Limited Tourniquet Use Associated with Decreased In-Hospital Opioid Consumption and Improved Hospital Metrics Following Primary Total Knee Arthroplasty

Nathaniel Ondeck[1], Felix Conrad Oettl, Aaron Ira Weinblatt, Ranqing Lan, Stephen Lyman[2], Jose Moises Gutierrez-Naranjo[1], Brian Chalmers[3], Alejandro Gonzalez Della Valle[3]
[1]Hospital For Special Surgery, [2]The Hospital for Special Surgery, [3]Hospital for Special Surgery

INTRODUCTION:
There is conflicting evidence regarding the association between tourniquet use and acute post-operative pain as well as hospital metrics after primary total knee arthroplasty (TKA).

In this context, the current study utilizes a large and single institution sample to evaluate in-hospital opioid consumption, time to clear physical therapy, and length of stay following four distinct tourniquet use patterns.

METHODS:
Patients undergoing a TKA procedure for osteoarthritis (OA) between 2019 and 2023 were identified. Exclusions included patients under the age of 45, diagnoses other than primary OA, TKA with concomitant hardware removal, another unrelated orthopaedic procedure within 90 days, and patients discharged to a rehabilitation center. Patient demographic information, co-morbidity information, and intra-operative variables were tabulated.

Tourniquet usage was classified as no tourniquet (7.0%), tourniquet use only for cementation and/or select portions of the case (16.3%), tourniquet use from incision through cementation (56%), and tourniquet use from incision through skin closure (20.7%).

Outcome variables included in-hospital post-operative opioid consumption (morphine milligram equivalents), time to clear physical therapy (hours), and length of stay (hours).

Differences in opioid usage amongst the four groups were compared using an ANOVA test, followed by a post-hoc Tukey's test. Differences in time to clear physical therapy and length of stay were compared using a Kruskal-Wallis test, followed by the pairwise Wilcoxon Test adjusted with a Bonferroni correction. Linear regressions that controlled for demographic factors (age, sex, body mass index, race, marital status, ASA score, Charlson Comorbidity Index score, smoking status, chronic pain diagnosis, and pre-operative opioid usage) as well as intra-operative variables (use of cement, use of technology, and year of surgery) were also utilized for all outcome variables.

RESULTS:
Ultimately, 17,850 patients were included in the study (Table 1).

After controlling for confounding factors, patients undergoing tourniquet use from incision through cementation as well as from incision through skin closure consumed an average of 11 ($P=0.006$) and 14 ($P<0.001$) MME more than the no tourniquet group (Figure 1). The patients with tourniquet use only during cementation demonstrated no significant difference in MME intake in comparison with the no tourniquet group.

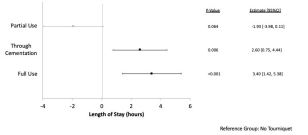
In comparison to no tourniquet use, patients with tourniquet use from incision through cementation and from incision through skin closure required an additional 2.97 ($P<0.001$) and 3.82 ($P<0.001$) hours to clear physical therapy (Figure 2). Tourniquet use only during cementation demonstrated no significant difference in time to clear physical therapy in comparison with the no tourniquet group.

Finally, patients undergoing tourniquet use from incision through cementation and from incision through skin closure had lengths of stay that were on average of 2.6 ($P=0.006$) and 3.4 ($P<0.001$) hours longer than the no tourniquet group while tourniquet use only during cementation again had no significant difference in length of stay in comparison to the no tourniquet group (Figure 3).

DISCUSSION AND CONCLUSION:
This study, which is the largest modern single institution tourniquet investigation to our knowledge, demonstrates that there are a variety of tourniquet usage patterns utilized during primary TKA procedures. Interestingly, no tourniquet use and limited tourniquet use, for example only during cementation, was associated with decreased in-hospital pain (as measured through MME intake) as well as decreased time to clear physical therapy and length of stay. As we enter a

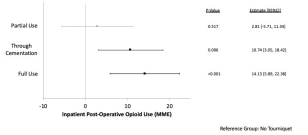
period of increased focus on rapid recovery protocols and outpatient arthroplasty, these findings should be considered when deciding upon a tourniquet usage strategy.

Figure 3: Length of Stay



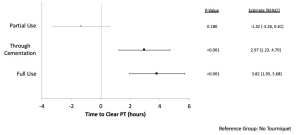
Reference Group: No Tourniquet

Figure 1: Inpatient Post-Operative Opioid Use



Reference Group: No Tourniquet

Figure 2: Time to Clear PT



Reference Group: No Tourniquet

TABLE 1
Patient Population

Characteristic	Number (#)	Percentage (%)
Overall	17,850	100.0
Age (years)		
< 60	3,451	19.3
60-69	7,177	40.2
70-79	5,858	32.8
≥80	1,364	7.7
Female Sex	10,867	60.9
Obesity		
Normal (< 25kg/m^2)	2,488	13.9
Overweight (≤25kg/m^2 and <30kg/m^2)	5,774	32.4
Obese (≥30kg/m^2)	9,588	53.7
Charlson Comorbidity Index (points)		
0	11,345	63.6
1	4,250	23.8
≥2	2,255	12.6
Cemented Arthroplasty	16,651	93.3
Technology		
None	9,154	51.3
Computer Navigation	6,534	36.6
Robotic	2,162	12.1
Tourniquet Use		
None	1,243	7.0
Select Tourniquet Use	2,914	16.3
From Incision through Cementation	10,003	56.0
From Incision through Skin Closure	3,690	20.7