COVID-19 in women with rheumatic disease who are pregnant: Data from the COVID-19 Global Rheumatology Alliance

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Abstract

Objectives

To describe coronavirus disease-2019 (COVID-19) and pregnancy outcomes in patients with rheumatic disease who were pregnant at the time of infection.

Methods

Since March 2020 the COVID-19 Global Rheumatology Alliance (GRA) has collected cases of patients with rheumatic disease with COVID-19. We report details of pregnant women at the time of COVID-19 infection, including obstetric details separately ascertained from providers.

Results

We report on 39 patients, including 22 with obstetric detail available. The mean and median age was 33 years, range 24-45 years. Rheumatic disease diagnoses included: rheumatoid arthritis (n=9), systemic lupus erythematosus (n=9), psoriatic/other inflammatory arthritides (n=8) and anti-phospholipid antibody syndrome (n=6). Most had a term birth (16/22), with 3 pre-term births, one termination, one miscarriage and one woman yet to deliver at time of report. A quarter (n=10/39) of pregnant women were hospitalised following COVID-19 diagnosis. Two of 39 (5%) required supplemental oxygen (both hospitalised); no patient died. The majority did not receive specific medication treatment for their COVID-19 (n=32/39, 82%), seven patients received some combination of anti-malarials, colchicine, anti-IL-1beta, azithromycin, glucocorticoids, and lopinavir/ritonavir.

Conclusion

Women with rheumatic diseases who were pregnant at the time of COVID-19 had favourable outcomes. These data have limitations due to the small size and methodology, though they provide cautious optimism for pregnancy outcomes for women with rheumatic disease given the increased risk of poor outcomes that have been reported in other series of pregnant women with COVID-19.

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Rheumatic diseases commonly occur in reproductive-aged women. The impact of pregnancy on the underlying rheumatic disease, the rheumatic disease impact on pregnancy, and the limitations in the use of anti-rheumatic medications can make disease management challenging(1, 2). With the global outbreak of the novel coronavirus disease 2019 (COVID-19), an additional level of complexity has been added for women with rheumatic diseases who wish to become pregnant.

There are limited data to inform COVID-19 prognosis and pregnancy outcomes in women who are pregnant and infected with SARS-CoV-2. Data reported in November 2020 included 23,434 pregnant women with COVID-19 and found they were significantly more likely than non-pregnant women to be admitted to an intensive care unit (ICU), receive invasive ventilation, receive extracorporeal membrane oxygenation, and die(3). However, none of these reports specifically included women with autoimmune or rheumatologic disorders or those taking immunosuppressive therapy.

Among non-pregnant patients with rheumatic disease and COVID-19, initial reports from the COVID-19 Global Rheumatology Alliance (C19-GRA) physician registry of patients suggested that patients generally fared well(4-8). Some medications were associated with poorer outcomes(4, 8). A large comparative study suggested that poorer outcomes in patients with rheumatic disease were likely mediated by co-morbidities(9). For the first time we report data from the C19-GRA registry on pregnant women with rheumatic disease who were diagnosed with COVID-19.

METHODS

Since March 24, 2020 health care providers globally have been able to enter data on people with rheumatic diseases diagnosed with COVID-19 into the C19-GRA provider REDCap survey(10, 11). Registry data elements include the provider name, city, country, and clinic; patient age, sex, race and ethnicity. Rheumatic disease data includes rheumatic disease medications (including glucocorticoids), physician-assessment of disease activity and comorbidities. Data on COVID-19 includes diagnosis date, symptoms, treatments, and outcomes, with available laboratory results also collected. Institutional review board exemption was granted for this registry. This study examines pregnant patients entered into the registry between March 24th 2020 and January 14th 2021.

On July 1, 2020 and then again on the 15th of January 2021 a follow-up REDCap survey was sent to providers who had indicated their patient was pregnant in the registry as of June 30th 2020 and 14th January 2021 respectively. Responses were received from providers who cared for 25 out of 44 women. Additional data requested included gravida, parity, number of fetuses in current pregnancy, gestational age at COVID-19 diagnosis and obstetric outcomes. Five patients diagnosed on symptoms alone, including three with additional pregnancy data, were subsequently excluded. Data on whether drugs were stopped or continued through the COVID-19 illness was also reported if entered by the provider into the registry. As a comparison we also included outcomes in non-pregnant women of child bearing age from the C19-GRA registry, aged 20-45 years old, with data provided from registry inception until the 14th of January 2021. Data are reported using descriptive statistics.

The C19-GRA physician registry was determined “not human subjects research” under US Federal Guidelines assessed by the University of California, San Francisco, and patient

consent was not required to be sought. Further details of the ethics procedures have been previously published (8).

