Clinical Practice Guideline
Peripheral Nerve Blocks in Upper and Lower Extremity

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National Association of Orthopaedic Nurses

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Disclaimer

This clinical practice guideline (CPG) was developed under the direction of the National Association of Orthopaedic Nurses Evidence-based Practice and Research Committee and is provided as an educational tool based on an assessment of current scientific and clinical research information. The tool is not intended to replace a clinician’s independent judgment and critical thinking but to enhance the clinician’s ability to manage care of the orthopaedic patient with a peripheral nerve block in the upper or lower extremity. Individual facility specific policy and procedure should be followed relating to care of the orthopaedic patient with a peripheral nerve block.

Levels of Evidence

The evidence within this clinical practice guideline is rated to differentiate evidence of varying strengths and quality. “The underlying assumption is that recommendations from strong evidence of high quality would be more likely to represent best practices than evidence of lower strength and less quality” (Newhouse, 2007, p. 90). Refer to the Appendix for an explanation of the levels of evidence contained within this guideline.
Table of Contents

Introduction ........................................................................................................................................ 4
Purpose ............................................................................................................................................. 5
Rationale for Guideline .................................................................................................................... 5
Goal of Clinical Practice Guideline ................................................................................................ 5
Assessment of Scientific Evidence ................................................................................................. 5
Nursing Diagnosis ............................................................................................................................ 6
Description ....................................................................................................................................... 6
Definition of the Problem ................................................................................................................. 7
Pathophysiology ............................................................................................................................... 7
Utilization of Clinical Quality Indicators ......................................................................................... 7
Nursing Interventions and Expected Outcomes ............................................................................. 7
Patient Care Management .............................................................................................................. 9
  Interventions .................................................................................................................................. 9
  Diagnostic Tests ............................................................................................................................. 11
  Risk Factors and Association Complications ............................................................................. 11
  Education – Patient & Family: ...................................................................................................... 12
Discharge Destination ..................................................................................................................... 12
Trends and Controversies .............................................................................................................. 13
Web Sites ........................................................................................................................................ 14
  Professionals: ............................................................................................................................... 14
  Patient and Family: ...................................................................................................................... 14
References ......................................................................................................................................... 15
Appendix: System for Rating the Strength of Evidence ................................................................. 19
Introduction

Orthopaedic surgery has lent itself to regional anesthesia due to the ability to isolate anesthesia to the extremity being operated on. The name regional anesthesia came about as the method of blocking a nerve plexus under direct vision during general anesthesia as to reduce anesthesia requirements and provide pain relief post-operatively (Hadzic, 2007) (Level V).

Regional anesthesia for total joint replacement, upper and lower extremity fractures and anterior cruciate ligament reconstruction, has shown to be beneficial with few major complications in the literature (Brull, Prasad, & Chan, 2009) (Level III), (Williams, et. al., 2006) (Level II), (Chan, Fransen, Parker, Assam & Chua, 2012) (Level I), (Parker, Griffiths, & Appadu, 2009) (Level III), (Stone, Wang, & Price, 2008) (Level III). Peripheral nerve block is a favorable regional anesthetic/analgesic option for extremity surgery and provides perioperative benefits. There are numerous types of peripheral nerve blocks such as femoral, sciatic, popliteal fossa, lumbar plexus, tibial, peroneal, saphenous, obturator, psoas, adductor canal, interscalene, supraclavicular, infracclavicular, and axillary. Peripheral nerve block can be a single injection which has a limited duration of local anesthetic action, or be a continuous peripheral nerve block (CPNB) which offers prolonged analgesia, or a combination of both (Hadzic, 2007) (Level V). There is increasing popularity of CPNB with less side effects than an indwelling epidural catheter and it extends relief in the post-operative recovery period (Wiegel, Gottschaldt, Hennebach, Hirschberg, & Reske, 2007) (Level IV).

