

Menopause as a Risk Factor for Progressive Collapsing Foot Deformity Following Plantar Fasciitis: A Retrospective Cohort Study

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INTRODUCTION: Progressive collapsing foot deformity (PCFD) is a common degenerative condition affecting approximately 3.3% of women over the age of 40, leading to foot and ankle pain, swelling, and decreased ambulatory capacity.¹ It was previously thought that posterior tibial tendon dysfunction was the main contributor to developing PCFD, however more recent studies revealed that combined degeneration of the supporting ligaments in the arch and hindfoot, including the plantar fascia, play a significant role.² The plantar fascia is critical in maintaining the medial longitudinal arch and its dysfunction in plantar fasciitis (PF) may predispose patients to PCFD.³ Women aged 45–64 are disproportionately affected by PF, potentially due to postmenopausal estrogen decline. Estrogen fluctuations have been associated with altered mechanical properties of tendons and ligaments, suggesting a possible hormonal influence on plantar fascia degeneration.⁵ This study aimed to investigate whether menopause increases the risk of progression from PF to PCFD and whether hormone replacement therapy (HRT) mitigates this risk.

METHODS: A retrospective cohort study was conducted using the PearlDiver claims database to evaluate the association between gender, menopausal status, and HRT use on progression from PF to PCFD. Patients ≥18 years with diagnoses of PF or PCFD were included; those with rheumatoid arthritis, diabetes, Charcot neuroarthropathy, or prior foot surgery were excluded. Those with a diagnosis of PCFD were stratified into propensity score matched cohorts of those with a prior diagnosis of PF and those with no PF history, matching for age, gender, tobacco use, and obesity. Postmenopausal women with HRT use and no HRT use were matched by age and Charlson Comorbidity Index (CCI). Patient demographics, comorbidities, and outcomes were analyzed using Chi squared statistical analysis and multivariate logistic regression.

RESULTS: A total of 250,000 patients with PCFD were analyzed. Among these, 3,037 patients (63.5% female) progressed from PF to PCFD after a median interval of 379 days (range, 1–2,465). Postmenopausal women accounted for 13.8% of those who progressed, and 85 women receiving hormone replacement therapy (HRT) were matched with 82 without HRT. Menopause significantly increased the odds of progression to PCFD (OR = 1.22, 95% CI 1.12–1.33, p < 0.05), independent of age, obesity, and tobacco use. Obesity was also associated with higher odds of progression (OR = 1.28, 95% CI 1.22–1.34, p < 0.05). HRT use did not significantly reduce the risk of progression; however, the interval between PF and PCFD diagnoses was longer among HRT users compared to non-users (median 904 vs. 639 days).

DISCUSSION: This large database study suggests that menopausal status is associated with an increased susceptibility to developing PCFD following PF, supporting the hypothesis that hormonal changes may influence ligamentous and fascial integrity in the foot. Although HRT did not significantly reduce the overall risk of progression, the longer interval between PF and PCFD diagnoses among HRT users may indicate a potential protective or delaying effect on connective tissue degeneration. However, given the retrospective nature of the analysis, reliance on administrative coding, and the limited sample size of patients receiving HRT, these results should be interpreted with caution. Prospective studies incorporating hormonal level assessment and biomechanical evaluation are warranted to further elucidate the relationship between menopause, HRT, and progressive foot deformity.

SIGNIFICANCE/CLINICAL RELEVANCE: These findings highlight the possible role of estrogen in maintaining the plantar fascia and delaying the development of PCFD, which may have implications for preventive or therapeutic strategies in postmenopausal women presenting with PF.

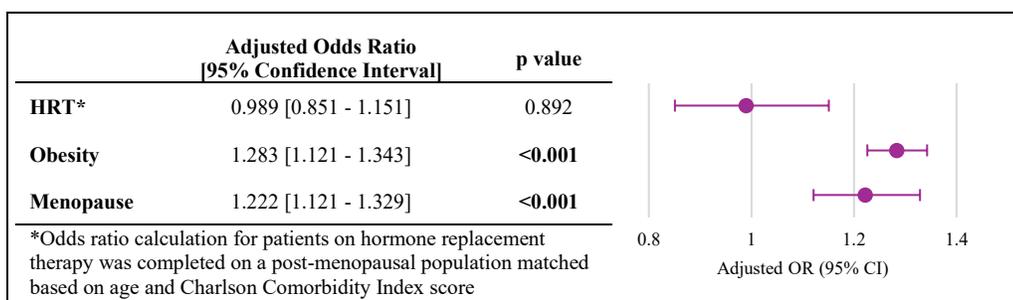


Figure 1: Impact of hormonal changes on progressing from PF to PCFD within 10 years.

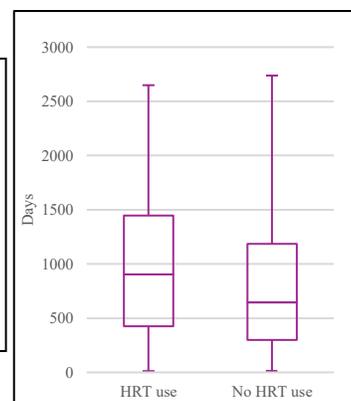


Figure 2: Number of Days between Progression from PF to PCFD for HRT users and HRT non-users

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