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A modern multimodal pain protocol eliminates the need for opioids for most patients following total knee arthroplasty: results from a retrospective comparative cohort study

Leland van Deventer[1], Amy Bronstone[2], Claudia Leonardi[3], Matthew Bennett[1], Peter Yager[1,2] and Vinod Dasa[1,2*]

[1] School of Medicine, Louisiana State University Health Sciences Center, New Orleans, LA, USA
[2] Department of Orthopaedic Surgery, Louisiana State University Health Sciences Center, 1542 Tulane Avenue, Box T6-7, New Orleans, LA 70112, USA

Ryan Sholar, MS3

Background

- The year prior to patients undergoing TKA, nearly ⅓ of patients are taking opioids for pain management
  - Significant risk of abuse, overdose, and dependence
- Side effects of opioids…
  - Sedation, dizziness
  - Nausea, vomiting
  - Constipation
  - Respiratory Failure, Death
- Multimodal analgesia following TKA has reduced opioid dependence
  - Multimodal analgesia is the standard of care for TKA patients
  - No universally accepted analgesic regimen

Goal of this Study...

To explore the hypothesis that “patients who received opioids only upon request would use fewer opioids during the first 3 months after TKA and have equivalent patient reported outcomes (PROs) compared to a group who received automatic opioids at discharge”

PPICO

Patient: Patients undergoing Total Knee Arthroplasty (TKA)

Problem: Total Knee Arthroplasty

Intervention: Opioid administration only upon request

Comparison: Automatic opioid administration

Outcome: Maintaining adequate pain management while limiting opioid use

Methods

- Retrospective study design conducted at Louisiana State University Health Sciences Center-New Orleans (LSUHSC-NO)
- Patients undergoing unilateral TKA performed by one orthopedic surgeon between January 2019 and August 2021
- Surgeon utilized an “enhanced recovery TKA protocol” for all patients
    - Anterior midline incision
    - Medial parapatellar arthrotomy
- 2 separate study groups treated consecutively
    - Group 1: January 2019-December 2019 → “Automatic Group” (AG)
    - Group 2: May 2020 - August 2021 → “Upon Request Group” (URG)
- Exclusion Criteria:
    - Patient had undergone TKA for contralateral joint
    - Patient underwent TKA between January 2020 - March 2020

Standard Medication Usage for ALL Patients in Study

- All patients received the same multimodal pain protocol prior to surgery
  - **5 days prior to TKA** → percutaneous cryoneurolysis performed by operating surgeon
    - Applying cold (< 20 C) to peripheral sensory nerves causing Wallerian degeneration
    - Targeting Superficial Geniculate, Anterior Femoral Cutaneous, and Infrapatellar branch of the Saphenous Nerves
      - Each provide sensory innervation to anterior knee
    - Lidocaine also used for local anesthesia
  - **Immediately before surgery**
    - Pregabalin, 150mg, single dose
    - Celecoxib, 200mg, single dose
    - IV Acetaminophen, 1000mg, single dose
    - Neuraxial anesthesia
  - **During surgery** → Periarticular infiltration of 0.25% Bupivacaine Hydrochloride
  - **After Surgery** (for patients requiring overnight hospital admission)
    - Acetaminophen, 650mg, q6
    - Pregabalin, 75mg, BID
    - Celecoxib, 200mg, BID
  - **Upon Discharge**
    - Acetaminophen, 325mg, q4 for 2 weeks
    - Diclofenac, 75mg, q12 for 6 weeks

Measurements of Interest

- Primary Outcomes
  - PROs at 2 weeks and 3 month follow up
  - Pain Intensity assessment
    - Patient-Reported Outcomes Measurement Information System (PROMIS-29)
      - 0-10 numerical pain rating scale
    - PROMIS Pain Interference scale
    - Knee Osteoarthritis Outcomes Score (KOOS)
      - Also explored symptoms, ADLs, QoL
      - 0-100 Score

Statistical Analyses and Comparisons

- Baseline patient characteristics
  - Chi Square Test for categorical data > 5 variables (sex, laterality, opioid naive vs. experienced)
  - Fisher's Exact test for categorical data < 5 variables (race, health insurance, Kellgren-Lawrence grade, contralateral TKA)
  - Student's t-test for continuous, normally distributed variables (age, BMI, overall deformity, PROs)
- Opioid Prescriptions in first 3 months following TKA
  - Chi Square Test for comparing proportions
  - Mann-Whitney U Test for comparing medians
- PROs at 2 weeks and 3 months after TKA
  - Repeated measures analysis of covariance to evaluate opioid prescription protocol, time
  - Adjusted for age and pre-op PROs (insurance type not included as covariate)
  - Student's t-test to compare PROs at each time point

