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Distal interphalangeal joint involvement in patients with rheumatoid arthritis: Where are we?

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Background/aim: Rheumatoid arthritis (RA) usually affects the wrist, metacarpophalangeal joint, and proximal interphalangeal joint of the hands. However, the distal interphalangeal (DIP) joints may also be involved in RA patients. In this study, we aimed to evaluate the frequency and associated factors of DIP joint erosion in patients with RA.
Materials and methods: Medical records of patients with RA were reviewed retrospectively. Patients with major trauma affecting DIP joints, osteoarthritis, erosive osteoarthritis, psoriatic arthritis, systemic sclerosis, calcium pyrophosphate dihydrate disease, and gout were excluded. Anteroposterior hand X-rays were evaluated and patients were divided into groups according to autoantibody profile.
Results: We reviewed 1213 patients with a mean age of 54.3 ± 12.5 years; 82.8% of them were female, and 95.4% had RA-type erosive changes. The DIP erosion rate was 12%. DIP involvement was generally unilateral and asymmetric, with the 3rd finger being the most commonly affected joint. Patients with DIP erosions had a significantly longer disease duration ($p = 0.036$). Older age was an independent predictive factor for DIP erosion ($p = 0.001$).
Conclusion: In this large-sample study, we reported DIP joint involvement in patients with RA. Advanced age could have affected the results because hand erosions increase above 50 years in a healthy population. Our results may provide a different perspective on joint involvement in RA.

Key words: Distal interphalangeal joint, erosive arthritis, rheumatoid arthritis

1. Introduction

Rheumatoid arthritis (RA) is a chronic, multisystemic, and autoimmune rheumatic disease that affects synovial joints and causes joint erosions. It is one of the most common inflammatory rheumatic diseases. The disease decreases work capacity and quality of life during RA [1]. Joint erosion occurs in 90% of patients with RA [2]. The 1987 American College of Rheumatology (ACR) RA revised classification criteria including clinical and radiological evaluation of hand joints such as metacarpophalangeal (MCP), and proximal interphalangeal (PIP) joints [3]. The 2010 ACR/European League against Rheumatism (EULAR) RA classification criteria include clinical assessment of hand joints (wrist, MCP, and PIP) [4]. Distal interphalangeal (DIP) joint involvement does not receive any points in the current classification criteria. Disease activity score-28 (DAS-28), which is the most commonly used RA disease activity scoring system, does not include DIP joint arthritis [5]. Modified Sharp score (mSS) is one of the radiographic scoring systems evaluating joint damage in patients with RA, and it includes 15 areas for joint space narrowing (JSN) and 16 areas for bone erosion, but neither erosion score nor JSN score includes DIP joints [6]. Distal interphalangeal joint involvement with radiological changes is well-defined in rheumatic diseases such as erosive osteoarthritis (EOA), hand osteoarthritis (OA), and psoriatic arthritis (PsA) [7,8]. Adult-onset Still's disease, anti-Jo-1 syndrome, calcium pyrophosphate dihydrate disease (CPPD), multicentric reticulohistiocytosis, and gout can also affect the DIP joints [9-13].

In our daily rheumatology practice, we encounter arthritis and/or arthralgia in DIP joints in patients with RA. All diseases that may cause DIP involvement are evaluated. In this large sample-sized study, we aimed to find the frequency and associated factors of DIP joint erosions in patients with RA.

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2. Materials and methods

We evaluated the RA patients followed up in our rheumatology department, who were 18 years of age or older, and who had an anterior-posterior hand X-ray within the last year were included in the study. The ACR/EULAR 2010 RA classification criteria were used to diagnose RA [4]. Demographic, laboratory, clinical, and treatment characteristics were noted from electronic medical records, retrospectively. The exclusion criteria included patients who had lost a large portion of the finger (including at least one DIP joint), had a history of fractures in the hand bones, or had overlapping rheumatologic or non-rheumatologic diseases that can cause erosions or deformities in the DIP joints, such as systemic sclerosis (SSc), PsA, CPPD, gout, EOA, and hand osteoarthritis (OA). Patients having hand deformities or signs on hand X-rays that were well defined for EOA or PsA, such as saw-tooth, gull-wing, mouse-ear, terminal tuft erosion, acro-osteolysis, or fluffy periostitis, were also excluded [8,14].

