Is Quadriceps Strength Affected by The Use of a Tourniquet or Adductor Canal Block Following Primary Total Knee Arthroplasty?

Jaclyn Aleksandra Konopka, Thomas R Bieganowski[1], Jerry Arraut, Spencer Alexander Ward, James D Slover, William B Macaulay[2], Claudette Malvina Lajam[3], Ran Schwarzkopf[4], Joshua Craig Rozell
[1]NYU Langone Health, [2]NYU Langone Medical Center, [3]NYU Langone Orthopedics, [4]NYU Langone Orthopedic Hospital, Hospital For Joi

INTRODUCTION:

Primary total knee arthroplasty (TKA) reduces pain and restores functional range of motion in patients with osteoarthritis. Some have postulated; however, that quadriceps weakness after surgery may delay post-operative rehabilitation and cause difficulty with ambulation. Our aim was to investigate whether primary TKA, tourniquet use, and adductor canal block (ACB) have an effect on post-operative quadriceps strength.

METHODS:

We prospectively analyzed 175 patients undergoing primary TKA between August 2021 and May 2022. Exclusion criteria included patients less than 18 years of age, a revision procedure, bilateral procedure, unicompartmental arthroplasty, intraoperative complications, and a history of a neurologic deficit to their knee that could impact quadriceps strength testing. Patients were stratified into four groups based on whether they received neither tourniquet nor ACB (NTNACB), a tourniquet only (TO), an ACB only (ACBO), or both a tourniquet and an ACB (TACB). Isometric knee extension muscle strength was measured preoperatively and on postoperative (PO) day zero or PO day one using a hand-held dynamometer. Demographic differences were assessed using chi-squared analysis and analysis of variance (ANOVA). Significant differences in quadriceps strength were determined using univariate linear regression.

RESULTS:

Average time to postoperative strength testing was 9.60 $\pm$ 7.88 hours. There were no significant differences in demographic variables (Table 1) or preoperative ipsilateral (p=0.252) and contralateral (p=0.351) quadriceps strength between cohorts (Table 2). Differences in postoperative ipsilateral quadriceps strength also did not reach statistical significance (p=0.156). Patients in the NTNACB group demonstrated significantly lower contralateral quadriceps strength postoperatively compared to the other three groups (NTNACB: 17.42 $\pm$ 9.32 vs TO: 22.18 $\pm$ 11.93 vs ACBO: 21.35 $\pm$ 9.48 vs TACB: 23.51 $\pm$ 8.41; p=0.032). Delta change in preoperative to postoperative quadriceps strength for both operative (p=0.130) and non-operative (p=0.704) extremities also exhibited no significant differences between cohorts.

DISCUSSION AND CONCLUSION:

This study sought to understand postoperative quadriceps function after TKA to optimize patient safety during physical therapy and improve quality of care. Quadriceps strength in the operative leg did not significantly change following surgery, even with the use of a tourniquet and/or ACB, suggesting that their combined use is safe. However, further analyses with larger patient populations are required to determine whether a true relationship exists between perioperative techniques and recovery after primary TKA.

Table 1. Demographic Data

	NTNACB (n=30)	TO (n=32)	ACBO (n=45)	TACB (n=68)	P-Value
Sex					0.735
Male	11 (36.7%)	11 (34.4%)	14 (31.1%)	18 (26.5%)	
Female	19 (63.3%)	21 (65.6%)	31 (68.9%)	50 (73.5%)	
Age (years, $\pm$ SD)	66.37 $\pm$ 12.22	67.13 $\pm$ 7.39	64.49 $\pm$ 9.50	68.31 $\pm$ 8.14	0.192
Smoking Status					0.994
Never Smoker	18 (60.0%)	20 (62.5%)	29 (64.4%)	39 (57.4%)	
Former Smoker	11 (36.7%)	11 (34.4%)	15 (33.3%)	27 (39.7%)	
Current Smoker	1 (3.3%)	1 (3.1%)	1 (2.2%)	2 (2.9%)	
Race					0.138
White	21 (70.0%)	14 (43.8%)	19 (42.2%)	33 (48.5%)	
Black or African American	3 (10.0%)	9 (28.1%)	11 (24.4%)	14 (20.6%)	
Asian	1 (3.3%)	3 (9.4%)	0 (0.0%)	2 (2.9%)	
Other	5 (16.7%)	6 (18.8%)	15 (33.3%)	19 (27.9%)	
ASA					0.304
I	1 (3.3%)	2 (6.3%)	1 (2.2%)	1 (1.5%)	
II	18 (60.0%)	24 (75.0%)	35 (77.8%)	43 (63.2%)	
III	11 (36.7%)	6 (18.8%)	9 (20.0%)	24 (35.3%)	
Previous Contralateral TKA	10 (33.3%)	9 (28.1%)	8 (17.8%)	21 (30.9%)	0.385
BMI (kg/m^2, $\pm$ SD)	29.95 $\pm$ 4.89	32.28 $\pm$ 5.54	33.21 $\pm$ 6.34	32.80 $\pm$ 7.31	0.150
Surgical Time (minutes, $\pm$ SD)	122.00 $\pm$ 38.28	109.00 $\pm$ 48.92	130.31 $\pm$ 33.56	111.47 $\pm$ 33.65	0.032
Gait Aid (%yes)	7 (23.3%)	9 (28.1%)	13 (28.9%)	24 (35.3%)	0.658

Table 2. Quadriceps Strength Comparison Based on Intervention

	NTNACB (n=30)	TO (n=32)	ACBO (n=45)	TACB (n=68)	P-Value
Preoperative					
Contralateral (lbs, $\pm$ SD)	23.01 + 11.33	26.79 + 12.62	22.85 + 10.32	23.82 + 13.66	0.351
ipsilateral (lbs, $\pm$ SD)	21.09 $\pm$ 9.45	23.83 $\pm$ 12.09	19.37 $\pm$ 10.24	22.04 $\pm$ 13.17	0.252
Postoperative					
Contralateral (lbs, $\pm$ SD)	17.42 $\pm$ 9.32	22.18 $\pm$ 11.93	21.35 $\pm$ 9.48	23.51 $\pm$ 8.41	0.032
ipsilateral (lbs, $\pm$ SD)	10.91 $\pm$ 8.16	14.30 $\pm$ 9.98	11.35 $\pm$ 6.21	13.89 $\pm$ 7.42	0.156
Delta Change					
Contralateral (lbs, $\pm$ SD)	-5.59 $\pm$ 7.99	-4.60 $\pm$ 14.45	-1.50 $\pm$ 10.80	-0.30 $\pm$ 12.45	0.704
ipsilateral (lbs, $\pm$ SD)	-10.17 $\pm$ 7.61	-9.53 $\pm$ 13.68	-8.02 $\pm$ 7.60	-8.16 $\pm$ 12.46	0.130