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Acute Pain Service Reference Manual:

Single Injection Nerve Blocks and Continuous Peripheral Nerve Blocks

2020

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KNOWLEDGE, SKILL AND JUDGEMENT FOR MANAGEMENT OF PATIENTS WITH SINGLE INJECTION NERVE BLOCKS AND CONTINUOUS PERIPHERAL NERVE BLOCKS

The purpose of this resource manual is to provide health care members with information that will assist them in the management of patients with pain, the monitoring of a patient with a single injection nerve block and/or a continuous peripheral nerve block.
As a professional, it is an expectation that the nurse and anesthesia assistant be responsible and accountable for ensuring that they have the knowledge, skill and judgement to provide quality patient care.

KNOWLEDGE:

Do I …?

- Know the anatomy and physiology of the peripheral nerves commonly accessed in nerve blocks
- Know the principles of nerve blocks
- Know the safety measures regarding the monitoring of a patient with a nerve block
- Know the mechanism for the transmission of pain and pain control
- Know the medications used in nerve blocks and their side effects

Medications

- Local anesthetics including bupivacaine, lidocaine, ropivacaine
- Epinephrine

Lipid Emulsion

- Know the possible complications associated with nerve blocks during insertion and maintenance as well as continuous peripheral nerve block catheter maintenance and removal.
- Know when and who to contact in an emergency situation with reference to:
  - Allergic reaction
  - Respiratory depression
  - Decrease in level of consciousness
  - Hypotension
  - Extensive sensory block
  - Excessive motor block
  - Local Anesthetic Systemic Toxicity (L.A.S.T)
  - Inadequate pain management
- Know where to locate the Policy, Procedure and Standards of Care.
- Know where to locate the 20% intralipid for the treatment of local anesthetic toxicity
- Know where to locate the nerve block equipment (nerve blocks are performed in the Operating Room (OR), Block Room, Emergency Department (ED), Intensive Care Unit (ICU), or Post Anesthetic Care Unit (PACU)

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SKILL:

I can …

- Assist with insertion (in PACU, Block room, ED and ICU).
- Demonstrate the assessment of sensory and motor block.
- Demonstrate the proper documentation with reference to:
  - Physician's Orders
  - Regional Anesthesia Procedure Record (RVH-0928 for AAs) and in PCS- Peripheral Nerve Block (PNB) Intervention
  - Medication Administration Record (if applicable)
  - Acute Pain Management Record
  - Motor and Sensory assessment findings
- Assess the learning needs and provide education for patients with reference to nerve injections and continuous peripheral nerve blocks

JUDGEMENT:

I will …

- Recognize and take appropriate nursing action with reference to:
  - Allergic reaction
  - Vital Signs and oxygen saturation changes
  - Decrease in level of consciousness
  - High sensory block
  - Excessive motor block
  - Local Anesthetic Systemic Toxicity
  - Inadequate pain management
  - Complications of a nerve block, catheter insertion and maintenance of the catheter including removal

COMPETENCIES:

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To establish competency in caring for a patient with a nerve block injection and/or continuous peripheral nerve block catheter insertion and maintenance:

- Review the learning package
- Attend an in-service on Pain Management, Nerve Block injections and continuous peripheral nerve blocks.
- Know and understand the RVH Corporate Policy and Procedure and Standard of Care pertaining to Nerve Blocks
- Know and understand the RVH policy regarding Advanced Practice Skills
- Successfully complete a written test with a minimum mark of 80%

To maintain competency the RN/RPN/AA will seek out further education and experience:

- If the skill has not been utilized regularly
- If the RN/RPN/AA does not feel confident in performing these skills
- As identified through peer evaluation and/or nursing unit manager

You are encouraged to access and utilize learning resources that can help you address your learning needs. These can include:

- Nursing Unit Manager and Clinical Educators
- Pain Management Nurse/ Department of Anesthesia/Anesthesia Assistants
- Nursing Staff
- RVH Acute Pain Service Resource Manual
- RVH policy, procedures, and standards of care
- The College of Nurses Standards
- The Health Library : current textbooks, journals, and internet
- Reference list

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DEFINITION OF TERMS

Dermatomes are areas of the skin innervated by a given pair of spinal nerves. The level corresponds to the vertebral number from which that pair of spinal nerve exists.

Horner's Syndrome is caused by the disruption of a nerve pathway from the brain to the face and eye on one side of the body. It is characterized by decreased pupil size on the affected side, drooping of the eye lid and decreased sweating on the affected side of the face.

Local anesthesia is a temporary loss of feeling in one small area of the body caused by the application of anesthetic preparation. The patient may be alert but has no feeling in the area of the body treated with the anesthetic. Local anesthetics may be injected or put on the skin to lessen pain during a medical, surgical, or dental procedure.

Local Anesthetic agents consist of a number of local anesthetic preparations which differ in onset of action, duration of effects and relative toxicity. The practitioner performing the nerve block determines the agent best suited to each patient. Longer acting agents such as bupivacaine 0.25% to 0.50% are commonly used in blocks of the lower extremities and may provide 12 to 18 hours of pain relief.

Major Plexus Blocks are areas where there are large intricate neural networks that innervate the extremities, part of the neck and pelvis. The four major plexuses are **cervical, brachial, lumbar and sacral**.

Blocks performed on the **cervical plexus** can include: deep cervical plexus block (paravertebral) or superficial cervical plexus (superficial face and scalp blocks).

Blocks performed on the **brachial plexus** can include: interscalene, supraclavicular, infraclavicular and axillary.

Blocks performed on the **lumbar plexus** can include femoral, saphenous (adductor canal block) and lateral cutaneous.

Blocks performed on the **sacral plexus** can include: sciatic and gluteal.

Field blocks are a regional anesthetic technique in which the goal is not to block individual nerves, but rather, a large area using a large volume of local anesthetic, usually proximally or around the boundaries of the surgical field. An example would be a Fascia Iliaca Block (FIB).

Peripheral nerve blocks are single injection blocks of a local anesthetic, aiming to block the individual nerves. Examples include popliteal, saphenous, ankle, median and ulnar.

Local Anesthetic Systemic Toxicity high plasma concentrations of a local anesthetic contributing to various signs and symptoms that could include and progress to respiratory and/or cardiac arrest.

INTRODUCTION TO NERVE BLOCK INJECTIONS

The following are principles of Nerve Blocks and analgesia:

A nerve block is a regional anesthetic technique which produces sensory and/or motor blockade in specific areas of the body. Onset and duration are dependent on the drugs used, their concentration and volume, the addition of epinephrine and the site of injection. Typical length of analgesic effect is 4 to 18 hours depending on these factors as well as the practitioner performing the block. Nerve blocks interrupt nociceptive nerve conduction of impulses through the use of local anesthetics, which bind to specific receptor sites on the Na+ channels in the nerve.

Nerve blocks are used in selected operative procedures. They can provide both preemptive analgesia and are used as a component in multimodal analgesia techniques that offer extended pain management both intra and postoperatively. Nerve blocks may provide an alternative to anesthesia or as an adjunct to anesthesia. Nerve blocks are commonly utilized preoperatively to minimize the pain stimulus before any surgical intervention begins. Detailed knowledge of anatomy, technique and possible complications is vital to correct placement of local anesthetic near the target nerves.

Advantages of peripheral nerve blocks for multimodal pain management include decreased postoperative pain, lower analgesia requirements, particularly opioids and increased patient satisfaction with their pain management. Nerve blocks may also facilitate earlier ambulation and discharge. A decrease in postoperative side effects such as sedation and nausea & vomiting have been reported which likely reflect the opioid sparing effects of this technique.

Limitations to single injection nerve blocks include technical expertise related to block administration, skilled clinicians to monitor patients intra-operatively and postoperatively, time allotment for insertion of the block and the suitability of patients for this procedure.

Single Injection Nerve blocks performed at RVH can be categorized as three different types, as defined in the policy and procedure:

1) Major Plexus Blocks
2) Peripheral Nerve Blocks
3) Field Blocks

A single injection of local anesthetic has limited and variable lengths of surgical anesthesia or pain relief. Typical length of analgesic effect related to single dose peripheral nerve blocks is 4 to 24 hours post injection. These are highly variable related

to a number of factors including choice of agent, dose and expertise of the practitioner placing the block.

INTRODUCTION TO CONTINUOUS PERIPHERAL NERVE BLOCKS

A continuous peripheral nerve block (CPNB) allows for area specific analgesia for different types of surgeries, similar to a single injection nerve block. However, compared to single-injection nerve block techniques, CPNB involves the percutaneous insertion of an indwelling catheter in the proximity of a target nerve (also known as a perineural catheter) that acts as a conduit for a continuous local anesthetic infusion.

