Secukinumab Reduces Subclinical Enthesitis in Moderate-to-Severe Plaque Psoriasis: A Single-Center, Retrospective Ultrasound Study

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Abstract

Background: Psoriatic arthritis (PsA) is a chronic progressive inflammatory arthritis associated with psoriasis, primarily affecting the spine and/or peripheral joints. Secukinumab is a fully human monoclonal antibody that inhibits interleukin-17A (IL-17A). In this study, we utilized musculoskeletal ultrasound (MSUS) to evaluate the therapeutic effects of secukinumab in treating moderate-to-severe plaque psoriasis patients with associated enthesitis.

Materials and methods: This single-center, retrospective study included 76 patients aged ≥ 18 years with moderate-to-severe plaque psoriasis and ultrasound-confirmed subclinical enthesitis, who were treated with secukinumab (300 mg) for 6 weeks.

Results: Secukinumab treatment resulted in significant improvements in skin lesions in patients with moderate-to-severe plaque psoriasis accompanied by subclinical enthesitis. Clinical assessments including Dermatology Life Quality Index (DLQI), body surface area (BSA), Psoriasis Area and Severity Index (PASI), and Investigator's Global Assessment (IGA) showed a marked improvement. After 6 weeks of secukinumab treatment, MSUS assessments revealed significant decreases in the thickness of bilateral enthesial attachment points at the quadriceps tendon, inferior patellar margin, Achilles tendon, and plantar fascia at the calcaneus, with the most pronounced improvement observed in the right Achilles tendon attachment point ($P = 2.71 \times 10^{-9}$).

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Discussion: Secukinumab rapidly improved cutaneous disease activity and reduced ultrasound-measured enthesial thickness in patients with moderate-to-severe plaque psoriasis and subclinical enthesitis. These findings suggest that IL-17A inhibition may help modulate early entheseal inflammation and support the use of MSUS for identifying and monitoring patients at risk of developing PsA.

Conclusions: Secukinumab significantly improves skin lesions and reduces enthesial thickness in patients with moderate-to-severe plaque psoriasis and subclinical enthesitis. These findings suggest a potential role for secukinumab in modifying early inflammatory processes and possibly delaying the progression to overt PsA, particularly in non-obese patients.

Keywords: psoriasis; psoriatic arthritis; musculoskeletal ultrasound; secukinumab; enthesitis; enthesial thickness; retrospective study

Introduction

Psoriasis is an immune-mediated chronic, recurrent, inflammatory and systemic disease influenced by both genetic and environmental factors. The prevalence of psoriatic arthritis (PsA), a type of arthritis associated with psoriasis, ranges from 0.69% to 5.80% among psoriasis patients in China[1,2]. Early screening and detection of PsA are of great significance, with enthesitis being one of the underlying pathological features[3].

Several studies indicate the existence of subclinical enthesitis in psoriasis patients, emphasizing the advantage of ultrasound and magnetic resonance imaging (MRI) over clinical examinations in evaluating enthesitis[4–7]. However, MRI demonstrates suboptimal sensitivity and specificity for detecting peripheral enthesitis and incurs prohibitive costs when repeated scans across multiple sites are required. Ultrasound, on the other hand, can clearly display features such as tendon calcification, intra-tendinous bone spurs, tendon edema, and bone erosion at enthesial sites[8]. Basant Elnady et al. revealed a PsA annual incidence rate of 4.3% in a 2-year follow-up of psoriasis patients. Compared to psoriasis patients without PsA development, those who developed PsA had a higher baseline prevalence of enthesitis[9]. Tinazzi et al. conducted a 3.5-year follow-up on 28 psoriasis patients with subclinical enthesitis, identifying quadriceps tendon thickness as an independent predictor for PsA development in seven cases[10]. These findings suggest that screening for subclinical enthesitis in psoriasis patients may aid in early PsA detection, potentially allowing for interventions to slow disease progression.

As research on the pathogenesis of psoriasis progresses, interleukin-17A (IL-17A) has been identified as a key effector cytokine in the development of psoriasis and PsA[11]. Secukinumab, the first fully human-specific monoclonal antibody targeting IL-17A, has demonstrated efficacy and safety in the treatment of moderate-to-severe plaque psoriasis in numerous studies[12,13]. However, limited research has been conducted on the impact of secukinumab on subclinical enthesitis in patients with moderate-to-severe plaque psoriasis. While the long-term efficacy of secukinumab on established PsA is well-documented, its ultra-early effects on subclinical enthesitis remain poorly characterized. The initial weeks of IL-17A blockade represent a critical window for observing the resolution of cytokine-driven inflammation before irreversible structural changes occur. Therefore, this study aimed to use musculoskeletal ultrasound (MSUS) to investigate the short-term (6-week) dynamics of secukinumab on subclinical enthesitis, providing insights into the early tissue-level response that may underpin its potential disease-modifying effects.

Methods

Patient screening for inclusion

This study included 76 patients who were diagnosed with moderate-to-severe plaque psoriasis, treated at the Dermatology Department of The Second Affiliated Hospital of Henan University of Science and Technology between March 2022 and July 2023. The study has been approved by the Ethics Committee of The Second Affiliated Hospital of Henan University of Science

and Technology. Inclusion criteria were: (1) age ≥ 18 years; (2) diagnosis of moderate-to-severe plaque psoriasis, defined as body surface area (BSA) ≥ 3%, Psoriasis Area and Severity Index (PASI) ≥ 3, and Dermatology Life Quality Index (DLQI) ≥ 6 according to Chinese guidelines[14]; (3) absence of clinical joint symptoms/signs; (4) ultrasound-confirmed enthesitis based on the Glasgow Ultrasound Enthesitis Scoring System (GUESS)[15]; and (5) eligibility for secukinumab treatment.

