Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

The Egyptian Rheumatologist 44 (2022) 209–213

Contents lists available at ScienceDirect

The Egyptian Rheumatologist

journal homepage: www.elsevier.com/locate/ejr

Frequency, characteristics and outcome of corona virus disease 2019 (COVID-19) infection in Iranian patients with rheumatic diseases

Shirin Assar *, Dena Mohamadzadeh, Mehran Pournazari, Parviz Soufivand

Rheumatology Department, Clinical Research Development Center, Imam Reza Hospital, Kermanshah University of Medical Sciences, Kermanshah, Iran

ARTICLE INFO

Article history:
Received 3 December 2021
Accepted 4 December 2021
Available online 10 December 2021

Keywords:
Autoimmune systemic diseases
COVID-19
Rheumatic diseases
SARS-CoV-2
Immunosuppressive and immunomodulatory therapies

ABSTRACT

Aim of the work: To investigate the frequency, clinical characteristics and outcome of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection in rheumatic diseases patients.
Patients and methods: One thousand patients with rheumatic diseases including systemic lupus erythematosus (SLE), rheumatoid arthritis (RA), psoriatic arthritis (PsA), axial spondyloarthritis (SpA), systemic sclerosis (SSc), Sjögren's syndrome (SS), Behçets disease (BD), vasculitis, idiopathic inflammatory myositis (IIM), relapsing polychondritis, sarcoidosis and antiphospholipid syndrome (APS) were studied. The following data were collected: age, sex, disease diagnosis, rheumatic disease medication. Rheumatic diseases patients were divided into two groups of infected and non-infected patients with COVID-19 and collected data were compared.
Results: The 1000 patients mean age was 43.4 ± 13 years and 84.1% were females. The main diagnosis was RA (37.1%), followed by SLE (23.8%), SpA (13.4%), SSc (12.4%), vasculitis, BD and rhupus in 2.4%, 2.3% and 2.2% respectively, SS and SSc in 0.7% each. Most patients were taking glucocorticoids (78.4%). A large majority of patients were taking at least one of the cDMARDs. 16.1% were taking biologic therapy. 221 rheumatic diseases patients with COVID-19 were identified. Of these, 38 patients (17.2%) were hospitalized and 9 patients (4.1%) died. No significant difference was observed for compared variables in patients with and without COVID-19 except for prednisolone >20 mg/d (0.64% vs 2.26%; p = 0.048).
Conclusion: Most rheumatic diseases do not seem to be a risk factor for developing COVID-19 infection and despite immunosuppressive therapies, there is no poorer outcome. Only, patients using prednisolone >20 mg/d are at higher risk of developing COVID-19 infection.

1. Introduction

Intrinsic immunological changes can produce chronic inflammation in multiple organs in autoimmune inflammatory disorders. The disorders themselves, as well as many of their treatments, are related to a higher risk of developing serious infections [1–4]. There is growing evidence of an association between COVID-19 infection and the development of autoimmune diseases [5] with a remarkable impact on the quality of life of those patients [6].

Whether patients with rheumatic diseases are more vulnerable to corona virus disease 2019 (COVID-19) infection is still unknown and the possible susceptibility of rheumatic patients for more severe COVID-19 infection or a poorer outcome has raised serious concerns [7]. Several disease modifying anti-rheumatic drugs (DMARDs) with immune-modulating actions such as hydroxychloroquine and tocilizumab may have a therapeutic or preventative effect on the viral infection or the consequent cytokine storm syndrome seen in COVID-19 [8,9].Patients with rheumatoid arthritis (RA) faced remarkable difficulty to obtain their medications during the pandemic with subsequent change in their disease status [10]. During the pandemic, low dose rituximab is an effective treatment option in the treatment of RA [11].

Patients with systemic rheumatic disease and low rate of acceptability to receive the COVID-19 vaccine, should be encouraged [12] as patient-reported adverse events were typical of those reported in the general population with a relatively low frequency of flare requiring medications [13].

Therefore patients with rheumatic disease represent an interesting study group because, on the one hand, this population is potentially more susceptible to severe COVID-19 infection due to the rheumatic disease and its treatment, on the other hand, many of these patients are receiving immune modulating medications, which have the potential to treat COVID-19 infection and improve prognosis.