Results

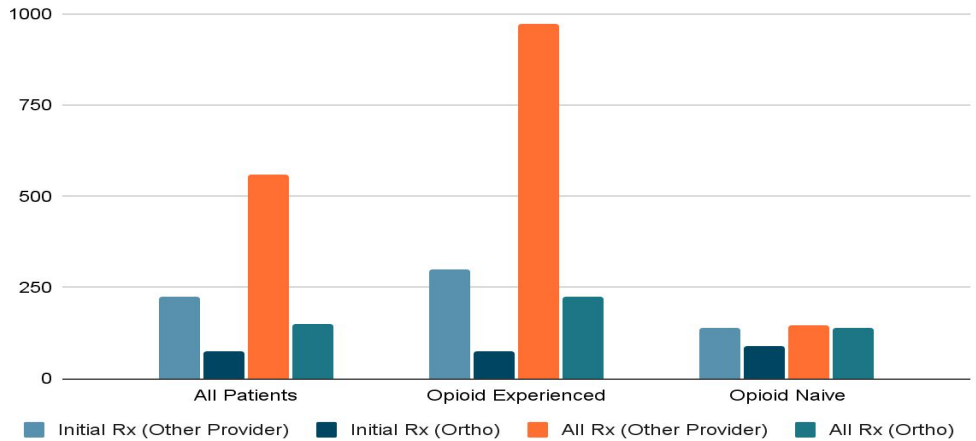
- Within 3 months following TKA…
  - 44.4% of patients in the URG received opioids vs. 95.8% in the AG (p < 0.0001)
    - Opioid Naive Patients: 28.0% in the URG received opioids vs. 94.6% in the AG (p < 0.0001)
      - 10% in the URG received > 1 refill vs. 33.9% in AG
    - Opioid Experienced Patients: 81.8% in the URG received opioids vs. 100% in the AG (p = 0.124)
      - 75% in the URG received > 1 refill vs. 59.1% in AG

Outcome[a]	Automatic (*n* = 72)	Upon Request (*n* = 72)
All Patients		
≥ 1 filled opioid prescription, % (n)	95.8 (69)	44.4 (32)
No. of prescriptions	1 (0–8)	0 (0–8)
≥ 1 refill, % (n)	43.1 (31)	25.0 (18)
Opioid-naïve Patients, n	56	50
≥ 1 filled opioid prescription, % (n)	94.6 (53)	28.0 (14)
No. of prescriptions	1 (0–8)	0 (0–7)
≥ 1 refill, % (n)	33.9 (19)	10.0 (5)
Opioid-experienced Patients, n	16	22
≥ 1 filled opioid prescription, % (n)	100 (16)	81.8 (18)
No. of prescriptions	3 (1–7)	2 (0–8)
≥ 1 refill, % (n)	75.0 (12)	59.1 (13)

Median MME Values

When getting opioids from other providers, Opioid Experienced patients had higher median MME scores for both initial and refill opioid prescriptions than Opioid Naive patients

- No significant statistical difference for Opioid Naive patients when receiving prescriptions



Patient Reported Outcomes

- No statistical difference between the URG and AG in any PRO measure at 2 weeks or 3 months
- Both groups showed significant improvement in recovery over 3 months

Table 4 Patient-reported Outcomes 3 Months After TKA

Outcome[a]	Automatic ($n = 72$)	Upon Request ($n = 72$)	Fixed effects		
			Group	Time	Group*Time
KOOS			---------- *p*-value ----------		
Pain	57.4 (1.8)	53.9 (2.2)	0.226	< 0.0001	0.480
Symptoms	57.0 (1.7)	56.6 (2.0)	0.864	< 0.0001	0.031
ADL	61.7 (1.9)	58.5 (2.2)	0.270	< 0.0001	0.890
QOL	40.2 (2.0)	38.7 (2.4)	0.635	< 0.0001	0.075
PROMIS-29					
Pain Interference	59.3 (0.9)	60.9 (0.9)	0.204	< 0.0001	0.603
Pain	4.6 (0.3)	4.8 (0.3)	0.731	< 0.0001	0.342

Challenges and Limitations

Challenges

- Reducing opioid prescriptions for opioid experienced patients
- Reducing opioid prescriptions from external providers other than the orthopedic team

Limitations

- Retrospective study design with a small sample size
- Selection bias (Due to COVID, URG was less likely to require hospitalization compared to AG)
- Single Orthopedic surgeon at a single institution limits generalizability
- Study measured opioid prescriptions filled rather than actual opioids consumed

Conclusion

- The results of this study **support** the hypothesis that patients in the URG had similar PROs to the AG
- Over half of all patients and 72% of opioid naive patients who received multimodal analgesia achieved an opioid free recovery following TKA
- Reducing opioid administration following TKA for both opioid naive and opioid experienced patients is a realistic possibility
    - 73/356 patients used opioids postoperatively
    - 86.3% of all patients used 10 or fewer opioid pills over 3 months
    - To achieve this goal, multimodal pain management should be expanded from the first 72 hours after TKA to 3 months
- **Future Research:** For chronic opioid users, does tapering opioid use within 60 days of TKA significantly reduce pain intensity and interference?