

Study of Rheumatoid Arthritis Patients with Foot Disorders and Deformities Occurrence

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Abstract

Background: *The most prevalent form of inflammatory arthritis is rheumatoid arthritis (RA) and it usually involves elbows, feet, wrists, knees, and ankles. The foot is the first region of the body to display RA signs and symptoms for certain patients. This research aimed to assess the prevalence of foot disorders in RA patients, identifying the relationship between the activity of the RA disease and foot disorders, as well as their effect and deformities occurrence.*

Patients and methods: *A total of 300 RA patients were included in this report. There were 240 women and 60 men, aged between 18 and 74. The following were done to all patients: complete historical review, complete clinical examination, and the evaluation of disease occurrence Complete blood count (CBC), Erythrocyte sedimentation rate (ESR), c-reactive protein (CRP), rheumatoid factor (RF) titer, and anti-cyclic citrullinated peptide (anti-CCP Ab) titer were used and X Ray on foot done to all patients*

Results: *We found that 31.6% of the study patients had foot deformities. 214 patients (71.3%) had normal gait while 86 patients (28.7.0%) had pathological gait. Hallux valgus was common among old age and obese RA patients. The foot deformities are associated with moderate and high DAS28 activity. Obese RA patients are more susceptible to have foot problems 2.89 times more than normal-weight RA patients. 176 patients (58.6%) had narrowing, 97 patients (32.33%) had osteoporosis 87 patients (29.0%) had erosion, 20 patients (6.67%) had bone cyst, 17 patients (5.6%) had subluxation and 14 patients (4.6%) had amalgamation.*

Conclusion: *This study showed that foot disorders in RA patients were substantially high. It accounted for about 59.3% of the total patients surveyed. This study demonstrated that there were 31.6% had foot deformities. Hallux valgus and overriding toes were the most prevalent foot deformities detected in RA patients. RA patients with a high risk of developing foot disorders had high BMI, high disease activity, and longer disease duration.*

Keywords: *Foot Disorders; Rheumatoid Arthritis; Deformities*

1. INTRODUCTION:

Rheumatoid Arthritis (RA) is a chronic inflammatory disorder affecting primarily cartilage and bone of small and middle-sized joints. The synovial inflammation and destruction of joints lead to pain, loss of function, muscle atrophy that results in disability and reduced quality of life. The frequency of foot involvement and rheumatoid foot problems have previously been reported from a different point of view [1]. Orthopedic RA-related surgery of the foot has a strong effect on pain and physical function in patients that do not respond to conservative clinical approaches. In intermediate to severe stages of the disease, conventional surgical treatment involves both joint preserving and joint sacrificing surgery to relieve pain and correct deformity in the rheumatoid forefoot. Some previous authors suggest as earlier as but less radical foot surgery. But in recent years, surgical procedures have been decreased in RA patients. [2]. Foot involvement and foot symptoms are seen frequently in RA. Physicians should be encouraged to perform the physical examination of the feet, assessment, and treatment of foot problems during the follow-ups. Individual proper medication and orthoses should be prescribed by the physicians and the management and compliance to insoles should be monitored as a part of treatment to enhance the quality of life of the patients suffering from this chronic condition. [3]. Numerous studies have reported an association between RA involvement or deformity of the forefoot in RA and functional disability. In those cases, orthotic devices and surgical treatment can relieve pain and improve function. However, there are a few studies on the effects of midfoot- and hindfoot arthritis in RA [4]. High BMI was correlated with foot problems in some previous studies because the excessive mechanical load affects joint damage. However, Jeong et al. found no significant difference in BMI between RA patients with foot or ankle involvement and without involvement. Besides, BMI was not associated with functional disability [5]. This study aimed to evaluate the foot disorders in RA patients and their complications or deformity.

2. PATIENTS AND METHODS:

This study was performed in the Rheumatology and Rehabilitation Department of Zagazig University Hospitals, after review and approval by the Institutional Review Board, Faculty of Medicine, Zagazig University. This study included a total of 300 RA patients. They were 240 females and 60 males, and their mean age (range) was 43.7 ± 10.05 (18-74) years. Disease duration ranged from 1-20 years. Study patients fulfilled the revised 2010 ACR/EULAR classification criteria for Rheumatoid Arthritis [6].

