

Postoperative Ketorolac Administration and Pseudoarthrosis Following Lumbar Spinal Fusion: A Matched Cohort Study

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INTRODUCTION: Ketorolac is increasingly used in multimodal pain regimens to reduce opioid use. However, its effect on bone healing, particularly after lumbar fusion, remains unclear. The aim of this study was to evaluate opioid utilization and pseudoarthrosis risk following lumbar spinal fusion in patients receiving postoperative ketorolac versus those who did not.

METHODS: Using the TriNetX database, we identified patients undergoing lumbar spinal fusion with ≥ 30 days of follow-up, excluding those with prior pseudoarthrosis. Patients were grouped by postoperative ketorolac use and matched 1:1 by sex, age, ethnicity, and comorbidities. Primary outcomes included opioid prescriptions at 7, 14, and 30 days. Pseudoarthrosis was assessed at 1 and 2 years. Secondary outcomes included bowel regimen use, ileus, DVT, PE, AKI, transfusion, infection, wound disruption, lab values (Hgb, Hct, Cr), readmissions, ED visits, and mechanical complications at 1 and 2 years.

RESULTS: After matching, 15,260 patients were included in each group. Ketorolac use was associated with fewer opioid prescriptions at all short-term timepoints (e.g., 2.5 vs. 2.8 at 7 days, $p < 0.001$) and less bowel regimen use ($p < 0.001$). DVT, PE, and ileus risk were lower in the ketorolac group ($p < 0.05$). No increase in AKI, Cr, or transfusion rates was observed. At 1 and 2 years, ketorolac users had reduced mechanical complications and comparable pseudoarthrosis rates.

DISCUSSION AND CONCLUSION: Postoperative ketorolac may reduce short-term opioid use and thromboembolic risk without increasing pseudoarthrosis or mechanical complications. These findings support ketorolac as a potentially safe adjunct in postoperative pain management. Further randomized trials are warranted.

Table I Propensity matching criteria for patients with and without ketorolac after lumbar spinal fusion

	Before Matching		After Matching	
	No Ketorolac (n=15,260)	P value	No Ketorolac (n=15,260)	P value
Age (SD)	58.1 (16.3)	61.0 (14.5)	58.2 (16.2)	58.5 (15.7)
Sex, n (%)				
Male	7259 (47.5)	45058 (51.3)	7257 (47.6)	7377 (48.3)
Female	7901 (51.7)	41987 (47.9)	7871 (51.6)	7791 (51.1)
Comorbidities, n (%)				
Anxiety disorders	3498 (22.9)	16484 (18.8)	3495 (22.9)	3386 (22.2)
CKD	1007 (6.6)	8126 (9.3)	1007 (6.6)	979 (6.4)
DM	2933 (19.2)	18773 (21.4)	2933 (19.2)	2858 (18.7)
Depression	3248 (21.2)	16675 (19.0)	3247 (21.3)	3117 (20.4)
Fibromyalgia	1005 (6.6)	6009 (6.8)	1005 (6.6)	907 (5.9)
Overweight & obesity	4042 (26.4)	20553 (23.4)	4038 (26.5)	3958 (25.9)
Medication				
Anidepressants	6127 (40.1)	30367 (34.6)	6114 (40.1)	6084 (39.9)
Non-Opioid	11674 (76.3)	57943 (66.0)	11641 (76.3)	11732 (76.9)
Anesthetics				
Opioid Analgesics	12025 (78.6)	59493 (67.8)	11992 (78.6)	12047 (78.9)
Sedatives/Hypnotics	9661 (63.2)	43463 (49.5)	9628 (63.1)	9695 (63.5)
NSAIDs	8505 (55.6)	42471 (48.4)	8483 (55.6)	8518 (55.8)

CKD, chronic kidney disease; DM, diabetes mellitus; NSAIDs, non-steroidal anti-inflammatory drug

Table II Risk analysis of short term outcomes for patients with and without ketorolac after posterior fusion

