Preoperative Chronic Pain Diagnosis Before TKA Leads to Lower Clinically Significant Symptomatic Improvement and Dissatisfaction at 1-year: A Prospective Analysis of 10,988 Patients

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INTRODUCTION:

One in four adults in the USA suffer from chronic pain – pain lasting longer than 3 months in one or more locations in your body. These patients can perceive pain differently and may not be satisfied with pain reliving surgeries like total knee arthroplasty (TKA). While studies have looked at the predictors of postoperative pain, there is a paucity of literature assessing the impact of preoperative chronic pain on postoperative TKA outcomes. Therefore, this study aimed to assess (1) clinically relevant improvement in patient-reported outcome measures (PROMs), and (2) self-reported satisfaction at 1-year between patients with and without a preoperative chronic pain diagnosis.

METHODS:

A cohort of primary elective unilateral TKAs performed at a large tertiary academic center in the United States from 2016-2022 were included (n = 10,988 patients). Electronic medical record (EMR) was used to identify a preoperative diagnosis of chronic pain using ICD-9 (338.2 and 338.4) and ICD-10 (G89.2 and G89.4) coding. Multivariable logistic regression models were used to compare 1-year PROMs between those with chronic pain versus those without chronic pain. The included PROMs were the Knee disability and Osteoarthritis Outcome Score (KOOS) Pain, Physical function Shortform (PS), Joint Replacement (JR), and Veteran Rand-12 mental component score (VR-12 MCS). Clinically relevant improvements were assessed through minimal clinically important difference (MCID) and Patient Acceptable Symptom State (PASS) threshold achievement. The models were controlled for pre-specified demographics and surgical confounding variables. The 'failure to reach the threshold (or the so-called treatment failure)' were modeled and considered as the event of interest in all the models. All tests were two-sided, with a Type I error rate of 0.05. Cohort characteristics are displayed in **Table 1**.

RESULTS:

Overall, 23.6% (2,589/10,988) of patients had a diagnosis of chronic pain before their TKA. A large majority of chronic pain and non-chronic pain patients achieved MCID in KOOS Pain (93 v 94%, p=0.15), PS (84 v 85%, p=0.42), and JR (91 v 92%, p=0.11). In comparison, significantly less patients with chronic pain achieved PASS thresholds in KOOS pain (63.2v70.9%), PS (59.8v67.1%) and JR (60.8v69.2%, p<0.001). Less chronic pain patients claimed to be satisfied at 1-year than non-chronic pain patients (80.2%v84%, p<0.001) **(Table 2)**. After adjusting for confounding variables, chronic pain was independently associated with failure to reach MCID improvement in KOOS JR (odds ratio [OR] 1.2; 95% confidence interval [CI]: 1,1.43; p=0.049) and VR12-MCS (OR 1.15; 95% CI: 1.03,1.29; p=0.01) **(Table 3)**. Chronic pain is also independently associated with failure to reach PASS threshold in KOOS pain (OR 1.25; 1.13,1.38; p=<0.001), PS (OR 1.22; 95% CI: 1.1,1.35; p<0.001) and JR (OR 1.28; 95% CI: 1.15,1.42; p<0.001) **(Table 4)**. Finally, those with chronic pain are more likely to fail to achieve satisfaction at 1-year after TKA (OR 1.17, 95% CI: 1.04,1.32; p=0.011) **(Table 5)**.

DISCUSSION AND CONCLUSION:

Nearly a quarter of patients undergoing TKA have a preoperative diagnosis of chronic pain. Chronic pain emerged as an independent predictor of failure to reach clinically significant improvements in knee pain, function, mental health, and satisfaction at 1-year. Clinicians should consider implementing tailored interventions and support mechanisms to address the unique needs of patients with chronic pain undergoing TKA, aiming to optimize postoperative outcomes and enhance patient satisfaction. Further research is warranted to explore additional strategies for mitigating the impact of chronic pain on TKA outcomes and improving overall patient care in this population.

