with no motor block to assure that the diagnosis of a compression syndrome is not missed.

Chest trauma

Rib fractures are the most common thoracic injuries with an incidence ranging from 10% to almost 30% in patients after trauma.⁸³ The mortality rate of patients with rib fractures ranges from 5.8% (single rib fracture) to 34.4% (multiple rib fractures) with an overall rate of 10%. Pain associated with rib fractures usually impairs pulmonary function and increases pulmonary morbidity. Appropriate, timely pain management should be a core intervention in managing these patients.

Epidural analgesia has been considered the gold standard for the management of pain after multiple rib fractures.⁸⁴ The increased use of enoxaparin for thromboprophylaxis has limited the use of this technique. Continuous paravertebral blocks represent an interesting alternative, and have been shown to be equi-effective when compared with epidural, continuous paravertebral blocks that produce similar improvements in respiratory function. The use of paravertebral blocks is associated with less hypotension⁸⁵ and lower risk of epidural haematoma even when used with enoxaparin.

Over the past few years consideration has been given to the use of wound^{86–92} and intra-articular infusion of local anaesthetics^{93–97} as an alternative to the use of continuous nerve blocks. However, these blocks are not effective when used in major surgery.⁹⁸ Although this technique has been shown to be better than a single block,⁹⁹ it has been shown to be less efficacious than continuous nerve blocks.^{100–103} Use of a continuous peripheral nerve block technique is associated with less opioid consumption and better recovery at 6 weeks than peri-articular infiltration.¹⁰³ In addition, the intra-articular infusion of local anaesthetics can produce chondrolysis.^{104 105}

Anticoagulation and continuous nerve blocks

Thrombolytic and antithrombotic therapy and continuous nerve blocks

This is a controversial topic. The most recent ASRA guidelines¹⁷ on regional anaesthesia in patients receiving antithrombotic or thrombolytic therapy recommend applying the same guidelines to deep and plexus blocks as for neuraxial blocks. These recommendations apply to the concomitant administration of thrombolytic therapy, antithrombotic therapy, or both in patients benefiting from blocks and are based on a very small number of case reports. These recommendations are complicated by a number of issues. Haematoma after the performance of nerve blocks has been reported even in the absence of administration of anticoagulation.^{106–116} Even in the hands of an expert, vascular punctures occur frequently during the performance of blocks.¹⁰⁹ Retroperitoneal haematoma is an established complication of both hip surgery¹¹⁷ and thrombolytic therapy.^{118–120} Frequently, the clinician is faced with the question of what to do in the case of concomitant administration of thromboprophylaxis (not *thrombolytic* or *antithrombotic* therapy). This distinction is important because the prevention of deep venous thrombosis and pulmonary thrombosis requires

doses of anticoagulant far lower than those used for therapeutic indications.

Table 2 presents bleeding complications and the conditions surrounding these events and their relationship to the use of thrombotic therapy, antithrombotic therapy,^{116 121–127} and thromboprophylaxis. Two patients reported to have renal subcapsular bleeding underwent lumbar plexus blocks at the level of L3. Neither patient received anticoagulant nor anti-inflammatory drugs before they became symptomatic. Major bleeding has been reported in two patients receiving lumbar sympathetic block together with irreversible platelet-aggregation inhibitors, which led to the death of one patient.¹²³

Thromboprophylaxis and continuous nerve blocks

Although certain trauma and surgical patients benefit from the administration of thromboprophylaxis for the prevention of deep venous thrombosis and pulmonary embolism, reports of simultaneous thromboprophylaxis and continuous nerve block are very limited.

We have not observed any major bleeding complications when using the following guidelines:¹²⁸

- (1) Blocks are performed 12 h after the last dose of enoxaparin and 24 h after the last dose of fondaparinux when used for thromboprophylaxis in patients with an INR<2.0.

- (2) Thromboprophylaxis can be initiated after the block is performed.
- (3) The perineural catheter can be removed regardless of the drug used for thromboprophylaxis based on the analgesic requirement without consideration for the INR¹²⁹ or the type of thromboprophylaxis and its timing.

This approach has been supported in a recent publication¹³⁰ that found no major bleeding in 3588 patients who underwent joint replacement (50.2% knee arthroplasty and 49.8% hip arthroplasty) and 6935 blocks in patients receiving thromboprophylaxis. Similar data have been reported with a combination of continuous paravertebral blocks and enoxaparin.¹³¹

Continuous nerve blocks and falls

Based on anecdotal case reports, small series, or both, it has been claimed that the use of continuous femoral blocks increases the risk of falls in patients undergoing lower extremity orthopaedic surgery.^{132–134} Data obtained from 33 328 patients have instead demonstrated that patients with continuous nerve blocks do not fall more frequently than either patients without blocks or other surgical patients.^{135 136} In considering the risk for falls, it is important to take into consideration the concentration of local anaesthetic and the rate of infusion. It is also important to recognize the role played by the preoperative conditions of the

Table 2 Major bleeding after the performance of blocks, administration of antithrombotic, thrombolytic therapy and thromboprophylaxis (number of haematoma). *Complications developing after a blind ilioinguinal/hypogastric block. †One patient died

