

# Orthopaedic Surgeries Decrease Chronic Opioid Use: The Relationship Between Preoperative and Postoperative Opioid Use Patterns

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## INTRODUCTION:

The opioid epidemic has massive societal and economic consequences, costing the United States more than \$500 billion per year. Opioid use in the management of musculoskeletal pathology has become widespread. We have examined seven common elective orthopaedic procedures in a large national cohort to better understand the relationship between pre and postoperative opioid consumption in these patients.

## METHODS:

An insurance company national claims database (2007-Q3 2015) of 22 million beneficiaries was used for this analysis. Cohorts of anterior cervical decompression and fusion (ACDF), posterior lumbar fusion (PLF), carpal tunnel release (CTR), rotator cuff repair (RCR), total knee arthroplasty (TKA), total hip arthroplasty (THA), and total shoulder arthroplasty (TSA) patients were created using International Classification of Diseases (ICD) and Current Procedural Terminology (CPT) codes. For THA, TKA, and TSA, we only included unilateral procedures. For PLF we included instrumented fusion with or without an interbody cage for degenerative pathology. Preoperative opioid use was classified as naïve, <3-months, 3-6-months, >6-months continuous (>6M), and >6-months but without prescription in 3-months before surgery (>6M-S), from pharmacy claims data. Chronic preoperative opioid use was defined as >6 months of opioid use, regardless of whether the patient stopped opioids before surgery. Our primary outcome measure was chronic postoperative opioid use, which was defined as  $\geq 8$  prescriptions for opioids in the 1-year period after surgery (corresponding to at least one prescription every 6 weeks for a year). Total opioid usage (measured in pills per patient per day in the year after surgery) was calculated for this group. Discontinuation of chronic opioid use was defined as <8 prescriptions for opioids in the 1-year period after surgery. To study the association between preoperative and postoperative opioid use, univariate log-rank test and multivariate Cox proportional hazards analyses were performed (R, The R Project for Statistical Computing). For all analyses, a p-value of <0.05 was considered statistically significant.

## RESULTS:

A total of 98,769 patients were included in this analysis. Preoperative opioid use varied according to the type of procedure (**Table 1**). PLF patients had the highest rate of chronic preoperative use at 28.25%, while CTR patients had the least at 11.95%. CTR had the highest proportion of opioid naïve patients at 41.11%, as compared to 23.36% of PLF patients ( $p < 0.0001$ ).

Chronic postoperative use among opioid naïve patients and discontinuation of chronic use also varied significantly between procedures (**Table 1**). Analysis of postoperative use patterns revealed that chronic postoperative users consumed an average of 2.6-3.4 pills of narcotics daily for one year, depending on the procedure. After PLF, 4.53% of opioid naïve patients used opioids chronically, as opposed to only 0.76% after CTR ( $p < 0.0001$ ).

Chronic preoperative use was associated with an increased risk of chronic postoperative use on adjusted analysis (**Table 2**). Preoperative opioid naïve patients had a strong negative association with chronic postoperative use (OR 0.094-0.224 depending on procedure,  $p < 0.0001$ ). In major joint arthroplasty and spinal fusion, chronic preoperative opioid users who did not have any prescription within 3-months before surgery had an associated lower risk of chronic postoperative opioid use (**Table 2**). For example, in ACDF, 68.15% of preoperative continuous chronic users continued chronic postoperative use as opposed to 14.37% of preoperative chronic users who did not receive a prescription within 3 months before surgery. This compares to 2.06% of opioid naïve ACDF patients who became chronic users postoperatively. Similar trends were seen in other procedures. An increasing duration of preoperative opioid use was also associated with increased chronic postoperative opioid use. The exact duration of preoperative use associated with an increased risk of chronic postoperative use varied by procedure (**Table 2**).

## DISCUSSION AND CONCLUSION:

Our analysis of seven common elective orthopaedic procedures found variation in opioid use patterns pre and postoperatively. A substantial percentage of patients undergoing orthopaedic surgery in this analysis were using opioids chronically before surgery. A sizeable proportion (41.65-61.95%) of chronic preoperative opioid users discontinued chronic opioids after orthopaedic surgery. Despite chronic preoperative use, stopping prescription within 3 months before surgery reduced the risk of chronic postoperative opioid use, especially in major total joint arthroplasty and spinal fusion. In conclusion, our results suggest that postoperative opioid utilization patterns vary with the type of procedure and preoperative opioid burden. While opioid naïve patients are least likely to start chronic use postoperatively, stopping or weaning off opioids preoperatively in chronic users appears to be beneficial. Furthermore, all of the orthopaedic procedures studied were associated with a significant overall reduction in chronic opioid use.

