



The impact of COVID-19 pandemic on patients with ANCA associated vasculitis

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Abstract

Introduction The coronavirus 2019 (COVID-19) pandemic has brought on challenges not only to acute care, but also chronic care of patients. Individuals maintained on immunosuppression appear to be especially susceptible to COVID-19 infection. Patients with ANCA-associated vasculitis (AAV) frequently require immunosuppression and may be at increased risk for developing COVID-19. The incidence and impact of COVID-19 on patients with AAV is currently not known. We aimed to investigate this impact via a telephone questionnaire-based patient survey and chart review.

Methods A cross-sectional study of AAV patients followed at two centers was conducted. Data regarding demographics, disease characteristics and therapy were confirmed by chart review. A telephone survey was conducted to ascertain symptoms and contact exposure related to COVID-19, as well as changes in health care delivery during the pandemic period between January and July, 2020.

Results Of the 206 patients surveyed, the median age was 64 years, 51% were female and mean (SD) disease duration was 7 (5) years. The majority had kidney (n = 160) and lung (n = 108) involvement. Seventy-five percent (n = 155) were receiving immunosuppression, with 77 patients (50%) receiving rituximab during the pandemic period. Of the 10 patients tested for severe acute respiratory syndrome coronavirus 2 (SARS CoV-2) by PCR, three were positive. Patients had a significant disruption in care; none had an in-person visit and 69% had a telemedicine consultation. Rituximab maintenance was postponed in 21 patients. Twelve patients experienced disease relapse.

Conclusion The incidence of COVID-19 in patients with AAV appears to be similar to that of the general population. For a patient population that requires active clinical surveillance, there is significant disruption in care as a result of the pandemic. Reduction of immunosuppression may not be indicated, and the risk of relapse likely far outweighs the risk of COVID-19.

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Introduction

As the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) disease 2019 (COVID-19) pandemic has evolved, there is concern that immunosuppressed patients, including those with ANCA-associated vasculitis (AAV), may be at increased risk for infection with COVID-19. Initial data involving patients with chronic arthritis on biologic and synthetic disease-modifying anti-rheumatic agents (DMARDs) did not demonstrate an association between immunosuppressive drugs and an increased risk of respiratory complications from COVID-19 [1]. However, a larger analysis of 600 patients with rheumatic disease demonstrated that patients on prednisone > 10 mg/day are at higher risk of hospitalization [2]. The incidence and impact of COVID-19 on care of patients with AAV is currently not known. We

aimed to investigate this impact via a COVID-19-specific telephone survey of AAV patients followed at two centers.

Methods

A cross-sectional study was conducted at the Johns Hopkins Hospital Vasculitis Center (Baltimore, Maryland, USA) and Royal Preston Hospital (Lancashire, UK). A COVID-19-specific telephone survey of all consecutive AAV patients followed at both centers was conducted (Supplement S1). Data regarding demographics, disease characteristics, comorbidities and therapy were confirmed by review of the electronic medical record. Information regarding current and previous therapies was collected. Ethical approval for this study was received from the institutional review board at Johns Hopkins University School of Medicine and the UK Health Research Authority and Confidentiality Advisory Group. All except one rituximab infusion at Preston was delivered in a COVID-free, non-acute clinical area.

We contacted patients between May 1st and July 23rd, 2020 to ascertain the presence of symptoms and contact exposure related to COVID-19, along with results of nasopharyngeal swabs. We also sought information regarding practice of personal protective measures (PPMs), contact exposure, travel to high-risk areas in Europe, United States and China, quarantine status and effect on delivery of health care during the period of pandemic from January to June 2020.

Descriptive data are presented as mean with standard deviation and median with range. Characteristics between the two cohorts are compared using the 2 tailed T-test for continuous variable and chi-square test or Fisher's exact test for categorical variables. All tests of significance were two sided and differences were considered significant if the p-value was less than 0.05.