	No block	Block thrombolytic therapy	Block thrombolytic therapy	Block antithrombotic	Block thromboprophylaxis
Vascular trauma					
Renal subscapular haematoma (lumbar sympathetic block [1]; lumbar plexus [2])	(3) ^{106 107}				
Upper extremity haematoma	(2) ^{108 109}				
Airway obstruction	(1) ¹¹⁰				
Prolonged Horner syndrome	(1) ¹¹¹				
Pulmonary haemorrhage	(1) ¹¹²				
Small bowel obstruction*	(2) ^{113 114}				
Haemoperitoneum*	(1) ¹¹⁵				
Chest haematoma (with heparin overdose)		(1) ¹²⁴			
Retroperitoneal haematoma		(2) ^{118 119}			
Femoral blocks					(1) ¹²⁰
Pudental block	(1) ¹¹⁶				
Lumbar plexus sympathetic blocks				(2) ^{123†}	(1) ¹²¹
With heparin overdose			(1) ¹²²		
Uncertain origin					
Lumbar plexus and femoral block					(1) ¹²⁵
Hip surgery, lumbar plexus, and femoral block					(1) ¹²⁶
Very elderly and lumbar plexus					(1) ¹²²
Major bleeding					
Continuous femoral block					(2) ¹²⁷
Continuous superficial sciatic block					(1) ¹²⁷

patient (preoperative quadriceps weakness, muscle atrophy, confusion, etc.), surgical technique and the perioperative use of opioids, anti-inflammatory drugs, and sedatives. For example, during total knee replacement, the insertion of the quadriceps muscle to the femur is partly sectioned, which results in mechanical weakness totally independent of the infusion of local anaesthetics. Patients undergoing total knee replacement are at a three-fold higher risk of fall than patients undergoing total hip replacement.¹³⁶ It is also critical to recognize that more than 20% of patients fall before a knee replacement.¹³⁷

Complications

Complications associated with perineural catheter placement or maintenance are uncommon¹³⁸ (see accompanying review in this issue by Jeng and colleagues).¹³⁹ They include local anaesthetic toxicity owing to intravascular placement of the catheter or over-dosage owing to accumulation or intravascular catheter migration. Other complications include bleeding, nerve injury, and infection. In rare instances, the use of this technique can mask the pain resulting from a nerve injury/compression (sciatic injury associated with tibial plateau fracture, radial injury associated with high humeral fracture, sciatic compression in the popliteal fossa after knee replacement), rhabdomyolysis, and consequently can result in delayed diagnosis. In these situations, it should be recognized that pain is not the only warning sign, whereas careful examination of the patient, especially when pain suddenly increases, can help in establishing an early diagnosis.

Infection

Despite the fact that evidence supports the concept that perineural catheters are often colonized,^{140 141} abscess at the site of the perineural catheter and septicaemia are very rare with continuous nerve blocks. Even though the incidence of perineural catheter infection is postulated to be very low, its real incidence has not been established.^{142 143} Factors explaining this concept include short duration of perineural infusions and the frequent use of antibiotic therapy in major orthopaedic surgery. This observation might explain reports of infections related to the use of continuous nerve block in patients who have undergone ambulatory surgery.^{144–148} There is also evidence that local anaesthetic solutions are bacteriostatic.¹⁴⁹ Established risk factors include local inflammation, patients in intensive care units, sex, absence of prophylactic antibiotics, diabetes mellitus, femoral and axillary catheters, and duration of infusion beyond 48 h.¹⁴³

In case of infection, the perineural catheter should be removed and appropriate antibiotics should be given.

Nerve injury

Nerve injury after the performance of a continuous nerve block is a rare event.^{150–152} Whether or not ultrasound guidance can reduce the frequency of nerve injury associated

with peripheral nerve blocks remains to be established. In the context of trauma and surgery, it is often difficult to determine whether the cause of the nerve injury is a direct result of the trauma, compression owing to positioning of the tourniquet, or to traction of the nerve. Often the block is unfairly implicated in the nerve injury. Frequently, transient neurological damage is reported.^{150–152} Local anaesthetics might play a role as these reports are more frequent with bupivacaine than with ropivacaine.¹⁵³

Serious plexus injuries have been reported with the performance of paravertebral block at the cervical, thoracic, and lumbar levels. While the exception, such injuries can represent a devastating complication including irreversible neurological damage with extensive epidural/subdural or total spinal anaesthesia blocks or in some cases paraplegia, quadriplegia, and death.⁵⁹

Failure to provide adequate pain control and the ability of the catheter to remain in place for the indicated period of time are considered by some as possible complications. The reported success rate varies between 70% and 90–100% for different blocks and approaches. Finally, while it is an exceptional occurrence, rupture of the catheter has been reported¹²⁰ and the surgical requirement for a removal of the perineural catheter^{5 154} and even in one case a catheter was left in place.¹⁵⁵

Conclusions

Continuous nerve blocks represent an important therapeutic tool in managing perioperative pain and trauma pain. They have been proved safe and effective, especially when combined with a multimodal approach to pain management.

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None declared.

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