

Facet Joints Involvement in Rheumatoid Arthritis: A Cross-Sectional Study

Tatiana Reitblat¹ , Lina Linov², Azaria Simanovich², Evgenia Cherniavsky²,
Fadi Bder², Leonid Kalichman^{3*} 

¹Rheumatology Unit, Barzilai Medical Center, Ben-Gurion University of the Negev, Beer-Sheva, Israel

²Radiology Department, Barzilai Medical Center, Ben-Gurion University of the Negev, Beer-Sheva, Israel

³Department of Physical Therapy, Recanati School for Community Health Professions, Faculty of Health Sciences, Ben-Gurion University of the Negev, Beer-Sheva, Israel

Email: *kleonid@bgu.ac.il, ta.ty.nar@bmc.gov.il, linal@barzi.health.gov.il, azarias@bmc.gov.il, evgeniac@bmc.gov.il, fadibder12@gmail.com, kleonid@bgu.ac.il

How to cite this paper: Reitblat, T., Linov, L., Simanovich, A., Cherniavsky, E., Bder, F. and Kalichman, L. (2019) Facet Joints Involvement in Rheumatoid Arthritis: A Cross-Sectional Study. *Open Journal of Rheumatology and Autoimmune Diseases*, 9, 121-128. <https://doi.org/10.4236/ojra.2019.94011>

Received: July 26, 2019

Accepted: October 5, 2019

Published: October 8, 2019

Copyright © 2019 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative

Commons Attribution International

License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Background: It has been accepted amongst rheumatologists that rheumatoid arthritis (RA) does not involve the facet joints (FJs) of the spine; nevertheless, the issue is still under debate. **Objective:** To compare the prevalence of FJs' changes between patients with RA and age- and sex-matched peers. **Methods:** CT scans of 34 patients with RA suffering from low back pain (LBP) were compared with 70 age- and sex-matched controls (individuals without RA, suffering from LBP) in a case-control study. The degenerative changes in the FJs were evaluated (*i.e.*, joint space narrowing, marginal osteophytes, articular process hypertrophy, subchondral sclerosis, inter-joint vacuum phenomenon, and subchondral cysts), in addition to the marginal erosions, the most characteristic feature of joint change in RA. Disease activity characteristics (CRP, ESR, DAS-28, SDAI, and CDAI), duration of RA, age, and sex were obtained from patients' clinical charts. **Results:** The prevalence of FJs' changes in patients with RA and age- and sex-matched controls were not significantly different at any spinal level or in a total L1-S1 score. Marginal erosions, a characteristic feature of joint changes in RA, were not found in any of our RA subjects. No difference was found in disease parameters and markers in individuals with RA with affected FJs and those without. The occurrence of FJs' changes amongst subjects with RA demonstrated no correlation with disease duration and activity. **Conclusions:** FJs of the lumbar spine are not involved in the inflammatory process of RA, and their LBP is not due to inflammation in FJs of the spine.

Keywords

Rheumatoid Arthritis, Facet Joints, Osteoarthritis, Lumbar Spine,

1. Introduction

It has commonly been accepted amongst rheumatologists that rheumatoid arthritis (RA) does not involve the facet joints (FJs) of the spine [1]. The FJs are synovial joints of the spine with hyaline cartilage overlying subchondral bone, a synovial membrane, and a joint capsule. Due to their high level of mobility and the considerable forces influencing FJs, especially in the lumbar area, significant degenerative changes can develop and constantly be a potential source of pain and disability [2]. There have been a few studies describing the prevalence of FJs' pathological changes due to RA [3] [4] [5], however, these studies are scarce, *i.e.* Stoddard and Chiverton's case report [4] and Kawaguchi *et al.* [3] usage of plane x-rays, which did not allow a detailed description of pathological findings. Only Yamada *et al.* [5] studied a large sample (n = 201) and used an MRI for evaluating pathological changes. However, there is still a need for a study of FJs in RA in different populations and samples.

