Continuous Femoral Nerve Block in Total Knee Replacements

Use of On-Q bloc vs. Traditional Pumps
Multimodal Perioperative Analgesia

- Opioids
- Ketamine
- Clonidine
- Local anesthetic infiltration
- Peripheral nerve blockade
- Non-steroidal anti-inflammatory agents
- Cryotherapy
- Transcutaneous electrical nerve stimulation (TENS)
Recent Gains in Knowledge

- Multi-modal approach lowers incidence of side effects
- More Specific, nerve blocks, regional blocks
- Pre-emptive analgesia
- Avoid or lower requirements for parenteral Narcotics when possible
<table>
<thead>
<tr>
<th>Pain Control Strategies</th>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preemptive Analgesia</strong></td>
<td>Cox I and II Inhibiting Drugs</td>
</tr>
<tr>
<td><strong>Peripheral Nerve Blocks</strong></td>
<td>Administer preoperatively and</td>
</tr>
<tr>
<td></td>
<td>postoperatively</td>
</tr>
<tr>
<td><strong>Preoperatively, Intraoperatively and Postoperatively</strong></td>
<td>NSAID’s</td>
</tr>
<tr>
<td><strong>Minimal dosing to minimize predictable dose response side effects</strong></td>
<td>Acetaminophen</td>
</tr>
<tr>
<td><strong>Acetaminophen</strong></td>
<td>Narcotics</td>
</tr>
<tr>
<td><strong>Narcotics</strong></td>
<td></td>
</tr>
</tbody>
</table>
Evolution of Pain Management

- Parenteral Narcotics
- Epidural
- Nerve Block
- Wound Infiltration
Continuous Femoral Nerve Block

- Prospective, Randomized Investigation
- Total Knee Arthroplasty (N=45)
- Standardized General Anesthesia
- **Perioperative Analgesia Randomization:**
  1. Morphine PCA (IV)
  2. Continuous Femoral 3-in-1 Block
  3. Continuous Lumber Epidural

- **Infusions:** Bupivacaine 0.125% + Sufentanil 0.1 mcg/ml + Clonidine 1 mcg/ml (10 cc/hr)

Singelyn, Anesth Analg 1998
<table>
<thead>
<tr>
<th>Variable</th>
<th>MSO4</th>
<th>FEM</th>
<th>EPID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower VAS scores (24 hrs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Rest</td>
<td>27</td>
<td>17</td>
<td>*</td>
</tr>
<tr>
<td>16 *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Movement</td>
<td>52</td>
<td>36</td>
<td>*</td>
</tr>
<tr>
<td>33 *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time to Ambulation (days)</td>
<td>4</td>
<td>3</td>
<td>*</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time to Achieve 90° Flexion (days)</td>
<td>17</td>
<td>9</td>
<td>*</td>
</tr>
<tr>
<td>8 *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration of Hospitalization &amp; Rehabilitation (days)</td>
<td>21</td>
<td>17</td>
<td>*</td>
</tr>
<tr>
<td>16 *</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* P ≤ 0.02

Singelyn, Anesth Analg 1998
Continuous Femoral Nerve Block

Knee Flexion (degrees)

Day 1  Day 7  6 Week  3 Month

Morphine  Femoral  Epidural

* P ≤ 0.05

Singelyn, Anesth Analg 1998
Femoral vs Epidural Catheters

Complications & Technical Difficulties

- Urinary Retention
- Catheter Difficulties
- Lateral Leg
- Kinked Catheter
- Difficult Insertion

Percent of Patients (%)

- Femoral
- Epidural
Anesthetic Requirements

End-tidal Forane (vol%)

Time (minutes)

* P < 0.05

Stevens, Anesthesiology 2000
Perioperative Analgesia

- Suppl Fentanyl Intra-op (% Pts)
- PACU VAS Scores
- 12 hr Post-op Morphine (mg)

* P < 0.05
Perioperative Blood Loss

- Intra-Operative: PCB - 22% lower than Control
- Post-Operative: PCB - 45% lower than Control

* P < 0.05
Sciatic Nerve Block & T.K.A.

