Adductor Canal Regional Anesthetic Placement in Pediatric Patients for Knee Arthroscopy: Defining the Optimal Location and Analysis of Other Trends

Zachary Li[1], Ameera Z. Syed[1], Theresa Pearce[1], Jessica Lu[1], Peter Somboonsong, William Li[1], Simon Tian[1], Aysha Hasan MD[2]

1. Drexel University College of Medicine, Philadelphia, PA
2. St. Christopher's Hospital for Children, Philadelphia, PA

Background and Significance

- Knee arthroscopy continues to grow as the largest application of arthroscopy and the most common treatment modality for sports-injuries in pediatric and adolescent populations.[1]

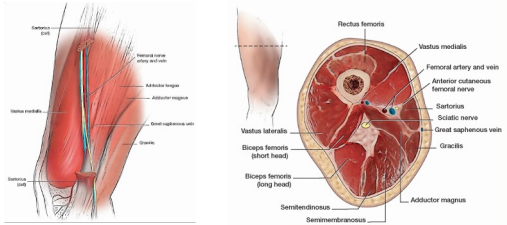
Figure 1.

Specialty	No. Prescriptions	Percentage of All Prescriptions
Dentist[a]	1 504 370	38.2
Surgery[b]	918 154	23.3
Physician assistant	282 194	7.2
Emergency medicine[c]	279 478	7.1
Nurse practitioner	218 143	5.5
Family medicine[d]	194 316	4.9
Obstetrics and/or gynecology[e]	138 889	3.5
Internal medicine[f]	85 539	2.2
General pediatrics	66 376	1.7
Podiatry	59 830	1.5
Pain medicine and anesthesiology[g]	43 359	1.1
Hematology and/or oncology[h]	37 605	1.0
Physical medicine and rehabilitation[i]	21 059	0.5
Hospice and/or palliative care	2599	0.1
All other prescribers[j]	81 434	2.1
Unknown	9836	0.2
Total[k]	3 943 231	100.0[l]

- Concurrently, opioid prescribing practices have increased in recent decades with 4 million opioid prescriptions dispensed to US pediatric patients in 2019, 46% being high risk (Figure 1).[2]
- With the aim of limiting opioid reliance and improving pain levels postoperatively, providers are supplementing general anesthesia with peripheral nerve blocks to provide patients with a safer multimodal pain management option.

Introduction

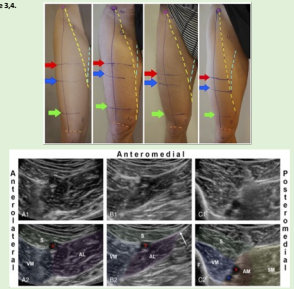
- An adductor canal block (ACB) is a type of peripheral local nerve block injected into the adductor canal of the thigh of a patient undergoing a knee arthroscopy.
- The precise location of ACB placement within the adductor canal has been poorly studied in pediatric patient populations.
- The nerves that enter and exit the adductor canal vary throughout different regions of the thigh, and thus precision of ACB placement can play an important role in postoperative pain management and eventual opioid usage.
- By optimizing ACB placement, we hope to improve postoperative pain levels in pediatric patients while simultaneously reducing their reliance on opioid medications.



Methods

Figure 2.

Figure 3,4.



- This is a prospective, double-blinded randomized control trial of 80 pediatric patients ages 5-17 undergoing knee arthroscopy at St. Christopher's Hospital for Children (Figure 2).
- Enrolled patients were randomized to receive ultrasound guided placement of an ACB using 0.2% ropivacaine in one of three locations in the thigh: proximal, middle, distal, or control group with saline (Figure 3,4).
- Study data from patients 1-60 are currently available and are presented.
- 60 patients, 14 proximal placement group, 15 in the middle placement group, 16 in the distal placement group, and 15 in the saline control group completed the study.

Results

Figure 5.

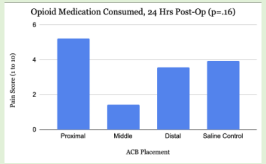


Figure 7.

