original article

Rheumatoid arthritis activity scores in patients with and without fibromyalgia syndrome

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BACKGROUND: Fibromyalgia syndrome (FM) is a systemic disease of unknown etiology, which can cause widespread musculoskeletal pain. In patients with rheumatoid arthritis (RA), FM can cause an additional symptom burden, which can affect some variables on the RA disease activity score 28 (DAS28), a tool that evaluates 28 joints in RA patients.
OBJECTIVE: Compare the results of four different versions of the DAS28 and the parameters used to determine disease activity scores in RA patients with and without FM, and determine whether there are treatment differences between RA patients with and without FM.
DESIGN: Retrospective, cross-sectional.
SETTING: Tertiary hospital.
PATIENTS AND METHODS: We identified patients diagnosed with RA between 1 September 2016 and 1 February 2020 and identified patients with and without FM.
MAIN OUTCOME MEASURES: Differences between variables in the DAS28 calculations (tender joint count [TJC], patient global assessment [PGA], and others), between patients with and without FM, and differences between patients with and without FM who were using or not using biological agents.
SAMPLE SIZE: 381, including 322 females (84.5%).
RESULTS: The frequency of FM in RA patients was 25.7% (89 females, 24.6%). In RA patients with FM, the TJC and PGA median values were significantly higher than in patients without FM ($P<.05$). The use of corticosteroids and biological therapy in patients with FM was more frequent than in patients without FM ($P<.05$). Compared to patients without FM, patients with FM switched treatment more often because of non-response to treatment ($P=.01$) Median values of the DAS28 scores (calculated by four different versions of the instrument) in RA patients with FM were higher than in patients without FM ($P<.05$).
CONCLUSION: The presence of FM in RA patients may affect the subjective variables in different versions of DAS28 scores, causing the disease activity to score higher on the instrument, erroneously indicating worse disease than is actually present.
LIMITATIONS: A single center, retrospective study.
CONFLICT OF INTEREST: None.

While rheumatoid arthritis (RA) is a chronic inflammatory disease that primarily affects small joints, fibromyalgia syndrome (FM) is a systemic disease of unknown cause, which can cause widespread musculoskeletal pain.[1] In studies conducted with RA patients, the prevalence of FM has been reported to be between 5% to 52%.[2]

Disease activity scores have been developed to standardize assessment and eliminate the variability between observers in monitoring disease activity and response to treatment in RA.[3,4] Among these, the RA disease activity score 28 (DAS28), in which 28 joints are evaluated, is used to make the decision to start biological treatments or not in cases of no response to conventional disease modifying antirheumatic drug (DMARD). Although the DAS28 score varies according to the version,[4] it is calculated with variables such as the tender joint count (TJC), the swollen joint count (SJC), the patient's global assessment (PGA) level, erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP). Our hypothesis is that the subjective variables used in four different DAS28 calculations are affected by the disease burden associated with FM. In addition, we suspect high DAS28 scores detected in RA patients with FM affect the choice of treatment since the treatment selection, especially biological treatments, is made according to DAS28 scores. The purpose of this study was to compare the results of four different versions of DAS28 and the parameters used to determine the disease activity scores in RA patients with and without FM. We also investigated whether there is a difference in treatment between RA patients with and without FM.

PATIENTS AND METHODS

Patients diagnosed with RA according to the 2010 American College of Rheumatology/ European League Against Rheumatism (ACR/EULAR) RA classification criteria between 1 September 2016 and 1 February 2020 were retrospectively analyzed.[5] Patients with RA who were also diagnosed with FM according to the ACR 2016 FM classification criteria were identified.[6] The study protocol was approved by the ethics committee of (Date: 03.03.2021, Decision No. 2021/495, Number: E-77192459-050.99-13639). The study was conducted in accordance with the Helsinki Declaration principles.

