Fracture Incidence in Women with Polycystic Ovarian Syndrome: A Retrospective Cohort Analysis

Tanya Li[1], Wali U. Pirzada[2], Ameera Syed[1], Simran Shamith[1], Kimberly Dong[2], Meghan Bishop[1, 2], Asif M. Ilyas[1, 2]
[1]Drexel University College of Medicine, Philadelphia, PA, [2]Rothman Orthopaedic Institute, Philadelphia, PA
tl965@drexel.edu

Disclosures: Tanya Li (N), Wali U. Pirzada (N), Ameera Syed (N), Simran Shamith (N), Kimberly Dong (N), Meghan Bishop (N), Asif M. Ilyas (N)

INTRODUCTION**:** Polycystic Ovarian Syndrome (PCOS) is an endocrine disorder that impacts reproductive-age women, characterized by metabolic disturbances and endocrine imbalances. These changes have been linked to alterations in bone health, yet the effect of PCOS on fracture risk is not well established. Understanding this relationship is important to guide clinical care and prevention strategies. This study aimed to evaluate the association between PCOS and fracture incidence in a large, diverse patient cohort, with the hypothesis that women with PCOS have a different risk of fractures than those without PCOS.

METHODS**:** A retrospective cohort study was conducted using the TriNetX research platform, including 176,261 female patients with PCOS and 7,140,958 without PCOS. The study assessed the occurrence of distal radius, femoral neck, ankle, and metatarsal fractures, which were identified through ICD-10 procedure codes. Fracture incidence was measured from one day following the PCOS diagnosis to the most recent available encounter. Analysis between cohorts was performed using measures of association, including odds and risk ratios, with adjustments for age, race, BMI, type 2 diabetes, tobacco use, vitamin D deficiency, osteoporosis, and long-term steroid use. Statistical significance was defined as a p-value of <0.05. Analyses were performed on de-identified data; therefore, institutional review board approval and informed consent were not required. Only female patients were included, with sex defined at birth based on external anatomy, as PCOS is a disorder specific to women.

RESULTS**:** Final analysis after matching included 174,937 patients in both cohorts. Incidence rates of distal radius, femoral neck, and metatarsal fractures were significantly reduced in patients with PCOS, with risk ratios of 0.7 (CI: 0.613-0.8), 0.647 (CI: 0.521-0.804), and 0.913 (CI: 0.834-0.998), respectively. Although the incidence rate of ankle fractures was also reduced in the PCOS cohort, this finding was not statistically significant (RR: 0.921, CI: 0.836-1.015).

DISCUSSION**:** Female patients with PCOS had lower rates of fractures, particularly at the distal radius, femoral neck, and metatarsals, supporting the hypothesis that PCOS alters fracture risk. This suggests a potential protective effect on bone health. Limitations include the retrospective design, reliance on ICD-10 coding, and unmeasured factors such as lifestyle, medications, and PCOS phenotype. Further research is warranted to investigate the mechanisms underlying fracture risk at specific bone sites.

SIGNIFICANCE/CLINICAL RELEVANCE**:** Fractures are a major source of morbidity, and understanding whether PCOS influences fracture risk could inform clinical care and prevention strategies for women with this prevalent endocrine disorder. Clarifying this relationship may also guide future research on bone health and targeted interventions in this population.

Table 1. Population Characteristics Pre- and Post-Propensity Matching

Characteristic	PCOS	Post-Match PCOS	Non-PCOS	Post-Match Non-PCOS
N (after exclusion)[1]	176,261	174,937	7,140,958	174,937
Age at Index (mean ± SD)	32 ± 9.57	32 ± 9.57	45.7 ± 19.7	32 ± 9.62
White	119,304 (68%)	119,277	6,952,827 (68%)	119,215
Black or African American	22,929 (13%)	22,927	931,139 (13%)	23135
Asian	8,813 (5%)	8,813	332,883 (5%)	8707
BMI ≥ 40	25,688 (15%)	25,656	180,125 (3%)	25,769
BMI 30–39	24,052 (14%)	24,020	314,168 (5%)	24,323
Type 2 Diabetes Mellitus	17,726 (10%)	17,699	557,297 (8%)	17,714
Tobacco Use	4,803 (3%)	4,797	130,407 (2%)	4,817
Osteoporosis (no fracture)	1,034 (1%)	1,034	287,524 (4%)	954
Vitamin D Deficiency	29,444 (17%)	29412	574,778 (8%)	29316
Long-term Steroid Use	3,743 (2%)	3,737	94,793 (1%)	3,777

Table 2. Fracture Incidence and Risk Estimates of PCOS vs. Non-PCOS Cohorts

Fracture location	PCOS	No PCOS	Risk Ratio (CI)	Odds Ratio (CI)	p-value
N	174,937	174,937			
Distal radius	367 (0.21%)	524 (0.03%)	0.7 (0.613, 0.8)	0.7 (0.612–0.8)	<0.001
Femoral neck	134 (0.077%)	207 (0.118%)	0.647 (0.521, 0.804)	0.647 (0.521–0.804)	<0.001
Ankle	780 (0.446%)	847 (0.484%)	0.921 (0.836, 1.015)	0.921 (0.835–1.015)	0.0959
Metatarsal	908 (0.519%)	995 (0.569%)	0.913 (0.834, 0.998)	0.912 (0.833–0.998)	0.0455