Diagnosis of joint erosion in DIP joints was based on EULAR definition as 'interruption of the cortex of the bone' [15]. 'Rheumatoid arthritis type joint involvement (RJI)' was based on mSS [6], and defined as having any joint erosion or JSN. 'Serious joint involvement (SJI)' was defined as having any erosion score ≥3 points or JSN score ≥4 points according to mSS. All of the hand X-rays were evaluated separately by the rheumatologists who were blinded to the patients. If there was no agreement between readers, X-rays were reevaluated by all readers, then a final common decision was made with full agreement. A nephelometric assay detected rheumatoid factor (RF); serum samples with results ≥14 IU/mL were defined as positive. Anticyclic citrullinated peptide antibody-2 IgG (anti-CCP) was detected by enzyme-linked immunosorbent assay; serum samples with results ≥5 U/mL were defined as positive. The study was approved by the local Ethics Committee and was conducted following the principles of the 1964 Declaration of Helsinki and its later amendments (approval no: 2023/03).

Statistical analysis was performed using SPSS 22.0 version (IBM SPSS, Chicago, IL). The results were given as a number, frequency, mean ± standard deviation, and/or median [25-75p] value. The chi-squared test and Fisher's exact test were used for the analysis of categorical data and independence between variables. The Mann–Whitney U test and independent-samples t-test were used to compare differences between groups according to the distribution analyses. Logistic regression analysis was performed to calculate the estimated values of the dependent variable as probabilities and to classify according to probability rules. The results were assessed at a 95% confidence interval, and a p-value of less than 0.05 was accepted as significant.

3. Results

We reviewed 1213 patients with a mean age of 54.3 ± 12.5 years, and 82.8% of them were female. The median disease duration was 5 [2–11] years. The rate of smoking history (active or ex) was 31.8%. Rheumatoid arthritis type joint involvement and SJI were observed in 95.4% and 24.7% of patients, respectively. We found the rate of DIP joint erosion as 12%. All of the patients with DIP erosions had a positive history of tenderness and swelling on DIP joints. None of the patients with DIP erosions had a positive family history (in first- and second-degree relatives) for PsA.

The minimum and maximum numbers of eroded DIP joints in patients were one and four, respectively. Only nine patients (6.1%) had bilateral-symmetrical DIP joint erosions. Isolated DIP joint erosion was absent. The most commonly affected DIP joint was the 3rd finger. Demographic, laboratory, clinical, and treatment characteristics are presented in Table 1. Table 2 shows the general characteristics of patients with and without DIP involvement. Both the RF- and anti-CCP–negative groups had a DIP erosion rate of 13.1%. When evaluated according to the autoantibody profile, there were no significant differences between all groups (Table 3).

In multivariate analysis, age was the independent predictive factor for DIP joint erosions ($p = 0.001$). Disease duration was the predictive factor for DIP erosion ($p = 0.036$), and there was no relationship between DIP joint erosion, sex, smoking, RF, anti-CCP, RJI, SJI, and biological agent use ($p > 0.05$).

4. Discussion

In this large-sample study, we evaluated the frequency and associated factors of DIP joint erosion in patients with RA. We found that erosive DIP joint involvement was 12.0%. The most commonly affected finger was the 3rd DIP. Distal interphalangeal joint erosions generally exhibited a unilateral-asymmetric pattern. Age emerged as an independent predictive factor for DIP joint erosions ($p = 0.001$).

Jacob et al. reported a higher rate of DIP joint erosion in seropositive RA patients compared to the age- and sex-matched control group (37% versus 14%) [16]. In their study, isolated DIP joint involvement was absent, the most commonly affected joint was the 3rd DIP, and DIP joint involvement was generally unilateral [16]. These findings are consistent with those of our study. In another study, the rate of DIP joint erosion was 16% in patients with RA. Halla et al. reported that the 2nd and 5th DIPs were the most commonly affected joints [17]. In addition, they reported the predominance of asymmetric patterns and the absence of isolated DIP involvement in

Table 1. The demographic, laboratory, clinical, and treatment characteristics.