Treatment protocol

According to the medication instructions, secukinumab (COSENTYX®, Novartis Pharm AG) was administered in initial doses during weeks 0–4, followed by maintenance doses every 4 weeks. The dosage consists of 2 injections of 150 mg each, totaling 300 mg. Our study established a treatment duration of 6 weeks (approximately 1.5 months). If patients experience disease recurrence or intolerance during the treatment period, dose adjustments or treatment discontinuation could be considered based on clinical guidelines. However, all 76 patients enrolled in this study completed the 6-week treatment as per the protocol, with no dropouts. Clinical assessments and ultrasound examinations were conducted at weeks 0 and 6 to evaluate the efficacy of secukinumab on moderate-to-severe plaque psoriasis with subclinical enthesitis.

Clinical examination

The clinical examination of each patient's bilateral lower extremities includes assessing tenderness and swelling at the superior pole of the patella (quadriceps tendon insertion point), inferior pole of the patella (patellar ligament origin), tibial tuberosity (patellar ligament insertion point), Achilles tendon, and plantar fascia. An experienced rheumatologist performs the clinical examination for tenderness and swelling at each site.

MSUS evaluation

Real-time ultrasound examinations were conducted by experienced sonographers with specialized training in MSUS. The Samsung (WS80A) and Philips (EPIQ5) color Doppler ultrasound diagnostic instruments equipped with a 3–12 MHz linear array transducer were utilized. All ultrasound distance data were subsequently analyzed for statistical purposes using the unit of measurement (centimeters, cm) as provided by the color Doppler ultrasound diagnostic instrument. For examinations of prepatellar bursitis and plantar fascia, the probe frequency was adjusted to penetration mode. Examinations of the superior pole of the patella (quadriceps tendon insertion point), inferior pole of the patella (patellar ligament origin), and tibial tuberosity (patellar ligament insertion point) were performed with the patient in a supine position and the knee joint flexed at 30°. Assessments of the Achilles tendon and plantar fascia were conducted with the patient in a prone position, with both feet hanging over the edge of the examination table and flexed at 90°. If the patient could not assume a prone position, lateral decubitus positioning was used to examine the heel and plantar fascia, with the knee and ankle joints flexed at 90°.

To ensure the consistency and reliability of ultrasound measurements, rigorous quality control protocols were implemented. First, all sonographers underwent standardized training in MSUS techniques, with a focus on enthesial imaging protocols and adherence to the GUESS. This included practice sessions on cadaver models and phantom studies to refine probe positioning, optimize image acquisition parameters (e.g., gain, depth, and frequency), and improve identification of enthesial abnormalities (e.g., thickening, bursal fluid, and bone erosion). To minimize inter- and intra-observer variability, repeated measurements were performed at each enthesial site (quadriceps tendon, patellar tendon, Achilles tendon, and plantar fascia) by the same sonographer. The mean of three consecutive measurements was used for analysis, reducing random error. Additionally, inter-rater reliability was established by having a second experienced sonographer independently assess 10% of scans; discrepancies were resolved through consensus review. Additionally, the ultrasound physicians were blinded to the clinical details of the patients. Clinical examinations and ultrasound measurements were conducted separately by different personnel, ensuring mutual unawareness of each other's results.

Criteria for confirming subclinical enthesitis

Subclinical enthesitis was determined if at least one

of the following abnormal ultrasound findings was observed[15–17]:

(1) Tendon attachment thickening: according to the GUESS criteria, thickening is considered if the quadriceps tendon attachment is ≥ 6.1 mm, the thickness between the patellar tendon insertion and origin is ≥ 4 mm, the thickness of the Achilles tendon is ≥ 5.29 mm, and the thickness of the plantar fascia at the calcaneal insertion is ≥ 4 mm.

(2) Deep bursal fluid at the tendon insertion.

(3) Discontinuous or deficient cortical bone at the tendon insertion, indicating bone erosion.

(4) Bony protrusions at the end of the enthesial bone contour are considered as bone spurs.

Outcomes

The primary outcomes of this study included:

(1) Clinical improvement in skin lesions: evaluated using DLQI, BSA, PASI, and Investigator's Global Assessment (IGA).

(2) Reduction in enthesial thickness: measured via MSUS at specific sites, including the quadriceps tendon insertion, inferior patellar margin, Achilles tendon, and plantar fascia at the calcaneus.

Secondary outcomes included:

(1) Resolution of bursitis, bone erosion, and bone spurs: assessed via MSUS for deep bursal fluid, cortical bone discontinuity, or bony protrusions at enthesial sites.

(2) Stratified treatment effects: analyzed by Body Mass Index (BMI) (< 28 vs. ≥ 28), gender, age, smoking/alcohol history, disease duration, comorbidities (diabetes, hypertension), and PASI (low < 10 vs. high ≥ 10).

Safety outcomes included monitoring for adverse events (AEs) and tolerability of secukinumab treatment.