**Table 2. Risk of chronic postoperative opioid use according to preoperative opioid use pattern. All data are presented as: OR (95% CI) p-value. (Preoperative use groups: >6M – >6 months continuous preoperative opioid use, >6M-S – >6 months preoperative use but without prescription in 3 months before surgery); TKA – total knee arthroplasty, THA – total hip arthroplasty, TSA – total shoulder arthroplasty, ACDF – anterior cervical decompression and fusion, PLF – posterior lumbar fusion, CTR – carpal tunnel release, RCR – rotator cuff repair)**

	TKA	THA	TSA	ACDF	PLF	CTR	RCR
<b>Opioid Naive</b>	OR: 0.117 (0.096-0.145) p<0.0001	OR: 0.094 (0.062-0.144) p<0.0001	OR: 0.182 (0.113-0.280) p<0.0001	OR: 0.212 (0.152-0.288) p<0.0001	OR: 0.187 (0.136-0.259) p<0.0001	OR: 0.212 (0.142-0.308) p<0.0001	OR: 0.224 (0.172-0.288) p<0.0001
<b>&lt;3-months</b>	OR: 0.591 (0.428-0.808) p=0.0012	OR: 0.738 (0.474-1.139) p=0.1725	OR: 1.479 (0.720-2.810) p=0.2568	OR: 1.094 (0.755-1.554) p=0.6256	OR: 0.646 (0.458-0.905) p=0.0118	OR: 1.4 (0.612-2.85) p=0.3881	OR: 1.454 (1.071-1.941) p=0.0135
<b>3-6 months</b>	OR: 1.297 (0.912-1.827) p=0.1421	OR: 1.382 (0.876-2.157) p=0.1587	OR: 4.708 (2.397-8.888) p<0.0001	OR: 2.866 (1.934-4.193) p<0.0001	OR: 1.815 (1.297-2.536) p=0.0004	OR: 10.723 (5.679-19.79) p<0.0001	OR: 4.268 (2.975-6.029) p<0.0001
<b>&gt;6M-S</b>	OR: 0.468 (0.374-0.586) p<0.0001	OR: 0.532 (0.337-0.841) p=0.0067	OR: 1.685 (1.068-2.583) p=0.0201	OR: 1.252 (0.893-1.723) p=0.1797	OR: 0.743 (0.535-1.033) p=0.0756	OR: 1.673 (1.074-2.518) p=0.017	OR: 1.752 (1.274-2.367) p=0.0004
<b>&gt;6M</b>	OR: 5.585 (4.582-6.833) p<0.0001	OR: 5.837 (4.130-8.409) p<0.0001	OR: 17.15 (13.47-21.93) p<0.0001	OR: 16.29 (13.87-19.18) p<0.0001	OR: 4.844 (3.681-6.372) p<0.0001	OR: 39.75 (32.11-49.42) p<0.0001	OR: 22.56 (19.57-26.04) p<0.0001

**Table 1. Characterization of preoperative opioid use among patients undergoing various orthopedic surgeries and net change in chronic opioid use postoperatively. (Preoperative use groups: >6M – >6 months continuous preoperative opioid use, >6M-S – >6 months preoperative use but without prescription in 3 months before surgery, TKA – total knee arthroplasty, THA – total hip arthroplasty, TSA – total shoulder arthroplasty, ACDF – anterior cervical decompression and fusion, PLF – posterior lumbar fusion, CTR – carpal tunnel release, RCR – rotator cuff repair)**

	TKA	THA	TSA	ACDF	PLF	CTR	RCR	P-Value
<b>Total Patients</b>	32,667	14,724	4,500	7,926	10,681	10,247	18,024	
<b>Unknown – Unable to Characterize</b>	13,904 (42.56)	5,882 (39.95)	2,095 (46.56)	3,387 (42.73)	4,426 (41.44)	4,637 (45.25)	8,836 (49.02)	<0.0001
<b>Opioid naïve</b>	13,359 (40.89)	5,942 (40.36)	1,494 (33.20)	2,991 (26.38)	2,495 (23.36)	4,213 (41.11)	6,107 (33.88)	<0.0001
<b>&lt;3 months</b>	405 (1.24)	440 (2.99)	78 (1.73)	321 (4.05)	429 (4.02)	118 (1.15)	657 (3.65)	<0.0001
<b>3-6 months</b>	213 (0.65)	247 (1.68)	52 (1.16)	180 (2.27)	313 (2.93)	54 (0.53)	215 (1.19)	<0.0001
<b>&gt;6M-S</b>	1,894 (5.80)	619 (4.20)	193 (4.29)	355 (4.48)	657 (6.15)	363 (3.54)	477 (2.65)	<0.0001
<b>&gt;6M</b>	2,892 (8.85)	1,594 (10.83)	588 (13.07)	1,592 (20.09)	2,361 (22.10)	862 (8.41)	1,732 (9.61)	<0.0001
<b>N, % of opioid naïve patients</b>	451 (3.38)	69 (1.16)	21 (1.41)	43 (2.06)	113 (4.53)	32 (0.76)	68 (1.11)	<0.0001
<b>N, % of &gt;6M-S group</b>	263 (13.89)	46 (7.43)	28 (14.51)	51 (14.37)	119 (18.11)	26 (7.16)	52 (10.90)	<0.0001
<b>N, % of &gt;6M group</b>	1,983 (68.57)	796 (49.94)	371 (63.10)	1,085 (68.15)	1,404 (59.47)	559 (64.85)	1,040 (60.05)	<0.0001
<b>Pills/patient/day over 1 year after surgery in chronic postoperative opioid use patients</b>	2.62	2.93	2.79	3.43	3.26	3.07	2.86	