Total patient count, n	1213
Male %, (n)	17.2 (209)
Female %, (n)	82.8 (1004)
Smoking history %, (n)	31.8 (386)
Age (mean standard deviation, years)	54.3 ± 12.5
Disease duration time (median [25–75p], years)	5 [2–11]
Rheumatoid factor positivity %, (n)	56.6 (686)
Anti-CCP positivity %, (n)	54.0 (655)
Biologic agent use %, (n)	30.8 (373)
Rheumatoid arthritis type joint involvement %, (n)	95.4 (1157)
Serious joint involvement %, (n)	24.7 (300)
Patients with DIP erosion %, (n)	12.0 (146)
Distribution of DIP erosions %, (n) 2.DIP 3.DIP 4.DIP 5.DIP	 12.5% (24) 41.9% (80) 26.7% (51) 18.9% (36)

Abbreviations: DIP, distal interphalangeal; anti-CCP, anticyclic citrullinated peptide.

Table 2. The general characteristics of patients with and without DIP involvement.

Variable	DIP joint involvement (–) group	DIP joint involvement (+) group
Total patient count, n	1067	146
Male %, (n)	18.1 (193)	11 (16)
Female %, (n)	81.9 (874)	89 (130)
Smoking history %, (n)	32.1 (343)	29.5 (43)
Age (mean ± standard deviation, years)	53.9±12.5	57.6±12.2
Disease duration time (median [25–75p], years)	5 [2–11]	6 [2–12]
RF positivity %, (n)	56.8 (606)	54.8 (80)
Anti-CCP positivity %, (n)	54.2 (579)	52 (76)
Biologic agent history %, (n)	30.3 (324)	33.5 (49)
Rheumatoid arthritis type joint involvement %, (n)	95 (1014)	98 (143)
Serious joint involvement %, (n)	24.2 (259)	28 (41)

Abbreviations: DIP, distal interphalangeal; RF, rheumatoid factor anti-CCP, anticyclic citrullinated peptide.

Table 3. Classification of patients according to autoantibodies.

Patient groups	**Patient with DIP erosion/total patient, n, (%)**
Group 1: RF (+) and Anti-CCP (+)	67/570 (11.8)
Group 2: RF (+) and Anti-CCP (–)	12/116 (10.3)
Group 3: RF (–) and Anti-CCP (+)	9/85 (10.6)
Group 4: RF (–) and Anti-CCP (–)	58/442 (13.1)

Abbreviations: DIP, distal interphalangeal; RF, rheumatoid factor; anti-CCP, anticyclic citrullinated peptide.

RA patients [17]. Papasavvas et al. reported the rate of DIP joint erosion as 12% in patients with RA, with 70% of DIP joint erosion presenting an asymmetrical pattern [18]. In a prospective study, erosive changes in DIP joints were 5.3% at the disease onset and 14.9% in the following third years in patients with RA [19]. The exclusion of OA is a cornerstone in the studies involving hand articulations. Because RA patients have an increased risk of developing OA than the non-RA population and OA is associated with enhanced marginal erosions in DIP joints in patients with RA [20,21].

In one study, DIP joint erosion was present in 12% of the RA group which was nearly half of the prevalence seen in the PsA group [22]. Another study reported a significantly higher rate of DIP erosion in patients with PsA compared to those with RA [23]. In this study, the mean age of RA patients was similar, but the mean disease duration was shorter compared to our study results [23]. In our study, both seropositive and seronegative RA patients had a DIP joint erosion rate of 11.5% and 12.7%, respectively ($p > 0.05$). Ikemura et al. identified an association between DIP joint erosion and advanced age, long disease duration, and PIP joint erosion [24]. Mizuuchi et al. reported a clinical DIP joint involvement rate of 2.1% in RA without any radiological evidence. Patients with clinical DIP involvement were significantly younger, and female patients were more frequently affected [25].

Limitations of our study included its retrospective nature, intra- and interobserver differences, lack of total modified Sharp score (mSS), and absence of imaging evidence such as ultrasonography or contrast-enhanced magnetic resonance imaging to detect synovitis. Distal interphalangeal joint synovitis can be documented by ultrasonography and indocyanine green-enhanced fluorescence optical imaging in patients with RA [26].

In conclusion, we detected DIP joint erosion in %12 of RA patients and identified age as an independent predictive factor for developing DIP joint erosion in RA. Advanced age could have affected our results because hand erosions increase above 50 years in a healthy population [27]. Our results may provide insights into the consideration of DIP involvement in RA patients and its evaluation and differential diagnosis.

Conflict of interest
The authors declare no conflicts of interest with respect to the authorship and/or publication of this article.

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