Advantages of the use of CPNB facilitates same-day discharge after many types of extremity surgery which would have required at least overnight admission for pain control only a few years ago. Even for patients who undergo knee or shoulder replacement surgery, CPNB analgesia decreases the time to achieve discharge criteria and may be continued outside of the hospital setting for patients eligible for ambulatory recovery.

A CPNB allows for an extended period of analgesia for as long as the catheter remains in place and is working effectively. Return of sensation occurs usually a few hours post catheter removal.

Limitations to CPNB include technical expertise related to insertion of the catheter, time allotment to perform the insertion, appropriately selected patients as the ability to look after the catheter while at home must be considered for outpatients and the use of limb immobilizers/ slings are often required to protect the surgical limb post operatively.

Patients going home with nerve blocks are required to receive specific post-operative instructions for care of the catheter, its removal, any expected issues as well as ensuring there is a care taker going home with the patient.
Follow up discharge phone calls by a knowledgeable health care provider, as well as a contact number for any issues that arise while at home are supplied to the patient on discharge.

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ANATOMY AND PHYSIOLOGY

Neural Anatomy of the Upper Extremities:

Approaches to the Brachial Plexus include:

- Interscalene; most commonly used for shoulder surgery
- Supraclavicular
- Infraclavicular
- Axillary

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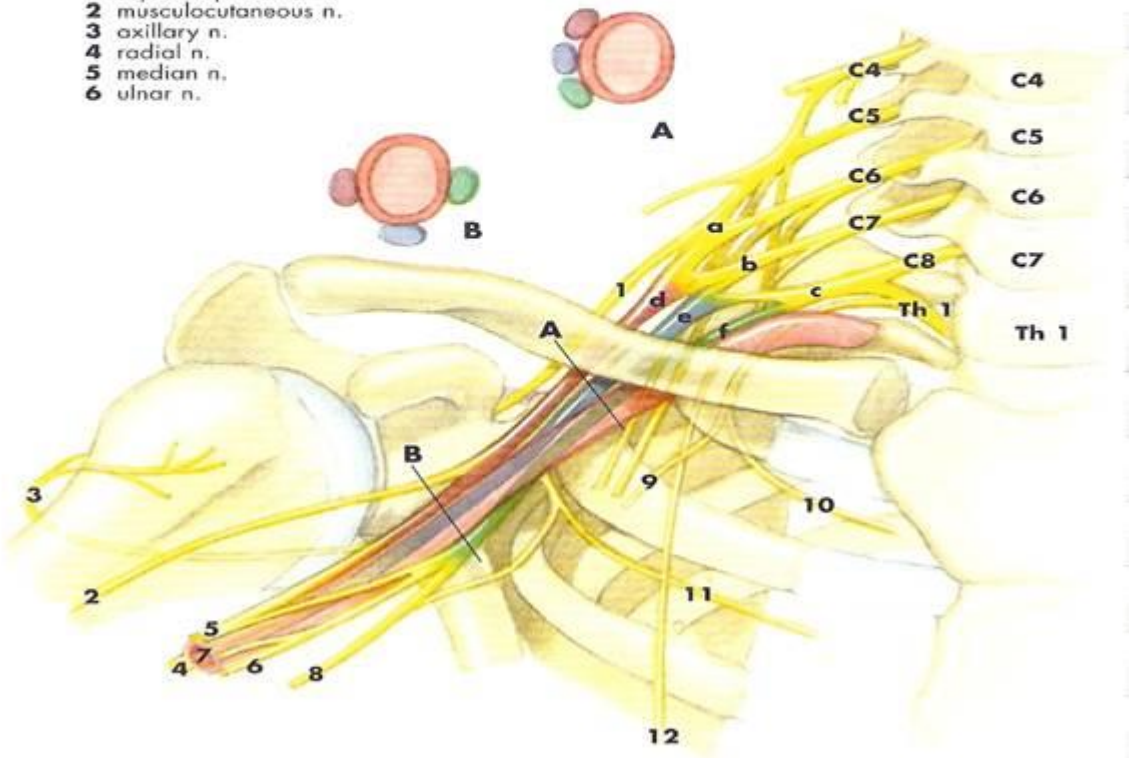
Anatomy of the brachial plexus

a superior trunk (rami ventrales C5 and C6)
b middle trunk (ramus ventralis C7)
c inferior trunk (rami ventrales C8 and Th1)
d lateral cord
e posterior cord
f medial cord

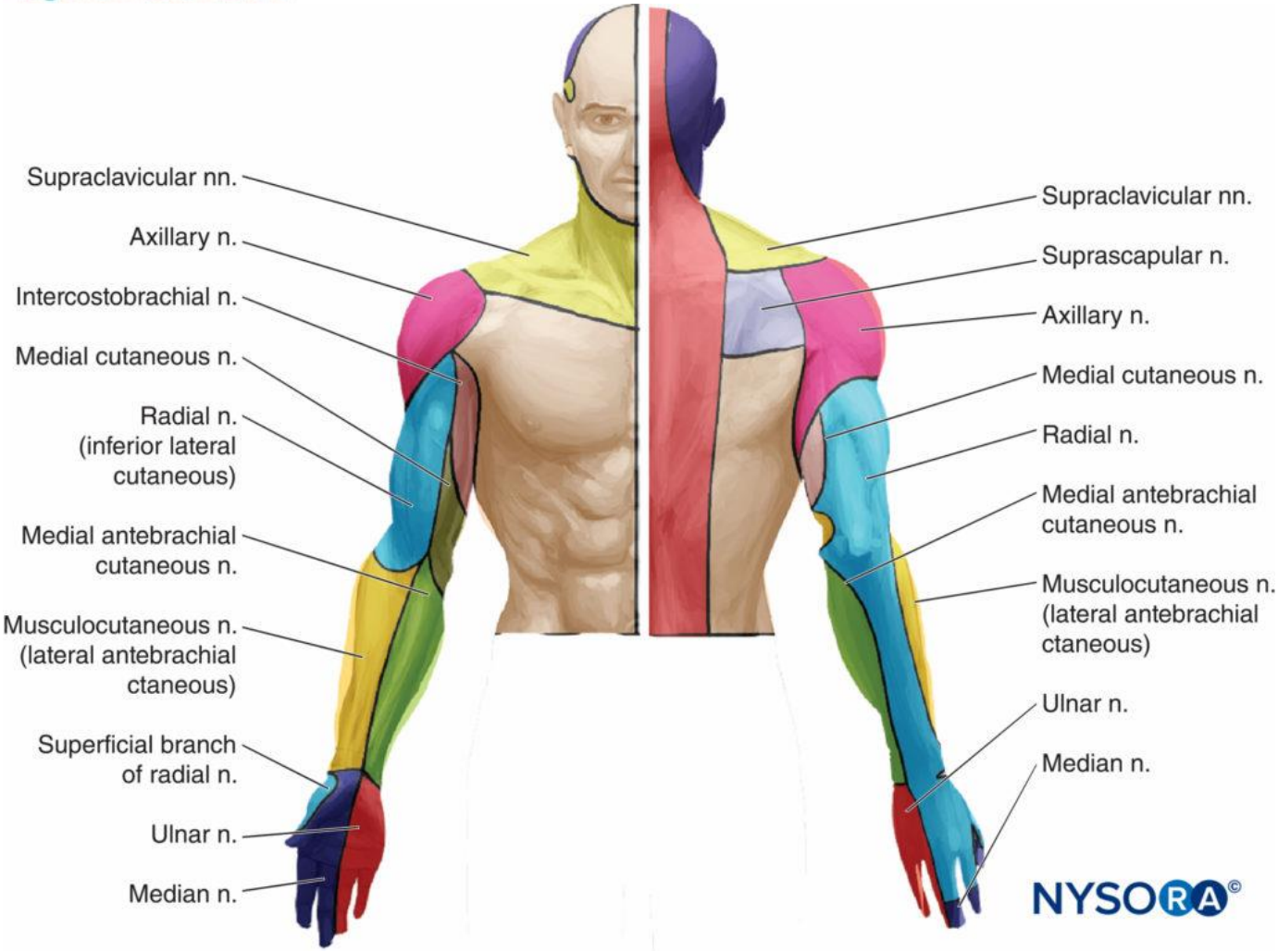
1 suprascapular n.
2 musculocutaneous n.
3 axillary n.
4 radial n.
5 median n.
6 ulnar n.
7 medial antebrachial cutaneous n.
8 medial brachial cutaneous n.
9 intercostobrachial n.
10 intercostal n. I
11 intercostal n. II
12 long thoracic n.



