Association of Preoperative Osteoporosis with Healthcare Utilization and Patient-Reported Outcomes following Primary Total Knee Arthroplasty: A Prospective Cohort Analysis of 6,318 Patients

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INTRODUCTION:
Existing literature acknowledges osteoporosis (OP) as a contributor to periprosthetic fractures, migration of components, and aseptic loosening following total knee arthroplasty (TKA). Yet, there is limited understanding of how OP influences healthcare utilization and patient-reported pain and functional improvement post-TKA. This study aimed to investigate two primary objectives: 1) to elucidate the relationship between a pre-TKA diagnosis of OP (both medicated and non-medicated) with healthcare utilization and patient-reported outcomes of pain and function, and 2) to examine whether DEXA scan-derived T-scores correlate with these outcomes.
METHODS:
A prospective cohort of primary elective TKA (2015-2018) was obtained (n=6,318); of which 4,883 (77.2%) completed one-year follow up. Outcomes included healthcare utilization (prolonged length of stay [LOS] >3 days, discharge disposition (DD), 90-day readmission, and one-year reoperation) as well as improvement in Knee Injury and Osteoarthritis Outcome Score (KOOS) Pain, KOOS-PS, and patient acceptable symptomatic state (PASS) attainment. Multivariable regression models were constructed to evaluate associations between OP diagnosis as well as T-scores and study outcomes, accounting for confounders (e.g., patient determinants/comorbidities and operative details).
RESULTS: The prevalence of OP pre-TKA was 66.7% (n=4,220 /6,318), of which 33.6% (n=1,422) were not prescribed OP medications and 19.1% had a DEXA scan (n=1,213/6,318). (**Table 1**) Compared to non-OP patients, those with OP were independently associated with higher odds of prolonged 90-day readmission ((OP with medications: odds ratio (OR):1.79 (95% confidence interval (CI):1.41-2.27); OP without medication: OR:1.69 (95%CI:1.3-2.2)). Medication-requiring osteoporosis was associated with prolonged LOS (OR: 1.21 (95% CI:1.02-1.43) and non-home discharge (OR: 1.56 (95% CI:1.25-1.95) when compared to non-OP patients. Non-medicated OP patients were less likely to have a higher 1-Year KOOS PS score (OR: 0.87 (95% CI:0.76-1) compared to non-OP patients. (**Table 2**) However, a similar pattern could not be established for KOOS-Pain (p=0.077). Higher T-Scores were associated with higher odds to have better 1-Y KOOS PS (OR: 1.19 (95% CI: 1.02, 1.39) but not HOOS pain. Moreover, T-scores were not associated with LOS, DD, 90-day readmission, pain or function improvement. (**Table 3**)
DISCUSSION AND CONCLUSION: OP patients face higher odds of 90-day readmission compared to non-OP patients. Medication-requiring OP patients also showed a significant association with prolonged LOS and non-home discharge. Interestingly, non-medicated OP patients were less likely to report a higher 1-Year KOOS PS score, suggesting a potential impact of OP on functional recovery, though this pattern was not reflected in KOOS-Pain scores. Moreover, patients with higher T-scores, indicating better bone density, had higher odds of better 1-Year KOOS PS, but no significant association with HOOS pain, LOS, discharge disposition, 90-day readmission, or overall pain and function improvement. This study reveals a considerable prevalence of osteoporosis (OP) pre-TKA, estimated at 66.7% of the sample. However, a major proportion of these patients (33.6%) were not prescribed OP medications, and only 19.1% underwent a DEXA scan. These findings underline the complex interplay between osteoporosis, its management, and post-TKA outcomes, highlighting the need for further research to optimize preoperative strategies and postoperative outcomes for OP patients undergoing TKA.

Table 1 Baseline characteristics of the included cohort

Variable	Level	Total (N=6318)
Age, Median [25th;75th]		66.0 [60.0;73.0]
Sex, N (%)	Male	2508 (39.7%)
	Female	3810 (60.3%)
Race, N (%)	White	4928 (81.8%)
	Other	183 (3.04%)
	Black	910 (15.1%)
CCI, Median [25th;75th]		0.00 [0.00;1.00]
BMI, Median [25th;75th]		31.8 [27.8;36.6]
Diagnosis, N (%)	Osteoarthritis	6139 (97.2%)
	Non-Osteoarthritis	179 (2.83%)
Smoking, N (%)	Never	3536 (56.0%)
	Ever	2781 (44.0%)
Education, Median [25th;75th]		14.0 [12.0;16.0]
Insurance, N (%)	Commercial/Private/Other	1432 (37.8%)
	Medicaid/Medicare	2361 (62.2%)
Osteoporosis, N (%)	No	2098 (33.2%)
	Yes	4220 (66.8%)
Medication, N (%)	No	2758 (43.7%)
	Yes	3560 (56.3%)
Medicated OP, N (%)	No OP	2098 (33.2%)
	OP on Medication	2798 (44.3%)
	OP without Medication	1422 (22.5%)
Lowest T Score, Median [25th;75th]		-1.30 [-1.90;-0.60]
Lowest T Score (Group), N (%)	<-2.5	105 (8.66%)
	>=-1	476 (39.2%)
	[-2.5,-1)	632 (52.1%)
Baseline Pain, Median [25th;75th]		38.9 [30.6;50.0]
Baseline PS, Median [25th;75th]		48.8 [38.0;58.0]

Table 2. Multivariable logistic regression demonstrating the association between preoperative diagnosis of osteoporosis (with and without medications) and study outcomes while accounting for age, comorbidity index (CCI), sex, race, BMI, preoperative diagnosis, smoking status, education, and insurance type.

Outcome	OP with medication		OP without medications	
	OR (95% CI)	P value	OR (95% CI)	P value
LOS >=3	1.21 (1.02, 1.43)	0.029	1.02 (0.83, 1.25)	0.88
DD: Other	1.56 (1.25, 1.95)	<0.001	1.17 (0.89, 1.55)	0.266
90-day readmission	1.79 (1.41, 2.27)	<0.001	1.69 (1.3, 2.2)	<0.001
1-Year Reoperation	1.06 (0.63, 1.78)	0.838	1.14 (0.65, 2.02)	0.643
1-Year KOOS Pain	0.9 (0.8, 1.01)	0.072	0.88 (0.77, 1.01)	0.077
1-Year KOOS PS	0.93 (0.82, 1.05)	0.239	0.87 (0.76, 1)	0.046
1-Year MCID KOOS Pain	0.93 (0.7, 1.23)	0.621	1.33 (0.99, 1.78)	0.062
1-Year MCID KOOS PS	1.04 (0.85, 1.26)	0.715	1.03 (0.83,1.29)	0.764
PASS: No	1.08 (0.89, 1.32)	0.423	0.98 (0.78, 1.23)	0.853

Table 3. Multivariable logistic regression demonstrating the association between preoperative T-scores and study outcomes while accounting for medication status, age, comorbidity index (CCI), sex, race, BMI, preoperative diagnosis, smoking status, education, and insurance type.

Outcome	OR (95% CI)	P value
LOS >=3	0.82 (0.68, 1)	0.052
DD: Other	0.86 (0.69, 1.07)	0.184
90-day readmission	0.88 (0.69, 1.11)	0.281
1-Year KOOS Pain	1.07 (0.93, 1.24)	0.352
1-Year KOOS PS	1.19 (1.02, 1.39)	0.028
1-Year MCID KOOS Pain	1 (0.72, 1.38)	0.987
1-Year MCID KOOS PS	1.06 (0.83, 1.34)	0.650
PASS: No	1.03 (0.81, 1.32)	0.784