Table 1. Types of Peripheral Nerve Blocks

<table>
<thead>
<tr>
<th>Name of Block</th>
<th>Location of Surgery</th>
<th>Examples</th>
<th>Location of Nerve Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interscalene block</td>
<td>Mid humerus to shoulder</td>
<td>Rotator cuff repair, Shoulder arthroscopy, Clavicle surgery</td>
<td>Neck</td>
</tr>
<tr>
<td>Supraclavicular block or infraclavicular block</td>
<td>Elbow and below (elbow, forearm or hand)</td>
<td>Wrist fracture, Wrist arthroscopy, Hand surgery</td>
<td>Above or below collarbone</td>
</tr>
<tr>
<td>Axillary block</td>
<td>Elbow and below (elbow, forearm or hand)</td>
<td>Wrist fracture, Wrist arthroscopy, Hand surgery</td>
<td>Axilla</td>
</tr>
<tr>
<td>Brachial Plexus nerve block</td>
<td>Shoulder or humerus Fractures</td>
<td>Total joint replacement</td>
<td>Neck</td>
</tr>
<tr>
<td>Femoral nerve block</td>
<td>Knee</td>
<td>Partial joint replacement</td>
<td>Upper thigh</td>
</tr>
<tr>
<td>Sciatric nerve block</td>
<td>Knee</td>
<td>Partial joint replacement</td>
<td>Buttock</td>
</tr>
<tr>
<td>Popliteal nerve block</td>
<td>Foot or ankle</td>
<td>Achilles tendon repair</td>
<td>Side of thigh or behind knee</td>
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<tr>
<td>----------------------</td>
<td>---------------</td>
<td>------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Lumbar plexus block</td>
<td>Hip</td>
<td>Hip arthroscopy</td>
<td>Back</td>
</tr>
<tr>
<td>Lateral cutaneous</td>
<td>Hip</td>
<td>Hip fracture</td>
<td>Back</td>
</tr>
<tr>
<td>Psoas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subcostal</td>
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**Purpose**

The purpose of the clinical practice guideline for PNB in the upper and lower extremity is multifactorial (1) to maintain safety and decrease risk of injury to the patient; (2) to educate nurses on the assessment, ongoing monitoring for pain and symptoms of anesthetic toxicity, and potential complications. This clinical practice guideline also provides an explanation of the pathophysiologic mechanisms involved and the steps to be implemented to ensure patient safety, quality of care and positive outcomes.

**Rationale for Guideline**

Due to the increasing use of PNBs it is necessary to be aware of complications, particularly falls occurring in this susceptible population (Marcus, 2009) (Level V). Orthopaedic nurses care for patients that have nerve blocks in both in-patient and out-patient settings (Pulido, Colwell, Henpecked, & Morris, 2002) (Level II). Anesthesia continues to introduce various types of PNBs. Nursing has been seeking direction to provide safe/quality care of patients with nerve blocks by using evidence-based practices.

**Goal of Clinical Practice Guideline**

The goal of the CPG is identification of evidence-based measures that will provide orthopaedic nurses with the knowledge base needed to effectively deliver high quality care among patients undergoing surgery of the upper and lower extremities utilizing nerve blocks for anesthesia/anesthetic pain management.

**Assessment of Scientific Evidence**

Studies have shown PNBs and CPNBs have a reported low incidence of complications and promote better postoperative analgesia, increased patient satisfaction, and have positive influence on surgical outcome and patient rehabilitation when compared with intravenous opioids. Anesthetic literature identifies that the complications may be the result of under-reporting. Major complications are rare. However, minor adverse effects associated with CPNB may be more common. One caution is that the motor blockade of the knee may be
prolonged thus preventing early mobilization, affecting quadriceps weakness, and placing patients at risk of falling. Another less reported caution is associated with supraclavicular nerve blocks and the risk for phrenic nerve palsy (Cornish, et al., 2007) (Level IV). The literature presents studies that challenge variable limitation such as the control group inclusion, sample size, type of surgery, technique or pain relief of CPNB (Brull, Prasad, & Chan, 2009) (Level III), (Wiegel, Gottschaldt, Hennebach, Hirschberg, & Reske, 2007) (Level IV).