- Prospective observational study
- N = 40
- Consecutive Primary TKA
- Spinal + Femoral catheter
- Postoperative
  - Femoral catheters (Ropiv 0.2% infusion)
- VAS scores < 3 : Femoral catheter alone
- VAS scores > 3 : Femoral catheter + Sciatic n. block
- Morphine PCA to all patients

Weber, Eur J Anaesthesiol 2002
Mayo’s Comprehensive Multi-modal Pain Management for TKA and THA

- **Outcome Data**
  - 1340 Patients Primary and Revisions Total Joints
  - **VAS Pain Scores**
    - 1/10 at rest
    - 2/10 with Physical Therapy
  - **Length of Stay**
    - Prior to Protocol: 5.2 days
    - Since Protocol initiated: 2.8 days
Mayo’s Total Joint Regional Anesthesia Protocol

- **Pre-Op Medications**
  - Oxycontin 20 mg PO
  - Celebrex 200 mg PO BID

- **Intra-op / Regional Anesthetic**
  - Psoas or Femoral catheter + Post-op infusion x 48 hrs
  - Sciatic block (TKR)

- **Post-Operative Analgesia**
  - Oxycontin 10-20 mg PO BID
  - Acetaminophen 1000 mg PO TID
  - Ketorolac 15 mg IV q 6 hrs x 4 doses
  - Oxycodone 5-10 mg PO q 4 hrs PRN
Regional Anesthesia Practice

**Communication**

**Nursing**
- PACU / Floor R.N.’s need to know normal side effects and signs of complications
- Should be able to give patient’s appropriate d/c instructions
- Should be able to care for catheters / infusion pumps

**Surgeons**
- Preop Patient education
- Understanding of indications / side effects of block
- Coordination of analgesia orders to avoid duplication / interactions
- Follow up complications

**Physical therapy**
- Increased analgesia = accelerated rehabilitation
- weakness not a deterrent to therapy

**Patients/ Caregivers**
- Must be informed of care of blocked extremity, catheters, and pumps
- Must understand need for multimodal approach
Femoral Nerve Block

Blockade of the femoral nerve provides sensory anesthesia of the anterior thigh, knee, and medial aspect of the calf, ankle and foot.

- The femoral nerve block should be distinguished from the "three-in-one" block, the technique of lumbar plexus anesthesia that achieves anesthesia of the lateral femoral coetaneous and obturator as well as the femoral nerves.
- Surgical anesthesia of the entire lower extremity can be obtained when the three-in-one block is combined with the sciatic block.
- This technique is used frequently at our institution as the primary anesthetic, or as the postoperative analgesic technique, for foot or ankle surgery.
Femoral Nerve anatomy
Figure 1b: Somatic neurotomal distribution of the lower extremity. (Copied with permission from Brown DL. Atlas of Regional Anesthesia.)
Figure 1a:
Somatic neurotomal distribution of the lower extremity. (Copied with permission from Brown DL. Atlas of Regional Anesthesia.)
Lower Extremity Blocks

- Total Knee Replacement
  - Lumbar Plexus Block
    - Femoral or Psoas Block
    - Sciatic Block
Common Indications

- Knee Surgery
- Foot and ankle surgery,
- Femoral neck fractures
- Total hip arthroplasty
- Facilitation positioning for placement of neuraxial block
- Profound analgesia is obtained without the adverse effects associated with opioids or Ketamine
- Pre- or postoperative analgesia for femoral shaft fractures
- Surgical anesthesia for outpatient saphenous vein stripping
- Anesthesia for outpatient knee arthroscopy
- Postoperative analgesia for knee procedures or total knee arthroplasty
- Anterior thigh muscle biopsies in children
- Femoropopliteal bypass surgery
Specific Contraindications

The presence of a prosthetic femoral artery graft is a relative contraindication to femoral nerve block.

Relatively contraindicated in situations where a dense sensory block could mask the onset of lower extremity compartment syndrome (e.g., fresh fractures of the tibia and fibula), applies to regional anesthesia of the lower extremity in general.

Coagulopathy

Neuropathy, e.g. Diabetic neuropathy

Infection in area

Patient Refusal

Known allergic reactions to agents used
Regional Anesthesia Practice

- Block rooms
  - Saves operating room time
  - *Continuous blocks will take time*
  - Universal regional anesthesia cart- equipment
  - Uniform written orders / block records
  - Protocols for infusions
Regional Anesthesia Practice

Equipment - Pumps

- I FLOW: ON-Q C-Bloc
  - Flow rates
    - 2 ml/hr to 10 ml/hr
    - 5 ml/hr basal with 5 ml bolus/hr
  - Volumes
    - 270 ml to 550 ml
  - Delivery from 1 to 4 days
  - Advantages
    - Smallest and lightest
    - Simplest
    - Disposable
    - No electronics or alarms
The Star
On-Q pumps