Due to a precise demonstration of osseous details [6] [7] [8] and a relatively low cost, computed tomography (CT) was found to be the preferred method for imaging lumbar facet joint osteoarthritis. Abnormalities of the FJs that can be observed and categorized by a CT include osteophyte formation, hypertrophy of articular processes, joint space narrowing, vacuum joint phenomenon, synovial and subchondral cysts, and calcification of the joint capsule [9] [10] [11].

Aim: To compare the prevalence of FJs' changes between patients with RA and age- and sex-matched peers and to evaluate the prevalence of changes in FJs that are characteristic of the RA inflammatory process. Our hypothesis was that changes in FJs are of similar prevalence to changes in an age- and sex-matched sample.

2. Methods

2.1. Design

Cross-sectional analytical case-control study of matched samples.

2.2. Setting

Rheumatology Unit, Barzilai Medical Center, Ashqelon, Israel.

2.3. Sample

CT scans of 34 patients diagnosed with RA using American College of Rheumatology/European League Against Rheumatism 2010 RA classification criteria [12], and 70 age- and sex-matched controls were performed at the Department of Radiology, Barzilai Medical Center, Ashqelon, Israel during 2015-2017.

Inclusion criteria: Spine CTs of patients suffering from long-lasting RA (at

least 5 years prior to a CT), and who had undergone a CT examination due to low back pain complaints.

Exclusion criteria: Space-occupying lesions of the lumbar spine, previous spinal surgery (as seen on the CT) or significant congenital spinal deformities (sacralization, lumbalization, scoliosis, hemivertebra) and other inflammatory diseases of the spine such as ankylosing spondylitis, psoriatic arthritis, reactive arthritis, irritable bowel disorders related arthritis, gout, etc. The control group comprised patients who were referred to CT imaging due to low back pain and controls matched by age and sex.

2.4. Ethical Considerations

Lumbar spine CTs were obtained from the Department of Radiology, Barzilai Medical Center, Israel. No intervention or imaging was performed for research purposes. The study was approved by the Ethical (Helsinki) Committee of the Barzilai Medical Center (#0101-16 BRZ).

2.5. Imaging Parameters

Study participants were imaged by a 64 or 16-slice CT scanner (Philips Medical, Brilliance Power 64 and 16). Each subject underwent an unenhanced lumbar spine CT using a sequential scan protocol with slice collimation of 140 kV (250 mAs for the lumbar spine on Brilliance Power 64) during a single end-inspiratory breath-hold (typical duration 16 - 20 seconds). For the lumbar scan, 250 - 285 slices with a thickness of 2 mm, and an increment of 1 mm were acquired covering 300 - 400 mm.

2.6. Reliability of CT Readings

Initially, TR and LL read one batch of CTs and developed a reading protocol for evaluating FJs' radiographic changes. Adhering to this protocol, the reader (LL) read and re-read 15 CTs performed two weeks apart, blinded to the identity of the patient in order to assess the intra-rater reliability of the FJs' evaluations. Intra-observer reliability tests (kappa statistics) were performed.

2.7. FJs Evaluation

One assessor, blinded to the patient's health status, read CTs of the lumbar spine (L1-S1) and assessed the FJs. To evaluate the changes in the FJs, the assessor evaluated the features proposed by Kalichman *et al.* [11] [13] such as joint space narrowing, marginal osteophytes, articular process hypertrophy, subchondral sclerosis, inter-joint vacuum phenomenon, and subchondral cysts. The most distinguishing features of joint change in RA, the marginal erosions without subchondral sclerosis or osteophytes [5] [14] were also evaluated. Changes in each joint were scored according to Kalichman *et al.*'s protocol [11]. The joint that received a score ≥ 3 was considered affected. In addition, we created a total L1-S1 score, where the individual who exhibited at least one affected FJ was considered

positive and those without affected joints, negative. We also computed the sum scores of changes in the intervertebral discs, FJs' osteophytes, and the total score of FJs' changes.