Exclusion criteria were incomplete file records, pregnant patients, patients younger than 18 years of age, patients with acute infection, patients with other inflammatory rheumatological and patients with endocrine diseases (such as hypothyroidism, hyperthyroidism) that may cause common musculoskeletal symptoms. Sociodemographic data such as age (year), gender, disease duration (year) and extra-articular findings (rheumatoid nodule, pulmonary involvement, ocular involvement, cardiac involvement, etc.) that may accompany RA were recorded. Other data collected included medical treatments (methotrexate, sulfasalazine, leflunomide, hydroxychloroquine, biological treatments, duloxetine, amitriptyline, pregabalin, gabapentin and others). The corticosteroid usage status and doses (mg/day) at the last visit to the hospital were determined and compared between the groups. Patients whose treatment was switched due to non-response to biological treatment were also determined. ESR (mm/h), CRP (mg/L), rheumatoid factor (RF) and anti-cyclic citrulline peptide (anti-CCP) results were noted. Based on the cut-off value of the laboratory where the tests were studied, RF (IU/mL) and anti-CCP (U/mL) values were accepted as positive or negative. Values above 30 IU/mL for RF and values above 5 U/mL for anti-CCP were accepted as positive. An electronic calculator was used to calculate the four DAS28 scores containing different variables.[4] Patients were categorized according to their disease activity score into those in remission (≤2.6) or with low disease activity (LDA: >2.6 and ≤3.2) and those with moderate disease activity (MDA: >3,2 and ≤5,1) or those with high disease activity (HDA: >5,1).[7]

Normality of the data distribution was determined with the Kolmogorov-Smirnov test. Mean and standard deviation (SD) were given for normally distributed data, and median and minimum-maximum values were given for non-normally distributed data. The *t* test was used for comparison of normally distributed data, and Mann Whitney-U test was used for non-normally distributed data. Pearson's chi-square test was used to determine the difference between groups. The relationship between variables that were not normally distributed was analyzed using the Spearman correlation test. The size of the correlation was interpreted as follows: 8.90 to 1.00 (-.90 to -1.00)=very high positive (negative) correlation; .70 to .90 (-.70 to -.90)=high positive (negative) correlation; .50 to .70 (-.50 to-.70)=moderate positive (negative) correlation; .30 to .50 (-.30 to -.50)=low positive (negative) correlation; and .00 to .30 (.00 to -.30)=negligible correlation. A value of $P<.05$ was accepted for significance. IBM SPSS version 26 was used for statistical analysis.

RESULTS

The 381 RA patients included 322 (84.5%) females and 59 (15.5%) males. The mean (SD) age of the patients was 59.2 (9.6) years and the median disease duration was 9 (0.25-35) years. Ninety-eight (25.7%) of the RA patients had FM, including 89 females (90.8%). Demographic

Table 1. Demographic, clinical characteristics and laboratory values of rheumatoid arthritis patients with and without fibromyalgia syndrome.

	Rheumatoid arthritis with fibromyalgia syndrome (n=98)	Rheumatoid arthritis without fibromyalgia syndrome (n=283)	*P* value
Age (years)	60.51 (10.54)	58.80 (9.22)	.158[a]
Disease duration (years)	10 (0.50-30.00)	9 (0.25-35.00)	.925[b]
Female	89 (90.8)	233 (82.3)	.045[c]
Positive rheumatoid factor	53 (54.1)	161 (56.9)	.629[c]
Positive anti-cyclic citrulline peptide	41 (41.8)	125 (44.2)	.688[c]
Extra-articular involvement	9 (9.2)	40 (14.1)	.207[c]
Corticosteroid	59 (60.2)	130 (45.9)	.015[c]
Methotrexate	54 (55.1)	161 (56.9)	.758[c]
Sulfasalazine	14 (14.3)	57 (20.1)	.199[c]
Leflunomide	60 (61.2)	141 (49.8)	.051[c]
Hydroxychloroquine	24 (24.5)	61 (21.6)	.548[c]
Biological agent	36 (36.7)	60 (21.2)	.002[c]
Corticosteroid usage dose (mg/day)	7.5 (0-20)	0 (0-20)	.018[b]
Tender joint count	4 (0-14)	0 (0-18)	.001[b]
Swollen joint count	0 (0-6)	0 (0-6)	.410[b]
Patient global assessment	5 (0-10)	0 (0-10)	.001[b]
Erythrocyte sedimentation rate (mm/h)	24 (5-109)	22 (3-140)	.256[b]
C-reactive protein (mg/L)	3.85 (0.24-87.7)	4.29 (0.01-248)	.919[b]
DAS28-S (4 parameters)	4.12 (1.36-7.32)	2.25 (0.77-7.49)	.001[b]
DAS28-CRP (4 parameters)	3.41 (1.04-6.36)	1.7 (0.96-6.61)	.001[b]
DAS28-S (3 parameters)	3.58 (1.63-6.33)	2.53 (0.99-6.52)	.001[b]
DAS28-CRP (3 parameters)	2.77 (1.24-5.30)	1.96 (1.15-5.72)	.001[b]
DAS28-S (4 parameters) Remission or LDA	43 (43.9)	233 (78.8)	.001[c]
DA28-CRP (4 parameters) Remission or LDA	47 (48)	232 (82)	.001[c]
DAS28-S (3 parameters) Remission or LDA	43 (43.9)	214 (75.6)	.001[c]
DAS28-CRP (3 parameters) Remission or LDA	59 (60.2)	236 (83.4)	.001[c]