- Less labor intensive when starting rehabilitation and its benefits
- NO ALARMS, no electrical power
- Fixed rate vs. Variable flow
- No infusion ports
- Function judged by size and response
- Patient can D/C in some settings
- Simplicity
Nerve Stimulator
Landmarks

Femoral Crease

www.nysora.com
Identification

- Ant. Sup. Iliac Spine
- Pubic Tubercle
- Nerve
- Artery
- Vein
- Symphysis
- Lymphatics
- Empty Space
Mark the spot
Femoral Artery
Femoral Artery palpation
The moment
Nerve Stimulation and Observation
# Trouble Shooting

<table>
<thead>
<tr>
<th>Response Obtained</th>
<th>Interpretation</th>
<th>Problem</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>No response</td>
<td>The needle is inserted either too medially or too laterally</td>
<td>Femoral artery not properly localized or the palpating hand moved during the procedure</td>
<td>Follow the systematic lateral angulation and reinsertion of the needle as described in the technique</td>
</tr>
<tr>
<td>Bone contact</td>
<td>The needle contacts hip or superior ramus of the pubic bone</td>
<td>The needle is inserted too deep</td>
<td>Withdraw to the level of the skin and reinsert in another direction</td>
</tr>
<tr>
<td>Local twitch</td>
<td>Direct stimulation of the iliopsoas or pectineus muscle</td>
<td>Too deep insertion</td>
<td>Withdraw to the level of the skin and reinsert in another direction</td>
</tr>
<tr>
<td>Twitch of the sartorius muscle</td>
<td>Sartorius muscle twitch</td>
<td>The needle tip is slightly anterior and medial to the main trunk of the femoral nerve</td>
<td>Redirect the needle laterally and advance deeper 1-3 mm</td>
</tr>
<tr>
<td>Vascular puncture</td>
<td>Blood in the syringe invariably indicates placement into the femoral artery</td>
<td>Too medial needle placement</td>
<td>Withdraw and reinsert laterally 1 cm</td>
</tr>
<tr>
<td>Patella twitch</td>
<td>Stimulation of the main trunk of the femoral nerve</td>
<td>None</td>
<td>Accept and inject local anesthetic</td>
</tr>
</tbody>
</table>
Tunneling
Clinical Pearls

- Dose thru catheter
- Secure catheter
- Tape flow restrictor away from wound
- Encourage multimodal pain approach
Specific Complications

Persistent quadriiceps weakness postoperatively suggests neural injury. The mechanism of nerve injury following peripheral nerve block includes direct nerve trauma from the needle, injury from intraneural injection, and compressive-ischemic injury caused by local hematoma formation. The differential diagnosis of postoperative peripheral nerve injury also includes compressive injury from improper patient positioning, ischemic injury from prolonged tourniquet use, and direct surgical trauma. Peripheral nerve injury related to regional anesthesia can be permanent but usually resolves over weeks. Efforts to avoid this complication include:

1. Avoidance of eliciting paresthesiae (intentionally or unintentionally) when locating the nerve.

2. Immediately stopping injection if a paresthesia is elicited during injection. Painful paresthesiae and resistance to injection suggests that the needle tip lies inside the nerve and that the solution is being injected intraneurally. If this occurs the needle should be pulled back slightly.

3. Avoiding injection when evoked motor responses occur at stimulus intensities <0.3 mA. Strong motor responses at such low intensities may indicate placement within the substance of the nerve.

4. Limiting the total volume of local anesthetic injected.
Regional Anesthesia Practice

Follow up

- Anesthesiologist to see POD 1 with pain RN
  - Pain control: VAS scores
  - For pain make additional interventions
  - Check catheter site to rule out infection or hematoma
  - Document lack of local anesthetic toxicity
- Pain team to see POD 2 and catheter D/C’d
- No billing codes as fee is built into initial insertion
Regional Anesthesia Practice

Follow up

- Home Catheters
  - Anesthesiologist
    - Catheters Placed
    - Instructions given and questions answered
    - Instruction sheet
  - Phone call backup
    - Pain: surgeon
    - Local anesthesia toxicity: anesthesiologist on call
- Pain team
  - Call daily while catheter running
  - Document call
  - Field questions
- Patient: pull catheter
Intravascular Injections of local Anesthetics

- Prevention, follow guidelines
- Preparation, hope for best prepare for worse, establish a routine; do not deviate
- Recognition
- Immediate response
- Bad outcome? Pray!
Who to Pray to?
Conclusion

- Multimodal Pain Control
  - Local anesthetic corner stone of approach
  - Wound or peripheral nerve catheter
- Think outside the box
- Make over the whole system for maximum benefit