

# Hormone Replacement Therapy Is Associated with Increased Tendon Injury and Surgical Repair in Perimenopausal Women: A Propensity-Matched International Cohort Study

George Bcharah, Alexandra Cancio-Bello, Zaid Shaker Elsabbagh, Joseph Brinkman, Calvin Nguyen, Phillip Karsen, Karan Patel, Anikar Chhabra

**INTRODUCTION:** Tendinopathies are a common source of pain and disability, particularly in midlife women, yet systemic factors influencing tendon health remain incompletely understood. Estrogen regulates extracellular matrix turnover, fibroblast function, and tendon remodeling, suggesting that hormone replacement therapy (HRT) may affect the risk of tendon degeneration or rupture. This study investigates the association between systemic HRT use and the incidence of common tendon injuries and surgical repairs in a national cohort of perimenopausal women.

**METHODS:** Using the TriNetX Research Network, we identified female patients aged  $\geq 45$  years diagnosed with major tendon pathologies, including rotator cuff tears, bicipital tendinitis, lateral or medial epicondylitis, Achilles tendinopathy, patellar tendinitis, or quadriceps strain. HRT exposure was defined as systemic estrogen and/or progesterin use within one year prior to diagnosis. Patients with contraindications to HRT were excluded. After 1:1 propensity score matching for demographics, comorbidities, body mass index, and medication exposures, two matched cohorts of 57,390 patients were generated. Primary outcomes included diagnosis rates of specific tendon conditions; secondary outcomes were lifetime rates of corresponding tendon repair procedures. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated.

**RESULTS:** HRT users had significantly higher rates of several tendon pathologies compared to matched controls: rotator cuff tear (39.6% vs. 38.6%,  $p < 0.001$ ), bicipital tendinitis (12.8% vs. 10.7%,  $p < 0.001$ ), lateral epicondylitis (27.6% vs. 22.3%,  $p < 0.001$ ), medial epicondylitis (6.7% vs. 5.2%,  $p < 0.001$ ), and Achilles tendinopathy (14.4% vs. 13.9%,  $p = 0.009$ ). Surgical repairs were also more common in the HRT group, including rotator cuff repair (7.1% vs. 6.7%, OR 1.07,  $p = 0.005$ ), biceps tendon repair (4.1% vs. 3.5%, OR 1.18,  $p < 0.001$ ), and Achilles tendon repair (0.7% vs. 0.6%, OR 1.16,  $p = 0.041$ ).

**DISCUSSION AND CONCLUSION:** Systemic HRT use in women over 45 was associated with increased risk of tendon injury and a greater likelihood of surgical repair. These findings underscore the need for heightened awareness of the musculoskeletal effects of hormone therapy and highlight an underexplored area in women's orthopedic health.

Figure 1. Rates of Tendon Injuries in the HRT and non-HRT Groups ( $n = 57,390$ ) ( $* = P < 0.05$ )

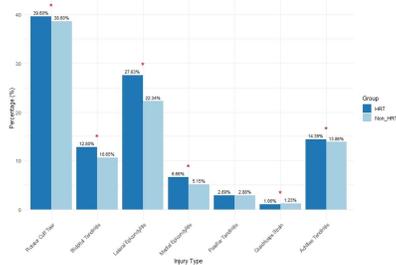


Table 1. Patient characteristics in the HRT and non-HRT cohorts with tendon injuries before and after propensity score matching

Variable	HRT Cohort (n=28,695)	Non-HRT Cohort (n=28,695)	P-value
Age (mean [SD])	52.1 (11.2)	52.1 (11.2)	0.990
White, n (%)	27,211 (94.7)	27,211 (94.7)	0.999
Black or African American, n (%)	442 (1.5)	442 (1.5)	0.999
Hispanic or Latino, n (%)	3,381 (11.8)	3,381 (11.8)	0.999
Insurance (Medicaid), n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Insurance (Medicare), n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Insurance (Private), n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Insurance (Other), n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Insurance (Uninsured), n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Insurance (Unknown), n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Body Mass Index (BMI), n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Diabetes, n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Hypertension, n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Cholesterol Abnormalities, n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Cardiovascular Disease, n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Respiratory Disease, n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Neurological Disease, n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Psychiatric Disease, n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Other Disease, n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Medication (Painkillers), n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Medication (Antidepressants), n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Medication (Antipsychotics), n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Medication (Antibiotics), n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Medication (Hormones), n (%)	2,191 (7.6)	2,191 (7.6)	0.999
Medication (Other), n (%)	2,191 (7.6)	2,191 (7.6)	0.999

Table 2. Life-Time Rates of Tendon Repairs and Reconstructions in the HRT and non-HRT cohorts

Outcomes	HRT Cohort (n, %)	Non-HRT Cohort (n, %)	Odds Ratio (95% Confidence Interval)	P-value
Tendon Repair (n=37,200)				
Rotator Cuff Repair	2,539 (4.4%)	1,989 (3.5%)	1.18 (1.11-1.26)	<0.001
Biceps Tendon Repair	72 (0.1%)	63 (0.1%)	1.14 (0.82-1.60)	0.438
Achilles Tendon Repair	422 (0.7%)	360 (0.6%)	1.16 (1.01-1.33)	0.001
Patellar Tendon Repair	4,068 (7.1%)	3,827 (6.7%)	1.07 (1.01-1.13)	0.001
Patella Tendon Repair	39 (0.0%)	38 (0.0%)	0.79 (0.49-1.27)	0.332

284 | TriNetX does not report counts of 0.