Data are mean and standard deviation (age), number of patients (% by column) or median (minimum, maximum). [a]*t* test; [b]Mann Whitney-U Test; [c]Pearson χ^2 test, LDA: Low disease activity. Remaining patients had MDA or HDA.

and clinical variables by diagnostic group are shown in **Table 1**. Among 96 patients using biological agents, 45 (46.9%) had switched treatment at least once due to non-response to treatment. Forty-nine (12.9%) of the RA patients had extra-articular involvement: 18 (4.7%) rheumatoid nodules, 16 (4.2%) pulmonary involvement, 7 (1.8%) ocular involvement, 4 (1.0%) cardiac involvement, and 4 (1.0%) vasculitic involvement. The frequency of corticosteroid and biological agent use in RA patients with FM was significantly higher than in RA patients without FM (*P*<.05). The median values of TJC and PGA in RA patients with FM were significantly higher than those of RA patients without FM (*P*<.05).

While 23 (63.9%) of 36 RA patients with FM using biological agents were switched due to non-response to treatment, 13 (36.1%) did not need to switch. While 22 (36.7%) of 60 RA patients without FM using biological agents were switched due to non-response to treatment, 38 (63.3%) did not need to switch. In RA patients with FM, the frequency of switches in biological agent treatment was significantly higher than those without FM (*P*=.010).

While there was a positive correlation between ESR and SJC in RA patients with FM (*P*=.001), there was no significant correlation with TJC and PGA (*P*=.090, *P*=.252, respectively) (**Table 2**). Also, while there was a positive correlation between CRP and SJC (*P*=.023), there was no significant correlation with TJC and PGA (*P*=.299, *P*=.414, respectively). The difference in the TJC median value in RA patients with FM using biological agents was statistically significant compared with those without FM (*P*=.003). **Table 3** shows other comparisons of the patients with and without FM in terms of disease activity score and parameters used in the score calculation in patients who used and do not use biological agents.

DISCUSSION

We found that DAS28 scores calculated by four different versions were higher in RA patients with FM than in patients without FM (*P*<.05). In RA patients with FM, the TJC and PGA median values were significantly higher than in patients without FM (*P*<.05). However, there was no significant difference in terms of SJC, ESR and CRP median values (*P*>.05). The frequency of use of corticosteroids and biological therapy in patients with FM which was switched because of non-response to treatment was higher than in patients without FM (*P*<.05).

A strength of this study is the large number of patients included, the fact that four different DAS28 versions were examined, and that it was the first study to examine the relationship between the parameters used

in DAS28 calculation in RA patients with and without FM. In addition, this is the first study that compared the frequency of biological agent switches in RA patients with and without FM. The most important limitation is that it was a single center and retrospective study.