Assessment Timing: clinical and ultrasound evaluations were performed at baseline (week 0) and post-treatment (week 6). Statistical comparisons used paired *t*-tests, Wilcoxon tests, or chi-square tests, with significance set at $P < 0.05$.

Statistical analysis

This study employs SPSS 26.0 statistical software or R (4.0.1) with the ggstatsplot package for data analysis. Descriptive statistics will be used to present continuous variables as means ± standard deviations or medians (interquartile ranges) according to the normality of the data, while categorical variables will be represented as frequencies or proportions. Paired sample *t*-tests, paired sample rank sum tests, or paired sample chi-square tests will be utilized for the comparison of continuous variables before and after treatment.

Stratified analyses will be conducted based on BMI, gender, age, history of alcohol consumption, smoking history, duration of illness, diabetes, hypertension, and PASI. The stratification thresholds are defined as follows: BMI < 28; age < 40 years; duration of illness < 5 years; PASI < 10; positive/negative history for alcohol consumption, hypertension, and diabetes; and gender (male/female). A bilateral *P* value less than 0.05 will be considered statistically significant.

Results

We conducted a demographic analysis of 76 enrolled patients, including gender, age, BMI index, and a history of smoking and alcohol consumption. Additionally, clinical data, such as relevant medical history of chronic diseases, were also collected. Specific parameters can be found in Table 1.

We initially focused on the treatment improvement in patients with moderate-to-severe plaque psoriasis accompanied by subclinical enthesitis on the skin surface using secukinumab. During the study, a paired rank-sum test was employed, and the results indicated a significant improvement in clinical assessments, including DLQI, BSA, PASI, and IGA ($P < 0.001$) after secukinumab treatment (Table 2). This suggests that secukinumab treatment can significantly enhance the skin condition of patients, with marked reductions observed in various scoring indicators.

Table 1: Baseline demographic and clinical characteristics of the study population (*N* = 76).

Parameters		Number	Percentage
Gender	Male	61	80.26%
	Female	15	19.74%
Age	< 40 years	42	55.26%
	≥ 40 years	34	44.73%
BMI	< 28	53	69.74%
	≥ 28	23	30.26%
Disease duration	< 3 years	17	22.37%
	≥ 3 years	59	77.63%
Hypertension	Negative	65	85.53%
	Positive	11	14.47%
Smoking	Negative	41	53.95%
	Positive	35	46.05%
Alcohol	Negative	69	90.79%
	Positive	7	9.21%
Diabetes	Negative	70	92.11%
	Positive	6	7.89%
PASI	Low (< 10)	10	13.16%
	High (≥ 10)	66	86.84%

The data was expressed as frequency and percentage.

Table 2: Changes in clinical scores from baseline to week 6 after secukinumab treatment.

Indicators	Before treatment	After treatment	*Z* value	*P* value
DLQI	12.0 (10.0, 14.0)	0 (0, 1.0)	−7.588	< 0.001
BSA	30.0 (15.0, 40.0)	0.75 (0, 1.0)	−7.576	< 0.001
PASI	18.60 (12.90, 31.45)	0.20 (0, 1.35)	−7.575	< 0.001
IGA	4.0 (3.0, 4.0)	1.0 (0, 1.0)	−7.668	< 0.001

The data were expressed as median and interquartile ranges.

Abbreviation: DLQI, Dermatology Life Quality Index; BSA, body surface area; PASI, Psoriasis area and severity index; IGA, Investigator's Global Assessment.

We further analyzed the impact of secukinumab on the improvement of enthesial thickness around the bones in patients with subclinical enthesitis. Statistical analysis was conducted using paired Student's *t*-tests for data points conforming to a normal distribution and Wilcoxon tests for non-normally distributed data. The results demonstrated a significant improvement in enthesial thickness at the attachment points of the quadriceps tendon, inferior pole of the patellar tendon, Achilles tendon, and plantar fascia under the heel bone ($P < 0.05$). Notably, the thickness improvement was most pronounced at the attachment point of the right Achilles tendon ($P = 2.71 \times 10^{-9}$). However, no significant differences were observed in the thickness of attachment points at the distal ends of the patella on both sides (Table 3). Fig. 1 illustrates the changes in thickness at the right Achilles tendon enthesial attachment point before and after secukinumab monoclonal antibody treatment.

Building upon ultrasound findings, we conducted further observations on the improvement of bursitis, bone erosion, and bone spur in patients. Utilizing paired chi-square tests, we statistically analyzed the patients' conditions before and after treatment. Neither bone erosion nor bone spurs were detected in any patient at either baseline or week 6. Before treatment, 68 patients had bilateral prepatellar bursitis, which showed no improvement after treatment.

As shown in Fig. 2, stratified analyses based on BMI, gender, age, alcohol consumption, smoking history, disease duration, diabetes, hypertension, and PASI (using the same statistical methods as the unstratified analysis) showed that treatment significantly reduced right Achilles tendon enthesial thickness in nearly all subgroups, including those defined by BMI, sex, age, disease duration, hypertension, smoking, alcohol consumption, and PASI (all $P < 0.01$; Hedges' g range: 0.55–1.08). The only exception was the diabetes subgroup ($n = 6$, $P = 0.20$). Numerically larger effect sizes were observed in patients with BMI ≥ 28, younger age, female sex, and low PASI scores.