2.8. Additional Data Collection

Age, sex and disease characteristics and markers (years of RA, presence of a rheumatoid factor, C-reactive protein (CRP); erythrocyte sedimentation rate (ESR); Disease Activity Score C-reactive protein (DAS-CRP); Disease Activity Score erythrocyte sedimentation rate (DAS-ESR); Clinical Disease Activity Index for RA (CDAI); Simple Disease Activity Index for RA (SDAI) were collected from the patients' clinical charts, close to the date of performing the CT scan.

2.9. Statistical Analysis

Statistical analysis was performed by the SPSS statistical package (Version 23). Significance levels were set at $P < 0.05$. Descriptive statistics characterized the study sample. Prevalence of FJs' changes was calculated at each spinal level and in the total lumbar spine. Subsequently, the χ^2 -test compared individuals with and without RA. A one-way ANOVA evaluated the association between these sum scores in RA patients vs. the controls.

3. Results

Descriptive statistics of the studied sample are shown in **Table 1**. No differences were found between subjects with RA and those without as to age and sex. The mean length of disease in subjects with RA was 7.15 ± 4.17 years; 76.5% were rheumatoid factor positive. The prevalence of FJs' changes in patients with RA and the age and sex-matched controls is shown in **Table 2**. No significant difference in the prevalence of affected FJs was found at any spinal level or in the total L1-S1 score. Virtually no subjects in our sample were found with characteristic features for RA erosion in FJs. Osteophytosis of FJs and disc degeneration were distributed equally between patients with RA and without. In addition, RA individuals with affected FJs and those without exhibited no difference in any of the disease parameters and/or markers (**Table 3**).

4. Discussion

Low back pain is a frequent health problem, especially amongst the adult population. Its prevalence is estimated at approximately 20% for ages 30 - 60 [15]. The cause of low back pain is diverse and may originate from any structure of vertebra complex, *i.e.* changes in intervertebral discs, ligaments structures, FJs, muscles, etc. In rheumatologic practice, we often see RA patients complaining of low back pain. The challenge is to recognize whether the pain is inflammatory, or not. Theoretically, the inflammation process in the lumbar spine region may appear only in the FJs, since there are only synovial joints in the region. Understanding the nature of structural changes in lumbar spine joints FJs (inflammatory

Table 1. Descriptive statistics of the studied sample.

Variables	Rheumatoid arthritis patients (N = 34)	Matched controls (N = 70)	Comparison
	Mean ± SD	Mean ± SD	t-test
Age (Years)	58.62 ± 9.97	58.04 ± 10.27	T = 0.269, d.f. = 101, p-value = 0.788
Years of rheumatoid arthritis	7.15 ± 4.17	-	-
CRP (mg/l)	5.62 ± 4.25	-	-
ESR (mm/hour)	21.06 ± 14.12	-	-
DAS-CRP	2.40 ± 0.96	-	-
DAS-ESR	2.61 ± 0.92	-	-
CDAI	7.50 ± 5.46	-	-
SDAI	8.08 ± 5.61	-	-
Variables	N (%)	N (%)	Chi-square test
Sex (Females)	29 (85.3%)	57 (82.6%)	$\chi^2 = 0.119$, d.f. = 1, p-value = 0.730
Rheumatoid factor positive	26 (76.5%)	-	-

CRP: C-reactive protein; ESR: erythrocyte sedimentation rate; DAS-CRP: disease activity score C-reactive protein; DAS-ESR: disease activity score erythrocyte sedimentation rate; CDAI: clinical disease activity index for rheumatoid arthritis; SDAI: simple disease activity index for rheumatoid arthritis.

Table 2. Prevalence of total FJ changes in patients with RA and age and sex-matched controls.