A + B: Sectional plane in the infraclavicular and axillary region. Please note the position of the cords.

Meier,G., Buttner,J. Regional anaesthesia pocket compendium of peripheral nerve blocks 4th edition, Arcis Publishing Company, Germany, 2006, pg. 10

Sensory Supply of the Upper Extremities:



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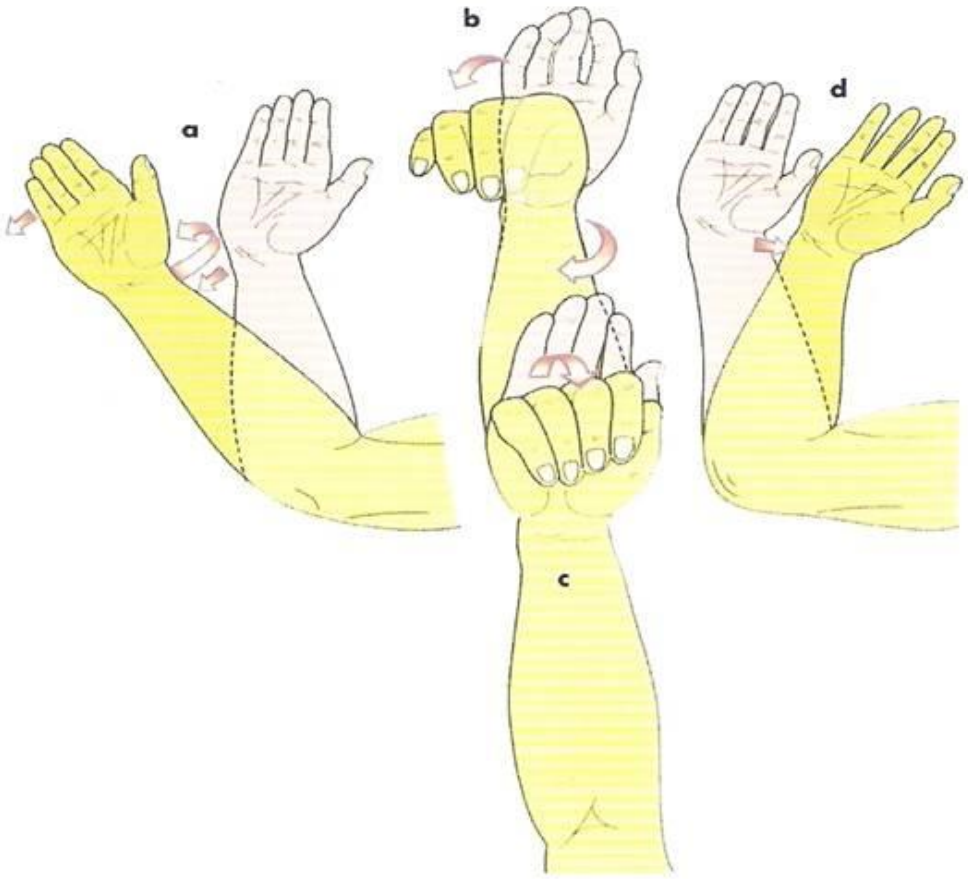
Upper extremity motor response to nerve stimulation

Motor functions of the peripheral nerves in the upper extremities

a radial n.: stretching elbow and fingers
b median n.: flexion of the fingers
c ulnar n.: flexion of the forth and fifth fingers with opposition of the first finger
d musculocutaneous n.: flexion (and supination) of the forearm



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Neural Anatomy of the Lower Extremities

Approaches to the Lumbar Plexus include:

- Femoral
- Popliteal
- Saphenous (adductor canal)

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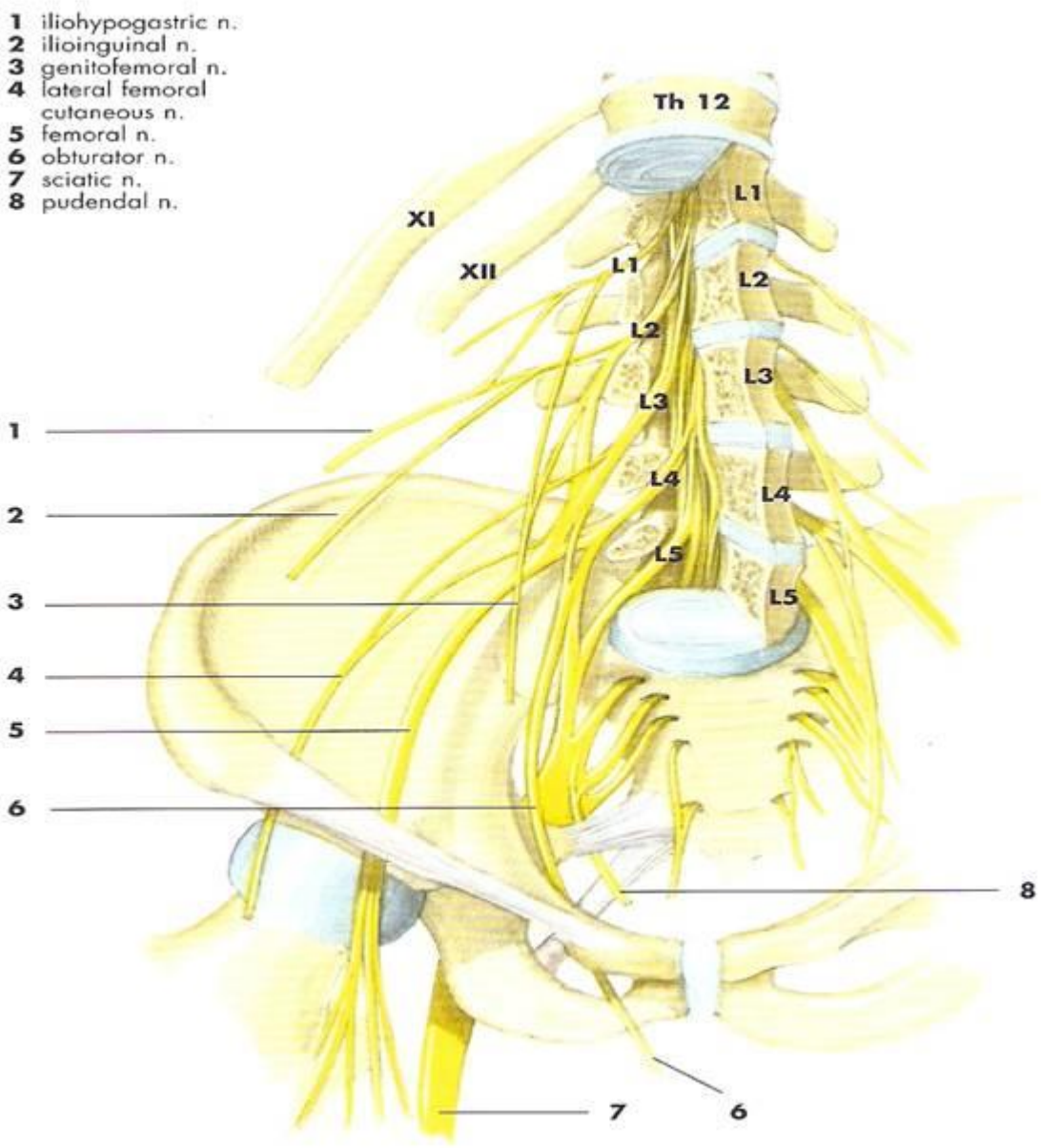
Lumbosacral plexus