Written informed consent was obtained from all participants. This study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Clinical assessment;

All patients had a complete clinical history, a general bodyweight stress examination, a height, a bodyweight index (BMI), lower limb edema, and a patient's gait. Local testing for

joint swelling, skin defects, arthritis, arthralgia, numbness, deformations, tenosynovitis, and subcutaneous nodules was performed. Modified DAS 28 evaluated the disease activity of RA patients [7].

Laboratory investigations;

All patients underwent complete blood counting (CBC), erythrocyte sedimentation (ESR), C-RP, titration for rheumatoid factor (RF), and titration for anti-cyclic citrullinated peptide (ACP).

Radiological Examination;

X-Ray foot has done for all patients.

Statistical methods

All data were collected, tabulated, and statistically analyzed using SPSS 23.0 for windows (SPSS Inc., Chicago, IL, USA2011). Quantitative data were expressed as the mean \pm SD & median (range), and qualitative data were expressed as absolute frequencies (number)& relative frequencies (percentage). Continuous data were checked for normality by using the Shapiro Walk test.

Independent samples Student's t-test was used to compare between two groups of normally distributed variables while Mann Whitney U test was used for non-normally distributed variables. ANOVA test was used to compare between more than two groups of normally distributed variables.

Percent of categorical variables were compared using the Chi-square test or Fisher's exact test when appropriate. McNemar test was used to compare paired categorical variables. All tests were two-sided. P-value < 0.05 was considered statistically significant (S), p-value < 0.001 was considered highly statistically significant (HS), and p-value ≥ 0.05 was considered statistically insignificant (NS).

3. RESULTS

A total of 300 RA patients were included in this study. There were 240 women and 60 men, aged between 18 and 74 with a mean age (range) was 43.7 ± 10.05 years. Demographic and clinical characteristics of RA patients are shown in **(Table 1)**. Laboratory parameters among RA patients where mean of ESR was 155.16 ± 28.9 with a range from (2-130), mean of CRP was 12.28 ± 16 with a range (0.4-82), mean of RF 56.63 ± 49.2 with a range (2-373) and mean of AntiCCP 111.1 ± 81.7 with a range (6-500) **(Table 2)**.

Among the studied 300 RA patients, there were 95 patients (31.6%) had foot deformities where 75 patients (25%) had hallux valgus, 66 patients (22%) had overriding toes, 25 patients (8.3%) had flexion deformity, 9 patients (3.0%) had pesplanus, 8 patients (2.7%) had splay foot and 3 patients (1.0%) had mallet toe. The patient may have more than deformity **(Table 3)**.

We found that 214 patients (71.3%) had normal gait while 86 patients (28.7.0%) had pathological gait. Among RA patients, orthotic devices were used by 51 patients only (17.0%) where walking aids in form of canes and crutches were used by 25 patients and 23

patients use foot orthosis (modified shoe and insole). However, 3 patients only use a Wheelchair (**Table 4**).

There was a statistically significant relation between Hallux valgus of foot among RA patients and age $p=0.003$, BMI $p=0.0001$. Hallux valgus was common among old age and obese RA patients. There is a significant relation between overriding toes of foot among RA patients and age $p=0.003$, BMI $p=0.028$. Overriding toes was common among old age RA patients. There was a statistically insignificant relation between flexion deformity and their socioeconomic parameters $p>0.05$ (**Table 5**).

There was a statistically significant relation between DAS28 activity level among RA patients and hallux valgus deformity $p=0.0001$, Overriding toe deformity $p=0.0001$, Flexion deformity foot deformity $p=0.01$. These foot deformities are associated with moderate and high DAS28 activity (**Table 6**).

Among 300 RA patients, 178 of the studied patients had foot disorders while 2 of them were pregnant so they were not included in the x-ray, 176 patients had radiological findings. 176 patients (58.6%) had narrowing, 97 patients (32.33%) had osteoporosis 87 patients (29.0%) had erosion, 20 patients (6.67%) had bone cyst, 17 patients (5.6%) had subluxation and 14 patients (4.6%) had amalgamation. (**Table 7**).