Segment	RA patients	Controls	Comparison (χ^2 -test)
L1-L2 Left	1 (3.0%)	1 (1.8%)	$\chi^2 = 0.157$, d.f. = 1, p = 0.692
L1-L2 Right	0 (0.0%)	0 (0.0%)	-
L2-L3 Left	0 (0.0%)	1 (1.7%)	$\chi^2 = 0.575$, d.f. = 1, p = 0.448
L2-L3 Right	1 (3.0%)	1 (1.8%)	$\chi^2 = 0.157$, d.f. = 1, p = 0.692
L3-L4 Left	2 (6.1%)	2 (3.4%)	$\chi^2 = 0.363$, d.f. = 1, p = 0.547
L3-L4 Right	1 (3.0%)	4 (6.9%)	$\chi^2 = 0.605$, d.f. = 1, p = 0.436
L4-L5 Left	2 (6.1%)	2 (3.4%)	$\chi^2 = 0.342$, d.f. = 1, p = 0.559
L4-L5 Right	4 (12.1%)	3 (5.3%)	$\chi^2 = 1.370$, d.f. = 1, p = 0.242
L5-S1 Left	4 (12.1%)	5 (8.9%)	$\chi^2 = 0.233$, d.f. = 1, p = 0.629
L5-S1 Right	0 (0.0%)	5 (8.8%)	$\chi^2 = 3.065$, d.f. = 1, p = 0.080
Total L1-S1 score	9 (27.3%)	11 (19.0%)	$\chi^2 = 0.846$, d.f. = 1, p = 0.358

RA: rheumatoid arthritis.

vs. degenerative), may assist in delivering a better differential diagnosis of FJs' changes, and encourage medical practitioners to introduce appropriate treatment for patients suffering from low back pain.

The earliest study found in the literature was performed in 1964 [16]. The authors found that disk narrowing without vertebral osteophytes, erosion in FJs,

Table 3. Association between changes in FJs and disease markers in RA patients (one-way ANOVA results).

Markers	No FJ changes	Affected FJ	Comparison
Age (years)	57.67 ± 9.91	60.00 ± 10.45	F = 0.353, p = 0.557
Years of rheumatoid arthritis	7.00 ± 4.45	7.56 ± 3.50	F = 0.113, p = 0.739
CRP (mg/l)	5.39 ± 4.81	6.22 ± 2.22	F = 0.247, p = 0.623
ESR (mm/hour)	17.64 ± 10.87	28.60 ± 18.69	F = 2.244, p = 0.156
DAS-CRP	2.34 ± 0.97	2.56 ± 0.96	F = 0.333, p = 0.568
DAS-ESR	2.51 ± 0.98	2.81 ± 0.84	F = 0.328, p = 0.577
CDAI	7.27 ± 5.14	8.11 ± 6.55	F = 0.152, p = 0.699
SDAI	7.84 ± 5.24	8.73 ± 6.80	F = 0.163, p = 0.690

CRP: C-reactive protein; ESR: erythrocyte sedimentation rate; DAS-CRP: disease activity score C-reactive protein; DAS-ESR: disease activity score erythrocyte sedimentation rate; CDAI: clinical disease activity index for rheumatoid arthritis; SDAI: simple disease activity index for rheumatoid arthritis.

and osteoporosis, were more common in their series of lateral lumbar spine x-rays of patients with RA. However, the same changes, which in their opinion could be attributed to RA, were found in a series of x-rays of the lumbar spine from a random population of males and females. In a more recent study, Yamada *et al.* [5] found a prevalence of erosions in FJs on MRI images in 38.7% of RA patients, and a prevalence of end-plate erosions in 30.8%. A comparison between the prevalence of erosion observed on MRI scans between the RA group and the healthy population was not performed in this study; therefore, it is questionable whether these findings could be attributable only to RA inflammation. While exploring FJs in our sample for erosions with characteristic features of RA, we did not observe any difference in the erosive process and osteophytosis between groups. Indeed, the CT scan is less sensitive compared with the MRI technique in the characterization of erosions, however, in Yamada *et al.*'s study, these characteristic findings were not mentioned.

