Anesthetic Techniques for Rapid Recovery in Total Knee Arthroplasty

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Disclosures

- Nothing relevant to this talk
  - DePuy Orthopaedics, Inc.
  - ConforMis, Inc.
  - Biocomposites, Inc.

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Introduction

- Total knee replacement is a painful surgery
- Anesthetic techniques and multi-modal pain management have evolved significantly over the last decade

Surgical Anesthetic Choice

- Spinal vs General
  - Neuraxial anesthesia has been shown to decrease:
    - DVT / PE

      Davis FM, et al JBJS Br 1989.
    - Bleeding / need for transfusion

      Rashiq S, Finegan BA. Can J Surg 2006.
    - Operative time

      Hu S, et al. JBJS Br 91. 2009.
    - Risk of infection

      Hu S, et al. JBJS Br 91. 2009.
    - Total operative cost.

      Gonano C, et al. Anesth Analg 2006.

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Surgical Anesthetic Choice

Differences in Short-Term Complications Between Spinal and General Anesthesia for Primary Total Knee Arthroplasty

Andrew J. Pugely, MD, Christopher T. Martin, MD, Yubo Gao, PhD, Sergio Mendoza-Lattes, MD, and John J. Callaghan, MD

Investigation performed at the University of Iowa Hospitals and Clinics, Iowa City, Iowa

- 14,052 Primary Total Knees – NSQIP Database Search
  - Spinal = 6030 (42.9%)
  - General = 8022 (57.1%)

JBJS Am. 2013 Feb 6;95(3):193-9.

- The spinal anesthesia group had a lower rate of:
  - Superficial wound infections ($p = 0.0003$)
  - Blood transfusions ($p = 0.0086$)
  - Overall complications ($p = 0.0032$).
  - Length of surgery ($p < 0.0001$)
  - Length of hospital stay ($p < 0.0001$)

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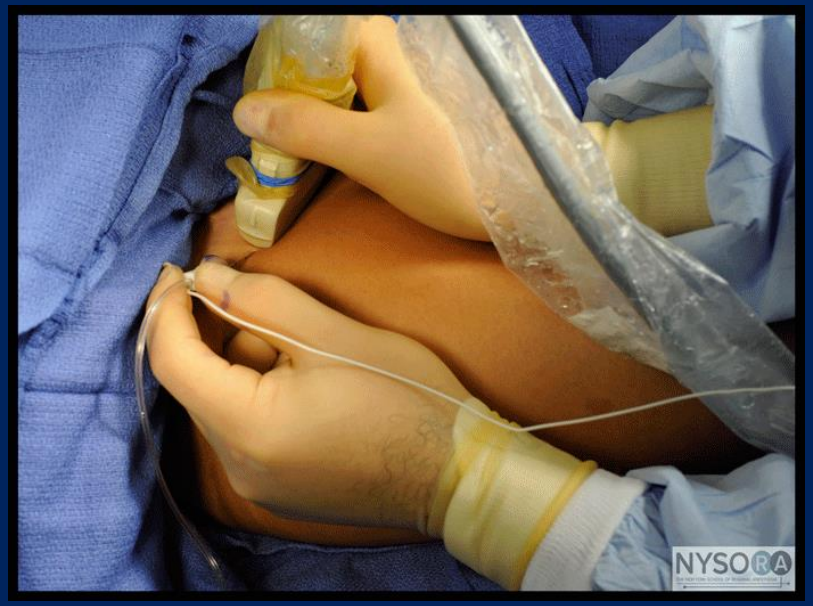
Peripheral Nerve Blocks

- Femoral Nerve Block
- Adductor Canal Block
- Sciatic Nerve Block
- Nerve Catheters vs Single Shot Blocks



