ORTHOPEDIC SURGERY TECHNIQUES & CLINICAL EVIDENCE
DISCLAIMERS

The disclaimers contained herein pertain to all information included in this booklet. The information provided herein is provided for educational purposes and represents the surgical techniques used by specific doctors. Catheter placements are intended for guidance only and are subject to the individual expertise, experience and school-of-thought of the surgeon placing the catheter. Always refer to the drug manufacturer’s prescribing information when administering any drug with the ON-Q* Pain Relief System. This protocol is not to be construed as a specific recommendation of I-Flow*, LLC.

Cautions
- Make sure the catheter is not in a vein or artery. Inadvertent intravascular delivery may result in systemic toxic effects. Refer to the drug manufacturer’s package insert.
- Patient may experience loss of motor control or feeling at and around the surgical area. Physician should instruct patient on appropriate measures to follow to avoid patient injury.
- Medications used with this system should be administered in accordance with instructions provided by the drug manufacturer. Physician is responsible for prescribing drug based on each patient’s clinical status (e.g., age, body weight, disease state of patient, concomitant medication(s)).
- Vasoconstrictors such as epinephrine or adrenaline are not recommended for continuous infusions.
- Refer to ON-Q* Directions for Use for full instructions on using the ON-Q* Continuous Nerve Block System.
- Consult with surgeon prior to performing block with any surgery that would be prone to compartment syndromes.

Indications For Use
- The ON-Q* pump is intended to provide continuous and/or intermittent delivery of medication (such as local anesthetics or narcotics) to or around surgical wound sites and/or close proximity to nerves for preoperative, perioperative and postoperative regional anesthesia and/or pain management. Routes of administration include: intraoperative site, perineural, percutaneous, and epidural.
- ON-Q* is intended to significantly decrease pain and narcotic use when used to deliver local anesthetics to or around surgical wound sites, or close proximity to nerves, when compared to narcotic only pain management.

Contraindications
- ON-Q* is not intended for blood, blood products, lipids, fat emulsions, or Total Parenteral Nutrition (TPN).
- ON-Q* is not intended for intravascular delivery.

There are inherent risks in all medical devices. Please refer to the product labeling for Indications, Cautions, Warnings, and Contraindications. Failure to follow the product labeling could directly impact patient safety. Physician is responsible for prescribing and administering medications per instructions provided by the drug manufacturer. Refer to www.halyardhealth.com for product safety Technical Bulletins.
The practice of regional anesthesia has expanded greatly over the past two decades.\(^1\)

As nerve block techniques, availability of training programs, equipment and technology have progressed, more patients are benefiting from superior non-narcotic postoperative pain control, reducing the need for opioids and their related complications.\(^2,3\)

The impact is particularly evident in orthopedic surgery, where patients may achieve earlier mobilization and return to daily activities, in addition to shorter hospital stays with fewer complications.\(^3,4,5\)

**Patient Benefits of Continuous Peripheral Nerve Blocks (CPNB) Orthopedic Surgery**

- Quicker rehabilitation and time to ambulation\(^4,5\)
- Earlier time to discharge\(^4,5\)
- Higher patient satisfaction\(^3,4\)

**Compared to Single Shot, CPNB Resulted in:**\(^3\)

- Decrease in pain scores through POD2 (P<0.001)
- Higher patient satisfaction (P<0.001)
- Decreased opioid use (P<0.001)
- Reduced nausea (P<0.003)

**Benefits of Adductor Canal Blocks**

**Why adductor canal blocks for TKA and ACL repairs?**

Peripheral nerve blocks are commonly used to relieve pain and to reduce opioids and opioid-related side effects. Femoral nerve blocks used for procedures such as total knee arthroplasties and ACL repairs have been associated with femoral quadriceps muscle weakness and, in turn, potentially increase risk of falls. Attempts to reduce quadriceps involvement after femoral nerve block (FNB) without compromising pain control have proven successful. Unlike FNB, the adductor canal block (ACB) is predominantly a sensory block, which preserves quadriceps muscle strength and ambulation ability better than the FNB.\(^6\)
ACL RECONSTRUCTION

Greg Hickman, MD
Medical and Anesthesia Director – The Andrews Institute, Gulf Breeze, FL

Products Used: **ON-Q* Pump:** CB004, ON-Q* with Select-A-Flow*, 400 ml x 2-14 ml/hr. Occasionally use CB6004, ON-Q* with the Select-A-Flow*, 600 ml x 2-14 ml/hr
**Needle:** 18 gauge Tuohy needle

Drugs in Pump: Local anesthetic of the physician’s choice.