**Nursing Diagnosis**

Risk for infection  
Risk for injury  
Risk for falls  
Potential for peripheral neurovascular dysfunction  
Risk for ineffective tissue perfusion: peripheral  
Risk for impaired mobility (walking)  
Risk for impaired transfer ability  
Potential for knowledge deficit  
Risk for anxiety  
Risk for acute pain  
Risk for ineffective breathing pattern

**Description**

Peripheral nerve blocks are typically performed for surgeries of the upper and lower extremities but can also be used for surgeries around the neck or groin. The operative part is exposed and prepped with antibacterial agent (e.g., chlorhexidine). The patient may or may not be sedated when the procedure is performed. Peripheral nerve block is accomplished by injecting a local anesthetic near the nerve/nerves that controls sensory and motor function to a specific part of the body. Administration of this local anesthetic involves three elements: a syringe, a needle, and a local anesthetic drug. The injection will temporarily numb the area. Ultrasound, which is preferred, or a nerve stimulator is used for correct placement (Ehlers, Jensen, & Bendtsen, 2012) (Level II), (Swenson, et al., 2006) (Level III). If a stimulator is used, a 2-inch, 21 gauge needle catheter is attached to the nerve stimulator to locate the nerve. The catheter is tunneled with the use of a nerve stimulator in which the stimulation current must be sufficient to elicit appropriate muscle twitch. The needle attached to the nerve stimulator is flushed with local anesthetic solution. The needle continues to advance until twitching of the muscles is observed. The nerve stimulator current is decreased. The effects of a peripheral nerve block are dependent on the medication used and can last 8-24 hours (FOAA, 2014) (Level V). Peripheral nerve blocks can be either combined with general anesthesia or epidural/spinal anesthesia or used as sole anesthetic (Sharma, Iorio, Specht, Davis-Lepie, & Healy, 2010) (Level III).

The anesthesiologist often uses a percutaneous catheter and a small lightweight portable infusion pump. A disposable mechanical or electronic pump that is able to maintain a constant flow rate or have a bolus option places the local anesthetic into the wound regionally versus systemically (Richman, Lui, Courpas, et al., 2006) (Level III).
Definition of the Problem

In today’s anesthetic practice, regional anesthesia is performed with high success and few complications. Serious adverse effects are rare. Adverse effects can be categorized as: local anesthetic toxicity, complications of needle placement, or spillover of local anesthetic to the surrounding neural structures (Graber & Kraay, 2010) (Level IV). Local anesthetic systemic toxicity (LAST) can occur because of unplanned intravascular injection or slow absorption from the injection site. This can manifest as reactions ranging from auditory changes, circumoral numbness, and agitation to seizures and central nervous system (CNS) depression. Complications of needle placement can include hematomas, dysesthesias, and other problems related to a specific nerve block. Other adverse effects reported in the literature emphasize peripheral nerve injury, positive bacterial colonization, hypotension, technical problems such as kinked, blocked, displaced or breakage of the catheter, unwanted alarms, failure of pain relief, and incidences of persistent weakness in the femorisquadriceps. Decreased quadriceps function may prevent early mobilization and place the patient at an increased risk of falling (Sharma, Iorio, Specht, Davis-Lepie, & Healy, 2010) (Level III), (Watts & Sharma, 2007) (Level III), (Capdevila, Pirat, Bringuier, Gaertner, Singelyn, et al., 2005) (Level IV), (Muraskin, Conrad, Zheng, Morey, & Enneking, 2007) (Level IV), (Wiegel, Gottschaldt, Hennebach, Hirschberg, & Reske, 2007) (Level IV).

Pathophysiology

A peripheral nerve is a complex structure consisting of fascicles held together by the epineurium, an enveloping external connective sheath. Each fascicle contains many nerve fibers and capillary blood vessels embedded in a loose connective tissue, the endoneurium. The perineurium is a multilayered epithelial sheath that surrounds individual fascicles. Nerve fibers depend on a specific endoneurial environment for their function (New York School of Regional Anesthesia, 2012) (Level V).