	Ketorolac (n=15,260)	No Ketorolac (n=15,260)	HR (95% CI)	P Value
Opioid Rx	15,822 (66.0)	15,810 (69.2)	1.070 (1.043 - 1.096)	<0.001
Risk	2.5 (1.9)	2.8 (2.0)	(-)	<0.001
Bowel Regimen Rx	12,805 (83.9)	12,889 (81.2)	1.094 (1.064 - 1.122)	<0.001
Risk	7.1 (3.1)	7.4 (3.1)	(-)	<0.001
# of Prescriptions	127 (0.8)	145 (1.0)	0.876 (0.690 - 1.111)	0.275
Post Op Ileus	46 (0.3)	58 (0.4)	0.801 (0.491 - 1.317)	0.400
PE	66 (0.4)	98 (0.6)	0.702 (0.512 - 0.961)	0.027
Surgical Site Infection	46 (0.3)	58 (0.4)	0.709 (0.491 - 1.029)	0.112
AKI	31 (0.2)	27 (0.2)	1.223 (0.731 - 2.033)	0.438
Transfusion	150 (1.0)	172 (1.1)	0.872 (0.761 - 1.000)	0.219
Hemoglobin	200 (1.3)	290 (1.9)	0.688 (0.571 - 0.834)	<0.001
Hematocrit	18 (1.1)	18 (1.2)	(-)	0.601
Creatinine	32 (0.2)	32 (0.2)	(-)	0.601
Readmission	2,081 (13.6)	2,640 (17.3)	0.779 (0.732 - 0.821)	<0.001
ED Visit	372 (2.5)	371 (2.4)	1.015 (1.158 - 1.377)	<0.001
14 Day Outcomes				
Opioid Rx	14,099 (92.3)	13,866 (90.9)	1.073 (1.048 - 1.099)	<0.001
Risk	2.3 (2.0)	2.6 (2.1)	(-)	<0.001
# of Prescriptions	127 (0.8)	145 (1.0)	0.876 (0.690 - 1.111)	0.275
Bowel Regimen Rx	12,805 (83.9)	12,889 (81.2)	1.094 (1.064 - 1.122)	<0.001
Risk	7.1 (3.1)	7.4 (3.1)	(-)	<0.001
# of Prescriptions	127 (0.8)	145 (1.0)	0.876 (0.690 - 1.111)	0.275
Post Op Ileus	46 (0.3)	58 (0.4)	0.801 (0.491 - 1.317)	0.400
DVT	15 (1.0)	24 (0.6)	0.612 (0.350 - 0.749)	<0.001
PE	19 (0.6)	14 (0.9)	0.602 (0.315 - 0.984)	0.045
Surgical Site Infection	17 (0.9)	11 (0.8)	1.191 (0.591 - 1.126)	0.163
Wound Disruption	19 (0.6)	18 (0.6)	0.824 (0.491 - 0.919)	<0.001
AKI	20 (1.3)	27 (1.6)	0.824 (0.491 - 0.919)	<0.001
Transfusion	21 (1.4)	30 (1.9)	0.709 (0.591 - 0.834)	<0.001
Hemoglobin	19 (1.1)	10 (1.1)	(-)	0.601
Hematocrit	32 (0.4)	32 (0.4)	(-)	0.601
Creatinine	9 (0.4)	9 (0.4)	(-)	0.601
Readmission	2,265 (15.5)	3,014 (19.8)	0.768 (0.738 - 0.811)	<0.001
ED Visit	75 (0.5)	79 (0.5)	1.311 (1.178 - 1.461)	<0.001
30 Day Outcomes				
Opioid Rx	14,221 (93.2)	14,085 (92.3)	1.066 (1.043 - 1.091)	<0.001
Risk	4.1 (4.4)	4.5 (4.7)	(-)	<0.001
# of Prescriptions	13,038 (85.4)	12,694 (83.2)	1.089 (1.063 - 1.116)	<0.001
Bowel Regimen Rx	11,674 (76.3)	11,732 (76.9)	0.812 (0.644 - 0.992)	0.041
Risk	17 (1.1)	17 (1.1)	(-)	<0.001
# of Prescriptions	17 (1.1)	17 (1.1)	0.959 (0.471 - 0.602)	<0.001
Post Op Ileus	14 (0.9)	20 (1.3)	0.696 (0.362 - 0.862)	0.001
DVT	19 (1.2)	14 (0.9)	1.055 (0.616 - 1.239)	0.405
PE	26 (1.7)	24 (0.7)	0.970 (0.616 - 1.132)	0.735
Surgical Site Infection	27 (1.8)	14 (0.9)	0.792 (0.476 - 0.928)	0.004
AKI	27 (1.8)	33 (2.2)	0.709 (0.591 - 0.836)	<0.001
Transfusion	19 (1.1)	10 (1.1)	(-)	0.601
Hemoglobin	32 (0.4)	32 (0.4)	(-)	0.601
Hematocrit	9 (0.4)	9 (0.4)	(-)	0.601
Creatinine	2,588 (16.8)	3,221 (21.8)	0.750 (0.717 - 0.795)	<0.001
Readmission	1,115 (7.3)	1,009 (6.6)	1.114 (1.021 - 1.211)	0.012
ED Visit				

HR, hazard ratio; CI, confidence interval; Rx, prescription; DVT, deep venous thrombosis; PE, pulmonary embolism; ED, emergency department

Table III Risk analysis of long term outcomes for patients with and without ketorolac after posterior fusion

	1 Year Outcomes		HR (95% CI)	P Value
	Ketorolac (n=15,260)	No Ketorolac (n=15,260)		
Surgical Site Infection	594 (3.9)	601 (3.9)	0.993 (0.887 - 1.113)	0.907
Wound Disruption	484 (3.2)	495 (3.2)	0.980 (0.865 - 1.111)	0.754
Mechanical Complications	243 (1.6)	327 (2.1)	0.751 (0.636 - 0.887)	0.001
Pseudoarthrosis	11 (0.1)	10 (0.1)	1.248 (0.517 - 3.013)	0.621
2 Year Outcomes				
Ketorolac (n=15,260)	No Ketorolac (n=15,260)	HR (95% CI)	P Value	
Surgical Site Infection	647 (4.2)	659 (4.3)	0.993 (0.891 - 1.107)	0.902
Wound Disruption	511 (3.3)	535 (3.5)	0.962 (0.853 - 1.087)	0.537
Mechanical Complications	338 (2.2)	431 (2.8)	0.806 (0.699 - 0.929)	0.003
Pseudoarthrosis	14 (0.1)	13 (0.1)	1.121 (0.527 - 2.385)	0.767

HR, hazard ratio; CI, confidence interval; Rx, prescription; DVT, deep venous thrombosis; PE, pulmonary embolism; ED, emergency department