Peer review under responsibility of Egyptian Society of Rheumatic Diseases.
* Corresponding author.
E-mail address: sh-asar@kums.ac.ir (S. Assar).

https://doi.org/10.1016/j.ejr.2021.12.002
1110-1164/

The aim of this study was to describe the characteristics, clinical manifestations and outcomes of rheumatic patients diagnosed with COVID-19 infection and also to determine the prevalence of COVID-19 infection in the study population and answer to the question whether this specific population have more susceptibility for COVID-19 and poorer outcome.

2. Patients and methods

This study was conducted at theoutpatient clinics and inpatient Rheumatology ward of Emam Reza and Golestan Hospitals in Kermanshah, Iran. Between Feb 18 and Aug 22, 2020, data was collected from 1000 patients with rheumatic diseases including systemic lupus erythematosus (SLE) [14], rheumatoid arthritis (RA) [15], psoriatic arthritis (PsA) [16], axial spondyloarthritis (SpA) [17], systemic sclerosis (SSc) [18], Sjögren's syndrome[19], Behçets disease (BD) [20], vasculitis, idiopathic inflammatory myositis (IIM) [21], relapsing polychondritis, sarcoidosis and antiphospholipid syndrome (APS) and all fulfilling their corresponding classification criteria. The local ethics committee approved the study (IR.KUMS.REC.1399.912) conducted in accordance to the Declaration of Helsinki's. Patients provided their informed consent.

Data from patients scheduled for a visit were recorded and a survey conducted by interview and the development of COVID-19 infection since the beginning of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic investigated. The following variables were considered: demographics, type of rheumatic disease and medications used.

A confirmed or highly suspected COVID-19 infection was considered in cases with positive reverse transcription polymerase chain reaction (RT-PCR), chest computerized tomography (CT) findings consistent with COVID-19 pneumonia, elevated levels of serum coronavirus IgM/IgG or those with symptoms and contact history to a patient diagnosed as COVID-19 infection. Patients were divided into those infected or non-infected during six months of the survey.

In cases with COVID-19 the following clinical symptoms were recorded: persistent fever >37.5 °C, myalgia, chills, dyspnea, malaise, non-productive cough, anosmia, ageusia, headache, loss of appetite, sore throat, diarrhoea, abdominal pain, sweating, rhinorrhea, nausea and vomiting, arthritis and arthralgia, deterioration of the rheumatic disease, confusion, hemiplegia, eye redness and skin rash. COVID-19 clinical outcomes were determined by assessing the recovery with and without hospitalization, intensive care admission and death.

Statistical analysis: Statistical Package for the Social Sciences (SPSS) version 25 was used. Variables were reported as frequency, percentage, mean and standard deviation (SD). Mann-Whitney, Chi-square and Fisher's exact tests were used to compare variables. Odds ratio (OR) with 95% confidence intervals (CI) were determined. Significance was defined at a $p < 0.05$.

3. Results

One thousand rheumatic diseases patients were studied with a mean age of 43.4 ± 13 years and were 841 (84.1%) females. RA was the most common diagnosis (37.1%), followed by SLE (23.8%), axial SpA (13.4 %) and SSc (12.4%). The majority of the patients were on steroids (78.4%) and NSAIDs were used by 50.5%. Patients were taking at least one conventional synthetic disease modifying antirheumatic drugs (DMARDs): methotrexate (34.1%), sulfasalazine (21.5%), azathioprine (19.3%), mycophenolate mofetil (13.9%), leflunomide (11.2%), hydroxychloroquine (35.5%) and 16.1% were taking targeted synthetic biologic bDMARDs: adalimumab (11%), etanercept (2.4%) and infliximab (2 %).

221 (22.1%) were infected with COVID-19. The age of the patients with and without COVID-19 was comparable (43.4 ± 13.3 vs 43.3 ± 11.9 years; p = 0.99). Clinical symptoms, way of diagnosis and clinical outcomes are reported in Tables 1–3. Distribution of rheumatic diseases and medications used between patients with and without COVID-19 infection are presented in Tables 4 and 5.

4. Discussion

Corona virus disease 2019 (COVID-19) is a novel infectious disease with diverse clinical manifestations and a wide range of disease severity. The influence of COVID-19 infection on patients with underlying rheumatic diseases is still not fully revealed. In this work the data of a large observational survey onrheumatic diseases patients with confirmed or highly suspected COVID-19 infection was presented, all of whom were followed up in rheumatology outpatient or inpatient.