Sakai *et al.* [17] examined 104 patients with RA together with their lumbar spine x-rays and MRI, regardless of low back pain. In 45.2%, disc lesions were found related to RA, thus, emphasizing the correlation between frequency of disc involvement and the number of affected RA peripheral joints. One of the fundamental views in the pathogenesis of RA is that inflammation occurs in the synovial membrane; hence, we cannot attribute the disc changes found in the studies to the inflammation process of RA. We found no difference between individuals with and without RA in relation to the prevalence of disk changes in the lumbar spine. These results are comparable with findings in the aforementioned studies. Moreover, we found that changes in synovial joints observed in the lumbar spine were similar in prevalence with the random population. Low back pain amongst the studied patients appeared while they were in the stage of low RA disease activity or in remission. We found no correlation between their disease activity parameters and FJs' changes. On the basis of our findings, we

suggest that the reason for low back pain amongst RA patients is not caused by disease activity and could possibly originate from other factors.

Limitations

Our study had several limitations. Firstly, the number of subjects was limited. Secondly, RA subjects commenced their treatment nearing the date of diagnosis; hence, it is possible that treatment was effective in preventing changes in the lumbar spine intervertebral discs and the FJs.

5. Conclusion

There were no differences found in FJs' changes between the RA subjects and controls. The occurrence of FJs' changes amongst the RA subjects revealed no correlation with disease duration and activity. According to our findings, we may assume that FJs of the lumbar spine are not involved in the inflammatory process of RA and low back pain amongst patients with RA is not due to inflammation in this region of the spine.

Compliance with Ethical Standards

The study was approved by the Ethical (Helsinki) Committee of the Barzilai Medical Center (#0101-16 BRZ).

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Isaac, Z. and Katz, J.N. (2015) Lumbar Spine Disorders. In: *Rheumatology*, 5th Edition, Mosby Elsevier, Philadelphia, 578-595.
- [2] Kalichman, L. and Hunter, D. (2007) Lumbar Facet Joint Osteoarthritis: A Review. *Seminars in Arthritis and Rheumatism*, **37**, 69-80. <https://doi.org/10.1016/j.semarthrit.2007.01.007>
- [3] Kawaguchi, Y., Matsuno, H., Kanamori, M., Ishihara, H., Ohmori, K. and Kimura, T. (2003) Radiologic Findings of the Lumbar Spine in Patients with Rheumatoid Arthritis, and a Review of Pathologic Mechanisms. *Journal of Spinal Disorders & Techniques*, **16**, 38-43. <https://doi.org/10.1097/00024720-200302000-00007>
- [4] Stoddard, J.E. and Chiverton, N. (2011) Thoracic Facet Joint Synovitis Causing Thoracic Spinal Cord Compression and Myelopathy in a Patient with Rheumatoid Arthritis. *Rheumatology (Oxford)*, **50**, 2141-2142. <https://doi.org/10.1093/rheumatology/ker226>
- [5] Yamada, K., Suzuki, A., Takahashi, S., Yasuda, H., Tada, M., Sugioka, Y., Okano, T., Koike, T. and Nakamura, H. (2014) MRI Evaluation of Lumbar Endplate and Facet Erosion in Rheumatoid Arthritis. *Journal of Spinal Disorders & Techniques*, **27**, E128-E135. <https://doi.org/10.1097/BSD.0b013e3182a22a34>
- [6] Raskin, S.P. (1981) Degenerative Changes of the Lumbar Spine: Assessment by Computed Tomography. *Orthopedics*, **4**, 186-195.