Pre-operative Technique: Because 50-60% of our patients have posterior pain after their ACL reconstruction, I selectively give a single shot tibial block to help patients get through the first night comfortably. Single shot femorals are a good option too, but at Andrews, we are going away from the femoral single shot, per surgeon request. If the patient is not required to have motor strength the first night, I still believe a single shot femoral is a good idea and a viable option to help get patients through the first night comfortably. The single shot femoral is not a great option for practices that want motor function the day of surgery.

**Note:** I now do a single shot adductor canal block and place the catheter in the PACU or do a pre-op adductor canal catheter placement. If I do place the catheters preoperatively, I come a little more proximal and turn the probe so it is proximal to distal and thread the catheter distally into the canal.

Adductor Canal Catheter Placement: Chlorhexidine prep and sterile drape over block area. Introduction of needle will be anterior thigh. Position ultrasound probe on with a cross section (short axis) view. Turn the probe to a 45 degree angle to help “aim” the needle and catheter up the canal. When you utilize the mid-thigh approach, the nerve to the vastus medialis is typically outside of the canal and usually visible (See Figure A). The needle will be brought in from distal to proximal in a medial approach to help with advancing the catheter up the canal (See Figures B and C). On smaller legs you go through the vastus medialis with the needle. On obese legs, the needle will often go through the Sartorius muscle, and the angle of the needle will be a little steeper.

This approach from the anterior side allows for better needle visualization. Pop through vastus medialis into the adductor canal. The nerve will be anterior to the artery. Inject 1 ml of local anesthetic to make sure you are in the correct area. The fascia of the sartorius muscle is lifted up and the adductor canal will open up (See Figure D). Continue to inject 1-2 ml to open adductor canal up for a total of approximately 10 ml, with consideration given to total dose delivered and patient’s clinical status. Thread catheter about 3-4 cm up the adductor canal.

Catheter Securement: Secure catheter with Tegaderm™. Skin glue can also be used to seal the needle insertion site.

Postoperative Bolus Technique: Patients go home with the catheter and the ON-Q* Pump set on zero since they already have the single shot block to get them through the night. We instruct patients to turn their pumps on at bedtime to 4-6 ml/hr so they don’t wake up in pain when the initial block wears off. When the single shot wears off and the pump infusion is started, about 10-20% of patients get a bolus of local anesthetic (approximately 10 ml) to help them get thru the transition on the morning of POD1. If we don’t have access to the patient to give them a bolus, we instruct them to turn the pump up to 14 ml/hr for one hour to give them a good local anesthetic spread throughout the canal.

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**Figure A – Patient A Pre-Injection**

| A: Femoral artery |
| AC: Adductor canal |
| NVM: Nerve of vastus medialis |
Why I like to do adductor canal blocks:

- Ability to do outpatient ACL repairs
- Avoid motor weakness and quad weakness with femoral nerve blocks
- Aggressive PT and quad strengthening on POD1
- Speed up rehabilitation
  - Having their quad control, patients can fully extend their legs immediately on POD1.
  - Patients also get to weight bearing faster.
ACL RECONSTRUCTION AND TOTAL KNEE ARTHROPLASTY

Mark Zimmerman, MD
Midwest Orthopedic Specialty Hospital, Franklin, WI

Continuous Nerve Block Technique: Adductor Canal Block

Products Used: ON-Q® Pump: CB004, ON-Q® with Select-A-Flow®,
400 ml X 2-14 ml/hr
Pump is started in PACU at 6 ml/hr
Needle: 10 or 11 cm Tuohy needle

Drugs in Pump: Local anesthetic of the physician’s choice.

Preoperative Technique: The patient is given Celebrex™ 400 mg and Gabapentin 300-600 mg p.o. preoperatively as part of multi-modal approach.

Catheter is placed preoperatively, but the pump is hooked up and started in the recovery room.

A single shot tibial nerve block is placed utilizing 6-8 ml of local anesthetic to help manage posterior knee pain with consideration given to the total dose delivered and patient’s clinical status.

Adductor Canal Catheter Placement:

The adductor canal block is performed in the upper thigh slightly caudal to the end of the femoral triangle in the proximal portion of the adductor canal.

In the proximal adductor canal the femoral artery is under the medial portion of the sartorius muscle (See Figure A).

Penetrate the sartorius muscle fascial layers just lateral to the femoral artery using a Tuohy needle (See Figures B and C).

Total dose is 20 ml of local anesthetic given in 5 ml increments with consideration given to the total dose delivered and patient’s clinical status. Negative aspiration and a 1 ml test dose should be given prior to each increment.

Watch spread of drug in the canal and be certain the drug spreads below the fascia and not into the muscle.

Occasionally additional fascial layers appear during injection. Penetrate the fascial layers so that the catheter is placed in the adductor canal. You may want to utilize color doppler if necessary to distinguish drug from venous structures.