Results

Of 206 patients, the median age was 64 years, 51% were female and the mean (SD) disease duration was 7 (5) years. The majority had kidney ($n = 160$, 78%) and lung ($n = 108$, 52%) involvement, with 36% ($n = 75$) having sino-nasal disease. Significant differences in age ($p = 0.003$), race ($p = 0.002$), disease type ($p = 0.3$), and co-morbidities ($p = 0.001$) were identified between the two cohorts. A history of relapsing disease was present in 39% ($n = 81$), with 64% ($n = 132$) and 77% ($n = 158$) having prior exposure to cyclophosphamide (CYC) and rituximab, respectively. Seventy-five percent ($n = 155$) were receiving immunosuppression, with 50% ($n = 77$) of these patients receiving rituximab during the pandemic period. Details of regimens

of immunosuppression and co-morbidities are presented in Tables 1 and 2.

Since the start of the pandemic (January 2020), all but one patient followed PPMs to decrease the risk of COVID-19 infection. Nearly all patients reported using a facemask/shield (97%), practiced social distancing (98%), washing hands frequently (92%) and 177 patients (83%) reported following all three PPMs. A majority ($n = 193$) of patients who completed the survey did not have symptoms of infection. Seven patients experienced cough, 6 had dyspnea, 4 patients each developed fever and myalgias. Seven of the symptomatic patients were not tested for COVID-19 infection and reported self-resolution of symptoms at the time of the survey. In total ten (four asymptomatic and six symptomatic) patients underwent PCR testing for COVID-19, of which only 3 were positive. Most patients self-quarantined after potential/confirmed COVID-19 exposure, with none developing COVID-19. Regarding delivery of care, 69% had video visits, none had in-person visits, and 13% of visits were rescheduled. Rituximab maintenance therapy was postponed in 21 patients. Twelve patients experienced disease relapse during this period. COVID-19 specific variables are represented in Table 3.

Of the three patients who developed COVID-19, two were PR3 positive with one MPO positive. Two patients were on remission maintenance with azathioprine, while one was receiving remission induction with rituximab for active vasculitis. All patients had symptoms of fever and dyspnea, with a duration of 1–9 days prior to confirmation of COVID-19. The two patients in remission required admission to intensive care; one required supplemental oxygen and the other non-invasive ventilation. In both cases, maintenance immunosuppression was held, and one received steroids. The third patient received a reduced dose of 1 g rituximab for remission induction as they tested positive for COVID-19 within 24 h of drug administration. They did not experience any serious complications of infection and were monitored as an outpatient. Recovery from COVID-19 identified by symptom resolution in three patients (negative viral testing in one patient). Median time to recovery was 25 days (range 3–64 days).

Twelve patients had disease relapse. Details of disease characteristics, maintenance therapy and immunosuppression at the time of relapse are presented in Table 4. Mean (SD) age was 67 (10) years with a mean (SD) disease duration of 5(3) years. Seven were PR3-ANCA positive and two had a history of relapsing disease. Organs involved at relapse included kidney in four patients and lung in three patients, while there was ENT involvement in three patients and neuropathy in two. At the time of relapse, all patients were on maintenance immunosuppression. Among the five patients on rituximab for remission maintenance, one missed a scheduled rituximab infusion, and rituximab infusion was