- [7] Houghton, V. (1995) Imaging Techniques in Intraspinous Diseases. In: Resnick, D., Ed., *Diagnosis of Bone and Joint Disorders*, 3rd Edition, WB Saunders Company, Philadelphia, 237-276.
- [8] Jarvik, J.G. and Deyo, R.A. (2002) Diagnostic Evaluation of Low Back Pain with Emphasis on Imaging. *Annals of Internal Medicine*, **137**, 586-597.
<https://doi.org/10.7326/0003-4819-137-7-200210010-00010>
- [9] Carrera, G.F., Houghton, V.M., Syvertsen, A. and Williams, A.L. (1980) Computed Tomography of the Lumbar Facet Joints. *Radiology*, **134**, 145-148.
<https://doi.org/10.1148/radiology.134.1.7350594>
- [10] Resnick, R. and Niwayama, G. (1995) Degenerative Disease of the Spine. In: Resnick, D., Ed., *Diagnosis of Bone and Joint Disorders*, 3rd Edition, WB Saunders Company, Philadelphia, 1372-1462.
- [11] Kalichman, L., Li, L., Kim, D., Guermazi, A., Berkin, V., O'Donnell, C., Hoffmann, U., Cole, R. and Hunter, D. (2008) Facet Joint Osteoarthritis and Low Back Pain in the Community-Based Population. *Spine*, **33**, 2560-2565.
<https://doi.org/10.1097/BRS.0b013e318184ef95>
- [12] Aletaha, D., Neogi, T., Silman, A.J., Funovits, J., Felson, D.T., Bingham, C.O., Birnbaum, N.S., Burmester, G.R., Bykerk, V.P., Cohen, M.D., Combe, B., Costenbader, K.H., Dougados, M., Emery, P., Ferraccioli, G., Hazes, J.M., Hobbs, K., Huizinga, T.W., Kavanaugh, A., Kay, J., Kvien, T.K., Laing, T., Mease, P., Menard, H.A., Moreland, L.W., Naden, R.L., Pincus, T., Smolen, J.S., Stanislawski-Biernat, E., Symmons, D., Tak, P.P., Upchurch, K.S., Vencovsky, J., Wolfe, F. and Hawker, G. (2010) Rheumatoid Arthritis Classification Criteria: An American College of Rheumatology/European League against Rheumatism Collaborative Initiative. *Annals of the Rheumatic Diseases*, **69**, 1580-1588. <https://doi.org/10.1136/ard.2010.138461>
- [13] Suri, P., Katz, J.N., Rainville, J., Kalichman, L., Guermazi, A. and Hunter, D.J. (2010) Vascular Disease Is Associated with Facet Joint Osteoarthritis. *Osteoarthritis and Cartilage*, **18**, 1127-1132. <https://doi.org/10.1016/j.joca.2010.06.012>
- [14] Van der Heijde, D., Dankert, T., Nieman, F., Rau, R. and Boers, M. (1999) Reliability and Sensitivity to Change of a Simplification of the Sharp/Van der Heijde Radiological Assessment in Rheumatoid Arthritis. *Rheumatology (Oxford, England)*, **38**, 941-947. <https://doi.org/10.1093/rheumatology/38.10.941>
- [15] Meucci, R.D., Fassa, A.G. and Faria, N.M. (2015) Prevalence of Chronic Low Back Pain: Systematic Review. *Revista de Saude Publica*, **49**, 1-10.
<https://doi.org/10.1590/S0034-8910.2015049005874>
- [16] Lawrence, J.S., Sharp, J., Ball, J. and Bier, F. (1964) Rheumatoid Arthritis of the Lumbar Spine. *Annals of the Rheumatic Diseases*, **23**, 205-217.
<https://doi.org/10.1136/ard.23.3.205>
- [17] Sakai, T., Sairyō, K., Hamada, D., Higashino, K., Katoh, S., Takata, Y., Shinomiya, F. and Yasui, N. (2008) Radiological Features of Lumbar Spinal Lesions in Patients with Rheumatoid Arthritis with Special Reference to the Changes around Intervertebral Discs. *The Spine Journal*, **8**, 605-611.
<https://doi.org/10.1016/j.spinee.2007.03.008>