RESULTS

Patient & Disease Characteristics

Thirty nine pregnant women were included in this study. Reported race/ethnicity were White (n=13, 33%), Latin American/Hispanic (n=9, 23%), Arab or Middle East (n=9, 23%), South or East Asian (n=6, 15%) and Black (n=2, 5%). The mean and median age was 33 years (standard deviation (SD) ± 5.5), range 24-45 years. Patients were reported as non-smokers (n=28) and former smokers (n=3); smoking status was unknown for eight women. Co-morbidities were reported in only eight patients, pre-pregnancy hypertension (n=3), morbid obesity (BMI >40 kg/m^2, n=2), obesity (BMI >30 kg/m2, n=1), psoriasis (n=1) and pre-gestational diabetes mellitus (n=1). Rheumatic disease diagnoses were (multiple diagnoses in the same patient are reported individually) systemic lupus erythematosus (SLE) (n=9), rheumatoid arthritis (n=9), other inflammatory arthritis (n=7), anti-phospholipid syndrome (n=6), axial spondyloarthritis (n=3), systemic sclerosis (n=2), inflammatory myositis (n=1), Sjogren's syndrome (n=1), mixed connective tissue disease (n=1), gout (n=1), Takayasu vasculitis (n=1), psoriatic arthritis (n=1), ANCA-vasculitis (n=1) and discoid lupus (n=1). A common co-diagnoses was SLE patients with co-existing antiphospholipid syndrome (n=2). Rheumatic disease activity was reported as remission (n=13), minimal or low (n=18), moderate (n=6), high (n=1) and unknown (n=1). Rheumatic disease treatment and COVID-19 treatment are shown in Table 1. About a quarter of patients were using glucocorticoids (n=10/44, 23%), most at low dose (see Table 1). Medication continuation data through the COVID-19 illness was reported for six medications; two anti-TNF drugs were stopped,

sulfasalazine was stopped in one patient and continued in one other, anti-malarial drugs were stopped in one patient and continued in one other. No other continuation data was provided.

Most patients had COVID-19 diagnosed by polymerase chain reaction testing (n=36), with the remainder by antibody serology, unknown or other. Three patients reported no symptoms from their COVID-19. In those reporting symptoms of COVID-19 infection, those reported by five or more patients included cough (n=24), fever (n=21), headache (n=12), anosmia (n=11), myalgia (n=11), shortness of breath (n=11), vomiting or nausea (n=8), arthralgia (n=8), altered taste (n=6) and sore throat (n=6). Medication treatment for COVID-19 included nil (n=32), hydroxychloroquine (n=7), azithromycin (n=3), lopinavir/ritonavir (n=2), glucocorticoids (n=2), IL-1β inhibitor (n=1) and colchicine (n=1). Outcomes of COVID-19 infection were: not hospitalised (n=29), hospitalised and no oxygen given (n=8) and hospitalised requiring supplemental oxygenation (n=2). None of the patients died. Outcomes compared to non-pregnant women of child bearing age from the COVID-19 Global Rheumatology Alliance are shown in Table 2.

Patients Requiring Supplemental Oxygen

Two patients required supplemental oxygen. The first was a 31-year-old woman with rheumatoid arthritis. She was on no specific anti-rheumatic treatment or glucocorticoids. COVID-19 was diagnosed by PCR. Her symptoms were of fever, cough, shortness of breath (SOB), myalgia and malaise. She was hospitalised and was lymphopaenic. She was treated with anti-malarials and glucocorticoid for COVID-19. She was symptomatic for ten days from the onset of COVID-19 symptoms to their resolution. The second patient who received supplemental oxygen was a 29 year old woman with the reported diagnosis of 'other inflammatory arthritis'. She was also on no specific anti-rheumatic treatment or

glucocorticoids. She was reported to have been diagnosed with COVID-19 by an unknown laboratory test. Her presenting symptoms were of cough and SOB. She was hospitalised and her lymphopaenia status was not reported. She received no specific COVID-19 treatment. She was symptomatic for seven days from onset of COVID-19 symptoms.

Pregnancy Information

Pregnancy information was available on 22 of 39 patients. Most were singleton pregnancies with one set of twins. The mean previous pregnancies per women were 3.6 (SD 2.5), and mean previous live births were 2.0 (SD 1.3). Three women were diagnosed with COVID-19 in the first trimester (0-12 weeks), 13 in the second trimester (13-28 weeks), and 6 in the third trimester (≥29 weeks). The mean gestation at COVID-19 infection was 23.3 (SD 9.0) weeks. Pregnancy outcome at the time of data collection is shown in Table 3. No women delivered due to their COVID-19 infection. There were 10 caesarean deliveries, 8 vaginal deliveries, 2 not delivered at the time of the report, one miscarriage and one termination (9 weeks, reasons not specified).