Discussion

This study demonstrates that short-term (6-week) treatment with secukinumab significantly improved both cutaneous manifestations and subclinical enthesitis in patients with moderate-to-severe plaque psoriasis. Given that enthesitis is recognized as an early hallmark and predictor of PsA development[3,10], timely identification

Table 3: Changes in enthesial thickness measured by ultrasound from baseline to week 6.

Location	Direction	Before treatment (cm)	After treatment (cm)	*Z*/*t* value	*P* value
Quadriceps tendon	Left	0.610 (0.530, 0.688)	0.490 (0.410, 0.570)	−5.142	< 0.001
	Right	0.618 ± 0.016	0.515 ± 0.015	40.940	< 0.001
Distal patellar	Left	0.384 ± 0.010	0.370 ± 0.008	9.530	< 0.001
	Right	0.398 ± 0.009	0.377 ± 0.009	14.380	< 0.001
Inferior pole of the patella–proximal patellar	Left	0.420 (0.363, 0.450)	0.360 (0.330, 0.390)	−5.122	< 0.001
	Right	0.410 (0.373, 0.460)	0.370 (0.330, 0.400)	−3.821	< 0.001
Achilles tendon	Left	0.470 (0.413, 0.548)	0.380 (0.343, 0.478)	−4.850	< 0.001
	Right	0.487 ± 0.010	0.407 ± 0.009	51.840	< 0.001
Inferior pole of the calcaneus–plantar aponeurosis	Left	0.375 (0.313, 0.430)	0.330 (0.270, 0.360)	−3.083	0.002
	Right	0.370 (0.330, 0.418)	0.320 (0.270, 0.358)	−4.358	< 0.001

The data were expressed as median (25th–75th percentile) or mean ± standard deviation according to the normality of the data. Thickness of the respective subclinical enthesial site measured in centimeters (cm) using ultrasound. *P* value of < 0.05 indicates a significant difference before and after treatment.

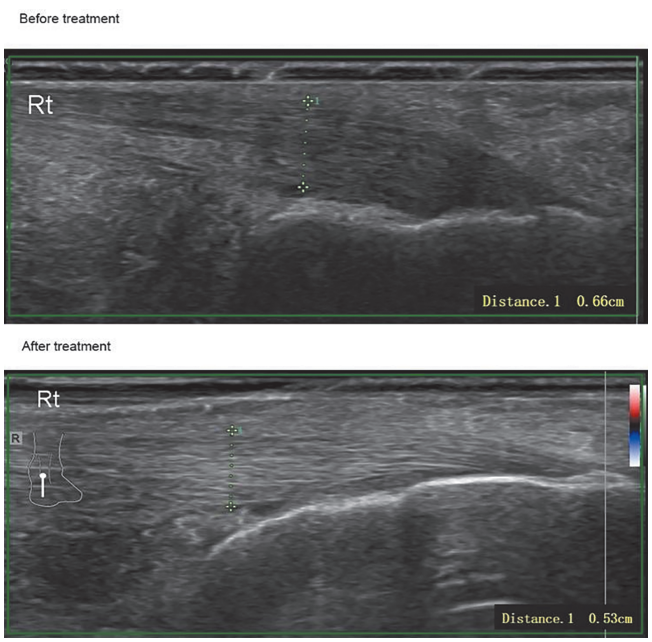

Figure 1: Ultrasound comparative images before and after treatment of the right Achilles tendon.

and treatment of enthesitis are of crucial significance in slowing disease progression[17,18].

The evaluation of PsA traditionally encompasses a range of clinical assessments, including tender and swollen joint counts, spinal mobility, and the extent of skin and nail involvement[19]. However, these clinical examinations often fail to detect early inflammatory changes in the entheses. MSUS offers a distinct advantage due to its ability to visualize subclinical pathology, such as tendon thickening, bursitis, and early bone erosions, with high sensitivity[20–22]. By utilizing MSUS, our study was able to objectively quantify the therapeutic effect of secukinumab on these subclinical lesions, an effect that would otherwise have been missed by clinical assessment alone. These findings hold important clinical implications for potentially intercepting the disease trajectory before the onset of symptomatic joint involvement.

The 6-week follow-up period is an important limitation, but it also provides a unique opportunity to capture the early pharmacodynamic effects of IL-17A inhibition on entheseal tissue. This timeframe aligns with the known rapid onset of action of secukinumab in psoriasis, allowing us to observe the resolution of active inflammation (e.g., edema and cellular infiltration) largely uncontaminated by long-term structural remodeling processes such as fibrosis or enthesophyte formation. The significant reduction in enthesial thickness observed at week 6 likely represents the de-escalation of inflammatory edema rather than complete structural reversal. However, demonstrating this early resolution is clinically meaningful for two reasons. First, persistent inflammatory edema is a driver of subsequent structural damage; its rapid suppression is a prerequisite for long-term disease modification.