A thousand rheumatic diseases patients were investigated and 221 (22.1 %) were diagnosed with COVID-19 infection. Of these, 17.2% were hospitalized, 3.6% were admitted to ICU, and 4.1% died. In line, the frequency of COVID-19 infection was not different from that estimated in the reference general population [22]. However, in this survey, onlysymptomatic rheumatic patients who had at least one positive PCR test for Covid-19, or symptomatic individuals who had close contact with an infected person were considered as COVID-19 infected. Yet, asymptomatic individuals may also be infected and the sensitivity of PCR tests to diagnose the COVID-19 infection is not definitive implying that the presented frequency could be underestimated. The mortality rate was also consistent with the general population [23,24].

Consistent with the current results, up to now, neither rheumatic diseases nor their treatments were associated with higher infection rates or worsening of COVID-19 outcomes [9,25].

A previous study from the United States [26] showed higher rates of ICU admission and the need for mechanical ventilation among hospitalized patients suffering from rheumatic disease.

Table 1
Clinical symptoms of rheumatic diseases patients with coronavirus disease 2019 (COVID-19) infection.

Clinical symptoms of COVID-19 n (%)	RD patients with COVID-19 (n = 221)
Fever	132 (59.7)
Myalgia	100 (45.2)
Chills	94 (42.5)
Dyspnea	71 (32.1)
Malaise	68 (30.8)
Cough	64 (28.6)
Anosmia	63 (28.5)
Ageusia	55 (24.9)
Headache	41 (18.6)
Loss of appetite	38 (17.2)
Sore throat	25 (11.3)
Diarrhea	25 (11.3)
Abdominal pain	16 (7.2)
Sweating	16 (7.2)
Rhinorrhea	15 (6.8)
Vomiting	13 (5.9)
Arthritis/Arthralgia	8 (3.6)
Deterioration of RD	7 (3.2)
Confusion	1 (0.45)
Hemiplegia	1 (0.45)
Eye redness	1 (0.45)
Skin rash	1 (0.45)

COVID-19: coronavirus disease 2019; RD: rheumatic disease.

Table 2
Diagnostic method of coronavirus disease 2019 (COVID-19) infection in rheumatic diseases patients.

Diagnosis of COVID-19 n (%)	RD patients with COVID-19 (n = 221)
Symptoms and contact history	70 (31.7)
PCR testing	60 (27.1)
Chest CT scan	52 (23.5)
PCR + CT	30 (13.6)
CT + IgG and IgM antibodies	4 (1.8)
IgG and IgM antibodies	3 (1.4)
CT + PCR + IgG and IgM antibodies	2 (0.9)

COVID-19: coronavirus disease 2019; RD: rheumatic disease, PCR: polymerized chain reaction, CT: computerized tomography, Ig: immunoglobulin.

Table 3
Outcome of rheumatic diseases patients infected with coronavirus disease 2019 (COVID-19).

Outcome n (%)	RD patients with COVID-19 (n = 221)
Recovery without hospitalization	183 (82.8)
Recovery with hospitalization	29 (13.1)
Death	9 (4.1)
ICU admission	8 (3.6)

RD: rheumatic disease, COVID-19: coronavirus disease 2019, ICU: intensive care unit.

The explanation might be the shortage of ICU beds in Iran within the time of the pandemic that led to a low rate of ICU admission.

In concordance with *Sun et al* [24] and *D'Silva et al* [26], the most frequently reported symptoms of COVID-19 infection were fever and chills, myalgia, dyspnea, malaise and cough; other symptoms like gastrointestinal symptoms were less common.

Type of rheumatic disease, age and sex were similar between rheumatic patients with and without COVID-19 infection. Neither SLE patients nor RA, SpA, PsA, SSc, vasculitis, BD, IIM was more susceptible to COVID-19. While in a large Italian study reported that the prevalence of COVID-19 infection in patients with systemic autoimmune disorders was higher [27].