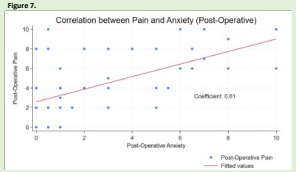
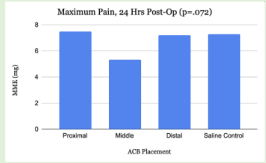


Figure 6.



- The primary outcomes are postoperative pain scores and opioids taken, standardized to morphine milligram equivalents (MME), in the 24 and 48-hour post-operative period.
- Secondary outcomes include correlational assessment of pre and post-operative anxiety of patients and caregivers, correlation between patient anxiety and pain, and a postoperative dermatome sensation test.
- The average age of patients enrolled in the study is 15.5 years old.
- Analysis of the primary outcomes showed no significant difference in pain scores or opioids taken at 24 and 48-hours postoperatively among groups.
- There is a strong positive correlation with increase anxiety leading to increased postoperative pain.

Discussion

- Adductor canal block placement in each of the thigh locations provided comparable 24- and 48-hour postoperative analgesia and opioid medication usage in our first 60 patients.
- Previous studies postulate that a mid-thigh nerve block injection, just proximal to the adductor canal, can target the nerve to vastus medialis, which provides innervation to the anteromedial aspect of the knee.[3]
- Targeting the vastus medialis nerve may be very important in providing analgesia following total knee arthroplasty.
- A drawback of a more proximal block injection location is the increased dermatome involvement in the event of a nerve injury.
- Conversely, if at the conclusion of this study, no true difference between any block injection locations is recorded, then it could be prudent to seek a more distal site of injection to preserve as much sensation as possible following an unlikely, but possible, nerve injury.
- There is a role of anxiety in playing a potential role and acting as a potential confound in pain experiences for this study and indicates the value of alleviating anxiety as a potential factor to lowering pain and reducing pain as a potential factor to alleviate anxiety.
- One limitation of the current study is that patients would receive opioid prescriptions under the discretion of the orthopedic surgeon, corresponding to the nature of the surgery and the standard of care.
- This means that not every patient would receive prescriptions for opioids.
- There was also variable adherence to opioids and over the counter medications by patients and caregivers, which may have skewed the results.
- These limitations are expected with the study's prospective clinical design.
- Stricter control conditions would have been unethical and difficult to enforce in a real clinical setting.
- The preliminary results of this study may suggest future ACB placement can be dependent on the preference of the anesthesiologist in locating the proper position of the saphenous nerve, regardless of location in the thigh.

Future Prospects

- We would like to investigate the long-term effects of ACB placement on pain levels and opioid medication reliance several months or years post-operatively.
- In addition to assessing pain levels and reliance on opioid medication following ACB placement, the completed study will investigate the relationship between pain and anxiety levels among patients and caregivers both pre and post-operatively.

References:1. Merkel D.L. Youth sport: positive and negative impact on young athletes. J Sports Med. 2013;4:151–160.
2. Kao-Ping Chua, Chad M. Brummett, Rena M. Conti, Amy S. Bohnert; Opioid Prescribing to US Children and Young Adults in 2019. Pediatrics September 2021; 148 (3): e2021051539. 10.1542/peds.2021-051539.
3. Vanamala R, Hammer N, Kieser D. Anatomical Landmarks for Intraoperative Adductor Canal Block in Total Knee Arthroplasty: A Cadaveric Feasibility Assessment. Arthroplasty Today. 2021 Jul 12;10:82-86. doi: 10.1016/j.artd.2021.05.004. PMID: 34286055; PMCID: PMC8280478.
Figures:
Figure 1: Kao-Ping Chua, Chad M. Brummett, Rena M. Conti, Amy S. Bohnert; Opioid Prescribing to US Children and Young Adults in 2019. Pediatrics September 2021; 148 (3): e2021051539. 10.1542/peds.2021-051539. [Figure 4]
Figures 2,3: Wong WY, Bjørn S, Strid JM, Børglum J, Bendtsen TF. Defining the Location of the Adductor Canal Using Ultrasound. Reg Anesth Pain Med. 2017 Mar/Apr;42(2):241-245. [Figures 1,2]