Fracture Risk, Epidemiology, and Association with Nutrition and Health Status after Gastric Bypass Surgery

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INTRODUCTION: This study aims to characterize the rate of fracture, fracture epidemiology, and associations between fracture and nutritional status after gastric bypass surgery.

METHODS: A total of 803 patients underwent gastric bypass surgery between 2005 and 2021 at three academic institutions. Demographics, nutritional status, and pre- and post-bypass fracture data were collected. Fragility fractures included the distal radius, proximal femur, proximal humerus, pelvis, spine, or ribs after a low energy mechanism. Fracture rates were calculated per 100,000 person-years and were compared to pre-bypass fracture rates and population controls. Fracture risk associations with health comorbidities and nutritional status were investigated.

RESULTS: The mean age at time of bypass was 43.8 ± 9.9 years. Mean BMI pre-bypass was 49.4 kg/m^2 and decreased to 34.8 kg/m^2 one-year post-bypass. In total, 661 patients (82.3%) were female. Pre-bypass fracture rate was 960/100,000 person years. After bypass surgery, 162 separate fractures were identified in 136 patients at a mean of 5.9 ± 3.9 years after bypass surgery, corresponding to a rate of 3,194/100,000 person-years. Rates were similar in males and females. Fragility fracture rate was 926.6/100,000 person-years. Mean age was 52.5 years at time of fracture. Fracture incidence ratios pre- and post-bypass surgery was 3.33 (95% CI 2.69-4.11, p<0.001) and fragility fracture incidence ratio was 7.65 (95% CI 4.69-12.68, p<0.001). Patients with fracture had greater BMI loss at one-year post-bypass (-15.6 versus -14.5, p=0.013), were more often tobacco smokers (25.0% versus 3.4%, p<0.001), and were less likely to have received protein (67.6% versus 75.7%, p=0.050) or vitamin D supplementation (10.3% versus 17.4%, p=0.041) after surgery, though there were no differences in nutritional laboratory values between groups with the numbers available at each follow-up timepoint.

DISCUSSION AND CONCLUSION: Patients have significantly elevated fracture rates and fragility fracture rates after gastric bypass surgery. The fracture rate for the mean age of this cohort would be expected in females approximately 8 years older and males 20 years older when compared to population controls. Greater weight loss, smoking, and absence of protein or vitamin D supplementation may be associated with increased risk of fracture.

Table 1. Fracture incidence post-bypass surgery in all patients, males, females, and specific fragility fractures. Fractures rates are compared to both pre-bypass rates and historical population controls.

	Post-Bypass Incidence	Pre-Bypass Incidence	Incidence Ratio [95% CI]	P-value	Age-Matched Population Controls Incidence[a,1]
All Fractures	3194	960	3.33 [2.69-4.11]	**< 0.001**	2280
Males	3004	1151	2.61 [1.49, 4.46]	**< 0.001**	2247
Females	3203	918	3.50 [2.77-4.43]	**< 0.001**	2313
Fragility Fractures	927	135	7.65 [4.69-12.68]	**< 0.001**	803

[a]Fracture incidence per 100,000 person years
[1]Derived from previously reported fracture rates in group of age 50-54 patients over 3-year period: Amin S, Achenbach SJ, Atkinson EJ, Khosla S, Melton LJ. "Trends in fracture incidence: A population based study over 20 years." *J Bone Miner Res*. 2014 Mar; 29(3):581-589.