Fibromyalgia syndrome can be seen at any age, including childhood.[9] This situation makes FM one of the most common diseases that physiatrists and rheumatologists will encounter. However, it is not always easy to distinguish between musculoskeletal pain caused by RA or FM. When we look at the literature, the association of inflammatory diseases and FM has been of interest to researchers.[10] In an updated meta-analysis of 26 cross-sectional studies involving RA patients the pooled prevalence of FM was determined to be 20%.[11-13] In our study, the frequency of FM accompanying RA (25.7%) was similar to the pooled prevalence in the meta-analysis. The overwhelming majority of FM patients we identified were women (90.8%), emphasizing that FM is a female gender-dominated disease.[14-18]

In our study, when RA patients with and without FM were compared in terms of age and duration of disease, there was no significant difference between the groups. Although there are studies in which the disease was shorter in RA patients with FM compared to those without FM, that was not a finding of our study. Consistent with our study, age and duration of disease in RA patients with and without FM was similar in several other studies.[14,16-21]

As in other studies, we found no difference between RA patients with and without FM in terms of RF and anti-CCP positivity and the frequency of extraarticular involvement.[16,18] In many countries, including Turkey, DAS28 scores are most frequently used in decision-making and treatment follow-up for RA treatment. In our study, the median values of the DAS28 score in four different versions in RA patients with FM were higher than in RA patients without FM. Similarly, higher disease ac-

Table 2. Correlations between DAS28 parameters in rheumatoid arthritis patients with and without fibromyalgia syndrome.

		Tender joint count	Swollen joint count	Patient global assessment	Erythrocyte sedimentation rate (mm/h)
Rheumatoid arthritis patients with fibromyalgia syndrome (n=98)					
Swollen joint count	R	.47			
	P value	.001			
Patient global assessment	R	.80	.39		
	P value	.001	.001		
Erythrocyte sedimentation rate (mm/h)	R	.17	.34	.12	
	P value	.090	.001	.252	
C-reactive protein (mg/L)	R	.11	.23	.08	.46
	P value	.299	.023	.414	.001
Rheumatoid arthritis patients without fibromyalgia syndrome (n=283)					
Swollen joint count	R	.82			
	P value	.001			
Patient global assessment	R	.86	.83		
	P value	.001	.001		
Erythrocyte sedimentation rate (mm/h)	R	.35	.38	.33	
	P value	.001	.001	.001	
C-reactive protein (mg/L)	R	.14	.23	.14	.49
	P value	.015	.001	.020	.001

All coefficient comparisons (R) by Spearman's correlation test

Table 3. Patients with and without fibromyalgia syndrome in terms of disease activity score and score calculation parameters in patients who used and did not use biological agents.