Table (1): Demographic and clinical characteristics of RA patients (n=300):

	n	%
Age per years		
• Mean \pm SD	43.7 \pm 10.05	
• (Range)	(18—74)	
Sex		
• Female	240	80.0
• Male	60	20.0
• Female/male ratio	4:1	
Occupation		
no work	21	7.0
housewife	216	72.0
employer	19	6.3
worker	44	14.7
BMI		
Normal	54	18.0
overweight	100	33.3
obese	146	48.7
• Mean \pm SD	30.8 \pm 5.4	
• (Range)	(22-47.7)	
Disease duration per years		
• Mean \pm SD	6.34 \pm 5.2	
• (Range)	(1-20)	

Disorder duration per years	
• Mean \pm SD	2.8 \pm 2.7
• (Range)	(2 months- 10 years)
Morning stiffness (minute)	
• Mean \pm SD	19.5 \pm 14.2
• (Range)	(0-90)
Joints affected	
	178 patients (59.3%)

BMI: body mass index. **SD:** standard deviation. **RA:** rheumatoid arthritis. **ESR:** erythrocyte sedimentation rate. **RF:** rheumatoid factor.

Table (2): Laboratory finding of the study of rheumatoid arthritis patients (n=300):

	Mean\pm SD	(range)
ESR (mm/hr)	34.37 \pm 22.8	(2-130)
CRP (mg/l)	12.28 \pm 16	(0.4-82)
RF (U/ml)	56.63 \pm 49.2	(2-373)
Positive	297	99%
negative	3	1%
AntiCCP (U/ml)	111.1 \pm 81.7	(6-500)
Positive	225	75%
negative	75	25%

Table (3): Frequency of foot deformities in rheumatoid arthritis patients:

Foot Deformities	yes	
	n	%
Hallux valgus	75	25.0%
Overriding toes	66	22.0%
Flexion deformity	25	8.3%
Pesplanus	9	3.0%

Splay foot	8	2.7%
Mallet toe	3	1.0%
Pes cavus	0	0.0

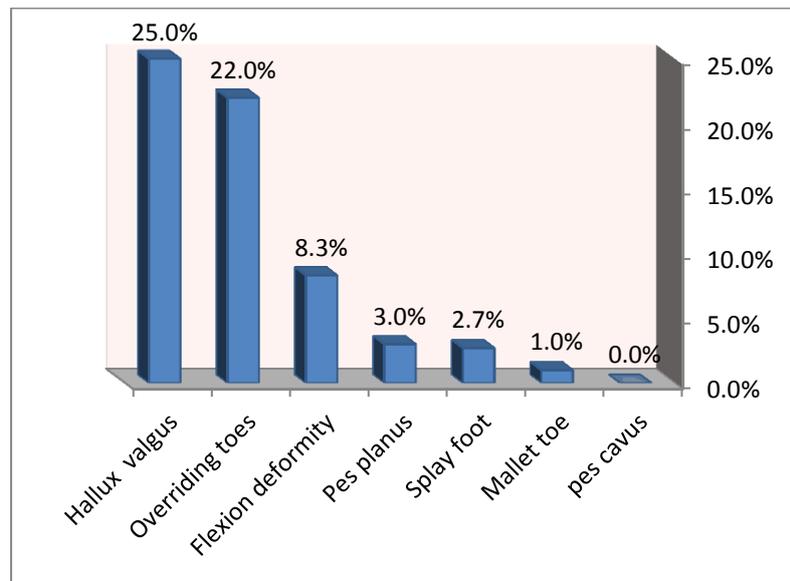


Fig. (1): Frequency of foot deformities in Rheumatoid Arthritis Patients.

Table (4): Frequency of rheumatoid arthritis patients used orthosis or walking aids:

Variables	n	%
Gait		
• Normal	214	71.3
• Pathological	86	28.7
Orthosis	51	17.0
Types of orthosis		
• Walking aid	25	8.3
• Foot orthosis	23	7.7
• Wheelchair	3	1.0

Table (5): Relation between hallux valgus, overriding toes, and flexion deformity among studied RA patients and their socio-demographic characteristics (N=300):