Local anesthetics are chemicals that inhibit neural excitation by preventing membrane depolarization. Anesthetics interfere with the neuronal membrane’s permeability to sodium. Disruption of sodium exchange results with the inhibition the neuronal impulses between the affected extremity and the brain. This affects the sensory, motor & sympathetic pathways, leaving the patient unable to feel or move the anesthetized extremity (Muraskin, Conrad, Zheng, Morey, & Enneking, 2007) (Level IV).

Utilization of Clinical Quality Indicators

Clinical quality indicators allow for the identification of areas that need improvement and serve as evidence-based guides that assist with the measurement of the quality and safety of patient care (Smith, 2011) (Level II). Clinical quality indicators specific to nerve block guidelines include improving patient safety and reducing risk of adverse events and the prevention of complications (American Society of Anesthesiologists, 2012) (Level V).

Nursing Interventions and Expected Outcomes

*Expected Outcomes:*

1. Optimal pain management using a multimodal pain management approach and in collaboration with health care providers (National Association of Orthopaedic Nurses, 2013) (Level VI)
2. Return of neuromuscular function and sensation
Assessment (including physical examination):

1. Review physician orders
2. Vital signs
3. Pain assessment, including the need for additional measures taken to control pain
4. Neurovascular assessment with attention to the sensory and motor responses below point of block
   a. Color: pink, pale, cyanotic
   b. Temperature: warm, cool, cold
   c. Capillary refill: < 3 sec > 3 sec
      Rapid, sluggish
   d. Edema: None
      +1 (barely detectable)
      +2 (indent < 5 sec)
      +3 (indent 5-10 sec)
      +4 (takes 30 sec to rebound)
      Shiny, Taut, Dependent, Weeps, General (anasarca)
   e. Sensation: Present, Decreased, Absent with or without stimulation
      i. Peroneal nerve- head of fibula to dorsum of foot
      ii. Tibial nerve- ventral surface of foot
      iii. Radial nerve- dorsal surface of hand, proximal part of first and second finger
      iv. Median nerve- palmer aspect of web space between thumb and first finger
      v. Ulnar nerve- fifth finger
   f. Motion: Active (moves per self)
      Passive (moves with assistance)
      i. Dorsiflexion
      ii. Plantar Flexion
      iii. Toe extension
      iv. Finger abduction, hyperextension, opposition
      v. Wrist flexion
   g. Pulses: Graded on a 0-4+ scale: 0 indicating no palpable pulse, 1+ indicating a faint but detectable pulse, 2+ indicating a slightly more diminished pulse than normal, 3+ indicating a normal pulse, 4+ indicating a bounding pulse. (Hill & Smith, 1990)
      i. Pedal: above dorsi-pedal artery of foot
      ii. Post-tibial: inner larger bone between knee & ankle, posterior to medial malleolus
      iii. Popliteal: behind the knee
      iv. Groin/Femoral: depression between thigh & trunk
      v. Radial: inner wrist
      vi. Ulnar: opposite the thumb
      vii. Brachial: antecubital space at elbow
h. Muscle strength (Seidel, 2011) (Level VI)
   Muscle test is scored as follows:
   i. No evidence of movement: Grade 0
   ii. Trace of movement: Grade 1
   iii. Full range of motion, but not against gravity (passive movement): Grade 2
   iv. Full range of motion against gravity but not against resistance: Grade 3
   v. Full range of motion against gravity and some resistance, but weak: Grade 4
   vi. Full range of motion against gravity, full resistance: Grade 5

5. Catheter site inspection with visual inspection of catheter site to assess for redness, edema, induration, drainage, pain and intact dressing, and leakage around catheter
   a. With a CPNB leakage is common: reinforce site, do not change or remove original dressing

6. Catheter inspection to ensure it is free of kinks and the clamp is in the open position

7. Skin inspection paying attention to areas of sensory deficit

8. Assess quadriceps weakness for femoral nerve block

9. Assess respiratory effort or loss of sensation at the level of the diaphragm for an interscalene or supraclavicular nerve block

10. Examine the infusion pump (for CPNB) and medication label for patient identifiers, drug name, drug concentration, volume and rate. Label CPNB tubing with “nerve block” label and trace line from pump to patient to prevent inadvertent intravenous administration.

