A Comprehensive Perioperative Regional Anesthesia and Acute Pain Pathway is Associated with Enhanced Recovery after Outpatient Anterior Cruciate Ligament Reconstruction

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Background and Aims : Outpatient anterior cruciate ligament reconstruction (ALCR) surgery is one of the most common sports orthopedics procedures performed in the world. The present study sought to determine if a comprehensive regional anesthesia and acute pain pathway (RAAPP) was associated with improved patient outcomes prior to discharge.

Methods: Retrospective data of all primary ALCR cases in a facility (N=103) were divided into Pre-(n=55) and Post-(n=48) RAAPP groups. Bivariate tests assessed group differences in demographic and clinical factors. Generalized linear models (GLMs) examined effect of group on highest post-operative numeric pain rating (NRS) pain scores, post-anesthesia care unit recovery time, and opioid utilization [morphine-equivalence dose (MED)] from surgery through discharge, while controlling for relevant covariates. Significance level was adjusted for three outcomes at $p < .017$.

Results: Post-RAAPP (94%) had more military service members than Pre-RAAPP (71%, $p < .01$). Surgical variables were similar except for increased surgical time, preoperative femoral and sciatic nerve blocks, preoperative acetaminophen, gabapentin, celecoxib, and intraoperative dexamethasone in the Post-RAAPP (all $p < .05$). GLMs controlled for military status and surgical time. Highest post-operative pain NRS scores prior to discharge [3.38 (95%CI 2.64, 4.11) vs. 6.38 (95%CI 5.60, 7.16)], post-anesthesia care unit recovery time [71 minutes (95%CI 61, 80) vs. 100 minutes (95%CI 89, 110)], and total perioperative opioid utilization [20.09 MED (95%CI 16.26, 23.91) vs. 42.74 MED (95%CI 38.69, 46.80)] were significantly lower in the Post-RAAPP than Pre-RAAPP, respectively (all $p < .001$).

Conclusions: Increased utilization of pre-operative regional anesthesia and non-opioid analgesics in ACLR were significantly associated with reduced pain scores, faster early recovery times, and opioid usage prior to discharge.

Table 1. Analgesia Pathway Group Differences Across Patient Characteristics

	Pre-RAAPP (n=55)	Post-RAAPP (n=48)	SMD	Significance level, p
Age, median [IQR]	25.00 [22.00, 31.50]	26.00 [22.00, 32.25]	0.003	0.75
Male, n (%)	42 (76.4)	42 (87.5)	0.29	0.20
Active-duty Military, n (%)	39 (70.9)	45 (93.8)	0.62	0.004
Body Mass Index, median [IQR]	26.66 [24.17, 29.20]	27.39 [24.61, 29.72]	0.09	0.45
Weight (kg), median [IQR]	85.40 [74.65, 93.05]	83.95 [75.62, 93.28]	0.08	0.76

Note: Continuous variables were not normally distributed, and group differences were assessed with Mann-Whitney U tests. Categorical variable differences were assessed with Fisher exact tests. SMD=Standardized Mean Difference.

References: 1) Secrist, E.S., et al., Pain Management After Outpatient Anterior Cruciate Ligament Reconstruction: A Systematic Review of RCTs. *Am J Sports Med*, 2016. 44(9): p. 2435-47. 2) Harbell, M.W., et al., Combined preoperative femoral and sciatic nerve blockade improves analgesia after anterior cruciate ligament reconstruction: a randomized controlled trial. *J Clin Anesth*, 2016. Sep; 33: p. 68-74. 3) Anderson, M.J., et al., A Systematic Summary of Systematic Reviews on the Topic of the Anterior Cruciate Ligament. *Orthop J Sports Med*, 2016. 4(3): p. 2325967116634074.

Table 2. Analgesia Pathway Group Differences Across Perioperative Factors and Analgesia Agents/Procedures

	Pre-RAAPP (n=55)	Post-RAAPP (n=48)	SMD	Significance level, p
Operation minutes, median [IQR]	90.00 [60.00, 129.50]	108.50 [77.50, 152.50]	0.40	0.04
Graft type, n (%)			0.19	0.10
Allograft	14 (25.5)	5 (10.4)		
Hamstring Autograft	21 (38.2)	26 (54.2)		
Patellar Tendon Autograft	20 (36.3)	17 (35.4)		
Concomitant surgical procedure, n (%)	24 (43.6)	20 (41.7)	0.04	1.00
Femoral nerve block, n (%)	18 (32.7)	4 (8.2)	1.97	<.001
None	13 (23.6)	44 (91.7)		
Administered pre-operatively	24 (43.6)	0 (0.0)		
Administered post-operatively	46 (83.6)	11 (22.9)	2.47	<0.001
Sciatic nerve block, n (%)	0 (0.0)	36 (75.0)		
None	9 (16.4)	1 (2.1)		
Administered pre-operatively	55 (100.0)	47 (97.9)	0.21	0.47
Adductor canal block, n (%)	0 (0.0)	0 (0.0)		
None	0 (0.0)	1 (2.1)		
Administered pre-operatively	0 (0.0)	0 (0.0)		
Administered post-operatively	0 (0.0)	1 (2.1)		
Pre-operative Medications				
Acetaminophen, n (%)	0 (0.0)	36 (75.0)	2.45	<0.001
Gabapentin, n (%)	0 (0.0)	37 (77.1)	2.59	<0.001
Celecoxib, n (%)	0 (0.0)	36 (75.0)	2.45	<0.001
Intra-operative Medications				
Dexamethasone, n (%)	38 (73.1)	46 (95.8)	0.66	0.002
Ondansetron, (%)	51 (92.7)	48 (100.0)	0.4	0.12
Ketamine, n (%)	4 (7.3)	10 (20.8)	0.39	0.08
Ketorolac, n (%)	11 (20.0)	3 (6.2)	0.42	0.05
Dexmedetomidine, n (%)	2 (3.6)	3 (6.2)	0.12	0.66
Acetaminophen, n (%)	5 (9.1)	2 (4.2)	0.20	0.45

Note: Continuous variables were not normally distributed, and group differences were assessed with Mann-Whitney U tests. Categorical variable differences were assessed with Fisher exact tests. SMD=Standardized Mean Difference.

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