Perioperative Pain Management Practices Vary Across Time And Setting For Pediatric ACL Reconstruction: National Trends From The PHIS Database

Nathan Markiewitz, MA[1]
Ishaan Swarup, MD[1]
Divya Talwar, PhD[1]
Wallis T. Muhly, MD[2]
Lawrence Wells,MD[1]
Brendan A. Williams, MD[1]
[1]Division of Orthopaedics, The Children's Hospital of Philadelphia, Philadelphia, PA, USA.
[2]Division of Anesthesia, The Children's Hospital of Philadelphia, Philadelphia, PA, USA

Background

Anterior Cruciate Ligament (ACL) tears are common injuries in the pediatric age group and often necessitates surgical intervention.[1] Surgical and anesthetic techniques appear to have enabled a shift to the ambulatory setting for the majority of these patients,[2] but trends in perioperative pain management have not been formally assessed in a national cohort.

Purpose

To describe recent trends in the United States in perioperative pain management and the associated length of stay following surgical treatment of ACL injuries in the pediatric population.

Methods

Pediatric patients (≤ 18yo) undergoing surgery for an ACL-related injury between January 2008 and December 2017 were identified in the Pediatric Health Information Systems (PHIS) Database producing a data set of n=19406. We modeled trajectories for oral and parenteral acetaminophen, ibuprofen, celecoxib, parenteral and intramuscular ketorolac, oral and parenteral opioids, using generalized additive models. Trajectories were decomposed into an average smooth function of linear time, an average seasonal smooth for months, and a hospital-specific function of linear time. Trajectories were adjusted for patient sex, race, primary payer, and a smooth function of patient age. The family-wise error rate for each predictor was controlled for using the Bonferroni correction, as a null predictor would produce a false positive 34% of the time given the number of drugs examined.

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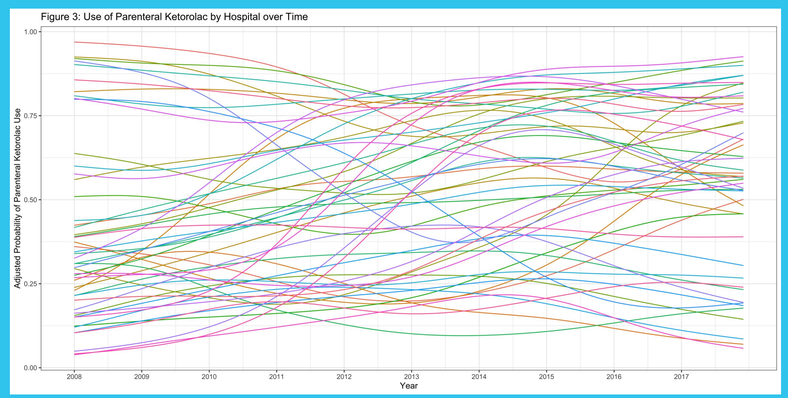
Perioperative pain management practices for ACL reconstruction significantly **varied across hospitals**, even after adjustment for patient characteristics.



Surgical setting significantly predicted all practices besides parenteral acetaminophen, with clear differences between patients in an ambulatory setting versus an observation or inpatient unit setting

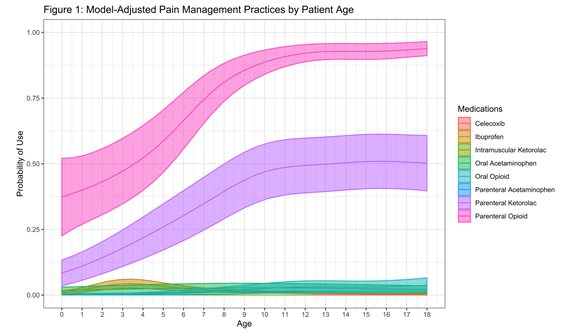
Table 1: Estimated Odds Ratios of the Effect of Operative Setting on Perioperative Drug Use

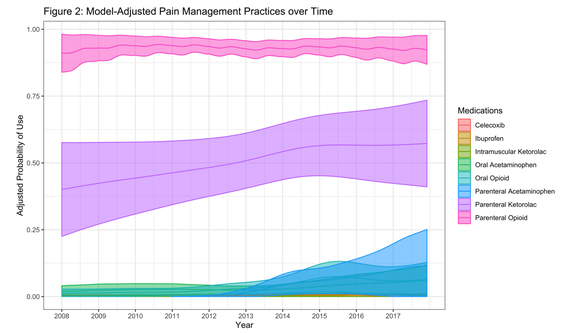
Drug	Route of Administration	Observation Unit	Inpatient Unit
Acetaminophen	Oral	17.255 [13.414, 22.197]*	6.391 [5.151, 7.931]*
	Parenteral	0.792 [0.55, 1.141]	0.65 [0.481, 0.879]
Ibuprofen	Oral	30.736 [21.934, 43.07]*	24.557 [17.905, 33.681]*
Celecoxib	Oral	13.934 [4.966, 39.099]*	3.324 [1.109, 9.966]*
Ketorolac	Parenteral	0.405 [0.333, 0.493]*	0.744 [0.632, 0.876]*
	Intramuscular	0.185 [0.046, 0.752]*	0.213 [0.088, 0.514]*
Opioids	Oral	8.926 [6.761, 11.785]*	3.438 [2.777, 4.255]*
	Parenteral	0.267 [0.214, 0.333]*	0.326 [0.272, 0.391]*

Reference Category: Ambulatory Surgical Setting; *significant at the corrected $\alpha < 0.05$ level.

Results

Models were fit in R using the *mgcv* package.[3] All models converged. Smooths of patient age are presented in Figure 1 and were significant for parenteral acetaminophen, ibuprofen, parenteral ketorolac, and parenteral and oral opioids (max p<1e-9). The average smooth trajectories of linear time are presented in Figure 2 and were significant for parenteral acetaminophen, intramuscular ketorolac, and parenteral and oral opioids (max p<2e-5). All hospital-specific trajectory random effects were significant (max p<1e-16), suggesting significant heterogeneity across hospitals. We present the heterogeneity of parenteral ketorolac use as an example in Figure 3. We found no significant effects of primary payer, race, or sex after correction. We found a significant effect of observation unit for all drugs and inpatient unit for all drugs besides parenteral acetaminophen, as reported in Table 1.





Conclusion

Pain management practices varied significantly, even after adjustment. Intramuscular ketorolac and parenteral acetaminophen use increased over the study period. Use of both parenteral and oral opioids markedly increased as a function of patient age. Surgical setting significantly predicted all practices besides parenteral acetaminophen. Future work should examine whether patient complexity drives the differences we see between surgical settings, or if there are other factors that account for them.

References

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