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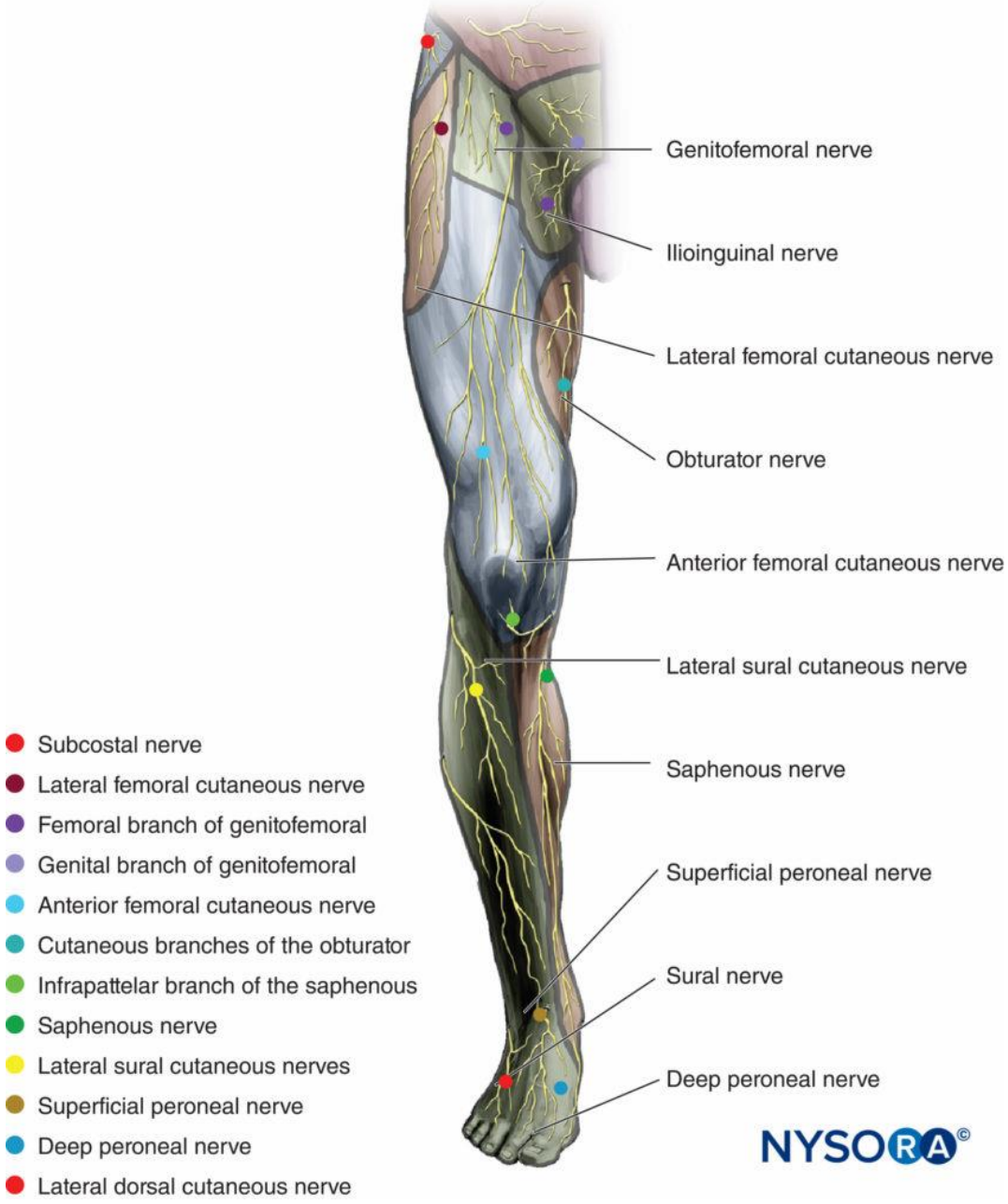
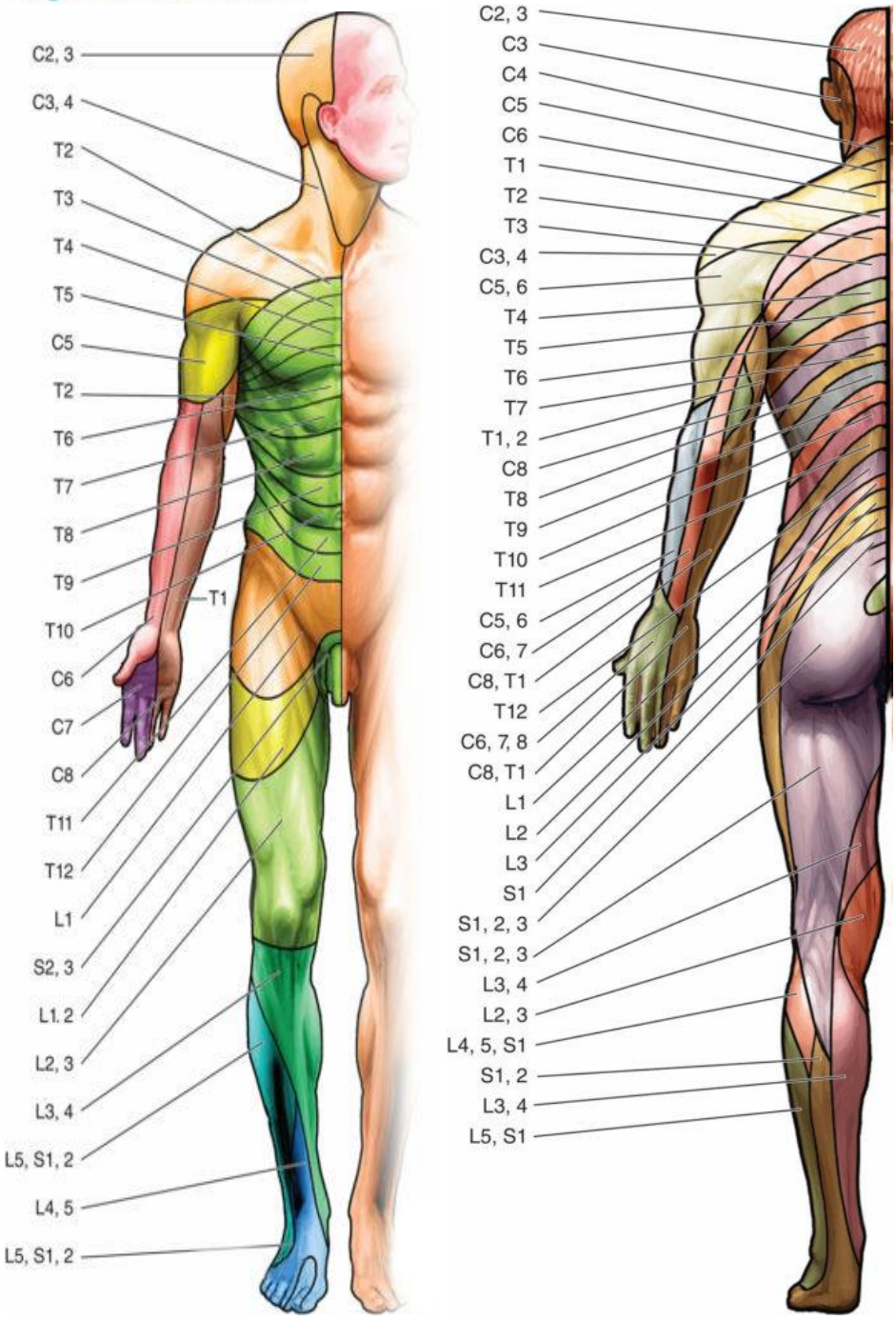
Sensory Supply for the Lower Extremities:



New York School of Anesthesia. *Cutaneous Nerve Blocks of the Lower Extremity.* Retrieved on July 15, 2019 from: https://www.nysora.com/techniques/lower-extremity/saphenous/cutaneous-nerve-blocks-lower-extremity/

Dermatome Levels for Motor and Sensory Documentation of the Upper and Lower Extremities:



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Sensory Block:

- The spinal cord gives rise to 31 pairs of spinal nerves branching off the spinal cord.
- Nerves branch from the 1st thoracic to the 5th sacral vertebrae.
- Each of these nerves is composed of an anterior motor root and a posterior sensory root.
- Each nerve receives sensory information that refers to a particular skin area.

SENSORY DERMATOMES REFERENCES

C-4	Clavicle
T-4	Nipple
T-10	Umbilicus

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PATHOPHYSIOLOGY OF NERVE BLOCKS

Local anesthetics work by binding to sodium channels in the nerve fibers, reducing the action potential and thus the subsequent nerve transmission of painful stimuli. This is a temporary effect causing loss of sensation in a specific area near the area of injection only. Local anesthetics block the generation and conduction of impulses through all nerve fibers—sensory, motor, and autonomic The duration of action for local anesthetic medication depend on a number of variables including-volume injected, absorption, and the addition of a vasoconstrictor. The addition of a vasoconstrictor, such as epinephrine 1:200,000, prolongs absorption of the local anesthetic and subsequently extends the duration of the block

SEQUENCE OF A NERVE BLOCK

- Temperature discrimination lost.
- Tactile sense diminished
- Motor weakness
- Proprioception lost.

Commonly Used Local Anesthetic Agents

Agent	Techniques	Maximum dose (mg/kg)	Typical Duration of Neural Blockade (Hours)
Bupivacaine 0.125%, 0.25%, 0.5%, 0.75%	Epidural, spinal, infiltration, peripheral nerve block	3 mg/kg	1.5 to 8 hours
Lidocaine 1%, 2%, 4%,	Epidural, spinal, infiltration, peripheral nerve block, intravenous regional, topical	4.5 mg/kg 7 mg/kg with epinephrine	0.75 to 2 hours
Ropivacaine 0.5%,	Epidural, spinal, infiltration, peripheral nerve block	3 mg/kg	1.5 to 8 hours

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NERVE BLOCK MEDICATION

For further information, please refer to the RVH Parenteral Drug Administration Manual.