11. Assess and report signs of LAST to the physician or anesthesiologist including: auditory changes, circumoral numbness, metallic taste, agitation, seizures, CNS depression.

12. Document assessment findings routinely and with changes.


**Patient Care Management**

**Interventions**

Nursing interventions used in PNB focus on prevention of complications. Staff and patients should be educated to the insensate extremity. When a patient is unable to feel or move the extremity they are subject to harm.

1. Preoperative
   a. Educate patient on the purpose and use of a peripheral nerve block to control pain
   b. Educate the patient to be careful of insensate extremities
   c. Educate the patient on the pain rating scale and the parameters for increasing/decreasing for CPNB’s per physician order
   d. Educate patient that this is one modality of pain management and other medications will be available if block alone is ineffective for pain control

2. Intraoperative
a. Pad bony prominences
b. Assess skin

3. Postoperative
   a. For all peripheral nerve blocks
      i. Anesthesia or credentialed nursing staff may initiate, adjust and/or administer boluses through the catheter. This may vary by specific state Nurse Practice Act
      ii. Monitor the patient for analgesic efficacy and side effects
      iii. Use analgesic(s) for breakthrough pain as ordered and anticipatory of block wearing off
      iv. Inspect operative extremity
      v. Avoid direct skin contact with ice or heat
      vi. Pad and protect the extremity
      vii. Evaluate activity levels and perform a functional assessment for safe patient transfer/ambulation
      viii. Initiate fall prevention strategies for safe ambulation, especially with lower extremity blocks until sensory and motor function returns
      ix. The order to discontinue the CPNB catheter must be obtained prior to removal
      x. Use a licensed professional with demonstrated competency to remove the CPNB catheter, noting organizational policies and state laws. The patient or family member may remove the CPNB catheter only if ordered and only after being instructed
      xi. The nurse should verify the end of the catheter is intact after removal
      xii. Document findings and treatments
   b. For upper extremity nerve blocks
      i. Use sling until sensory/motor function returns
      ii. Assess for Horner’s syndrome (ipsilateral pupillary constriction, hoarseness, nasal congestion or conjunctival hyperemia)
      iii. Assess for signs and symptoms of pneumothorax (respiratory distress, hypoxemia, hypotension, or tachycardia)
   c. For lower extremity nerve blocks, CFNB and FNB
      i. Instruct not to bear weight without the use of a knee immobilizer if ordered by physician
      ii. Assess for muscle strength prior to ambulation
      iii. Ambulation may need to be supervised or restricted until quadriceps function intact
      iv. Implement fall prevention strategies
         1. Apply gait belt or other assistive devise(s)
         2. Lock and lower bed
         3. Apply non-slip footwear
         4. Emphasize that the patient is never to get up without help
         5. Position call light within reach or stay with the patient
v. Dangle to rule out orthostatic hypotension  
vi. Use a team approach with two or more staff to transfer a patient with CPNB  
vi. Encourage use of the unaffected limb to direct movement  
viii. Avoid asking the patient to pivot or turn with the anesthetized leg (unable to perform)  
ix. Limit time up to reduce muscle fatigue  
x. Educate patient and staff about the increased fall risk and document  


Diagnostic Tests
These diagnostic tests are ordered and utilized for the insertion and placement of PNB and CPNB by the Anesthesiologist.

Ultrasonography is a diagnostic technique in which high-frequency sound waves are directed at internal body structures, and a record is made of the wave pulses as they are reflected back through the tissues. The different acoustic densities differentiate between solid and cystic structures and thereby form an “image” of what organ being studied (Pagana&Pagana, 2002) (Level V).