No association between prior steroids or biologic usage and susceptibility to COVID-19 was detected except for *prednisolone* dosage > 20 mg/daily. In contrast, a previous study from Spain reported a greater prevalence of COVID-19 in patients on ts/bDMARDs therapy [28]. It should be noted that, at the time of conducting this work, two drugs: anti interleukin 6 and CTLA4-Ig, were not available for the treatment of rheumatic diseases patients in Iran; therefore therapeutic data resulting fromts/bDMARDs should be interpreted with caution. However, a protective effect of these two therapies against COVID-19 was shown [29,30].Analysis from a recent European registry [31], revealed that rheumatic diseases patients who used *glucocorticoids* > 10 mg/day were at higher risk of COVID-19 related hospitalization. In the present study, a vast majority of patients with COVID-19 were taking glucocorticoids (76.9%) despite that the hospitalization rate (17.2%) was not higher than the general population [32]. It was found that a significantly higher rate of patients using predisolone > 20 mg/d, were infected with COVID-19 but not at higher risk of COVID-19 related hospitalization. The preventive or therapeutic effect of *hydroxychloroquine* (HCQ) in COVID-19 infections was suggested, but still controversial [33]. SLE patients that were under long-term treatment with HCQ and a large survey on rheumatic diseases patients showed that this drug does not have a preventive effect [34,35]. Inconsistent with these studies, current findings indicate that a similar proportion of patients with and without COVID-19 infection used HCQ. Neither prior *NSAIDs* use nor DMARDs were associated with susceptibility to COVID-19. Most previous studies showed a similar result [28,31,36].

Our findings support the theory that the presence of other risk factors rather than the pre-existing rheumatic disorders or ongoing immunosuppressive treatment influences the prognosis of COVID-19 infection.

The main strength of this study was the large number of patients with various rheumatic diseases that let us determine the frequency of COVID-19 in the study population and compare the clinical characteristics and outcome of SARS- CoV-2 infections in the infected and non-infected groups.

This study had some limitations. First, we did not have a healthy control group to compare the prevalence and outcome of COVID-19 with the general population of our city. Therefore, the outcome and mortality rate was compared with previous global studies. In addition, due to national PCR test shortage a vast majority of patients were considered as COVID-19 infections just according to clinical symptoms and close contact history with an infected person or chest CT scan findings, and they were not confirmed with

Table 4
Different types of rheumatic disease compared between patients with and without coronavirus disease 2019 (COVID-19) infection.

RD n (%)	non COVID-19 (n = 779)	COVID-19 (n = 221)	p	OR	95%CI
SLE	184 (23.6)	54 (24.4)	0.8	1.1	0.7–1.5
RA	293 (37.6)	78 (35.3)	0.53	0.9	0.7–1.2
SLE/RA (rupus)	18 (2.3)	4 (1.8)	0.65	0.78	0.3–2.3
SSc	100 (12.8)	24 (10.9)	0.43	0.83	0.5–1.3
SLE + SSc	4 (0.5)	1 (0.5)	>0.99	0.88	0.1–7.9
Axial SpA	101 (12.9)	33 (14.9)	0.45	1.18	0.8–1.8
PsA	12 (1.5)	8 (3.6)	0.06	2.4	0.97–5.9
SS	6 (0.8)	1 (0.5)	0.96	0.59	0.1–4.9
BD	19 (2.4)	4 (1.8)	0.79	0.74	0.3–2.2
IIM	5 (0.6)	2 (0.9)	0.96	1.41	0.3–7.3
Vasculitis	17 (2.2)	7 (3.2)	0.45	1.47	0.6–3.6
APS	1 (0.1)	1 (0.5)	0.39	3.54	0.2–56.7
SLE/APS	9 (1.2)	1 (0.5)	0.59	0.39	0.1–3.1
SLE/RA/APS	3 (0.4)	0 (0)	–		
RP	0 (0)	1 (0.5)	–		
Sarcoidosis	3 (0.4)	0 (0)	–		
SSc + PM	3 (0.4)	0 (0)	–		
SLE + AS	0 (0)	1 (0.5)	–		
RA + vasculitis	1 (0.1)	1 (0.5)	–		

RA: rheumatoid arthritis, SLE: systemic lupus erythematosus, SSc: systemic sclerosis, APS: anti phospholipid syndrome, SpA:axial spondyloarthritis, PsA: psoriatic arthritis, SS: Sjögren's syndrome, BD: Behçet's disease, IIM: idiopathic inflammatory myositis, APS: anti-phospholipid syndrome, RP: relapsing polychondritis, PM: polymyositis.

Table 5
Medication used by rheumatic diseases patients with and without coronavirus disease 2019 (COVID-19) infection.