Variables	Hallux valgus			Overriding toes			Flexion deformity		
	(n=75)	χ^2	P value	(n=66)	χ^2	P value	(n=25)	χ^2	P value
Age per years									
Mean \pm SD	46.7 \pm 9.6	t=2.9	0.003	48.2 \pm 10.7	t=4.2	0.0001	44.9 \pm 12.2		
(Range)	27-70		(S)	30-74		(S)	(30-74)	t=0.62	0.54
Sex	n	%		n	%		n	%	
Female 240	57	23.8	1	57	23.8	2.1	22	9.2	1.1
Male 60	18	30.0	0.32	9	15.0	0.14	3	5.0	0.3
Occupation									
no work 21	6	28.6		3	14.3		1	4.8	
Housewife 216	51	23.6	9.2	51	23.6		19	8.8	2.7
Employer 19	10	52.6	0.027	5	26.3	2.2	0	.0	0.53
Worker 44	8	18.2	(S)	7	15.9		5	11.4	
BMI									
Normal 54	11	20.4		15	27.8		6	11.1	
Overweight 100	13	13.0	15.9	13	13.0	7.1	5	5.0	0.0001
Obese 146	51	34.9	(S)	38	26.0	0.028(S)	14	9.6	2.3
									0.32

Table (6): Relation between disease activity and types of foot deformities among rheumatoid arthritis patients:

	DAS28 activity level						n	χ^2	p-value
	low activity n=90		moderate activity n=136		High activity n=74				
	n	%	n	%	n	%			
Hallux valgus									
yes	13	17.3	30	40.0	32	42.7	75	19.1	0.0001(S)
no	77	34.2	106	47.1	42	18.7	225		
Overriding toe									
yes	5	7.6	36	54.5	25	37.9	66	21.7	0.0001(S)
no	85	36.3	100	42.7	49	20.9	234		
Mallet toe									
yes	2	66.7	0	0	1	33.3	3	2.8	0.24
no	88	29.6	136	45.8	73	24.6	297		
Splay foot									
yes	2	25.0	2	25.0	4	50.0	8	2.9	0.23
no	88	30.1	134	45.9	70	24.0	292		
Flexion deformity									
yes	3	12	10	40.0	12	48.0	25	9.14	0.01(S)
no	87	31.6	126	45.8	62	22.5	275		
Pes planus									
yes	0	0	5	55.6	4	44.4	9	4.5	0.107
no	90	30.9	131	45.0	70	24.1	291		

Table (7): Radiological findings of the foot in rheumatoid arthritis Patients

X-ray finding	n 300	%
Erosion	87	29.0
Narrowing	176	58.67
Amalgamation	14	4.67
Subluxation	17	5.67
Bone cyst	20	6.67
Juxta articular osteoporosis	97	32.33
Tenosynovitis diagnosed via ultrasound	13	4.33

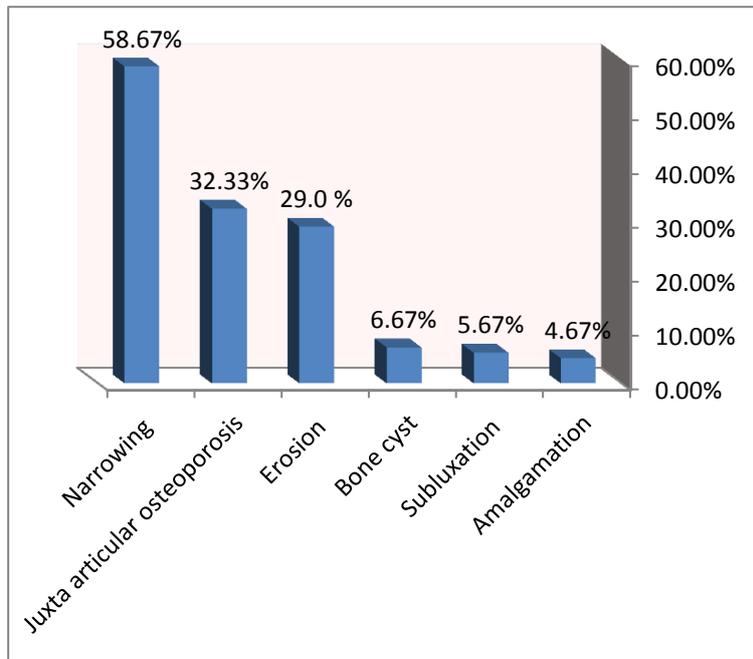


Fig. (2): X-ray finding of Foot in Rheumatoid Arthritis Patients

4. DISCUSSION:

RA is an autoimmune disease that usually affects the hands and feet' tiny joints. The pain, rigidity, gradual joint destruction, and deformity with a severe impairment are typically illustrated. Quality of life impairments in RA was recorded [8]. Foot problems can lead to less travel distance, a health-related disability, and a greater risk of falling [9]. The present study aimed to evaluate the foot disorders in RA patients and their impact on functional ability and frequency of deformities associated.