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Peripheral Nerve Blocks

Machi T, Ilfeld B, Ball ST, et al. *J Anesthesiology.* In Press

- Randomized 80 patients to Adductor Canal Catheter (39) vs Femoral Nerve Catheter (41)
- No significant difference in pain or opioid usage
- Patients mobilized significantly faster with Adductor Block
  - Timed Up / Go Test & Independent Ambulation with PT
  - POD#1: 72% Adductor vs 27% Femoral ($p<0.001$)
  - POD#2: 95% Adductor vs 76% Femoral ($p<0.01$)

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Peripheral Nerve Blocks

- Femoral Nerve Block vs. Adductor Canal Block
  - Adductor Block preserves quad strength resulting in significantly faster *safe* mobilization
  - Femoral NB provides slightly better pain control

	Pain Control	Fall Risk	Independent Ambulation	Discharge Readiness
Femoral Nerve	Better	Increased	Delayed	Delayed
Adductor Canal	Good	Low	Earlier	Earlier

Gettings J, et al. AAHKS Annual Meeting. 2013.
Machi T, Ilfeld B, Ball ST, et al. J Anesthesiology. In Press.

Peripheral Nerve Blocks

- Complications
  - ***Neurologic Complication Rate***
    - Short-term (<6 weeks) = 1 – 2%
    - Long-term (>6 weeks) > 0.2%

      Borgeat. Anestheosiology 2003; 99: 436.

      Neuburger. Anesthesist 2006; 55: 33.
  - ***Falls associated with Femoral NB's***
    - Older patients undergoing TKA have fall risk at baseline
    - **Elevates fall risk by 1 – 2%**

      Memtsoudis. Anesth 2014; 120:551.

Fell POD1 while Regional Anesthesia was in the room

Peri-Articular Injection Cocktail

- Multiple proposed concoctions *with a common theme*
  - Local Anesthetic (Ropivacaine or Bupivacaine)
  - Epinephrine (up to 0.5 mL of 1:1000)
  - +/- Ketorolac (Toradol)
  - +/- Morphine
  - +/- Corticosteroid
  - +/- Antibiotic

Ranawat Cocktail:
Meftah M, et al. Orthopedics (35). May 2012.

Dosages for Deep Intraoperative Injection

Agent	Dosage
Marcaine 0.5% (5 mg/cc)[a]	200-400 mg
Morphine sulphate (8 mg)	0.8 cc
Adrenaline 1/1000 (300 µg)	0.3 cc
Antibiotic	750 mg
Corticosteroids	40 mg
Normal saline	22 cc

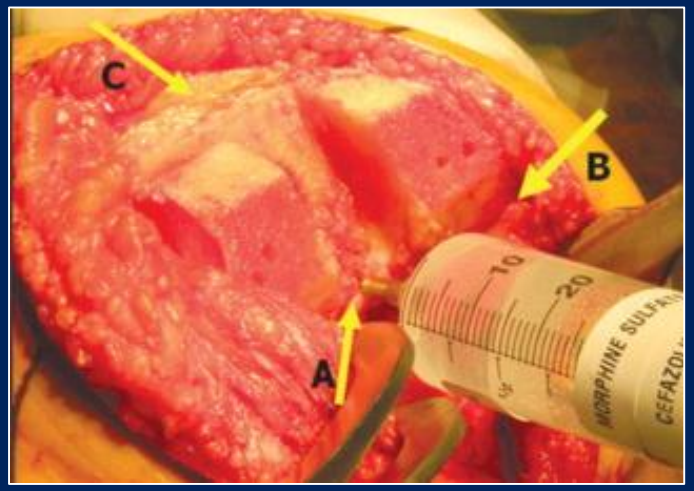
[a]*Maximum dose of marcaine is 400 mg/d.*

Dosages for Superficial Intraoperative Injection

Agent	Dosage
Marcaine 0.5% (5 mg/cc)	200-400 mg
Normal saline	22 cc

Peri-Articular Injection Cocktail

- Method of Injection
  - Posterior capsule prior to implantation
    - Careful laterally (peroneal n)
  - Fat pad
  - Medial sleeve at the proximal tibia
  - Medial and lateral retinaculum
  - Femoral periosteum
  - Extensor mechanism at the arthrotomy
  - Subcutaneous fat layer (local only)



