Continuous Femoral Nerve Blockade Versus Periarticular Liposomal Bupivacaine Infiltration for Analgesia After Total Knee Arthroplasty

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Introduction

Total Knee Arthroplasty (TKA) is a common orthopedic surgical procedure that requires adequate postoperative analgesia in order to allow for the early initiation of physical therapy, which may subsequently shorten the duration of hospitalization and improve patient satisfaction. There is increasing demand to minimize the hospital length of stay (LOS) after TKA to reduce overall healthcare costs. We compared infiltration of liposomal bupivacaine (LB) by the surgical team to continuous femoral nerve blockade (CFNB) under the hypothesis that CFNB would be superior to LB . The primary outcome was patient reported pain scores at 24-hours (Numeric Rating Scale 0-10 [NRS]). Secondary outcomes included NRS pain scores at 12, 36, and 48-hours, cumulative opioid consumption, time-to-first-opioid-administration, distance ambulated on post-operative day (POD) 1 and 2, and hospital LOS in hours.

Materials and Methods

- This was an IRB approved retrospective analysis of 180 patients that underwent total knee arthroplasty.
- Two groups of 90 patients that either received CFNB or single injection femoral block and infiltration of periarticular LB by the orthopedic surgeon were compared. All patients also received single injection sciatic nerve blocks as well as spinal anesthesia.
- Primary outcome –NRS pain rating recorded by nursing staff at 24 hours
- Secondary outcomes: NRS pain scores recorded by the nursing staff at 12, 36, and 48 hours; greatest ambulatory distance achieved with PT on postoperative days 1 and 2; time to first administration of opioid on the post-surgical ward; cumulative opioid consumption at 24 and 48 hours; and total time to readiness to discharge in hours.

Results

Primary and secondary outcomes can be found in Table 2

- NRS pain scores at 24 hours were significantly lower in the CFNB group compared to LB group.
- The following secondary outcomes favored the CFNB group compared to the LB group: Lower NRS pain scores at 12 and 36 hours, prolonged time-to-first opioid administration, and decreased cumulative opioid consumption at 24 and 48 hours.
- Distance ambulated was not significantly different between the two groups on POD1. However, on POD2 the distance ambulated by the LB group was statistically greater than the CFNB group.
- There was also a statistically significant shorter hospital LOS in the LB group compared to the CFNB group.

Table 1: Demographics, Preoperative Pain Scores and Pre-medications

	Group		p-value
	Liposomal Bupivacaine	Continuous Femoral Nerve Catheter	
Demographics			
Number of Patients	90	90	N/A
Age (years) mean +/- SD	65.1 (+/- 8.0)	65.8 (+/- 8.5)	0.57
BMI Mean +/- SD	30.6 (+/- 4.3)	31.6 (+/- 5.03)	0.29
Sex (% Female)	44.4%	38.9%	0.55
Pre-Op Numerical Reported Pain Score Mean +/- SD	4.7 (+/-2.9)	5.1 (+/-2.6)	0.46
Medication Administration			
Pre-op Acetaminophen (% receiving)	92.2%	91.1%	0.78
Pre-op Celecoxib (% receiving)	54.4%	55.5%	1
Pre-op Pregabalin (% receiving)	67.7%	67.7%	1
Fentanyl (mcg)	164.8 (+/- 68)	199.7 (+/- 102.5)	0.22

Table 2. Primary Outcome NRS at 24 hrs and Secondary Outcomes.

	Liposomal Bupivacaine	Continuous Femoral Nerve Catheter	P-value*
NRS Pain Score 24 hrs (primary outcome) mean +/- SD	4.55 +/- 3.0	2.5 +/- 3.3	0.0001
NRS Pain Score 12 hrs Mean +/- SD	4.1 +/- 3.2	1.9 +/- 3.2	0.0001
NRS Pain Score 36 hrs Mean +/- SD	3.7 +/- 2.9	2.2 +/- 2.9	0.0008
NRS Pain Score 48 hrs Mean +/- SD	2.1 +/- 2.6	2.0 +/- 2.9	0.6900
Time to First Opioid Admin hrs Mean +/- SD	9.4 +/- 3.0	18.8 +/- 10.9	0.0001
Total Opioid Consumption 24 hrs (morphine equivalents) Mean +/- SD	31.8 +/- 16.7	17.3 +/- 11.1	0.0001
Total Opioid Consumption 48 hrs (morphine equivalents) Mean +/- SD	65.2 +/- 11.2	37.9 +/- 24.3	0.0001
Distance Ambulated POD1 (feet) Mean +/- SD	97.5 +/- 97.3	72.4 +/- 103.0	0.08
Distance Ambulated POD2 (feet) Mean +/-SD	206.7 +/- 135.2	166.5 +/- 110.0	0.015
Time to Hospital Discharge (hours) Mean +/- SD	57.4 +/- 14.8	67.2 +/- 20.6	0.0003

Discussion

These results suggest that when combined with a single injection sciatic nerve block, analgesia after TKA is better with CFNB as compared to LB infiltration. CFNB resulted in lower pain scores at 12, 24, and 36-hours, lower cumulative opioid consumption through 24-hours and 48-hours, and a longer time-to-first-opioid-administration. However, LB favored a farther distance walked on POD2 and a shorter time to hospital discharge.

References

1. William C. Schroer, MD et al; Does Extended-Release Liposomal Bupivacaine Better Control Pain Than Bupivacaine After Total Knee Arthroplasty (TKA)? A Prospective, Randomized Clinical Trial; The Journal of Arthroplasty 30 Suppl. 1 (2015) 64–67.

2. Brandon J. Horn, DO et al; Femoral Nerve Block vs Periarticular Bupivacaine Liposome Injection After Primary Total Knee Arthroplasty: Effect on Patient Outcomes; The Journal of the American Osteopathic Association December 2015, Vol 115, No. 12.

3. Stephen Yu MD et al; Pain Control and Functional Milestones in Total Knee Arthroplasty: Liposomal Bupivacaine versus Femoral Nerve Block; Clin Orthop Relat Res (2017) 475:110–117.

4. Adam W. Amundson, M.D.; A Three-arm Randomized Clinical Trial Comparing Continuous Femoral Plus Single-injection Sciatic Peripheral Nerve Blocks versus Periarticular Injection with Ropivacaine or Liposomal Bupivacaine for Patients Undergoing Total Knee Arthroplasty; Anesthesiology 2017; 126:1139-50.