	Rheumatoid arthritis patients with fibromyalgia syndrome (n=98)	Rheumatoid arthritis patients without fibromyalgia syndrome (n=283)	*P* value
Used biological agent (n=96)			
Erythrocyte sedimentation rate (mm/h)	22 (7-89)	22 (3-113)	.832[a]
C-reactive protein (mg/L)	4.9 (0.24-87.7)	3.7 (0.2-124)	.477[a]
Tender joint count	4 (0-14)	0 (0-15)	.003[a]
Swollen joint count	0 (0-6)	0 (0-6)	.934[a]
Patient global assessment	0 (0-10)	0 (0-10)	.007[a]
DAS 28-S (4 parameters)	4.01 (1.36-7.32)	2.37 (0.77-7.49)	.046[a]
DAS 28-CRP (4 parameters)	3.43 (1.04-6.19)	1.64 (1.03-6.61)	.005[a]
DAS 28-S (3 parameters)	3.71 (1.63-6.33)	2.72 (0.99-6.52)	.037[a]
DAS 28-CRP (3 parameters)	3.02 (1.24-5.08)	1.89 (1.22-7.72)	.004[a]
DAS 28-S (4 parameters) Remission or LDA	17 (47.2)	47 (78.3)	.002[b]
DAS 28-CRP (4 parameters) Remission or LDA	17 (47.2)	49 (81.7)	.001[b]
DAS 28-S (3 parameters) Remission or LDA	16 (44.4)	44 (73.3)	.005[b]
DAS 28-CRP (3 parameters) Remission or LDA	21 (58.3)	50 (83.3)	.007[b]
Did not use biological agent (n=285)			
Sedimentation (mm/hr)	24 (5-109)	22 (5-140)	.154[a]
C-reactive protein (mg/L)	3.85 (0.38-67)	4.3 (0.01-248)	.540[a]
Tender joint count	4 (0-14)	0 (0-18)	.001[a]
Swollen joint count	0 (0-5)	0 (0-6)	.450[a]
Patient global assessment	6 (0-10)	0 (0-10)	.001[a]
DAS 28-S (4 parameters)	4.12 (1.61-7.13)	2.25 (1.13-7.29)	.001[a]
DAS 28-CRP (4 parameters)	3.41 (1.08-6.36)	1.75 (0.96-6.56)	.001[a]
DAS 28-S (3 parameters)	3.58 (1.9-6.14)	2.53 (1.38-6.46)	.001[a]
DAS 28-CRP (3 parameters)	2.72 (1.28-5.30)	1.98 (1.15-5.67)	.001[a]
DAS 28-S (4 parameters) Remission or LDA	26 (41.9)	176 (78.9)	.001[b]
DAS 28-CRP (4 parameters) Remission or LDA	30 (48.4)	183 (82.1)	.001[b]
DAS 28-S (3 parameters) Remission or LDA	27 (43.5)	170 (76.2)	.001[b]
DAS 28-CRP (3 parameters) Remission or LDA	38 (61.3)	186 (83.4)	.001[b]

Data are mean and standard deviation (age), number of patients (%) or median (minimum, maximum). [a]Mann Whitney-U; Test [b]Pearson χ^2 Test, LDA: Low disease activity

tivity scores have been reported in RA patients with FM compared to RA patients not having FM in other studies.[14,21,22] In addition, the frequency of patients reaching remission or at least LDA calculated by four different versions of DAS28 in our study was significantly lower in RA patients with FM than in patients without FM.

We found that the median values of ESR, CRP and the SJC were not different between RA patients with and without FM. Interestingly, the TJC and PGA median values were significantly higher in RA patients with FM. We interpreted this as meaning that both the TJC and the PGA level were affected by the disease burden of FM. In our opinion, the number of sensitive joints and the PGE parameters may be affected by the presence of FM only because they are completely subjective. Since sedimentation and CRP levels are completely objective parameters and the number of swollen joints is a relatively objective variable, we may not find any difference between the groups. While Zammurrad et al found that all parameters used when calculating DAS28-S (4 parameters) were higher in RA patients with FM compared to those without FM, some studies found a difference only in terms of subjective parameters, as in to our study.[14,17,21]

Salaffi et al found that the median value of DAS28-S (3 parameters) was similar in RA patients with and without FM, while the median value of DAS28-S (4 parameters) was significantly higher in those with FM compared to those without FM.[18] In our study, we found that the median values of both DAS28-S (3 parameters) and DAS28-S (4 parameters) were higher in RA patients with FM. We interpreted this as possibly meaning that the TJC used when calculating DAS28-S (3 parameters) also has a subjective character, like PGA. In a study by Leeb et al comparing patients with only RA and those with only FM, they found that the TJC and the mean PGA of isolated FM patients were significantly higher than isolated RA patients; however, as expected, they found that only the SJC and ESR values were higher in patients with only RA compared to those with only FM. Based on these results, they stated that DAS28 values for determining disease activity in RA patients may give erroneous results in the presence of accompanying FM.[23]

In demonstrating RA disease activity, ESR is the most commonly used acute phase reactant in daily outpatient practice. In our study, we did not find a significant relationship between the ESR value and TJC and PGA in RA patients with FM. However, we found a significantly low positive correlation with SJC (R=.337, *P*=.001). We found a significantly low positive correlation between ESR and TJC, SJC and PGA in RA patients without FM (R=.350, *P*=.000; R=.378, *P*=.000; R=.330, *P*=.000, respectively). We interpreted this low, significant, positive correlation of ESR, which is an objective parameter, with SJC, which is also an objective parameter, as that objective parameters may be more important than subjective TJC and PGA in determining disease activity in RA patients with FM. We did not find any other study examining the relationship between DAS28 parameters in RA patients with and without FM.