RD n (%)	non COVID-19 (n = 779)	COVID-19 (n = 221)	p	OR	95%CI
Prednisolone	614 (78.8)	170 (76.9)	0.54	0.9	0.63–1.28
≤ 5 mg	469 (60.2)	135 (61.1)	0.81	1.04	0.76–1.41
5–10 mg	133 (17.1)	28 (12.7)	0.49	0.7	0.45–1.09
>10–20 mg	7 (0.9)	2 (0.9)	0.35	1.01	0.21–4.88
>20 mg	5 (0.6)	5 (2.3)	**0.048**	3.58	1.03–12.5
Hydroxychloroquine	275 (35.3)	80 (36.2)	0.8	1.04	0.76–1.42
Methotrexate	258 (33.1)	83 (37.6)	0.22	1.21	0.89–1.66
sulfasalazine	165 (21.2)	50 (22.6)	0.71	1.09	0.76–1.56
Azathioprine	152 (19.5)	41 (18.6)	0.75	0.94	0.64–1.38
Mycophenolate mofetil	112 (14.4)	27 (12.2)	0.41	0.83	0.53–1.3
Leflunomide	93 (11.9)	19 (8.6)	0.16	1.37	0.8–2.35
Cyclosporine	6 (0.8)	0 (0)	–	–	–
Cyclophosphamide	20 (2.6)	5 (2.3)	0.99	0.88	0.33–2.37
Biologics	122 (15.7)	39 (17.6)	0.23	1.15	0.78–1.71
Adalimumab	84 (10.8)	26 (11.8)	0.68	1.1	0.69–1.76
Etanercept	21 (2.7)	3 (1.4)	0.32	0.92	0.27–3.12
Infliximab	13 (1.7)	7 (3.2)	0.17	1.93	0.76–4.89
Tofacitinib	1 (0.1)	2 (0.9)	0.12	7.11	0.64–78.7
Rituximab	3 (0.4)	1 (0.5)	>0.99	1.18	0.12–11.4
Others					
NSAIDs	389 (49.9)	116 (52.5)	0.5	1.11	0.82–1.41
Aspirin	118 (15.1)	23 (10.4)	0.07	0.65	0.41–1.05
warfarin	22 (2.8)	5 (2.3)	0.81	0.8	0.3–2.13
Colchicine	17 (2.2)	3 (1.4)	0.6	0.62	0.18–2.12

NSAID: non-steroidal anti-inflammatory drugs.

PCR testing. Finally, as mentioned above, we did not consider the asymptomatic patients in this survey.