LOCAL ANESTHETHICS: Bupivacaine (Marcaine), Lidocaine, Ropivacaine

Indications for Use:

- To provide analgesia by blocking transmission of impulses in the nerve fibers.

Action:

- Blocks depolarization by interfering with sodium channel exchange across the nerve cell membrane. Generation and conduction of nerve impulses are prevented.
- Action can be prolonged if combined with epinephrine.

Potential Adverse Effects:

- Allergic Reaction:
  - Rare but can be life threatening
  - Bronchospasm, uticaria, angioedema
  - Anaphylactic shock

- Local Tissue Reactions:
  - Uticaria
  - Blush

- Systemic Toxicity:
  - This can result from:
    - Intravascular injection of local anesthetic
    - Overdose of medication
    - Multiple injections of local anesthetic
    - Injection into a highly vascular tissue bed

- CNS:
  - Excessive depression of inhibitor fibers or centers allowing excessive excitatory input
  - Anxiety, apprehension, nervousness, convulsions, unconsciousness
  - Muscle twitching
  - Numbness of fingers or lips

- CV:

  - Dose related delay in transmission of cardiac impulses by exerting action on cardiac sodium channels
  - Decreased myocardial contractility, refractory dysrhythmias, vasodilation, cardiac arrest

- Respiratory:
  - Apnea, respiratory arrest, status asthmaticus

- GI:
  - Nausea, vomiting

- EENT:
  - Blurred vision, tinnitus

EPINEPHRINE:

Indications for use

- To prolong action of local anesthetics by vasoconstriction of blood vessels and decrease vascular uptake
- Decreases peak medication blood levels because it slows vascular uptake, allowing larger volumes to be injected with decrease chance of toxicity developing.

Action

- Vasoconstriction of localized vessels leads to decreased absorption of local anesthetic drug.

Potential adverse effects

CNS:
- cerebral hemorrhage, tremors, dizziness, restlessness,

CVS
- cardiac arrhythmias, palpitations, tachycardia, hypertension

Resp
- pulmonary edema, dyspnea,

Other
- hyperglycemia

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INDICATIONS FOR SINGLE INJECTION NERVE BLOCKS

Analgesia related to

- Lower limb surgery
- Upper limb surgery
- Abdominal surgery
- Chronic pain management

Many patients experience chronic disease states where ongoing pain is a common issue. These patients may benefit greatly from the addition of a nerve block to their analgesic regime. As mentioned previously, the opioid sparing effects of nerve blocks and the use of adjunct therapy is often associated with greater patient comfort and satisfaction.

CONTRAINDICATIONS TO SINGLE INJECTION NERVE BLOCKS

Absolute Contraindications	Relative Contraindications	Other Considerations
• Patient refusal • Infection at the injection site • Full anticoagulation pre procedure • Coagulopathies	• Bacteremia/sepsis • Low molecular weight Heparin (LMWH) • Pre-existing neurological disorders such as peripheral neuropathies • Substantial head injury • Sedated or unresponsive patients	• Drug allergies to opioids or anesthetic agents

INDICATIONS FOR CONTINUOUS PERIPHERAL NERVE BLOCKS

Patients who meet the criteria for CPNB and to facilitate same-day discharge after many types of extremity surgery which would have required at least overnight admission for pain control. For patients who undergo knee or shoulder replacement surgery. A continuous peripheral nerve block allows for an extended period of analgesia for as long as the catheter remains in and is working effectively. Return of sensation occurs usually a few hours post catheter removal.

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CONTRAINDICATIONS TO CONTINUOUS PERIPHRAL NERVE BLOCKS

Absolute Contraindications	Relative Contraindications	Other Considerations
• Patient refusal • Infection at the injection site • Full anticoagulation pre procedure • Uncorrected bleeding disorder • Liver dysfunction defined as any patient with Child-Pugh's Class B/C liver cirrhosis (classification score used to determine severity of liver disease) • Renal dysfunction defined as creatinine clearance equal to or less than 30 mL/min • BMI greater than or equal to 40 kg • Known severe obstructive sleep apnea (OSA) AHI greater than or equal to events/hour or STOP-Bang score 5 to 8, for patients without a known diagnosis of OSA • Severe COPD, asthma or restrictive lung disease • ASA class 4/5	• Bacteremia/sepsis • Pre-existing neurological disorders such as peripheral neuropathies • Substantial head injury • Sedated or unresponsive patients • Age over 80 years	• Drug allergies to opioids or anesthetic agents • Inability to participate in preoperative and post-operative education, counselling and follow-up; lack of sufficient intellectual ability or understanding; significant mental or psychiatric concerns • Lack of support during recovery • Resides far from hospital (greater than 2 hours driving distance from RVH proposed) • Chronic pain with narcotic dependence

STOP-Bang questionnaire

☐Yes	☐No	**Snoring?** Do you **snore loudly** (loud enough to be heard through closed doors, or your bed partner elbows you for snoring at night)?
☐Yes	☐No	**Tired?** Do you often feel **tired, fatigued, or sleepy** during the daytime (such as falling asleep during driving)?
☐Yes	☐No	**Observed?** Has anyone **observed** you **stop breathing** or **choking/gasping** during your sleep?
☐Yes	☐No	**Pressure?** Do you have or are being treated for **high blood pressure**?
☐Yes	☐No	**Body mass index more than 35 kg/m²?**
☐Yes	☐No	**Age older than 50 years old?**
☐Yes	☐No	**Neck size large? (measured around Adam's apple)** For male, is your shirt collar 17 inches or larger? For female, is your shirt collar 16 inches or larger?
☐Yes	☐No	**Gender = Male?**
Scoring criteria:		
		Low risk of OSA: Yes to 0 to 2 questions
		Intermediate risk of OSA: Yes to 3 to 4 questions
		High risk of OSA: Yes to 5 to 8 questions

References:

Chung F, Yegneswaran B, Liao P, et al. (2008). *STOP questionnaire: a tool to screen patients for obstructive sleep apnea.* Anesthesiology; 108:812.

Chung F, Subramanyam R, Liao P, et al. (2012). *High STOP-Bang score indicates a high probability of obstructive sleep apnoea.* Br J Anaesth; 108:768.

COMPLICATIONS

Potential life threatening complications from Nerve block injections are rare but present. If nerve damage occurs it is usually temporary, and most patients make a full recovery within a few days or weeks. Permanent nerve damage is rare.

- All patients require continuous monitoring capabilities: ECG, NIBP, SpO2 for block insertion and catheter placement
- Frequent assessment of the patient is required to rule out local anesthetic toxicity.

Complication	Rationale	Assessment / Intervention
Nerve Injury	• Mechanical nerve injury by needle (laceration)	• Use of ultrasound guidance improves safety • Short bevel insulated needles • Needles of appropriate length for each block technique • Surface localization • Slow controlled needle advancement • Use of Nerve stimulator • Most authors suggest that nerve stimulation with current intensity 0.2 to 0.5 mA (0.1 msec) indicates intimate needle-nerve placement • Stimulation with current intensity less than 0.2mA may be associated with intraneural needle placement • Motor response to nerve stimulation may be absent even when the needle is inserted intraneurally.
	• Intraneural injection	• Avoidance of forceful, fast injections • Avoidance of injection against abnormal resistance • Abort injection if pain is reported by the patient • Use fractionated injections
	• Compressive hematoma	• Use of ultrasound guidance improves safety • Avoidance of vascular structures
	• Toxicity of injected solution	• Correct choice of local anesthetic (strength and volume)
	• Neuronal ischemia (disrupted blood supply)	• Use of ultrasound guidance to avoid vascular structures

Complication	Rationale	Assessment / Intervention
Vascular injury	• Hemorrhage • Hematoma • A large hematoma may press on a nerve causing damage	• Use of ultrasound guidance to avoid vascular structures • Correct patient selection
Infections	• Lack of sterile technique	• Maintain sterile technique
Pneumothorax	• Caused by stimulating needle pleural puncture during Brachial Plexus Blocks (Shoulder)	• Needles of appropriate length for each block technique • Slow controlled needle advancement • Use of ultrasound guidance to avoid pleural structures
Dural puncture	• Caused by stimulating needle puncture during Brachial Plexus Blocks (Shoulder)	• Needles of appropriate length for each block technique • Slow controlled needle advancement • Use of ultrasound guidance to avoid dural and accidental puncture