In our study, the frequency of use of conventional disease modifying antirheumatic drug (DMARD) treatments was not different between RA patients with and without FM, while the frequency of steroid use and the median steroid use dose were higher in RA patients accompanied by FM. In addition, both the frequency of use of biological agents and the frequency of switching to biological agent therapy due to clinical non-response in RA patients with FM was significantly higher than in those without FM. In a study by Chakr et al, the frequency of corticosteroid use was higher in RA patients with FM compared to those without FM, as in our study; however, the same study emphasized that the frequency of leflunomide use was higher in RA patients with FM, and the frequency of using biological agents was similar in both groups.[24] In a study by Lee et al, the frequency of corticosteroid and biological agent use was similar in RA patients with and without FM, and the frequency of conventional DMARD use, especially methotrexate, was higher in RA patients without FM.[16] We interpreted the higher detection of disease activity in RA patients with FM as being related to subjective parameters, which encourages the use of corticosteroids and biological agents. A conclusion supporting our interpretation was reported by Salaffi et al who showed that RA patients with FM after biological agent or conventional DMARD treatment had a lower rate of reaching remission determined by a simplified disease activity index (SDAI) compared to those without FM. They even claimed that the presence of FM with RA was a marker of inability to achieve SDAI remission.[25] A similar result was reported in a study by Durán et al in which patients with FM had higher DAS28, clinical disease activity index (CDAI) and SDAI scores than those without FM in 697 RA patients.[22] RA patients with FM achieved remission or LDA less often due to the initial high DAS28 scores compared to those without FM.[22] Silva et al reported that verification of high disease activity by ultrasound before prescribing biological agents to RA patients with FM will reduce the use of biological agents and significantly reduce healthcare costs.[26] Lee et al suggested that the disease activity assessment method, multi-biomarker disease activity (MBDA) score, which is made with completely objective blood values, is a useful objective criterion for determin-

ing active inflammation in all patients, including RA patients with FM.[16] However, the use of the MBDA score in daily practice seems difficult for now due to the difficulty in accessing available biomarkers.[16]

In conclusion, the presence of FM in RA patients may affect the subjective variables in different versions of the DAS28 instrument, resulting in higher scores, erroneously indicating worse disease than is actually present. In RA patients with FM, the frequency of corticosteroid and biological agent use and biological agent switch was higher than in RA patients without FM. We think that clinicians should be more careful in evaluating high DAS28 scores in the treatment planning of patients with RA accompanied by FM.