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Peri-Articular Injection Cocktail

- Growing volume of Level 1 evidence
  - First 24-48 hours
    - Less pain
    - Less opioid use
    - Faster progress with ROM, strength and ambulation
    - Higher patient satisfaction
  - Some benefits may persist for 1 to 4 weeks
    - Better ROM
    - Faster functional recovery
    - Faster discontinuation of assistive walking devices

Busch CA, et al. JBJS Am. May 2006.
Fu P, et al. Knee. Aug 2009.
Mullaji A, et al. J Arthroplasty. Sept 2010.

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Peri-Articular Injection Cocktail

- **Exparel (Liposomal bupivacaine)**
  - Formulated to allow controlled release and prolonged anesthetic effect (72 – 96 hours)
  - Exparel costs $285
  - Equivalent bupivacaine dose costs < $3

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Peri-Articular Injection Cocktail

- Exparel (Liposomal bupivacaine)
- 2 papers from the AAOS 2015
  - Exparel alone vs. Control with *NO* injection at all
    - Improved pain control and decreased narcotic usage in Exparel group.

      Malkani AL, et al. AAOS Annual Meeting, Las Vegas, 2015.
  - Exparel with supplemental bupivacaine injection vs. Bupivacaine alone in context of full multimodal pain management pathway
    - Narcotic usage equivalent
    - Day 1 pain score 4.5 vs 4.6
    - Day 2 pain score 4.4 v 4.8
    - Day 3 pain score 3.5 v 3.7

      Diesfeld P, et al. AAOS Annual Meeting, Las Vegas, 2015.

Celecoxib (Celebrex)

- Dosing Protocol
  - 100 mg BID for 7 days prior to surgery - ***Optional***
  - 400 mg 2 hours before surgery
  - 200 mg BID during hospital stay
  - 100 mg BID for one month after surgery
  - ↓ Pain
  - ↓ Narcotics usage in the hospital *and* at home after surgery
  - ↓ Nausea, vomiting and pruritis
  - Better ROM during first 3 days after surgery
    - Reuben SS, et al: Anesth Analg 106; 2008.

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Peri-operative Steroid Dosing

- Two prospective, randomized, controlled trials have shown significant benefit with steroids
- Decreased inflammation
  - lower circulating IL-6 levels
- Decreased pain and narcotic consumption
- Decreased nausea / vomiting
- Greater distances ambulated on POD 1 and 2
- Shorter length of stay
- No Infections, no wound healing problems

Backes JR et al. AAHKS Annual Meeting. Dallas 2013.

Jules-Elysee et al. JBJS 94-A. 2012.

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My Preferred Peri-operative Protocol for Total Knees

Adductor Canal Block / Catheter

Spinal Anesthetic

Peri-Articular Injection:

- Ropivacaine (0.5%) 60 mL
- Ketorolac 60 mg
- Morphine 8 mg
- Epinephrine (1:1000) 0.5 mL

Intra-articular Injection:

(after capsule closed)

- TXA 2 gm (20 mL)
- Vancomycin 500 mg (10 mL)

Decadron

- 10 mg IV prior to incision
- 8 mg IV q 24 hrs x 2 days

Celebrex

- 400 mg PO prior to surgery
- 200 mg PO BID in hospital
- 100 mg PO BID x 4 weeks after d/c

Acetaminophen

- 1000 mg IV intra-op
- 650 mg PO q 6 hours post-op

Narcotic Regimen

- Oxycontin 10 mg PO BID *or* Ultram 100 mg PO q 6 hrs
- Oxycodone 5-10 mg q 4 prn
- Dilaudid 1 mg IV q 4 prn

Thank You

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