Local Aesthetic Toxicity

Signs and Symptoms of Local Anesthetic Toxicity		Assessment / Intervention
Mild	• Circumoral numbness/ tingling • Slurred speech • Visual disturbance • Tinnitus • Metallic taste • Agitation • Confusion	• Stop injection / infusion of local anesthetic • Call for help • Apply oxygen (if not present) • Consider lipid emulsion therapy at the first cardiac or CNS signs of a serious LAST event • Call for LAST Rescue kit (500 mL lipid emulsion 20%, Several large syringes and needles for administration, IV tubing with in-line filter, ASRA LAST checklist) • Mild symptoms can typically be managed with oxygen and Midazolam (1 to 4 mg) to reduce seizure threshold • For moderate / severe toxicity ACLS/ BCLS support may be required • Maintain ventilation as hypoxemia & acidosis will exacerbate toxicity • Alert the nearest cardiopulmonary bypass team- resuscitation may be prolonged
Moderate	• Convulsions • Seizures • Altered conscious state	
Severe	• Respiratory arrest • Cardiac arrhythmias/Arrest	

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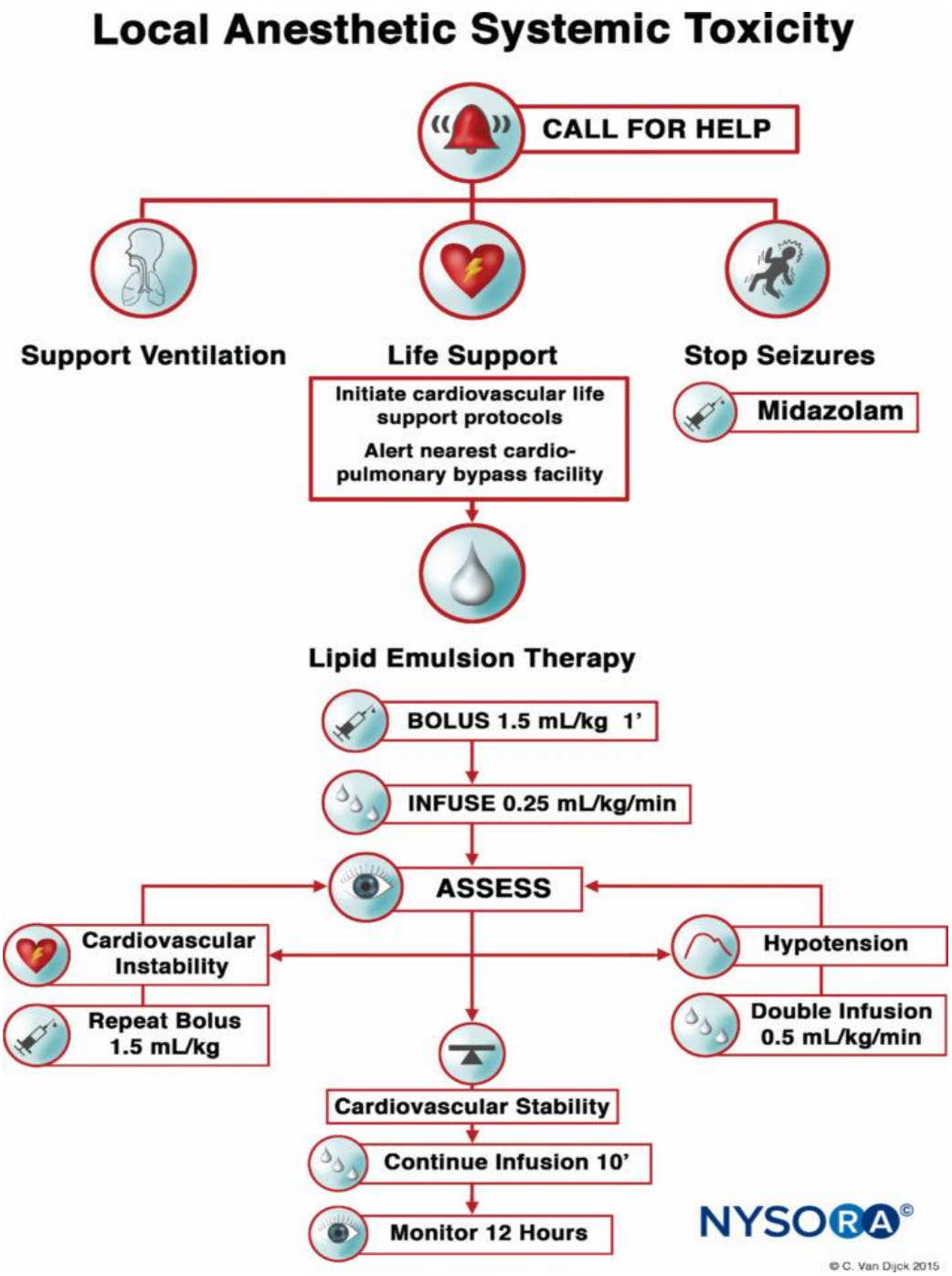

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CONTINUOUS PERIPHERAL NERVE BLOCK CATHETER REMOVAL

RNs and AAs may remove a continuous peripheral nerve block catheter with the order of the Acute Pain Service Physician. Patients who are discharged home with a peripheral nerve block catheter will be taught how to remove the catheter.

Procedure:

- Place the patient in a position of comfort allowing easy access to the catheter site.
- Loosen and remove tape from the area, stabilizing the catheter at the insertion site.
- Gently pull the catheter out in a constant steady motion. If resistance is felt, stop the procedure. Notify Anesthesia. NEVER force the catheter.
- Apply band aid over the puncture site if necessary.
- Assess the catheter tip to visualize a black or blue tip; the dressing and surrounding area for drainage, redness, heat and/or hematoma formation.
- Document the following:
  - Time of removal
  - Insertion site condition
  - Condition of the catheter i.e. intact
  - Assessments

COMPLICATIONS OF CONTINUOUS PERIPHERAL NERVE BLOCK CATHETER REMOVAL

Major complications of catheter removal are rare:

COMPLICATION	RATIONALE	ASSESSMENT/INTERVENTION
Knotted catheter	• May occur if excessive length of catheter is inserted • Resistance will be met when attempting to remove catheter	• If resistance met, stop. Tape catheter in place and notify anesthesiologist
Catheter looped around nerve root	• Pain felt when catheter is pulled on • Increased traction on catheter may result in avulsion of nerve root	• If patient complains of pain while catheter is being removed, stop and notify the anesthesiologist
Local Inflammation	• May occur if catheter	• Inspection of the catheter insertion

at the insertions site	remains in for prolonged duration • May occur with frequent bolus and increased catheter manipulation	site, ensure dressing is dry and intact • Notify anesthesiologist if any signs of redness, swelling, drainage, or increase in body temperature
Nerve dysfunction	• Nerve dysfunction (i.e. paresthesia, pain, or weakness persisting longer than 24 hours post catheter removal) • Hematoma around nerve root, due to anatomical damage (i.e. intravascular or intrathecal migration)	• Assess patient's pain level, motor and sensory function post catheter removal • Patient education regarding duration of block effect and importance of notifying a physician if prolonged duration occurs • Notify anesthesiologist if paresthesia, pain or weakness occur greater than 24 hours after catheter removal
Catheter Shearing	• May occur if catheter is inserted beyond the needle tip and then pulled back • Catheter fragment may be retained in site	• Inspect catheter tip on removal to ensure the catheter is intact • Notify anesthesiologist if catheter is not intact and save catheter for inspection
Hematoma	• Injury to adjacent vascular structures • Multiple punctures during insertion	• Inspect site for swelling, bruising, pain, and sensation • Time is the treatment for hematoma. Usually resolves in 1 to 2 weeks

ROUTINE CARE OF THE PATIENT

In caring for a patient with a single injection nerve block and/or nerve catheter, the nurse must ensure adequate pain control and good risk management through ongoing assessments and early intervention to avoid potential problems.

- All patients receiving a major plexus block or peripheral nerve block, must have a patent peripheral vascular access for a minimum of 24 hours or the duration of their hospital stay, whichever is less.
- Document in the EMR under Analgesia: Peripheral Nerve Block/PNB Catheter
- Change nerve block catheter tubing if the tubing becomes contaminated, or contamination is suspected and/or if there is fluid leakage
- Elevate head of bed for patients that had interscalene block (due to potential for recurrent laryngeal nerve & phrenic nerve involvement)
- Patients with interscalene blocks need close monitoring for signs and symptoms of pneumothorax, hoarseness of voice, Horner's syndrome and phrenic nerve involvement.