Advance the catheter into the adductor canal through the needle. Catheter is advanced slightly past the needle tip, and needle is pulled out keeping the catheter in place.

Small amount of air and/or fluid is injected through the catheter under ultrasound visualization to verify catheter position.

Catheter Securement: Catheter is secured with your preference of skin adhesive, SteriStrips and Tegaderm™.

Postoperative Technique: Patients go home with the catheter in place. For my total knee patient, I prescribe Celebrex™ 200 mg BID and Gabapentin 300 mg BID are also prescribed as part of our multi-modal approach to pain management.
ACL RECONSTRUCTION AND TOTAL KNEE ARTHROPLASTY (CONTINUED)

Salvatore Bommarito, DO
Senior Staff Anesthesiologist
Henry Ford Macomb Hospital, Charter Township of Clinton, MI

Products Used: ON-Q* Pump: CB004, ON-Q* with Select-A-Flow*, 400 ml X 2-14 ml/hr
Needle: 18 gauge Tuohy Needle

Drugs in Pump: Local anesthetic of the physician’s choice.

Preoperative Technique: For the last two years we have been performing adductor canal blocks exclusively for total knee arthroplasties and ACL repairs, per surgeons’ request. In our practice, all continuous adductor canal blocks are performed pre-operatively. Since we switched from continuous femoral nerve blocks to continuous adductor canal blocks, we have had zero falls attributed to blocks, while maintaining a greater than 90% reduction in average pain scores. We have also been able to achieve early ambulation with all patients actively participating in physical therapy. These blocks have allowed us to reduce the length of stay and dramatically reduce overall narcotic consumption. This block has significantly improved the quality of care for our orthopedic patients.

Adductor Canal Catheter Placement
- All blocks are performed under strict sterile conditions.
- The block is performed approximately at the midpoint of the thigh (See Figure A). One must be careful not to perform the block too proximal as a “true” femoral nerve block may develop with loss of the advantages of the adductor canal block.
- We are looking to ultrasound an image where the femoral artery sits below the sartorius muscle and slightly on top of the vastus medialis. I perform all blocks in plane from a “lateral to medial” direction. I follow the needle tip under/between the fascial plane of the sartorius muscle and position my needle in the adductor canal (See Figure B). It may not be possible to see the nerve but this is not important.
- After negative aspiration, 20 ml of local is injected in 5 ml increments with negative aspiration after each 5 ml. It is paramount that you are able to see the bolus expanding/dilating the adductor canal and not outside the intended target.
I then feed the catheter in approximately 3 cm past the needle tip and the needle is then removed.

In my opinion, the most important step is confirming placement of the catheter. You do not have to see the catheter but you must see re-expansion of the adductor canal when a small bolus is given in the catheter. I ultrasound the area where the block was performed and another 2-4 ml of local is given via the catheter to confirm its placement. Remember that the catheter tip may be in correct placement but if the majority of the infusion travels outside the adductor canal, this will lead to a high number of failed blocks.

**Catheter Securement:** I routinely use skin adhesive on all of my catheter insertion sites as this helps prevent any leakage. This step is not mandatory but if eliminated, you must reassure your patients and staff that the catheter may leak from the insertion site and as long as the block is proving effective, it is not a problem.

**Postoperative Technique:**

**ACL’s:** Patients are discharged with catheter/ON-Q* Postoperative Pain Management System. Catheter is set at 10 ml/hr. Patients are given detailed instructions.

**Total Knee Arthroplasty:** Patients go to the floor with catheter/ON-Q* Postoperative Pain Management System. Pump is set at 10 ml/hr and it may be adjusted on a PRN basis. Currently, we have been giving the TKA patients a bolus prior to discharge and re-attaching a second pump for continued relief while they are at home with consideration given to total daily dose and clinical status of the patient.

**Our experience: Advantages of Continuous Adductor Canal Blocks**

- Zero to negligible motor weakness (Quad sparing)
- Early ambulation/improved effort during physician therapy
- Reduction in overall narcotic consumption
- Decrease in length of stay
- Improved patient satisfaction/HCAHPS scores
- Improved surgeon/administrator satisfaction
- Quicker time to discharge
- Decrease in expected admissions for pain control

STUDY DESIGN: Double-blind, randomized controlled

NUMBER OF PATIENTS: Adductor Canal Block (ACB): 23 patients
Femoral Nerve Block (FNB): 27 patients

SUMMARY: Patients undergoing total knee arthroplasty (TKA) with spinal anesthesia received a 30 ml bolus of ropivacaine 0.2% followed by a continuous infusion of ropivacaine 0.2%, 8 ml/hr via an electronic PCA pump for 24 hours. Primary measurement was difference in quadriceps muscle strength between the groups, assessed using muscle volumetric isometric contraction (MVIC) as a percentage from baseline. Quadriceps strength was significantly higher in the ACB group (52%) compared with the FNB group (18%), P=0004 at 24 hours. No difference between the groups regarding morphine consumption, pain during flexion, adductor muscle strength, mobilization ability.

