Increased Risk of Significant Prostheses-Related Complications in Patients with a Recent History of Prior Fragility Fracture: A Matched Cohort Analysis

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INTRODUCTION: As the utilization of total knee arthroplasty (TKA) continues to grow, a concomitant increase in the number of patients with low mineral bone density who undergo TKA is expected. The purpose of this study is to assess the rates of short-term, implant-related complications and secondary fragility fracture following TKA in patients with and without a recent history of a prior fragility fracture.

METHODS: A matched retrospective cohort study was performed using the PearlDiver database to determine the impact of a preceding fragility fracture on rates of short-term complications following TKA. All patients who underwent TKA excluding those with diagnoses of metabolic bone diseases or metastatic malignancies between 2013 and 2017 were included for analysis. The analysis of various implant-related complication rates at 1- and 2-years post-TKA was completed using multivariate logistic regression to control for age, sex, smoking, osteoarthritis, and osteoporosis. Statistical significance was set at $P<0.05$. Rates of these complications were also analyzed in patients who did and did not receive osteoporosis treatment following their fragility fracture.

RESULTS:

Following exclusions, 799,536 patients were identified, with 29,999 having experienced a fragility fracture within the 3 years prior to their TKA. These patients were significantly more likely to experience periprosthetic fractures (Odds Ratio (OR) = 2.30, 95% Confidence Interval (CI), 1.71-3.12), non-infection related revisions (OR = 1.40, 95% CI, 1.18-1.66), secondary fragility fractures (OR = 5.01, 95% CI, 4.59-5.48), prosthetic loosening (OR = 1.40, 95% CI, 1.01-1.96), dislocation (OR = 1.82, 95% CI, 1.34-2.48), instability (OR = 1.48, 95% CI, 1.22-1.78), and periprosthetic infection (OR = 1.58, 95% CI, 1.38-1.81) within 1 year of their TKA. This significant difference in complication rates continued through the 2-year post-TKA mark. A combination of vitamin D and bisphosphonate therapy was associated with decreased rates of revision arthroplasty 2-years after a TKA (OR = 0.54, 95% CI, 0.31 – 0.94), otherwise, patients who received preoperative osteoporosis treatment with vitamin D supplementation and/or bisphosphonate therapy largely experienced the same rate of postoperative implant-related complications.

DISCUSSION AND CONCLUSION:

Sustaining a fragility fracture within 3 years prior to TKA increases the risk of implant-related postoperative complications, identifying a group at higher risk for morbidity after TKA. Many of the short-term complications of TKA have varying and often detrimental impacts on a patient's quality of life. Periprosthetic fractures following TKA, especially within the elderly population, have a 1-year mortality rate that ranges between 11% and 44.8%. These patients often require hospital admission and may undergo revision arthroplasty or open reduction-internal fixation (ORIF), both of which carry increased rates of further complications and mortality. Specifically, 37.2% of patients who underwent revision knee arthroplasty experienced a complication, compared to just 2.5% in patients undergoing primary TKA. In addition to increased rates of morbidity and mortality, these short-term complications also lead to a significantly increased financial burden on both the patient and the greater healthcare system. A recent study reported that total 90-day follow-up costs for revision knee arthroplasty could reach $68,624 depending on the discharge disposition, compared to $51,810 for primary arthroplasty. Similarly, in the situation where a patient requires readmission within 90 days, the revision knee arthroplasty patient's readmission cost is on average $16,186, compared to $9,753 for the patient who underwent primary knee arthroplasty. These results are important for orthopaedic surgeons counseling patients with a recent history of a fragility fracture on of the potential for increased implant-related complications after undergoing TKA.