Assessments of the patient include:

- Vital signs: Blood pressure, pulse, respirations and oxygen saturation
- Pain scale score
- Sedation score
- Level of sensory block
- Extent of motor block
- Ongoing assessments for resolution of nerve block as evidenced by return of sensation and movement to the affected site

Inform anesthesia or Acute Pain Service immediately of significant changes in patient condition.

CARE FOR THE PATIENTS GOING HOME

- For same day discharge, ensure the patient has the proper immobilization device as ordered by the Most Responsible Provider (MRP) (e.g. upper limb- sling, lower limb- Zimmer)
- Provide health teaching to patient and family for same day discharge patients including review of the Peripheral Nerve Patient teaching pamphlet highlighting:
    a. limited use of affected extremity
    b. needs for assistance with activities of daily living
    c. alteration in mobility
    d. pain management as the nerve block wears off
    e. protection of extremity with proper positioning and/or immobilization
    f. decreased sensation of extremity including caution when exposing extremity to heat and cold.

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Sedation Score/ Assessment:

To assess sedation, record the appropriate Richmond Agitation Sedation Scale (RASS):

Richmond Agitation Sedation Scale (RASS)

Score	Term	Description
+4	Combative	Overtly combative or violent, immediate danger to staff
+3	Very Agitated	Pulls on or removes tubes or catheters, aggressive behavior toward staff
+2	Agitated	Frequent non purposeful movement or patient-ventilator dyssynchrony
+1	Restless	Anxious or apprehensive but movements not aggressive or vigorous
0	Alert and Calm	
-1	Drowsy	Not fully alert, sustained (>10 seconds) awakening, eye contact to voice
-2	Light Sedation	Briefly (<10 seconds) awakens with eye contact to voice
-3	Moderate Sedation	Any movement (but no eye contact) to voice
-4	Deep Sedation	No response to voice, any movement to physical stimulation
-5	Unarousable	No response to voice or physical stimulation
Procedure		
1.	Observe patient. Is patient alert and calm (score 0)?	
2.	Does patient have behavior that is consistent with restlessness or agitation?	
	Assign score +1 to +4 using the criteria listed above.	
3.	If the patient is not alert, in a loud speaking voice state patient's name and direct patient to open eyes and look at speaker. Repeat once if necessary. Can prompt patient to continue looking at speaker.	
	Patient has eye opening and eye contact, which is sustained for more than 10 seconds (score -1).	
	Patient has eye opening and eye contact, but this is not sustained for 10 seconds (score -2).	
	Patient has any movement in response to voice, excluding eye contact (score -3).	
4.	If patient does not respond to voice, physically stimulate patient by shaking shoulder and then rubbing sternum if there is no response.	
	Patient has any movement to physical stimulation (score -4).	
	Patient has no response to voice or physical stimulation (score -5).	

(Sessler C, Gosnell M, Grap MJ, et al. 2002)

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Pain Management Assessment:

- Pain assessment needs to be ongoing and consistent. Health teaching of the patient must include instructions to notify the nursing staff of any discomfort.

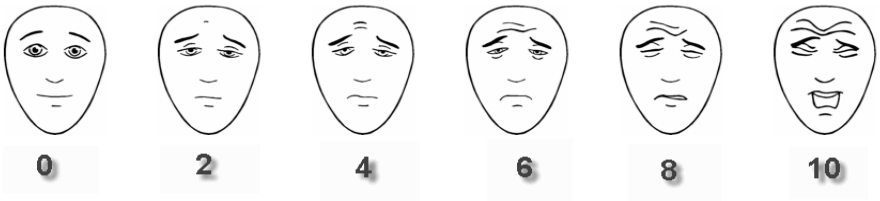
- Assessed and charted on the RVH PCS Interventions:
  a) Physical Assessment→ CVS →Motor Function and Sensation
  b) Pain Assessment with each vital sign and sedation score

Subjective score:
S 0 – No pain
S 3 to 4- Manageable pain
S 10 – Most severe pain patient can imagine

Objective Pain Score: (only utilized when patient is unable to verbalize pain)

Ob1 = Resting quietly
Ob2 = Restless
Ob3 = Grimacing
Ob4 = Writhing and crying out
Ob5 = Maintenance of analgesia

Faces Scale Revised:



In cases where patients have indwelling PNB catheters and pain scores are continuing to rise, it may be necessary to call anaesthesia to potentially administer additional bolus doses of local anaesthetic or adjust infusion pumps as required while in a temporary monitored setting. These procedures would only be undertaken by an anaesthesiologist. PNB catheter patients are monitored every 4 hours and PRN until 24 hours after PNB catheter is removed.

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Motor Function Assessment:

The rationale for regular motor checks is identification of peripheral nerve injury. This is a rare complication but does bear close observation.
The following motor scale may be effectively utilized in patients who have received a lower limb PNB. Documentation of findings can be done on EMR under the Analgesia: *Epidural/ Spinal Intervention or Physical System Assessment → Cardiovascular & Neurovascular Assessment*
Patients with peripheral nerve blocks will have limited use of extremity, alteration in mobility or immobilization of the extremity for protection or proper positioning for surgical repair healing. I.e. Total knee replacement patients may require Zimmer splint for ambulation or patients with rotator cuff repair use a shoulder immobilizer to protect the affected limb and avoid further injury and/or surgical site compromise.

Motor Scale	
Mild (Lift/Flex- Knee & Feet)	Mild (Flex-Ext Wrist)
Moderate (Flex- Ankle & Feet)	Mod(Flex-Ext Elbow)
Maximum (No Flexion)	Max (Add-Abd Shoulder)
Motor Block Absent	

Motor Block Scale
0 = No Block
1 = Able to lift and flex knees
2 = Able to move ankles and feet only
3 = unable to move legs or feet

Sensory Block Assessment:

Cold fibers are most sensitive to anesthetic block; therefore, a cold substance (ice cube) is used to assess the level of sensory block. Assess an unblocked area (such as opposite arm or leg) by asking the patient to describe their perception once ice is applied (i.e. cold), and compare this with the sensation experienced when the ice is applied to an expected blocked area. A sensory block exists if there is a difference in cold sensation or the patient is unable to feel any sensation. Document the associated dermatome level.

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INITIATION OF SINGLE INJECTION NERVE BLOCK AND CONTINUOUS PERIPHERAL NERVE CATHETER ANALGESIA

1. Speak with patient to confirm planned procedure and understanding of proposed nerve block. Answer any questions regarding block.
2. Explain procedure and reassure patient.
3. Place patient in a position of comfort and one which facilitates placement of the nerve block and apply monitors for ECG, pulse oximetry, B/P. Establish baseline vitals before procedure commences.
4. Gather sterile supplies & equipment for procedure.
5. Assist anesthesiologist with procedure including preparation of the site, placement and operation of nerve stimulator, use of ultrasound to confirm position, administration of local anesthetic as per MRP instruction. PNBs are typically done with the addition of ultrasound guidance to ensure proper placement of the medication near the nerve but not within the nerve (interneural). A nerve stimulator is connected to the insulated stimulating needle and a small electrical current is passed through the needle which stimulates the muscles associated with that motor nerve to contract. It is through the combination of both ultrasound guidance and nerve stimulation that correct placement of the local anesthetic agent can be achieved. The local anesthetic agent is injected slowly, 5 mL at a time, with gentle aspiration through the needle before each bolus dose. This ensures that the needle has not inadvertently been placed intravascularly.
6. Monitor vital signs (HR & BP) every 5 minutes and document patient status throughout procedure. Close observation for signs and symptoms of local anesthetic toxicity during block placement is vital. Administer sedatives as ordered.
7. Monitor for signs of local anesthetic toxicity and document significant findings:
    a) Numbness of tongue, circumoral tingling
    b) Tinnitus
    c) Metallic taste in the mouth
    d) Light-headedness
    e) Visual disturbances
    f) Tremors
    g) Dysarthria, change in affect, drowsiness
    h) Loss of consciousness leading to convulsions and then apnea
    i) Cardiac Involvement

    Patients on cardiac monitoring may show effects on cardiovascular conduction contractility and vascular tone, beginning with myocardial depression, followed by increased HR and BP. Prolonged PR interval, widening of the QRS, AV dissociation and arrhythmias may occur with vasodilation leading to decreased BP.
8. Once complete and the patient is stable they may be transported to the operating suite or nursing unit as required.
    - Monitor and document movement and sensation in block area every 4 hours and as required for 24 hours or the length of the patients stay, whichever is less.

9. Patients with a single injection *major plexus* or *peripheral nerve block* should be monitored for signs of local anesthetic toxicity for the first 30 minutes after injection. They must also have peripheral intravenous access for a minimum of 24 hours unless being discharged the day of surgery.