ADVERSE EVENTS AND COMPLICATIONS: One overdose of morphine, which resolved quickly. No other adverse events or falls.

CONCLUSION: “ACB preserved quadriceps muscle strength better than FNB, without demonstrating statistically or clinically significant inferiority in pain relief.”


STUDY DESIGN: Parallel double-blind, placebo-controlled randomized trial

NUMBER OF PATIENTS: Ropivacaine Group: 34 patients
Placebo Group: 37 patients

SUMMARY: Total knee arthroplasty (TKA) patients had a catheter placed in the adductor canal using US-guided technique immediately postoperatively. Patients received intermittent 30 ml injections of ropivacaine, 0.75% or saline (Placebo) via the catheter at 6, 12, and 18 hour intervals for postoperative pain relief. Patients in the ropivacaine group had significantly reduced morphine consumption from 0 to 24h (40±21 vs. 56±26mg, P=0.006) Additionally, pain was significantly reduced during flexion of the knee (P=0.01), but not at rest compared to the placebo group. Patients in the ropivacaine group also ambulated significantly faster at 24h (36±17vs. 50±29s, P=0.03) per the Timed-up-and-go (TUG) test.

CONCLUSION: “This almost pure sensory block may be a useful analgesic adjuvant for acute postoperative pain management after TKA.” Compared to placebo, continuous adductor canal block (CACB) reduced morphine consumption and pain during 45 degrees flexion of the knee and significantly improved ambulation.


STUDY DESIGN: Meta-analysis. 44 randomized controlled studies analyzed. 2,141 patients.

SUMMARY: Patients had a variety of surgical procedures including cardiothoracic, general, orthopedic, and gynecologic-urologic. Continuous infusion wound site catheters were placed in a variety of locations and delivered a continuous infusion of local anesthetic to the surgical area. Continuous wound site catheters consistently demonstrated reduced pain scores and less morphine use across all groups. Additionally, better patient satisfaction achieved in all groups combined, (p< 0.007) and length of stay was reduced by one hospital day overall. Infection rates were 0.7% in the treatment group and 1.2% in the control group. There was less PONV in all groups combined (P< 0.001).

ADVERSE EVENTS AND COMPLICATIONS: Incidences of technical failure were low (1%). No reports of local anesthetic toxicity.

CONCLUSION: “Both qualitative and quantitative systematic review identified the efficacy of continuous wound catheters with improved analgesia, reduced opioid use and side effects, increased patient satisfaction and perhaps reduced hospital stay.”
ADDITIONAL RESOURCES FOR ADDUCTOR CANAL BLOCKS

ADDUCTOR CANAL BLOCKS ON BLOCKJOCK.COM
Adductor Canal Catheters for Major Knee Surgery (basic membership required to view)
Adductor anatomy and landmarks: 4:10 – 5:07
Distribution of lower leg innervation: 5:09 – 5:40
The clinical data: 6:22 – 8:40
Technique: 8:42 – 10:00
Live technique: 10:01 – 13:45

ACL ADDUCTOR TECHNIQUE TIME POINTS (DR. GREG HICKMAN)
Technique/Protocol: 16:44 – 19:50

ADDUCTOR CANAL TECHNIQUE TIME POINTS (DR. MARK ZIMMERMAN)
Technique/Protocol: 36:37 – 43:49
Narcotic Sparing with Adductor Canal Blocks: 43:50 – 48:30
Postoperative Adjuncts to Adductor Canal Blocks: 48:36 – 51:50

BLOCKJOCKS WEBINAR (DR. GREG HICKMAN TECHNIQUE)
US-Guided Adductor Canal Catheter — Oblique Technique Distal to Proximal (requires VIP Subscription to view)
Technique overview: 0:17 – 1:39
Prepping and draping: 1:40 – 2:06
Local injection technique: 2:08 – 3:53
Needle approach: 3:53 – 6:19
Threading the catheter: 6:20 – 7:29
Testing the catheter placement: 7:30 – 8:12
Viewing the saphenous nerve and Sartorius muscle to confirm correct placement: 8:39 – 9:05

REFERENCES
BETTER OUTCOMES. SATISFIED PATIENTS.

For more information please visit halyardhealth.com
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1-844-HALYARD (1-844-425-9273)