Table 2. A comparison of the rates of short-term postoperative complications following total knee arthroplasty in patients with a prior fragility fracture and a matched control

Complication	Prior FF (n = 29,503)	No Prior FF (n = 29,503)	OR (95% CI)	p - value
Periprosthetic Fracture (%)				
1 year	142 (0.48)	62 (0.21)	2.30 (1.71 - 3.12)	**< 0.001**
2 years	199 (0.67)	78 (0.26)	2.56 (1.98 - 3.35)	**< 0.001**
Any Fragility Fracture (%)				
1 year	2,866 (9.71)	631 (2.14)	5.01 (4.59 - 5.48)	**< 0.001**
2 years	4,297 (14.56)	1,170 (3.97)	4.24 (3.97 - 4.54)	**< 0.001**
Revision (%)				
1 year	321 (1.10)	230 (0.78)	1.40 (1.18 - 1.66)	**< 0.001**
2 years	476 (1.61)	350 (1.19)	1.37 (1.19 - 1.58)	**< 0.001**
Instability (%)				
1 year	177 (0.60)	98 (0.33)	1.81 (1.42 - 2.33)	**< 0.001**
2 years	262 (0.89)	178 (0.60)	1.48 (1.22 - 1.79)	**< 0.001**
Loosening (%)				
1 year	84 (0.28)	60 (0.20)	1.40 (1.01 - 1.96)	**0.046**
2 years	129 (0.43)	95 (0.32)	1.36 (1.05 - 1.78)	**0.027**
Dislocation (%)				
1 year	116 (0.39)	64 (0.22)	1.82 (1.34- 2.48)	**< 0.001**
2 years	168 (0.57)	88 (0.30)	1.92 (1.49 -2.49)	**< 0.001**
Deep Periprosthetic Infection (%)				
6 months	555 (1.88)	355 (1.20)	1.58 (1.38 - 1.81)	**< 0.001**
1 year	688 (2.33)	440 (1.49)	1.58 (1.40 - 1.79)	**< 0.001**

FF = fragility fracture; OR = odds ratio; CI = confidence interval

Table 3. Effect of Pharmaceutical Treatment on Likelihood of Short-Term Complications Following Total Knee Arthroplasty

Complication	Bisphosphonate Treatment (n = 4,311)	No Treatment (n = 4,311)	OR (95% CI)	p - value
PPFx (%)				
1 year	20 (0.46)	24 (0.56)	0.83 (0.46 - 1.51)	0.650
2 years	31 (0.72)	36 (0.84)	0.86 (0.53 - 1.39)	0.624
FFx (%)				
1 year	519 (12.04)	526 (12.20)	0.98 (0.86 - 1.12)	0.843
2 years	799 (18.53)	796 (18.46)	1.00 (0.90 - 1.12)	0.956
Revision (%)				
1 year	38 (0.88)	41 (0.95)	0.93 (0.59 - 1.45)	0.821
2 years	53 (1.23)	58 (1.35)	0.92 (0.63 - 1.33)	0.702
Complication	Vitamin D Supplementation (n = 3,865)	No Treatment (n = 3,865)	OR (95% CI)	p - value
PPFx (%)				
1 year	22 (0.57)	23 (0.60)	0.96 (0.53 - 1.72)	1.000
2 years	33 (0.85)	33 (0.85)	1.00 (0.61 - 1.65)	1.000
FFx (%)				
1 year	399 (10.32)	427 (11.05)	0.93 (0.80 - 1.07)	0.320
2 years	603 (15.60)	646 (16.71)	0.92 (0.82 - 1.04)	0.194
Revision (%)				
1 year	45 (1.16)	38 (0.98)	1.19 (0.77- 1.83)	0.508
2 years	64 (1.66)	62 (1.60)	1.03 (0.73 - 1.47)	0.928
Complication	Combination Treatment (n = 1,724)	No Treatment (n = 1,724)	OR (95% CI)	p - value
PPFx (%)				
1 year	14 (0.81)	16 (0.93)	0.87 (0.43 - 1.80)	0.856
2 years	20 (1.16)	22 (1.28)	0.91 (0.49 - 1.67)	0.877
FFx (%)				
1 year	237 (13.75)	190 (11.02)	1.29 (1.05 - 1.58)	**0.018**
2 years	361 (20.94)	301 (17.46)	1.25 (1.06 - 1.48)	**0.011**
Revision (%)				
1 year	14 (0.81)	23 (1.33)	0.61 (0.31 - 1.18)	0.186
2 years	19 (1.10)	35 (2.03)	0.54 (0.31 - 0.94)	**0.040**

PPFx = periprosthetic fracture; FFx = fragility fracture; OR = odds ratio; CI = confidence interval