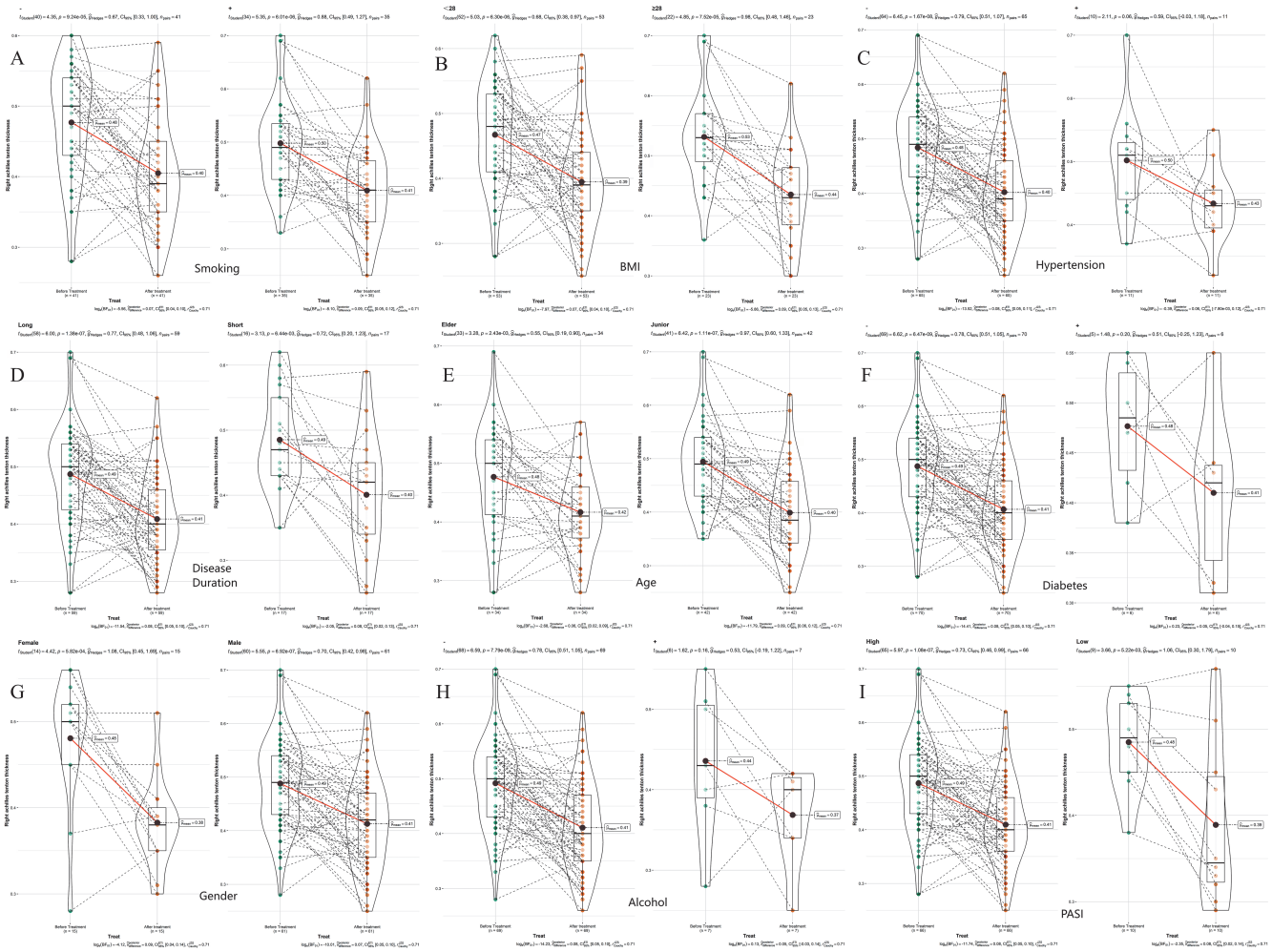

Figure 2: A violin plot illustrates the distribution of attachment point thickness before and after treatment. Green dots represent the numerical values of attachment point thickness before treatment, with darker colors indicating a higher frequency of samples at that location. Red dots represent the attachment point thickness after treatment. The dashed lines connecting them represent paired samples. (A) smoking history, (B) body mass index (BMI), (C) hypertension, (D) disease duration, (E) age, (F) diabetes (glycemic categories), (G) gender, (H) alcohol consumption, and (I) Psoriasis Area and Severity Index (PASI).

Second, our findings establish an ultra-early sonographic benchmark for treatment response, which could inform future trial designs and potentially serve as an early biomarker for drug efficacy.

Our results align with and extend the findings from recent pivotal trials. The ultrasound monitoring of enthesitis and synovitis in psoriatic arthritis treatment (ULTIMATE) trial rigorously established the efficacy of secukinumab in reducing synovitis and enthesitis in patients with established PsA over 52 weeks[23]. More pertinently, the Interception in Very Early Psoriatic Arthritis (IVEPSA) study demonstrated that early intervention with secukinumab in high-risk psoriasis patients with subclinical joint inflammation could significantly reduce the 12-month incidence of clinical PsA[24]. While IVEPSA was a prospective, placebo-controlled trial focused on disease prevention, our real-world, retrospective study complements it by showing that even a short 6-week course of secukinumab in a routine clinical setting can induce measurable regression of subclinical enthesial thickness. The 2023 European League Against Rheumatism (EULAR) recommendations for the management of PsA emphasize the importance of early intervention and tight disease control, supporting the rationale for screening and treating subclinical enthesitis in high-risk psoriasis patients[25,26]. Future research should extend follow-up to 24–52 weeks to determine whether

these early improvements translate into durable structural benefits and reduced progression to clinical PsA.