Table 1 – Cohort demographics comparing chronic pain versus non-chronic pain patients undergoing TKA

Variable	Level	Total (N=10988)	No Chronic Pain (N=8399)	Chronic Pain (N=2589)	P-value
Age		67 [58.0, 73.0]	67 [58.0, 73.0]	67 [58.0, 73.0]	0.885
Sex	Male	4375 (39.8%)	3320 (39.5%)	1055 (40.7%)	<0.001
	Female	6613 (60.2%)	4879 (58.1%)	1734 (67.2%)	
BMI		31.4 [27.3, 36.2]	31.0 [27.1, 35.4]	33.2 [27.9, 38.1]	<0.001
Race	White	9245 (84.1%)	7125 (84.8%)	2120 (81.9%)	<0.001
	Black	1013 (9.2%)	189 (2.30%)	37 (2.10%)	
	Other	1230 (11.6%)	885 (10.5%)	345 (14.4%)	
Education		16 [14.0, 16.0]	16 [14.0, 16.0]	16 [14.0, 16.0]	0.247
Smoking	Never	6281 (57.2%)	4807 (57.8%)	1474 (54.4%)	<0.001
	Quit 6m+	3787 (34.5%)	2853 (33.8%)	932 (36.0%)	
	Quit <6m	320 (2.90%)	240 (2.80%)	80 (3.10%)	
	Current	611 (5.50%)	454 (5.40%)	157 (6.00%)	
ADI		54 [33.0, 74.0]	53 [32.0, 73.0]	57 [37.0, 77.0]	<0.001
OUI		3.00 [0.00, 3.00]	3.00 [0.00, 3.00]	3.00 [0.00, 3.00]	<0.001
Insurance	Private	5981 (55.3%)	4567 (55.9%)	1414 (53.7%)	<0.001
	Medicaid	565 (5.70%)	329 (4.00%)	236 (9.10%)	
	Medicare	4161 (38.5%)	3220 (39.4%)	941 (35.7%)	
	Other	121 (1.27%)	109 (1.37%)	12 (0.53%)	
PROM Phenotype	Pain+ PS+ MCS+	3890 (24.1%)	2106 (24.9%)	784 (30.7%)	<0.001
	Pain+ PS+ MCS-	1181 (14.4%)	1233 (14.5%)	388 (14.2%)	
	Pain+ PS- MCS+	1466 (3.90%)	292 (3.40%)	77 (2.80%)	
	Pain+ PS- MCS-	2466 (3.20%)	291 (3.40%)	93 (3.30%)	
	Pain- PS+ MCS+	9313 (8.20%)	781 (8.10%)	249 (8.60%)	
	Pain- PS+ MCS-	8963 (8.10%)	695 (7.80%)	229 (8.80%)	
	Pain- PS- MCS+	11503 (10.8%)	1169 (13.7%)	381 (14.7%)	
	Pain- PS- MCS-	28428 (20.9%)	1901 (22.4%)	727 (28.3%)	
Diagnosis	OA	10978 (97.2%)	8383 (97.2%)	2595 (96.7%)	0.373
	non-OA	312 (2.80%)	217 (2.80%)	72 (2.90%)	
Anesthesia	Spinal	10178 (92.7%)	7777 (92.6%)	2401 (92.7%)	<0.001
	General	809 (7.17%)	599 (7.13%)	210 (7.98%)	
	Other	329 (3.02%)	249 (3.00%)	89 (3.10%)	
SAMC		13 [9.00, 19]	78 [9.00, 19]	13 [9.00, 19]	<0.001
Reoperation	No	13258 (91.4%)	10140 (91.7%)	3098 (91.7%)	0.323
	Yes	830 (6.30%)	678 (6.40%)	160 (4.81%)	

BMI: body mass index, ADI: area deprivation index, OUI: charlson comorbidity index, SAMC: narcotic opioid risk score