Nerve stimulator is a medical device in which a stimulation needle is placed sufficiently close to the target nerve, predefined electrical pulses generate muscle contractions at motor efferent fibers and electrically elicited paresthesias at sensory afferent fibers. During this procedure, direct contact of the injection needle with the nerve is intentionally avoided. The nerve stimulator is intended only for the pre-operative localization of nerves; under no circumstances may it be used on a patient during surgery. (B. Braun Medical, 2009) (Level V).

Risk Factors and Association Complications  
1. Neurological complications  
   a. Injury or anesthetic blockade of adjacent structures  
   b. Mechanical trauma to the nerve by needle or intrafascicular injection  
   c. Neuronal ischemia  
   d. Inadvertent needle placement into unwanted locations  
   e. Neurotoxicity of local anesthetics  
   f. Foot drop  
   g. Phrenic nerve palsy, usually effected unilaterally  
      i. May report difficulty breathing or shortness of breath  
      ii. Lung sounds may be diminished on the affected side  
2. Hematoma  
3. Infection  
4. Falls  
5. Drug error  
6. Local anesthetic systemic toxicity (LAST)  
   a. Symptoms progress from tachycardia and hypertension to ringing in the ears, metallic taste in the mouth, numbness of lips, twitching of the eyes and lips and seizures
Education – Patient & Family:

1. Inform patient to expect feelings of numbness and tingling in the recovery period
2. Inform patient that postsurgical pain will return once the block resolves
3. Teach patient to protect any areas with altered sensation (with movement, heat, cold)
4. Inform patient that pain will return once nerve block wears off and to notify the nurse to ensure adequate pain control
5. Explain side effects and contraindications of medications and use the teach-back method for patient/family understanding
6. Instruct patient for signs and symptoms of infection including temperature of more than 101.5 F, redness, drainage from the catheter site, excessive swelling or bleeding of the operative extremity, and pain that is not relieved with medication or rest
7. Patients discharged home with a CPNB infusion pump
   a. Strongly recommend a caregiver be present for the duration of the local anesthetic infusion and be available while the catheter is in use
   b. Provide patients with verbal/written instructions and contact numbers in which to call immediately if:
      i. The catheter site displays signs of infection
      ii. The extremities show signs and symptoms of compartment syndrome
      iii. The patient shows symptoms of local anesthetic toxicity
   c. Provide detailed directions regarding use of the infusion pump, including how to stop the infusion, catheter site care, and removal to patient/caregiver.
   d. Instruct patient to call provider if the motor and sensory effects do not resolve in 36 hours
8. Block specific teaching
   a. Femoral blocks
      i. Instruct patient not to get out of bed without assistance
      ii. Instruct patient to use brace or remain NWB until quadriceps function is fully returned
      iii. Have patient demonstrate proficiency with assistive devices prior to discharging home
   b. Brachial Plexus blocks
      i. Instruct patient to pad areas near the ulnar and radial nerves
      ii. Use of a sling until sensory and motor function returns is recommended

Discharge Destination

Patients can be discharged to a variety of settings post-operatively with continuous perineural infusion pumps to include home, extended care facilities or rehabilitation centers. Prolonged perineural infusion does not necessitate hospitalization. If the patient is going home they will need to demonstrate proficiency with assistive devices (crutches/walker) and ability to state a plan for dealing with obstacles (e.g., stairs).
It is recommended to have a caregiver present for the duration of the local anesthetic infusion if the patient is discharged home. The caregiver should be instructed on the post-operative and pain management plan while the catheter is in use.

Along with standard post-operative instructions, the patient and caregiver should be provided with verbal and written information to include contact numbers to call immediately if the catheter site displays signs and symptoms of infection or if the patient has symptoms of local anesthetic toxicity educate the patient/caregiver to call 911. Detailed instructions include infusion pump use, expectations regarding surgical block resolution, breakthrough pain management, and catheter site care. The patient should be instructed to sponge bathe instead of showering. Instruction on the catheter removal plan should be communicated to include inspection of the catheter tip at discontinuation. The patient should be instructed not to drive or operate heavy machinery.