REFERENCES

1. Häuser W, Ablin J, Fitzcharles MA, Littlejohn G, Luciano JV, Usui C, et al. Fibromyalgia. Nat Rev Dis Primers. 2015 Aug 13;1:15022. doi: 10.1038/nrdp.2015.22. PMID: 27189527.
2. Zhao SS, Duffield SJ, Goodson NJ. The prevalence and impact of comorbid fibromyalgia in inflammatory arthritis. Best Pract Res Clin Rheumatol. 2019 Jun;33(3):101423. doi: 10.1016/j.berh.2019.06.005. Epub 2019 Jul 17. PMID: 31703796.
3. van Gestel AM, Haagsma CJ, van Riel PL. Validation of rheumatoid arthritis improvement criteria that include simplified joint counts. Arthritis Rheum. 1998 Oct;41(10):1845-50. doi: 10.1002/1529-0131(199810) 41:10<1845::AID-ART17>3.0.CO;2-K. PMID: 9778226.
4. DAS-score. NL. Home of the DAS (Disease Activity Score in rheumatoid arthritis). https://www.das-score.nl/en/ (accessed; September 1th 2016 - February 1th 2020).
5. Aletaha D, Neogi T, Silman AJ, Funovits J, Felson DT, Bingham CO 3rd, et al. 2010 Rheumatoid arthritis classification criteria: an American College of Rheumatology/European League Against Rheumatism collaborative initiative. Arthritis Rheum. 2010 Sep;62(9):2569-81. doi: 10.1002/art.27584. PMID: 20872595.
6. Wolfe F, Clauw DJ, Fitzcharles MA, Goldenberg DL, Häuser W, Katz RL, et al. 2016 Revisions to the 2010/2011 fibromyalgia diagnostic criteria. Semin Arthritis Rheum. 2016 Dec;46(3):319-329. doi: 10.1016/j.semarthrit.2016.08.012. Epub 2016 Aug 30. PMID: 27916278.
7. Balsa A, Carmona L, Gonzalez-Alvaro I, Belmonte MA, Tena X, Sanmarti R. Value of Disease Activity Score 28 (DAS 28) and DAS 28-3 compared to American College of Rheumatology-defined remission in rheumatoid arthritis. J Rheumatol. 2004;31:40-6.
8. Hinkle DE, Wiersma W, Jurs SG. Applied statistics for the behavioral sciences. Houghton Mifflin College Division; eBook. 2003.
9. Durmaz Y, Alayli G, Canbaz S, Zahiroglu Y, Bilgici A, Ilhanli I, et al. Prevalence of juvenile fibromyalgia syndrome in an urban population of Turkish adolescents: impact on depressive symptoms, quality of life and school performance. Chin Med J (Engl). 2013;126(19):3705-11. PMID: 24112168.
10. Coskun Benlidayi I. Fibromyalgia interferes with disease activity and biological therapy response in inflammatory rheumatic diseases. Rheumatol Int. 2020 Jun;40(6):849-858. doi: 10.1007/s00296-019-04506-2. Epub 2020 Jan 3. PMID: 31900502.
11. Duffield SJ, Miller N, Zhao S, Goodson NJ. Concomitant fibromyalgia complicating chronic inflammatory arthritis: a systematic review and meta-analysis. Rheumatology (Oxford). 2018 Aug 1;57(8):1453-1460. doi: 10.1093/rheumatology/key112. PMID: 29788461; PMCID: PMC6055651.
12. Wolfe F, Walitt B. No Association of Fibromyalgia and Seronegative Rheumatoid Arthritis-The Need for Uniform Application of Fibromyalgia Criteria in Research Studies: Comment on the Article by Doss et al. Arthritis Rheumatol. 2017 Mar;69(3):679-680. doi: 10.1002/art.39998. PMID: 27860437.
13. Provan SA, Austad C, Halsaa V, Hammer HB, Kvien TK, Uhlig T. Fibromyalgia in patients with rheumatoid arthritis. A 10-year follow-up study, results from the Oslo Rheumatoid Arthritis Register. Clin Exp Rheumatol. 2019 Jan-Feb;37 Suppl 116(1):58-62. Epub 2019 Jan 8. PMID: 30620293.
14. Zammurrad S, Munir W, Farooqi A. Disease activity score in rheumatoid arthritis with or without secondary fibromyalgia. J Coll Physicians Surg Pak. 2013 Jun;23(6):413-7. PMID: 23763802.
15. Ubago Linares Mdel C, Ruiz-Pérez I, Bermejo Pérez MJ, Olry de Labry-Lima A, Hernández-Torres E, Plazaola-Castaño J. Analysis of the impact of fibromyalgia on quality of life: associated factors. Clin Rheumatol. 2008 May;27(5):613-9. doi: 10.1007/s10067-007-0756-1. Epub 2007 Oct 2. PMID: 17909739.