Table 1 Baseline demographics and clinical characteristics

AAV-specific variables	Number of subjects n = 206	Entire cohort n = 206	Hopkins n = 117	Preston n = 89	p-value
Age	Mean years (SD)	64 (14)	61 (15)	68 (11)	0.0003
Gender, n (%)	Female	106 (51)	66 (56)	40 (45)	0.1
Race, n (%)	White	184 (89)	97 (83)	87 (98)	
	African-American	12 (6)	12 (10)	0 (0)	0.002
	Other	10 (5)	8 (7)	2 (2)	
Diagnosis, n (%)	GPA	116 (56)	63 (54)	53 (59)	
	MPA	68 (33)	46 (39)	22 (25)	0.03
	EGPA	22 (11)	8 (7)	14 (16)	
Disease duration	Mean years (SD)	6.77 (5)	7.2 (6)	6.2 (4)	0.2
ANCA type, n (%)	PR3	104 (50)	59 (50)	45 (51)	0.7
	MPO	93 (45)	55 (47)	38 (43)	
	Negative	9 (4)	3 (3)	6 (7)	
Organs involved, n (%)	Kidney	161 (78)	97 (83)	64 (72)	0.06
	Lung	108 (52)	68 (58)	40 (45)	0.06
	Ears	16 (8)	12 (10)	4 (4)	0.1
	Eyes	29 (14)	19 (16)	10 (11)	0.3
	Nose and sinus	75 (36)	42 (36)	33 (37)	0.9
	Heart	3 (1)	2 (2)	1 (1)	0.7
	GI tract	7 (3)	5 (4)	2 (2)	0.4
	Nerves	29 (14)	16 (14)	13 (15)	0.8
	Skin	32 (16)	14 (12)	18 (20)	0.1
	Joints	35 (17)	21 (18)	14 (16)	0.7
History of vasculitis relapse, n (%)		81 (39)	42 (36)	39 (44)	0.3
Current use of ACE inhibitors, n (%)		40 (19)	29 (25)	11 (12)	0.1
Current use of ARBs, n (%)		45 (22)	25 (21)	20 (22)	0.1
Comorbidities, n (%)					0.001
	Hypertension	129 (63)	91 (78)	38 (43)	2E-7
	Diabetes	24 (12)	12 (10)	12 (13)	0.5
	Heart disease	23 (11)	11 (9)	12 (13)	0.4
	Cerebrovascular disease	4 (2)	1 (1)	3 (3)	0.2
	Chronic kidney disease	128 (62)	68 (58)	62 (70)	0.09
	Dialysis	6 (3)	5 (4)	1 (1)	0.2
	Organ transplant	8 (4)	8 (7)	0 (0)	0.01
	Cancer	15 (7)	5 (4)	10 (11)	0.06
	No comorbidities	26 (13)	17 (14)	9 (10)	0.3

Table 2 Details of immunosuppression regimen

	Prior use			Current use		
	Entire cohort	Hopkins	Preston	Entire cohort	Hopkins	Preston
Cyclophosphamide, n (%)	132 (64)	61 (52)	71 (80)	6 (3)	0 (0)	6 (7)
Rituximab, n (%)	158 (77)	95 (81)	63 (71)	107 (52)	54 (46)	53 (59)
Received rituximab after June 2019, n (%)	–			105 (51)	58 (50)	47 (53)
Rituximab use during pandemic period, n (%)	–			77 (38)	39 (33)	38 (43)
Prednisone, n (%)	204 (99)	116 (99)	88 (99)	96 (47)	53 (45)	43 (48)
Methotrexate, n (%)	21 (10)	12 (10)	9 (10)	6 (3)	4 (3)	2 (2)
Azathioprine, n (%)	63 (31)	33 (28)	30 (34)	17 (8)	9 (8)	8 (9)
Mycophenolate mofetil, n (%)	41 (20)	16 (14)	25 (28)	22 (11)	11 (9)	11 (12)
Leflunomide, n (%)	3 (1)	3 (3)	0 (0)	3 (1)	3 (3)	0 (0)

Table 3 COVID-19 exposure, health care delivery and outcomes

Contact with COVID-19 infected individual, n (%)	5 (2)
Traveled to high risk areas since December 2019, n (%)	3 (1)
Quarantined for COVID-19 infection, n (%)	3 (1)
Symptoms, n (%)	
No symptoms	193 (94)
Fever	4 (2)
Cough	7 (3)
Dyspnea	6 (3)
Headache	2 (1)
Altered smell/taste	1 (0)
Sore throat	2 (1)
Muscle ache	4 (2)
Nausea, vomiting, diarrhea	2 (1)
Tested for COVID-19, n (%)	10 (5)
COVID-19 test result, n (%)	
Positive	3 (30)
Negative	7 (70)
Relapse during pandemic, n (%)	
Yes	12 (6)
Measures taken to prevent COVID-19, n (%)	
None	1 (0)
Social distancing	202 (98)
Face mask	199 (97)
Hand washing	190 (92)
All of the above	171 (83)
Changes in health care during pandemic period, n (%)	
None	23 (11)
Regular in-person visit with physician	0 (0)
Video visits with physician	142 (69)
Rescheduled clinic visits	26 (13)
Missed medications for at least 1 day	1 (0)
Reduced medication dosage	14 (7)
Maintenance rituximab infusion postponed	21 (10)
Decreased blood draw frequency	33 (16)