   This includes ECG and BP monitoring as follows:
   a) every 5 minutes for first 15 minutes following block
   b) then every 15 minutes times 3

- Patients with a single injection *field block* should be monitored for signs of local anesthetic toxicity for the first 15 minutes after injection.

This includes BP and HR monitoring as follows:
a) Pre procedure
b) Immediately post procedure
c) 15 minutes post procedure

Report regarding patient status both pre, intra, and post procedure is provided to the receiving nurse. Follow any orders as per Acute Pain Service thereafter.

EQUIPMENT FOR SINGLE INJECTION NERVE BLOCK PROCEDURE:

Major Plexus or Peripheral Nerve Block

1. Local Anesthetic of physician choice (examples include: Bupivacaine 0.25% with Epinephrine, Ropivacaine) 20 to 40 mL as directed by MRP.
2. 1 x 20 mL syringes
3. 2 x 18 g Blunt tip needles
4. SoluPrep Swab (2% chlorhexidine gluconate with 70% isopropyl alcohol)
5. Sterile gloves
6. 5 mL of 2% plain Lidocaine
7. 3 mL syringe
8. 25 g needle
9. 4 pack of sterile towels
10. Hyperechoic needle (with or without stimulating option) (22 g x 50 mm or 22 g x 80 mm)
11. Nerve Stimulator and ECG sticker for application (if required)
12. Ultrasound with appropriate probe
13. Sterile Ultrasound cover
14. Sterile Ultrasound gel
15. Monitors (Blood pressure, ECG at minimum, Spo2)

Field Block

1. Local Anesthetic of physician choice (i.e. Bupivacaine 0.25% with Epinephrine)
2. 2 x 20mL syringes
3. 3 x 18 g blunt tip needles
4. SoluPrep Swab (2% chlorhexidine gluconate with 70% isopropyl alcohol)
5. Sterile gloves
6. 5 mL of 2% plain Lidocaine
7. 3 mL syringe

8. 25 g needle
9. 4 pack of sterile towels
10. Monitors (Blood pressure, HR)
    (The following are optional only if the MRP uses Ultrasound)
11. Ultrasound with appropriate probe
12. Sterile Ultrasound cover
13. Sterile Ultrasound gel

EQUIPMENT FOR CONTINUOUS PERIPHERAL NERVE BLOCKS PROCEDURES:

1. Local anesthetic of physician choice (i.e. Bupivacaine)
2. 1x 20 mL syringe
3. 2x 18 g blunt tip needle
4. SoluPrep Swab (2% with chlorhexidine gluconate and 70% isopropyl alcohol)
5. Sterile gloves
6. 5 mL of 2% plain Lidocaine
7. 25 g Needle
8. 3 mL syringe
9. 4x4 gauze
10. 4 pack of sterile towels
11. Selection of catheter sets of appropriate diameter and length (i.e. 50 mm vs 80 mm length)
12. Nerve stimulator and electrodes (if required)
13. Ultrasound machine
14. Ultrasound with appropriate probe
15. Sterile ultrasound cover
16. Sterile ultrasound gel
17. Occlusive dressing (1x REF1624W, 1x REF 1626W)
18. Catheter securement device
19. 1 x Dermabond securement adhesive
20. Connectors for proximal tip of catheter
21. Medication reservoir and tubing for post op set up

Continuous Peripheral Nerve Block Infusions Using the Baxter® Elastomeric Pump

The Baxter® Elastomeric Pump is a non-electric medication pump designed to provide ambulatory infusion therapy. The local anesthetic is delivered to the patient as the elastomeric balloon consistently deflates and gently pushes the solution through the infusion tubing and into the PNB catheter.

The Elastomeric Infusor pump will be supplied by Pharmacy. The Infusor will be provided prefilled and primed. If the solution is in the fridge this will need to be removed and allowed to come up to room temperature before attaching it to the patient.

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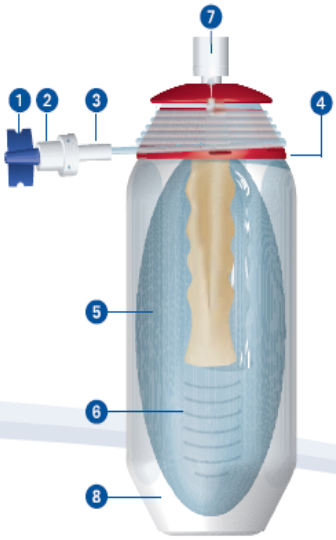
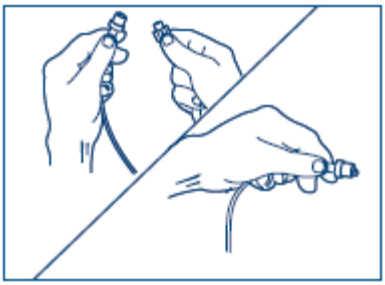
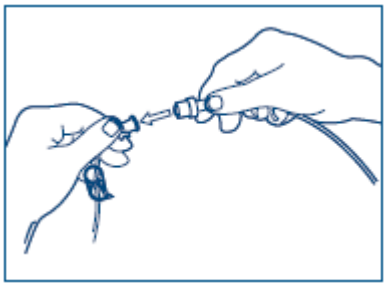
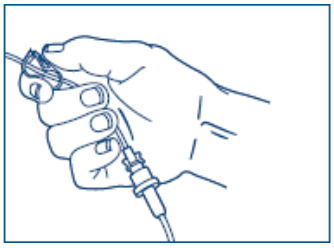
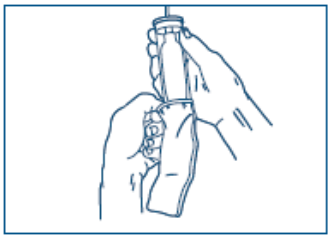
The Elastomeric Infusor:

1. **Winged Luer Cap** protects the opening and stops the flow of medication.
2. **Luer Lock Connector** at the end of the tubing attaches the Infusor/Intermate to the catheter/port.
3. **Flow Restrictor** controls the infusion rate of the medication.
4. **Tubing** is kink-resistant and carries the medication from the device into the patient's body.
5. **Balloon Reservoir** holds the medication.
6. **Progression Lines** may be horizontal or vertical on the plastic housing. These show you the progress of the infusion.
7. **Fill Port Cap** protects the Infusor/Intermate device.
8. **Plastic Housing**.



Connecting the Infusor to the Peripheral Nerve Block Catheter:

	Remove the winged luer cap from the end of the Infusor tubing. Check to make sure that liquid has moved to the end of the tubing.
	Remove the cap from the end of the PNB catheter. Attach the Infusor tubing to the PNB catheter with a quarter clockwise turn. Tape the Luer Lock Connector securely to the patient's skin. Note: <u>Do not</u> use cleaning solutions on the tubings as this could lead to irritation/damage to the nerve.

	**REMEMBER**, open the clamp on the Infusor device so that the fluid can start flowing.
	Place the Infusor in its carrying bag so it is secure. Ensure the top of the device is carried as close to the level of the Luer Lock Connector as possible.

Factors that may affect delivery of the local anesthetic:

	Clinical Information	**Practical Guidance**
Temperature	The Infusor flow rate is most accurate at 33.3 degrees Celsius. • Flow rate will increase by approximately 2.3 percent per 1 degree Celsius increase in temperature. • Flow rate will decrease by approximately 2.3 percent per 1 degree Celsius decrease in temperature.	• Keep luer lock connector at a constant temperature during infusion • Do not expose Infusor to extreme heat or attempt to rewarm solution • If the Infusor is refrigerated, remove it and allow the device to reach room temperature <u>How to achieve the correct temperature:</u> A temperature of 33.3 degrees Celsius is achieved when the *Luer Lock Connector* is taped to the patient's torso. A temperature of 31.1 degrees Celsius is achieved when the *Luer Lock Connector* is tape to a peripheral site such as a limb.
Viscosity	The Infusor flow rate is most accurate with a diluent solution of 5% dextrose. <u>Note:</u> An Infusor filled with 0.9% sodium chloride as a diluent will flow approximately 10% faster than the labelled rate.	When using the Infusor for continuous PNB infusions the diluent should be 5% dextrose.

Pump Height	Flow rate is most accurate when the balloon reservoir and the *Luer Lock Connector* are at the same height. Flow rate can decrease approximately 0.5% per 2.5 cm if the balloon reservoir is below the *Luer Lock Connector.* Flow rate can increase approximately 0.5% per 2.5 cm if the balloon reservoir is above the *Luer Lock Connector.*	Once connected to the patients PNB catheter, instruct the patient to keep the top of the Infusor as close to the level of the *Luer Lock Connector* as possible. A carrying case can assist patients in maintaining the correct height of the Infusor.

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