The lack of improvement in bilateral prepatellar bursitis after 6 weeks of secukinumab treatment warrants consideration. First, while enthesitis is mechanistically driven by IL-17A pathway activation involving γδ T cells and group 3 innate lymphoid cells (ILC3s), the immunopathology of bursitis remains less characterized[27]. Bursal inflammation may be sustained by synovial-like fibroblasts interacting with immune cells, potentially making it less dependent on a single cytokine axis[28]. Second, different musculoskeletal tissues exhibit distinct kinetics of inflammatory resolution, as demonstrated in rheumatoid arthritis where synovitis improvement preceded tenosynovitis improvement during treatment[29]. Third, structural alterations such as fibrosis, once established, may limit reversibility. Evidence from chronic tendinopathy shows IL-17 can promote type III collagen deposition, suggesting that repair attempts may not be easily reversed[30]. Additionally, a comparative ultrasound study in PsA reported that while inflammatory changes were reversible with biologic therapy, bone erosions and enthesophytes were not, supporting the notion that chronic structural changes may be less responsive[31].Collectively, these observations suggest that the absence of bursitis improvement may reflect a combination of distinct immunopathology, slower resolution kinetics, and potentially irreversible structural changes. Dedicated studies on bursitis in PsA are needed to clarify these mechanisms.

In this study, numerically larger effect sizes were observed in patients with BMI ≥ 28, but this subgroup difference was not formally tested for interaction and the sample size was small (n = 23). Therefore, we cannot conclude that BMI influences the short-term ultrasound response of subclinical enthesitis to secukinumab. The existing literature on BMI and biologic efficacy in psoriatic disease is inconsistent. Higher BMI has been associated with treatment resistance and lower Psoriasis Area and Severity Index 90 (PASI90) response rates in psoriasis, and with higher drug discontinuation due to insufficient efficacy[32,33]. However, systematic reviews in PsA suggest that IL-17/IL-23 inhibitors may be less affected by BMI than tumor necrosis factor (TNF) inhibitors , and the negative predictive effect of obesity did not reach statistical significance in quantitative analyses[34,35]. The British Society for Rheumatology 2022 guidelines recommend that treatment choice should not be influenced by body weight, but weight loss support should be offered to overweight/obese patients to maximise treatment response[36]. Direct evidence on subclinical enthesitis is limited, and available studies have not stratified by BMI[37]. Given the small sample size and inconsistent literature, our findings should be considered exploratory. Additionally, numerically larger effect sizes were also observed in younger patients, females, and those with lower baseline PASI. However, as with the BMI subgroup, these differences were not formally tested for interaction and the sample sizes were limited. The existing evidence on the influence of age, sex, and baseline PASI on treatment response in psoriatic disease is inconsistent and largely derived from skin outcomes rather than subclinical enthesitis. For skin responses, younger age and lower baseline PASI have been associated with better biologic outcomes, which is consistent with the direction of our numerical findings[38,39]. In contrast, the evidence for sex is mixed: some studies report better responses in females, while others favour males[35,40,41]. Different biologics may show variable efficacy on enthesitis in PsA trials , highlighting the complexity of predicting treatment response at the entheseal level[42]. Given the limited and inconsistent evidence and the exploratory nature of our subgroup findings, no definitive conclusions can be drawn regarding the influence of age, sex, or baseline PASI on the efficacy of secukinumab for subclinical enthesitis. Future prospective studies with larger sample sizes and adequately powered subgroup analyses (including formal interaction tests) are needed to clarify the potential influence of BMI, age, sex, and baseline PASI on treatment response.

Limitations

This study has several limitations that should be acknowledged. First, the retrospective, single-center design without a placebo or active comparator precludes definitive establishment of causality. The observed improvements may reflect, in part, natural disease fluctuation or measurement variability. Second, while rigorous quality control was implemented, the absence of a centralized, blinded imaging core laboratory may introduce measurement bias. Third, the lack of clinical

symptom assessment (pain, tenderness, and functional impairment) limits the comprehensive evaluation of treatment effect on patient-relevant outcomes, and this information can not be retrospectively supplemented. Fourth, subgroup analyses (e.g., BMI ≥ 28, diabetes, age, sex, and baseline PASI) had limited statistical power due to small sample sizes, and interaction tests were not performed; therefore, these exploratory findings should be interpreted with caution.

Conclusion

In conclusion, this study demonstrates that a short 6-week course of secukinumab significantly improves both skin lesions and ultrasound-confirmed subclinical enthesitis in patients with moderate-to-severe plaque psoriasis. By capturing the ultra-early tissue-level response to IL-17A inhibition, our findings provide a sonographic benchmark for treatment effect and support the rationale for early intervention in high-risk psoriasis patients. While longer follow-up is needed to confirm whether these early improvements translate into reduced progression to clinical PsA, this study highlights the potential of MSUS as a sensitive tool for detecting and monitoring subclinical enthesitis in routine clinical practice.

Author contributions

Zesong Wang: conceptualization, methodology, project administration, resources, supervision, validation, writing-original draft; Weibo Jiang: data curation, formal analysis, investigation; Shuoting Li: investigation, data curation, formal analysis; Minghui Zhou: data curation, formal analysis, investigation; Xinggang Ju: investigation, data curation, writing–review & editing. All authors approved the final version of the manuscript and agreed to its publication.

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Ethics statement

This study was conducted according to the Declaration of Helsinki principles, and was approved by the Ethics Committee of The Second Affiliated Hospital of Henan University of Science and Technology (Approval No. L2023004, dated September 27, 2023). Patient consent was waived.

Data availability statement

The datasets used or analyzed during the current study are available from the corresponding author on reasonable request.