In conclusion, there is no significant association between type of rheumatic disease or medications and susceptibility to COVID-19 infection except for prednisolone > 20 mg/ daily. The mortality rate in rheumatic patients was similar to the general population. Most rheumatic diseases does not seem to be a risk factor for developing COVID-19 infection, and despite immunosuppressive, and immunomodulatory therapies, there is no poorer outcome in these patients. These findings may be important for managing rheumatologic diseases during COVID-19 pandemic.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] Listing J, Gerhold K, Zink A. The risk of infections associated with rheumatoid arthritis, with its comorbidity and treatment. Rheumatology (Oxford) 2013;52(1):53–61.
[2] Mehta B, Pedro S, Ozen G, Kalil A, Wolfe F, Mikuls T, et al. Serious infection risk in rheumatoid arthritis compared with non-inflammatory rheumatic and musculoskeletal diseases: a US national cohort study. RMD Open 2019;5(1):e000935. doi: https://doi.org/10.1136/rmdopen-2019-000935.
[3] Tektonidou MG, Wang Z, Dasgupta A, Ward MM. Burden of serious infections in adults with systemic lupus erythematosus: a national population-based study, 1996–2011. Arthritis Care Res (Hoboken) 2015;67(8):1078–85.
[4] Schmidt J, Smail A, Roche B, Gay P, Salle V, Pellet H, et al. Incidence of severe infections and infection-related mortality during the course of giant cell arteritis: a multicenter, prospective, double-cohort study. Arthritis Rheumatol 2016;68(6):1477–82.
[5] Assar S, Pournazari M, Soufivand P, Mohamadzadeh D. Systemic lupus erythematosus after coronavirus disease-2019 (COVID-19) infection: Case-based review. Egypt Rheumatol 2022;44(2):145–9.
[6] Zomalheto Z, Assogba C, Dossou-yovo H. Impact of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV2) infection and disease-2019 (COVID-19) on the quality of life of rheumatoid arthritis patients in Benin. Egypt Rheumatol 2021;43(1):23–7.
[7] Abualfadl E, Ismail F, Shereef RRE, Hassan E, Tharwat S, Mohamed EF, et al. ECR COVID19-Study Group. Impact of COVID-19 pandemic on rheumatoid arthritis from a Multi-Centre patient-reported questionnaire survey: influence of gender, rural-urban gap and north-south gradient. Rheumatol Int 2021;41(2):345–53.
[8] Durmaz Y, Ilhanli I. Six month assessment of low dose rituximab in the treatment of rheumatoid arthritis during coronavirus disease 2019 (COVID-19) pandemic. Egypt Rheumatol 2021;43(3):253–6.
[9] Figueroa-Parra G, Aguirre-Garcia GM, Gamboa-Alonso CM, Camacho-Ortiz A, Galarza-Delgado DA. Are my patients with rheumatic diseases at higher risk of COVID-19? Ann Rheum Dis 2020;79(6):839–40.
[10] Lu C, Li S, Liu Yi. Role of immunosuppressive therapy in rheumatic diseases concurrent with COVID-19. Ann Rheum Dis 2020;79(6):737–9.
[11] Mehta P, McAuley DF, Brown M, Sanchez E, Tattersall RS, Manson JJ. COVID-19: consider cytokine storm syndromes and immunosuppression. Lancet 2020;395(10229):1033–4.
[12] Hammam N, Tharwat S, Shereef RRE, Elsaman AM, Khalil NM, Fathi HM, et al. Egyptian College of Rheumatology (ECR) COVID-19 Study Group. Rheumatology university faculty opinion on coronavirus disease-19 (COVID-19) vaccines: the vaXurvey study from Egypt. Rheumatol Int 2021;41(9):1607–16.
[13] Sattui SE, Liew JW, Kennedy K, Sirotich E, Putman M, Moni TT, et al. Early experience of COVID-19 vaccination in adults with systemic rheumatic diseases: results from the COVID-19 Global Rheumatology Alliance Vaccine Survey. RMD Open 2021;7(3):e001814. doi: https://doi.org/10.1136/rmdopen-2021-001814.
[14] Petri M, Orbai A-M, Alarcón GS, Gordon C, Merrill JT, Fortin PR, et al. Derivation and validation of the Systemic Lupus International Collaborating Clinics classification criteria for systemic lupus erythematosus. Arthritis Rheum 2012;64(8):2677–86.
[15] Aletaha D, Neogi T, Silman AJ, Funovits J, David T, Bingham3rd Co,, et al. Rheumatoid arthritis classification criteria: an American College of Rheumatology/European league against rheumatism collaborative initiative. Arthritis Rheum 2010;62(9):2569–81.
[16] Tillett W, Costa L, Jadon D, Wallis D, Cavill C, McHUGH J, et al. The ClASsification for psoriatic ARthritis (CASPAR) criteria – a retrospective feasibility, sensitivity, and specificity study: table 1. J Rheumatol 2012;39(1):154–6.
[17] Rudwaleit M, van der Heijde D, Landewé R, et al. The development of Assessment of SpondyloArthritis international Society classification criteria for axial spondyloarthritis (part II): validation and final selection. Ann Rheum Dis 2009;68:777–83.
[18] Khanna D, Christopher P, Maureen D, Fransen J. Classification criteria for systemic sclerosis: an American college of rheumatology/European league against rheumatism collaborative initiative. Ann Rheum Dis 2013;72(11):1747–55.
[19] Shiboski CH, Shiboski SC, Seror R, et al. American College of Rheumatology/European League Against Rheumatism classification criteria for primary Sjogren's syndrome. Ann Rheum Dis 2016;2017:9–16.