**Trends and Controversies**

The use of peripheral nerve blocks may become a mainstay of perioperative pain management.

The multimodal approach for postsurgical pain management is critical to patient recovery with peripheral nerve blocks. Possible examples include but are not limited to: pharmacological agents (e.g., oral/intravenous/topical) and non-pharmacological interventions (e.g., distraction/thermal/imagery).

Bupivacaine liposome (Exparel®) is classed as amide anesthetic/analgesic and is approved by the Food and Drug Administration as a single infiltration into the surgical site to produce post-surgical analgesia. It is not a peripheral nerve block. It is being used as part of multimodal pain management.

Updates and improvements in technology related to equipment, needles, catheters and infusion pumps may be made available in the future.

Modification of infiltration techniques may need further research.

Regional anesthesia in children should continue to be monitored.

Another type of peripheral nerve block, the adductor canal block, has recently been studied and is showing promise in the total knee arthroplasty patient population. Initial research studies show an improvement in pain control with a decreased motor involvement, thus reducing the fall risk. Future research is needed to compare adductor canal blocks with femoral nerve blocks.

(Jaeger, et al., 2013) (Level II)
Web Sites

Professionals:
www.hssanes.org/for-patients/block-descriptions-femoral.htm
www.usra.ca/sb_femoral
www.linkinghub.elsevier.com/retrieve/pii/S0883540304002591

Patient and Family:
http://www.webmd.com/pain-management/guide/nerve-blocks
www.hssanes.org/for-patients/block-descriptions-femoral.htm
www.clinicaltrials.gov/ct2/show/NCT00135889
References

Agency for Healthcare Research and Quality. (2011a). 04.81 injection of anesthetic into peripheral nerve for analgesia. Retrieved from http://hcupnet.ahrq.gov/HCUPnet.jsp?Parms=H4sIAAAAAAAAATMLE4sSwTzDDY0TA0IMkzMTDUwSfKzME5LS8tMBEignQYms4A0Abw1G8otAAAA9CB1212874A6E6E3D55E50D232C267500C51B5CE7


Agency for Healthcare Research and Quality. (2011c). ICD-9-CM principal procedure code: 81.54 total knee replacement. Retrieved from http://hcupnet.ahrq.gov/HCUPnet.jsp?Parms=H4sIAAAAAAAAATMLE4sSwTzDDY0TA0IMkzMSrUwTPizNUUxLDE5KTcoJcAxjzUxN9k3MBME0CEjMSkt0NUoEALaka2w7AaAEE2DE249811F2D8E0E12CE3956C6EAF3F77A0DF4


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<thead>
<tr>
<th>Level</th>
<th>Description</th>
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<tbody>
<tr>
<td>Level I</td>
<td>High-quality randomized controlled trial with large sample and statistically significant difference or no statistically significant difference but narrow confidence intervals Evidence from a systematic review, a meta-analysis, or an evidence-based clinical practice guideline where only results from randomized controlled clinical trials were used.</td>
</tr>
<tr>
<td>Level II</td>
<td>Evidence from at least one well-designed randomized prospective comparative clinical trial. Systematic review of primarily Level II studies.</td>
</tr>
<tr>
<td>Level III</td>
<td>Evidence from well-designed case controlled trials without randomization, comparative studies and evidence from a systematic review, a meta-analysis, or an evidence-based clinical practice guideline where results from randomized clinical trials and controlled clinical trials were used. Systematic review of primarily Level III studies.</td>
</tr>
<tr>
<td>Level IV</td>
<td>Evidence from case series and cohort studies. Evidence from well-designed descriptive, qualitative, or psychometric studies. Evidence from a systematic review, a meta-analysis, or meta-synthesis of descriptive or qualitative studies.</td>
</tr>
<tr>
<td>Level V</td>
<td>Evidence from the opinion of authorities or experts.</td>
</tr>
<tr>
<td>Level VI</td>
<td>Common practice, as documented in clinical articles or nursing textbooks.</td>
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</table>