Table 2 – Summary statistics of baseline and 1-year PROMs and satisfaction

Variable	Level	Total	No Chronic Pain	Chronic Pain	P-value	N
Baseline KOOS Pain		38.9 [30.6,50.0]	41.7 [32.8,50.0]	30.9 [22.8,41.7]	<0.001	13895
Baseline KOOS PS		51.5 [42.2,58.6]	51.5 [42.2,58.6]	48.8 [37.0,58.6]	<0.001	13887
Baseline KOOS JR		44.8 [34.9,52.5]	44.8 [34.9,52.5]	44.8 [34.2,52.5]	<0.001	12666
Baseline MCS		53.1 [45.1,60.3]	53.3 [45.3,60.3]	52.5 [44.7,59.2]	<0.001	13889
1y KOOS Pain		86.1 [72.2,97.2]	86.9 [73.3,97.2]	83.3 [69.4,94.4]	<0.001	10908
1y KOOS PS		73.1 [64.7,81.2]	73.5 [66.4,81.2]	72.5 [61.0,81.2]	<0.001	10458
1y KOOS JR		76.3 [66.8,81.0]	76.9 [66.8,81.6]	75.3 [63.8,80.6]	<0.001	9241
1y VR12-MCS		56.4 [47.9,60.8]	56.8 [48.0,61.1]	55.0 [46.0,60.4]	<0.001	10919
MCID KOOS Pain	Failure	725 (6.65%)	518 (6.47%)	187 (7.28%)	0.152	10908
	Improved	10183 (93.4%)	7881 (93.5%)	2301 (92.7%)		
MCID KOOS PS	Failure	1580 (15.1%)	1191 (15.0%)	387 (15.8%)	0.428	10453
	MCID	8873 (84.9%)	6788 (85.0%)	2085 (84.4%)		
MCID KOOS JR	Failure	797 (8.60%)	578 (8.35%)	219 (9.63%)	0.112	9238
	Improved	8443 (91.4%)	6343 (91.6%)	2098 (90.3%)		
MCID MCS	Failure	4951 (83.3%)	3282 (80.4%)	1619 (69.0%)	0.761	10919
	Improved	4988 (36.7%)	3038 (36.8%)	930 (37.8%)		
PASS KOOS Pain	Failure	3176 (30.9%)	2431 (29.1%)	845 (34.8%)	<0.001	10908
	Improved	7332 (69.1%)	5969 (70.9%)	1623 (65.2%)		
PASS KOOS PS	Failure	3420 (34.4%)	2621 (32.9%)	905 (40.2%)	<0.001	10458
	Improved	8038 (65.4%)	5338 (67.1%)	1489 (59.8%)		
PASS KOOS JR	Failure	3041 (31.9%)	2110 (30.8%)	908 (39.2%)	<0.001	9241
	Improved	6200 (67.1%)	4791 (69.2%)	1409 (60.8%)		
Satisfied	No	1884 (16.8%)	1380 (16.0%)	488 (19.8%)	<0.001	10674
	Yes	8870 (83.1%)	6850 (84.0%)	2012 (80.2%)		

Table 3 - Multivariable logistic regression model, using **failure to reach MCID improvement in KOOS Pain, PS, JR, and MCS** as outcomes.

		MCID KOOS Pain			MCID KOOS PS			MCID KOOS JR			MCID VR12 MCS		
Factor	Level	OR (95%CI)	Joint P-value	Overall P-value	OR (95%CI)	Joint P-value	Overall P-value	OR (95%CI)	Joint P-value	Overall P-value	OR (95%CI)	Joint P-value	Overall P-value
Group	Chronic Pain	1.17 (0.96,1.42)	0.1	0.1	1.1 (0.97,1.25)	0.137	0.137	1.2 (1,1.43)	0.049	0.049	1.15 (1.03,1.29)	0.01	0.01
	Non-Chronic Pain	1 [ref]			1 [ref]			1 [ref]			1 [ref]		
	Chronic Pain												

This model was adjusted for Age, Sex, BMI, Race, Education, Smoking, ADI, CCI, Insurance, Diagnosis, Anesthesia, PROM Phenotype, Baseline PS, Time. The full model can be seen in appendix 1.

Table 4 - Multivariable logistic regression model results, using **failure to reach attainment of PASS thresholds in KOOS Pain, PS, JR** as outcomes.

		KOOS Pain PASS			KOOS PS PASS			KOOS JR PASS		
Factor	Level	OR (95%CI)	Joint P-value	Overall P-value	OR (95%CI)	Joint P-value	Overall P-value	OR (95%CI)	Joint P-value	Overall P-value
Group	Chronic Pain	1.25 (1.13,1.38)	<0.001	<0.001	1.22 (1.1,1.35)	<0.001	<0.001	1.28 (1.15,1.42)	<0.001	<0.001
	Non-Chronic Pain	1 [ref]			1 [ref]			1 [ref]		

This model was adjusted for Age, Sex, BMI, Race, Education, Smoking, ADI, CCI, Insurance, Diagnosis, Anesthesia, PROM Phenotype, Baseline PS, Time.

Table 5 - Multivariable logistic regression model results, using **failure to answer PASS** (yes) as outcome.

Factor	Level	OR (95%CI)	P-value	Overall P-value
Group	Chronic Pain (v no Chronic Pain)	1.17 (1.04, 1.32)	0.011	0.011

This model was adjusted for Age, Sex, BMI, Race, Education, Smoking, ADI, CCI, Insurance, Diagnosis, Anesthesia, PROM Phenotype, Baseline PS, Time.