AI statement

The authors used GPT-4 online version as a language-editing tool to improve grammar, clarity, and readability. The AI tool was not used for data analysis, data generation, image processing, or scientific content creation. All outputs were carefully reviewed and verified by the authors, who take full responsibility for the final content.

Conflicts of interest

The authors confirm that there are no conflicts of interest related to the manuscript.

References

1. Yang Q, Qu L, Tian H, et al. Prevalence and characteristics of psoriatic arthritis in Chinese patients with psoriasis. *J Eur Acad Dermatol Venereol.* 2011;25(12):1409-1414.
2. Lu C, Yang F, Liu H, et al. Chinese Registry of Psoriatic Arthritis (CREPAR): I. clinical characteristics of Chinese patients with psoriatic arthritis. *Int J Rheum Dis.* 2023;26(9):1737-1744.
3. Kaeley GS, Eder L, Aydin SZ, Gutierrez M, Bakewell C. Enthesitis: a hallmark of psoriatic arthritis. *Semin Arthritis Rheum.* 2018;48(1):35-43.
4. Bolkan Günaydın E, Aladağ P, Tecer D, Yenice IS, Adışen E, Göğüş FN. Ultrasonographic evaluation of subclinical enthesitis in patients with psoriasis. *Int J Rheum Dis.* 2020;23(6):744-752.
5. Klaassen KM, Ploegmakers MJ, van de Kerkhof PC, Klein WM, Pasch MC. Subclinical enthesitis in nail psoriasis patients: a case-control study. *J Dtsch Dermatol Ges.* 2017;15(4):405-412.
6. Naredo E, Möller I, de Miguel E, et al. High prevalence of ultrasonographic synovitis and enthesopathy in patients with psoriasis without psoriatic arthritis: a prospective case-control study. *Rheumatology (Oxford).* 2011;50(10):1838-1848.
7. Coates LC, Hodgson R, Conaghan PG, Freeston JE.

MRI and ultrasonography for diagnosis and monitoring of psoriatic arthritis. *Best Pract Res Clin Rheumatol.* 2012;26(6):805-822.
8. Gandjbakhch F, Terslev L, Joshua F, et al. Ultrasound in the evaluation of enthesitis: status and perspectives. *Arthritis Res Ther.* 2011;13(6):R188.
9. Elnady B, El Shaarawy NK, Dawoud NM, et al. Subclinical synovitis and enthesitis in psoriasis patients and controls by ultrasonography in Saudi Arabia; incidence of psoriatic arthritis during two years. *Clin Rheumatol.* 2019;38(6):1627-1635.
10. Tinazzi I, McGonagle D, Biasi D, et al. Preliminary evidence that subclinical enthesopathy may predict psoriatic arthritis in patients with psoriasis. *J Rheumatol.* 2011;38(12):2691-2692.
11. Blauvelt A, Chiricozzi A. The immunologic role of IL-17 in psoriasis and psoriatic arthritis pathogenesis. *Clin Rev Allergy Immunol.* 2018;55(3):379-390.
12. Warren RB, Blauvelt A, Poulin Y, et al. Efficacy and safety of risankizumab vs. secukinumab in patients with moderate-to-severe plaque psoriasis (IMMerge): results from a phase III, randomized, open-label, efficacy-assessor-blinded clinical trial. *Br J Dermatol.* 2021; 184(1):50-59.
13. Gottlieb AB, Deodhar A, Mcinnes IB, et al. Long-term safety of secukinumab over five years in patients with moderate-to-severe plaque psoriasis, psoriatic arthritis and ankylosing spondylitis: update on integrated pooled clinical trial and post-marketing surveillance data. *Acta Derm Venereol.* 2022;102:adv00698.
14. Committee on Psoriasis, Chinese Society of Dermatology. Guideline for the diagnosis and treatment of psoriasis in China (2023 edition). *Chin J Dermatol.* 2023;56(7):573-625.
15. Balint PV, Kane D, Wilson H, McInnes IB, Sturrock RD. Ultrasonography of entheseal insertions in the lower limb in spondyloarthropathy. *Ann Rheum Dis.* 2002;61(10):905-910.
16. Agache M, Popescu CC, Popa L, Codreanu C. Ultrasound enthesitis in psoriasis patients with or without psoriatic arthritis, a cross-sectional analysis. *Medicina (Kaunas).* 2022;58(11):1557.
17. Lassoued Ferjani H, Maatallah K, Miri S, et al. Enthesitis-related arthritis: monitoring and specific tools. *J Pediatr (Rio J).* 2022;98(3):223-229.
18. Taylor WJ. Impact of psoriatic arthritis on the patient: through the lens of the WHO International Classification of Functioning, Health, and Disability. *Curr Rheumatol Rep.* 2012;14(4):369-374.
19. Sarbu MI, Sarbu N, Cristea Ene D, et al. New perspectives on diagnosing psoriatic arthritis by imaging techniques. *Open Access Rheumatol.* 2021;13:343-352.
20. Zhou H, Qiu L, Sun P, et al. Clinical joints manifestations in patients with psoriatic arthritis on musculoskeletal ultrasound. *Clin Rheumatol.* 2022;41(4):1211-1218.
21. Florescu A, Vere CC, Florescu LM, Mușetescu AE, Bondari A, Ciurea PL. Clinical and ultrasound assessment of enthesis in psoriatic arthritis in a Romanian cohort. *Curr Health Sci J.* 2018;44(4):347-351.
22. Kane D. The role of ultrasound in the diagnosis and management of psoriatic arthritis. *Curr Rheumatol Rep.* 2005;7(4):319-324.
23. D'Agostino MA, Carron P, Gaillez C, et al. Effects of secukinumab on synovitis and enthesitis in patients with psoriatic arthritis: 52-week clinical and ultrasound results from the randomised, double-blind ULTIMATE trial with open label extension. *Semin Arthritis Rheum.* 2023;63:152259.
24. Kampylafka E, Simon D, d'Oliveira I, et al. Disease interception with interleukin-17 inhibition in high-risk psoriasis patients with subclinical joint inflammation-data from the prospective IVEPSA study. *Arthritis Res Ther.* 2019;21(1):178.
25. Gossec L, Kerschbaumer A, Ferreira RJO, et al. EULAR recommendations for the management of psoriatic arthritis with pharmacological therapies: 2023 update. *Ann Rheum Dis.* 2024;83(6):706-719.
26. Kerschbaumer A, Smolen JS, Ferreira RJO, et al. Efficacy and safety of pharmacological treatment of psoriatic arthritis: a systematic literature research informing the 2023 update of the EULAR recommendations for the management of psoriatic arthritis. *Ann Rheum Dis.* 2024;83(6):760-774.
27. Najm A, Goodyear CS, McInnes IB, Siebert S. Phenotypic heterogeneity in psoriatic arthritis: towards tissue pathology-based therapy. *Nat Rev Rheumatol.* 2023; 19(3):153-165.
28. Crowe LAN, Akbar M, de Vos RJ, et al. Pathways driving tendinopathy and enthesitis: siblings or distant cousins in musculoskeletal medicine? *Lancet Rheumatol.* 2023; 5(5):e293-e304.
29. Matthijssen XME, Niemantsverdriet E, Le Cessie S, van der Helm-van Mil AHM. Differing time-orders of inflammation decrease between ACPA subsets in RA patients suggest differences in underlying inflammatory pathways. *Rheumatology (Oxford).* 2021;60(6):2969-2975.
30. Russell T, Bridgewood C, Rowe H, Altaie A, Jones E, McGonagle D. Cytokine "fine tuning" of enthesis tissue homeostasis as a pointer to spondyloarthritis pathogenesis with a focus on relevant TNF and IL-17 targeted therapies. *Semin Immunopathol.* 2021;43(2):193-206.
31. Wang Y, Xiao Y, Zhang L, et al. Superior effect of adalimumab versus secukinumab on ultrasound-confirmed synovitis in psoriatic arthritis: comprehensive evidence from musculoskeletal ultrasound and clinical assessments. *J Dermatolog Treat.* 2024;35(1):2411849.
32. Kim HJ, Lee EH, Jung Y. Association of obesity and innate immune markers with resistance to biologic therapy