postponed in a second patient in the setting of the pandemic. Rituximab with prednisone was used for remission induction treatment for these relapses in nine patients and one patient each received induction therapy with cyclophosphamide and prednisone, increase in doses of azathioprine, trimethoprim–sulfamethoxazole and prednisone. There were no cases of COVID-19 infection among patients experiencing disease relapse.

Discussion

The era of the COVID-19 pandemic has been challenging for longitudinal management of patients with chronic disease. Health authorities continue to advise that patients

on immunosuppression are at higher risk for COVID-19 infection [3]. There is no current evidence-based guidance on the use of immunosuppression in patients with AAV during the pandemic, a disease frequently associated with high rates of relapse in the absence of maintenance therapy. Additionally, patients with rheumatic diseases have not been included in many large studies of patients with COVID-19 [4–6]. This hinders understanding of susceptibility for infection, along with outcomes associated with COVID-19 in this population.

Preliminary data regarding the incidence of COVID-19 in patients with autoimmune diseases are available via a survey done in Tuscany, Italy [7]. An incidence rate of 0.22% has been reported, comparable to that observed in the general population of Tuscany. However, < 10% (n = 40) of patients in this cohort represented patients with AAV, with none reported to have COVID-19. A Spanish consortium reported that COVID-19 disease course and mortality in patients with rheumatic disease on biologic therapies did not differ from the general population [8]. Further, the incidence of hospitalizations among patients with autoimmune diseases is similar to patients with COVID-19 in the general population [9]. Additionally, all of the aforementioned report incidence and clinical course of COVID-19 in patients with rheumatic disease at large, with the inclusion of only a minority of patients with AAV (Table S1). With respect to our study, the overall incidence of COVID-19 in our cohort of AAV patients is 1.4%, which is close to the current cumulative incidence of 1.2% in the United States [10]. These findings are encouraging and demonstrate that patients with AAV on immunosuppression may not be at higher risk for COVID-19 in comparison to the general population. The majority of patients surveyed followed guidelines with personal protective measures, which mitigates infection in this high-risk cohort.

Regular outpatient surveillance with serial measurement of ANCA titers and B-cell kinetics are the best practice for detection of disease relapse [11, 12]. Measures to decrease healthcare encounters were evident in most patients. Various centers will need to devise alternate methods to adapt to conditions borne as a result of the pandemic, balancing potential viral exposures with the need for robust monitoring of AAV.

Based on experience from SARS-CoV and MERS-CoV, glucocorticoid use has been associated with delayed viral clearance from blood and the respiratory tract [13, 14]. Minimizing the use of glucocorticoids may be another approach to lessen the effects of COVID-19 in patients with AAV. All patients receiving maintenance steroid therapy from both centers were on less than 10 mg/day of prednisone (most on < 5 mg/day), with none requiring hospitalization. This further supports data from the COVID-19 Global Rheumatology alliance which showed that steroid dosage > 10 mg is associated with higher rates of hospitalization [2].

Table 4 Characteristics and outcome of relapses during pandemic

Patient no	Disease duration (years)	Disease type	ANCA type	Prior maintenance Tx	IS at time of relapse	Organs involved at relapse	Relapse Tx
1	3	MPA	MPO	RTX	RTX ^a	Kidney	RTX + P
2	4	GPA	PR3	RTX	RTX ^b	Kidney, lung	RTX + P
3	10	MPA	MPO	MMF + P	MMF + P	Kidney	RTX
4	1.9	MPA	MPO	RTX + P	RTX + P	Peripheral nerves	RTX + P
5	2	MPA	MPO	None	MMF + P	Lung	RTX
6	4.6	GPA	PR3	MMF + P	MMF + P	ENT	TMP–SMZ
7	2	GPA	PR3	P + TMP–SMZ	P + TMP–SMZ	Lung	RTX
8	8	GPA	PR3	AZA + TMP–SMZ	AZA	ENT	AZA + TMP–SMZ
9	2	EGPA	PR3	RTX + TMP–SMZ	RTX	Kidney	RTX + P
10	2	GPA	PR3	MTX + P	MTX + P	Eyes	RTX + P
11	6	GPA	Negative	MMF + P	MMF + P	ENT	CYC + P
12	10.5	GPA	PR3	RTX	RTX	Peripheral nerves	RTX + P