16. Lee YC, Hackett J, Frits M, Iannaccone CK, Shadick NA, Weinblatt ME, et al. Multibiomarker disease activity score and C-reactive protein in a cross-sectional observational study of patients with rheumatoid arthritis with and without concomitant fibromyalgia. Rheumatology (Oxford). 2016 Apr;55(4):640-8. doi: 10.1093/rheumatology/kev388. Epub 2015 Nov 25. PMID: 26608972; PMCID: PMC4795537.
17. Kılıçarslan A, Yurdakul FG, Bodur H. Diagnosing fibromyalgia in rheumatoid arthritis: The importance of assessing disease activity. Turk J Phys Med Rehabil. 2018 May 15;64(2):133-139. doi: 10.5606/tftrd.2018.1618. PMID: 31453503; PMCID: PMC6657755.
18. Salaffi F, Di Carlo M, Carotti M, Sarzi-Puttini P. The subjective components of the Disease Activity Score 28-joints (DAS 28) in rheumatoid arthritis patients and co-existing fibromyalgia. Rheumatol Int. 2018 Oct;38(10):1911-1918. doi: 10.1007/s00296-018-4096-z. Epub 2018 Jun 28. PMID: 29955927.
19. Sivas F, Aktekin LA, Eser F, Yurdakul FG, Oksuz E, Ozoran K, et al. Comparative results of DAS-28 and quality of life in patients with rheumatoid arthritis and fibromyalgia. Turk J Rheumatol. 2010;25:179-83.
20. Naranjo A, Ojeda S, Francisco F, Erausquin C, Rúa-Figueroa I, Rodríguez-Lozano C. Fibromyalgia in patients with rheumatoid arthritis is associated with higher scores of disability. Ann Rheum Dis. 2002 Jul;61(7):660-1. doi: 10.1136/ard.61.7.660. PMID: 12079919; PMCID: PMC1754142.
21. Roig Vilaseca D, Hoces Otero C. Efecto de la coexistencia de fibromialgia en el índice DAS 28 en mujeres con artritis reumatoide [Effect of the Coexistence of Fibromyalgia in the DAS 28 Index in Women with Rheumatoid Arthritis]. Reumatol Clin. 2008 May;4(3):96-9. Spanish. doi: 10.1016/S1699-258X(08)71811-4. Epub 2008 Oct 28. PMID: 21794508.
22. Durán J, Combe B, Niu J, Rincheval N, Gaujoux-Viala C, Felson DT. The effect on treatment response of fibromyalgic symptoms in early rheumatoid arthritis patients: results from the ESPOIR cohort. Rheumatology (Oxford). 2015 Dec;54(12):2166-70. doi: 10.1093/rheumatology/kev254. Epub 2015 Jul 14. Erratum in: Rheumatology (Oxford). 2017 Jul 1;56(7):1244. PMID: 26175470; PMCID: PMC4861641.
23. Leeb BF, Andel I, Sautner J, Nothnagl T, Rintelen B. The DAS 28 in rheumatoid arthritis and fibromyalgia patients. Rheumatology (Oxford). 2004 Dec;43(12):1504-7. doi: 10.1093/rheumatology/keh322. Epub 2004 Jul 13. PMID: 15252215.
24. Chakr RMDS, Brenol C, Ranzolin A, Bernardes A, Dalosto AP, Ferrari G, et al. Rheumatoid arthritis seems to have DMARD treatment decision influenced by fibromyalgia. Rev Bras Reumatol Engl Ed. 2017 Sep-Oct;57(5):403-411. English, Portuguese. doi: 10.1016/j.rbre.2017.01.004. Epub 2017 Feb 10. PMID: 29037312.
25. Salaffi F, Gerardi MC, Atzeni F, Batticciotto A, Talotta R, Draghessi A, et al. The influence of fibromyalgia on achieving remission in patients with long-standing rheumatoid arthritis. Rheumatol Int. 2017 Dec;37(12):2035-2042. doi: 10.1007/s00296-017-3792-4. Epub 2017 Sep 5. PMID: 28875224.
26. Silva Chakr RMD, Santos JCO, Alves LDS, de Andrade NPB, Ranzolin A, Brenol CV. Ultrasound Assessment of Disease Activity Prevents Disease-Modifying Antirheumatic Drug (DMARD) Escalation and May Reduce DMARD-Related Direct Costs in Rheumatoid Arthritis With Fibromyalgia: An Exploratory Study. J Ultrasound Med. 2020 Jul;39(7):1271-1278. doi: 10.1002/jum.15215. Epub 2020 Jan 20. PMID: 31958164.