DISCUSSION

Using data from a global registry, we report on outcomes of 39 pregnant women with rheumatic diseases who developed COVID-19. Ten patients were hospitalized but only two required supplemental oxygen. There were no deaths.

The C19-GRA have previously reported that in persons with rheumatic conditions, older age, comorbidities and higher doses of prednisone, high disease activity and some specific medications were associated with poorer outcomes (4, 8). However, information on outcomes of pregnant women with rheumatic conditions remain limited. Recent data from the Centers

for Disease Control (CDC) suggests that pregnant women with COVID-19 infection are more likely to be hospitalized and require mechanical ventilation and may have a higher likelihood of death compared to non-pregnant women(3). Similarly in a report from the United Kingdom of 427 pregnant women admitted to the hospital, 10% required mechanical ventilation and 1% died(12). Importantly, half of these hospitalized patients were from racial and ethnic minorities. Similarly, in the non-pregnant patients from the GRA registry, odds of poor outcome were increased in ethnic minorities in the US (13). The presence of rheumatic disease and rheumatic disease medication also has the potential to influence outcome in pregnant women.

In our small patient series, the co-existence of a systemic rheumatologic disease and pregnancy did not portend worse outcomes from COVID-19 infection than what has been observed in the general population of pregnant women.

Our study is limited in that the patient number is small and we have incomplete data on obstetric outcomes. As the C19-GRA registry data are voluntarily submitted, there may be selection bias in reported cases with more complex rheumatic diseases and active disease being reported as well as the bias that more severe COVID-19 cases are more likely to be included in the registry. Thus, the data in the registry cannot address the individual risk infection, morbidity or pregnancy outcome. In addition, our patients were young, had few co-morbidities and were on low glucocorticoid doses, all of which may have contributed to a more benign course. Finally, these findings are purely descriptive. Further data that are collected on pregnant patients within the C19-GRA registry will be analysed to inform disease and pregnancy outcomes for women with rheumatic diseases who are pregnant and have COVID-19. A priority is collecting data on obstetric and fetal outcomes in this group of patients.

In conclusion, pregnancy and COVID-19 outcomes in pregnant patients with systemic rheumatic disease were relatively benign in this patient series. However, data on all pregnancy outcomes and whether there were any cases of vertical transmission to infants is not available. Additional cases with greater granularity of data regarding pregnancy and fetal outcomes in the rheumatic disease population will greatly enhance our knowledge in this area.

Disclaimer: The views expressed here are those of the authors and participating members of the COVID-19 Global Rheumatology Alliance, and do not necessarily represent the views of the American College of Rheumatology (ACR), the European Alliance of Associations for Rheumatology (EULAR), the (UK) National Health Service (NHS), the National Institute for Health Research (NIHR), or the (UK) Department of Health, or any other organisation.