300 RA patients participated in this study (240 females and 60 males). This study found that 59.3% of patients with RA had foot implications (Table 1), which was in agreement with a study that found that seventy-four patients (61.7%) had a foot or ankle RA involvement [10]. In the current study, RA patients were 30.8 ± 5.4 kg/m² and ranged from (22-47.7) kg/m², where 146 patients of them were obese (48.7%), 100 patients of them were overweight (33.3%) and 54 patients of them were normal weight (18.0%), (Table 1).

Nikiphorou et al. [11] found that obesity has been implicated as a risk factor for developing RA and is increasingly prevalent comorbidity seen on the first presentation of RA.

In the present study, the mean of ESR was 155.16 ± 28.9 with a range from (2-130), mean of CRP was 12.28 ± 16 with a range (0.4-82), mean of RF 56.63 ± 49.2 with a range (2-373) and mean of Anti CCP 111.1 ± 81.7 with a range (6-500), (Table 2).

This came in agreement with a study where researchers found that RF levels being more strongly influenced by RA activity. **Arnett et al. [12]** found that 75% to 80% of RA patients had a high titer of RF.

Hirata et al. [13] found that there was a highly significant increase in ESR and anti-CCP in RA patients.

Blackburn and Chatham, [14] stated that CRP is an acute-phase protein which frequently elevated in patients with RA.

In the present study, among the studied RA patients, there were 75 patients (25%) had hallux valgus, 66 patients (22%) had overriding toes, 16 patients (5.3%) had flexion deformity, 9 patients (3.0%) had pesplanus and hammer toe, 8 patients (2.7%) had sunlight toes and 3 patients (1.0%) had mallet toe, (Table 3).

In the present study, 214 patients (71.3%) had a normal gait. 86 patients (28.7.0%) had pathological gait, only 17.0% of them using orthosis. 25 patients use Walking aid (cane), 3 patients use wheelchairs, and patients 23 use Foot orthosis (modified shoe and insole), (Table 4).

Turner et al. [15]; Turner and Woodburn, [16], Turner et al. [17] found that RA is associated with altered gait and increased plantar pressures.

Gijon-Nogueron et al. [18] found that treatment with orthoses might be expected to produce improvements in these areas. However, their analysis of the articles selected for the study shows that there are no significant differences, as regards outcomes, between using a foot orthosis and another insole or, indeed, a placebo. And this explains the small number of patients using orthosis.

In the current study, there was a statistically significant relation between Hallux valgus of foot among RA patients and age $p=0.003$, BMI $p=0.0001$. Hallux valgus was common among old age and obese RA patients. There is a significant relation between overriding toes of foot among RA patients and age $p=0.003$, BMI $p=0.028$. Overriding toes was common among old age RA patients, (Table 5).

In agreement with our study, **Roddy et al. [19]** found that Hallux valgus was associated with age and BMI. Also, **Menz, [20]** found that Overriding toes was common among old age RA patients.

In the current study, all patients had to narrow, Juxta articular osteoporosis was present in 55.11% of patients, erosion was found in 49.43% of patients while Amalgamation,

Subluxation, Bonecyst, and Tenosynovitis diagnosed via ultrasound were found in 7.95 %, 9.66%, 11.36%, and 7.39% respectively (Table 7).

In agreement with our study, **Stolt et al. [21]** found that Hallux valgus seems to be the most common structural problem in RA patients, affecting 35–65.3% of persons [22,23]. Lesser toe deformities, including hammer and claw toes, are found in 6.3–86% of persons [224]. Flat foot affects 11–42.1% of RA patients [23] and splay foot in 25.3% [25]. Taylor's bunion affects approximately one in five RA patients [23]. Hallux rigidus seem to affect a small number of patients (1–2.1%) [25].

5. CONCLUSION:

This study showed that foot disorders in RA patients were substantially high. It accounted for about 59.3% of the total patients surveyed. This study demonstrated that there were 31.6% had foot deformities. Hallux valgus and overriding toes were the most prevalent foot deformities detected in RA patients. RA patients with a high risk of developing foot disorders had high BMI, high disease activity, and longer disease duration.

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