[20] International Team for the Revision of the International Criteria for Behcet's Disease (ITR-ICBD). Revision of the International Criteria for Behcet's disease (ICBD). Clin Exp Rheumatol. 2006;24(Suppl 42):S14-5.
[21] Bohan A, Peter JB. Polymyositis and Dermatomyositis. N Engl J Med 1975February13;292(7):344–7.
[22] Poustchi H, Darvishian M, Mohammadi Z, Shayanrad A, Delavari A, Bahadorimonfared A, et al. SARS-CoV-2 antibody seroprevalence in the general population and high-risk occupational groups across 18 cities in Iran: a population-based cross-sectional study. Lancet Infect Dis 2021;21 (4):473–81.
[23] Chaibakhsh S, Pourhoseingholi A, Vahedi M. Global Incidence and Mortality Rate of COVID-19; Special Focus on Iran, Italy and China. Arch Iran Med 2020;23(7):455–61.
[24] Sun P, Lu X, Xu C, Sun W, Pan B. Understanding of COVID-19 based on current evidence. J Med Virol 2020;92(6):548–51.
[25] Favalli EG, Ingegnoli F, Cimaz R, Caporali R. What is the true incidence of COVID-19 in patients with rheumatic diseases?. Ann Rheum Dis 2021;80:e18.
[26] D'Silva KM, Serling-Boyd N, Wallwork R, Hsu T, Fu X, Gravallese EM, et al. Clinical characteristics and outcomes of patients with coronavirus disease 2019 (COVID-19) and rheumatic disease: a comparative cohort study from a US 'hot spot'. Ann Rheum Dis 2020;79(9):1156–62.
[27] Ferri C, Giuggioli D, Raimondo V, L'Andolina M, Tavoni A, Cecchetti R, et al. COVID-19 and rheumatic autoimmune systemic diseases: report of a large Italian patients series. Clin Rheumatol 2020;39(11):3195–204.
[28] Pablos JL, Abasolo L, Alvaro-Gracia JM, Blanco FJ, Blanco R, Castrejón I, et al. Prevalence of hospital PCR-confirmed COVID-19 cases in patients with chronic inflammatory and autoimmune rheumatic diseases. Ann Rheum Dis 2020;79 (9):1170–3.
[29] McGonagle D, Sharif K, O'Regan A, Bridgewood C. The role of cytokines including interleukin-6 in COVID-19 induced pneumonia and macrophage activation syndrome-like disease. Autoimmun Rev 2020;19(6):102537. doi: https://doi.org/10.1016/j.autrev.2020.102537.
[30] Michelena X, Borrell H, López-Corbeto M, López-Lasanta M, Moreno E, Pascual-Pastor M, et al. Incidence of COVID-19 in a cohort of adult and paediatric patients with rheumatic diseases treated with targeted biologic and synthetic disease-modifying anti-rheumatic drugs. Semin Arthritis Rheum 2020;50 (4):564–70.
[31] Gianfrancesco M, Hyrich KL, Al-Adely S, Carmona L, Danila MI, Gossec L, et al. Characteristics associated with hospitalisation for COVID-19 in people with rheumatic disease: data from the COVID-19 Global Rheumatology Alliance physician-reported registry. Ann Rheum Dis 2020;79(7):859–66.
[32] Nikpouraghdam M, Jalali Farahani A, Alishiri G, Heydari S, Ebrahimnia M, Samadinia H, et al. Epidemiological characteristics of coronavirus disease 2019 (COVID-19) patients in IRAN: A single center study. J Clin Virol 2020;127:104378. doi: https://doi.org/10.1016/j.jcv.2020.104378.
[33] Graef ER, Liew JW, Putman MS, Simard JF, Sirotich E, Berenbaum F, et al. Festina lente: hydroxychloroquine, COVID-19 and the role of the rheumatologist. Ann Rheum Dis 2020;79(6):734–6.
[34] Mathian A, Mahevas M, Rohmer J, Roumier M, Cohen-Aubart F, Amador-Borrero B, et al. Clinical course of coronavirus disease 2019 (COVID-19) in a series of 17 patients with systemic lupus erythematosus under long-term treatment with hydroxychloroquine. Ann Rheum Dis 2020;79(6):837–9.
[35] Gentry CA, Humphrey MB, Thind SK, Hendrickson SC, Kurdgelashvili G, Williams RJ. Long-term hydroxychloroquine use in patients with rheumatic conditions and development of SARS-CoV-2 infection: a retrospective cohort study. Lancet Rheumatol 2020;2(11):e689–97.
[36] Cordtz R, Lindhardsen J, Soussi BG, Vela J, Uhrenholt L, Westermann R, et al. Incidence and severeness of COVID-19 hospitalisation in patients with inflammatory rheumatic disease: a nationwide cohort study from Denmark. Rheumatology (Oxford) 2020:keaa897.