References

1. Sammaritano LR, Bermas BL, Chakravarty EE, Chambers C, Clowse MEB, Lockshin MD, et al. 2020 American College of Rheumatology Guideline for the Management of Reproductive Health in Rheumatic and Musculoskeletal Diseases. Arthritis Rheumatol. 2020;72:529-56.
2. Andreoli L, Bertsias GK, Agmon-Levin N, Brown S, Cervera R, Costedoat-Chalumeau N, et al. EULAR recommendations for women's health and the management of family planning, assisted reproduction, pregnancy and menopause in patients with systemic lupus erythematosus and/or antiphospholipid syndrome. Ann Rheum Dis. 2017;76:476-85.
3. Zambrano LD, Ellington S, Strid P, Galang RR, Oduyebo T, Tong VT, et al. Update: Characteristics of Symptomatic Women of Reproductive Age with Laboratory-Confirmed SARS-CoV-2 Infection by Pregnancy Status - United States, January 22-October 3, 2020. MMWR Morb Mortal Wkly Rep. 2020;69:1641-7.
4. 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;79:859-66.
5. Gianfrancesco M, Yazdany J, Robinson PC. Epidemiology and outcomes of novel coronavirus 2019 in patients with immune-mediated inflammatory diseases. Curr Opin Rheumatol. 2020;32:434-40.
6. Gianfrancesco MA, Hyrich KL, Gossec L, Strangfeld A, Carmona L, Mateus EF, et al. Rheumatic disease and COVID-19: initial data from the COVID-19 Global Rheumatology Alliance provider registries. Lancet Rheumatol. 2020;2:e250-e3.
7. Grainger R, Machado PM, Robinson PC. Novel coronavirus disease-2019 (COVID-19) in people with rheumatic disease: epidemiology & outcomes. Best Practice & Research Clinical Rheumatology. 2021;35:101657.
8. Strangfeld A, Schäfer M, Gianfrancesco M, Lawson-Tovey S, Liew J, Ljung L, et al. Factors Associated with COVID-19-related Death in People with Rheumatic Diseases: Results from the COVID-19 Global Rheumatology Alliance physician-reported registry. Ann Rheum Dis. 2021;80:930-42
9. D'Silva KM, Jorge A, Cohen A, McCormick N, Zhang Y, Wallace ZS, et al. COVID-19 Outcomes in Patients with Systemic Autoimmune Rheumatic Diseases (SARDs) Compared to the General Population: A US Multi-Center Comparative Cohort Study. Arthritis Rheumatol. 2020; e-published 10th December 2020
10. Liew JW, Bhana S, Costello W, Hausmann JS, Machado PM, Robinson PC, et al. The COVID-19 Global Rheumatology Alliance: evaluating the rapid design and implementation of an international registry against best practice. Rheumatology (Oxford). 2021;60:353-8
11. Wallace ZS, Bhana S, Hausmann JS, Robinson PC, Sufka P, Sirotich E, et al. The Rheumatology Community responds to the COVID-19 pandemic: the establishment of the COVID-19 global rheumatology alliance. Rheumatology (Oxford). 2020;59:1204-6.
12. Knight M, Bunch K, Vousden N, Morris E, Simpson N, Gale C, et al. Characteristics and outcomes of pregnant women admitted to hospital with confirmed SARS-CoV-2 infection in UK: national population based cohort study. BMJ. 2020;369:m2107.
13. Gianfrancesco MA, Leykina LA, Izadi Z, Taylor T, Sparks JA, Harrison C, et al. Association of Race and Ethnicity With COVID-19 Outcomes in Rheumatic Disease: Data From the COVID-19 Global Rheumatology Alliance Physician Registry. Arthritis & Rheumatology. 2021;73:374-80.

Table 1: Participant Characteristics and COVID-19 Treatments

Rheumatic Disease Diagnosis*	Number (%)
Systemic Lupus Erythematosus	9 (23%)
Rheumatoid Arthritis	9 (23%)
Other Inflammatory Arthritis	7 (18%)
Antiphospholipid antibody syndrome	6 (15%)
Axial spondyloarthritis	3 (8%)
Systemic sclerosis	2 (5%)
Inflammatory myositis	1 (3%)
Mixed connective tissue disease	1 (3%)
Sjogren's syndrome	1 (3%)
Gout	1 (3%)
ANCA vasculitis	1 (3%)
Psoriatic arthritis	1 (3%)
Takayasu arteritis	1 (3%)
Discoid lupus	1 (3%)
Rheumatic Medication Use at time of infection*	
No medications reported	17 (44%)
Hydroxychloroquine	14 (36%)
Anti-TNF	6 (15%)
Azathioprine	4 (10%)
Sulfasalazine	4 (10%)
Colchicine	1 (3%)
Intravenous immunoglobulin	1 (3%)†
Medication Combinations at time of infection	
Hydroxychloroquine & anti-TNF	2 (5%)
Hydroxychloroquine & azathioprine	3 (8%)
Hydroxychloroquine & sulfasalazine	2 (5%)
Glucocorticoid Use at time of infection	
Any glucocorticoid use	8 (21%)
Glucocorticoid monotherapy	2 (5%)
Glucocorticoid dose ≥ 10 mg/day	1 (3%)
Daily glucocorticoid doses	
2.5mg	1
5mg	6
10mg	1
COVID-19 Treatment*	

No treatment except supportive care	32 (82%)
Anti-malarials (e.g. hydroxychloroquine)	7 (18%)
Azithromycin	3 (8%)
Glucocorticoids	2 (5%)
Lopinavir/ritonavir	2 (5%)
IL-1β inhibitor	1 (3%)
Colchicine	1 (3%)

*Not mutually exclusive; ANCA Anti-neutrophil cytoplasmic antibody; TNF tumour necrosis factor

Table 2: Outcomes in pregnant patients compared to non-pregnant patients

	Pregnant N = 39	Non-Pregnant N = 1878
Not Hospitalized	29 (74%)	1584 (84%)
Hospitalized	10 (26%)	126 (7%)
Hospitalized with supplement oxygen	2 (5%)	127 (7%)
Death	0 (0%)	41 (2%)

Table 3: Pregnancy Outcomes (n=22)

Pregnancy Status	Number	Gestation
Termination	1	9 weeks
Miscarriage	1	<20 weeks
Ongoing	1	19 weeks
Pre-term birth (<37/40)	3	32, 35 and 36 weeks
Term Birth (≥37/40)	16	Median = 39 weeks