Tx treatment, MPA microscopic polyangiitis, GPA granulomatosis with polyangiitis, EGPA eosinophilic granulomatosis with polyangiitis, MPO myeloperoxidase, PR3 proteinase 3, RTX rituximab, MMF mycophenolate mofetil, P prednisone, TMP–SMZ trimethoprim–sulfamethoxazole, AZ: azathioprine, MTX methotrexate, CYC cyclophosphamide

^aRTX postponed by physician

^bRTX infusion canceled by patient

There continues to be a lack of evidence-based guidance for the use of rituximab in patients with AAV during the pandemic. Experience with rituximab use in the context of COVID-19 has been reported in multiple sclerosis and pemphigus vulgaris [15, 16]. Patients with multiple sclerosis on anti-CD20 therapy had adequate resolution of COVID-19 [15]. A case series of pemphigus vulgaris patients on rituximab demonstrated that only 5/147 patients developed COVID-19, with none requiring hospitalization [16]. An Italian survey of 159 pediatric patients with relapsing nephrotic syndrome treated with anti-CD20 antibodies identified no cases of COVID-19 infection [17]. Severe respiratory presentations of COVID-19 have been reported immediately post rituximab therapy in patients with rheumatic disease [18, 19], albeit one of the reports does hypothesize that rituximab may have limited the cytokine storm and delayed worsening of clinical status of a patient with AAV [19]. Indeed, our patient tested positive for COVID-19 immediately post rituximab administration and had an uneventful course despite being elderly. In addition, a case series of patients with autoimmune disease has shown that baseline biologic therapy use is not associated with worse COVID-19 outcomes [9]. Twenty-one (30%) of 77 patients on maintenance rituximab therapy had postponement of infusion in our study. Two (10%) of the 21 patients with postponement had evidence of disease relapse. Most concerning, 6% (n = 12) of patients in the overall cohort had disease relapse. Furthermore, all relapsing patients were on maintenance immunosuppression with no alteration to their regimen in all but two patients.

These high relapse rates may be attributable to lack of in-person consultation required to gauge extra-renal relapses. Based on these data, it is possible that the risk of relapse may outweigh the risk of COVID-19 infection in the setting of immunosuppression withdrawal.

Our study is not without limitations. The study was conducted in centers with different healthcare systems, with differences in incidence of COVID-19 and the majority of patients being Caucasian and an absence of a control group for comparison. Only ten patients underwent COVID-19 testing and hence the incidence of asymptomatic carrier state or masked symptoms related to COVID-19 cannot be ascertained, especially whilst being on immunosuppression. The lack of a control group limits epidemiological conclusions from this study. Despite these limitations, this is the first study assessing the impact of COVID-19 infection in AAV patients, and the majority of the patients surveyed were on immunosuppression, representative of the AAV population.

Our data demonstrate that continual monitoring of AAV patients during the pandemic is paramount. Patients with AAV have similar incidence of COVID-19 in comparison to the general population. These data also support that withdrawal of maintenance therapy to prevent COVID-19 may not be advisable in most circumstances and may be associated with disease relapse. A balanced approach to continuation versus withdrawal of therapy needs to be tailored to the risk of infection and disease relapse in the era of the pandemic. Continued safe use of immunosuppression is on the basis that all patients utilize PPMs as demonstrated in our cohort. Our experience with relapse treatment demonstrates

that current induction therapy can be safely administered during the pandemic.

Compliance with ethical standards

Conflict of interest DG reports being consultant to ChemoCentryx and Aurinia. The other authors do not report any conflict of interest.

Ethical statement The study was approved by the Institutional review board of both the hospitals.

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