in psoriasis. *JAMA Dermatol.* 2025;161(6):629-634.
33. Pirro F, Caldarola G, Chiricozzi A, et al. Impact of body mass index on the efficacy of biological therapies in patients with psoriasis: a real-world study. *Clin Drug Investig.* 2021;41(10):917-925.
34. Zeng L, Yang K, Zhang T, et al. Effect of body mass index on treatment response of biologic/targeted-synthetic DMARDs in patients with rheumatoid arthritis, psoriatic arthritis or axial spondyloarthritis. A systematic review. *Autoimmun Rev.* 2023;22(7):103357.
35. Künzler T, Bamert M, Sprott H. Factors predicting treatment response to biological and targeted synthetic disease-modifying antirheumatic drugs in psoriatic arthritis—a systematic review and meta-analysis. *Clin Rheumatol.* 2024;43(12):3723-3746.
36. Tucker L, Allen A, Chandler D, et al. The 2022 British society for rheumatology guideline for the treatment of psoriatic arthritis with biologic and targeted synthetic DMARDs. *Rheumatology (Oxford).* 2022;61(9):e255-e266.
37. Liu Z, Chen J, Zhou K, et al. Effectiveness of biologics on synovitis and enthesitis using musculoskeletal ultrasound assessment in subclinical psoriatic arthritis: a 12-week observational real-world study. *J Am Acad Dermatol.* 2026;94(1):41-47.
38. Hjort G, Schwarz CW, Skov L, Loft N. Clinical characteristics associated with response to biologics in the treatment of psoriasis: a meta-analysis. *JAMA Dermatol.* 2024;160(8):830-837.
39. Galluzzo M, Talamonti M, Bernardini N, et al. Real-world outcomes in patients with moderate-to-severe plaque psoriasis treated with guselkumab for up to 1 year. *Expert Opin Biol Ther.* 2022;22(12):1585-1592.
40. Maul JT, Augustin M, Sorbe C, et al. Association of sex and systemic therapy treatment outcomes in psoriasis: a two-country, multicentre, prospective, noninterventional registry study. *Br J Dermatol.* 2021;185(6):1160-1168.
41. Preis S, Ziehfreund S, Biedermann T, Horster S, Zink A. A systematic review of sex and gender differences in treatment outcome of inflammatory skin diseases: is it time for new guidelines? *J Eur Acad Dermatol Venereol.* 2025;39(3):512-528.
42. Attar RZ, Gottlieb AB, Aydin SZ. Understanding enthesitis in psoriatic disease: insights and implications. *Am J Clin Dermatol.* 2026;27(1):121-136.