Clinical Features of COVID-19 Infection in Patients Treated at a Large Veterans Affairs Medical Center

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ABSTRACT

Introduction: During recent months, reports describing the characteristics of COVID-19 patients in China, Italy, and the United States have been published. Military veterans represent another unique population affected by COVID-19. This report summarizes the demographics and baseline clinical comorbidities in veterans testing positive for COVID-19 in Milwaukee, Wisconsin.

Methods: Patient evaluations were conducted at the Zablocki VA Medical Center, Milwaukee, Wisconsin between March 11 and June 1, 2020. Patient demographics, baseline comorbidities, home medications, presenting symptoms, and outcomes were obtained via electronic medical record.

Results: Ninety-five patients (88 men, 7 women) tested positive for COVID-19 and were evaluated. Fourteen required mechanical ventilation; 50 and 31 patients were treated in the hospital without ventilation or were discharged to home isolation, respectively. Discharged patients were younger than patients hospitalized. Most patients with COVID-19 were African American (63.2%). Patients whose disease progressed to mechanical ventilation had, on admission, more dyspnea, higher heart and respiratory rates, and lower oxygen saturation than other patients. COVID-19 patients who required mechanical ventilation had a longer length of stay and higher mortality than other groups and were more likely to have a history of hypertension and hyperlipidemia than patients who were discharged to home quarantine (85.7% and 78.6% vs 48.4% and 45.2%, respectively; $P < 0.05$ for each).

Conclusion: COVID-19-positive veterans are predominantly African American men with hypertension and hyperlipidemia receiving beta blockers or ACEi/ARB. COVID-19-positive veterans who presented with dyspnea, tachypnea, tachycardia, and hypoxemia were more likely to require endotracheal intubation and mechanical ventilation, had longer hospital length-of-stay, and experienced greater mortality than comparison groups.

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INTRODUCTION

The first confirmed case of coronavirus disease 2019 (COVID-19) in the United States was identified in the state of Washington on January 31, 2020. At this writing (October 6, 2020), more than 7.6 million cases and 212,485 deaths have been reported in the US alone.[1] Clinical reports recently have appeared in the medical literature, most often originating from countries with the greatest numbers of cases, including China,[2,3] Italy,[4,5] and the US,[6-9] that describe the risk factors, clinical features, and treatment of patients with COVID-19. Despite the similarities in the disease presentation across different cultures, ethnicities, and socioeconomic situations, the goals of reports differ, making each report unique. For example, investigators from New York City reported on the most common comorbidities associated with hospital admission with COVID-19 and found a higher prevalence of hypertension, obesity, and diabetes.[8] Another study of COVID-19 patients in Chicago focused on risk factors for severe respiratory complications and noted that elderly diabetic males were the population at highest risk.[9]

Military veterans represent another unique population that has been affected by COVID-19. Patients treated at Veterans Affairs (VA) hospitals are known to have more medical comorbidities and psychiatric conditions of prolonged chronicity and greater severity versus those in the civilian population.[10] VA patients are predominately older men who are more likely to be unemployed,

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financially disadvantaged, have less medical knowledge, and more often belong to a minority group than those treated in other institutions.[11,12] The authors reviewed their experience with COVID-19 at the Clement J. Zablocki VA Medical Center in Milwaukee, Wisconsin, and compared the demographic characteristics, comorbid conditions, treatment, and outcome of these patients with those described in other US general hospital populations.

METHODS

Patients treated for COVID-19 between March 11, 2020 and June 1, 2020 were included in the evaluation, which was approved by the Clement J. Zablocki VA Medical Center Institutional Review Board. Only patients with confirmed COVID-19 infection identified using the reverse transcriptase polymerase chain reaction test of nasopharyngeal or oropharyngeal swabs were included. The VA clinical pharmacy conducted these tests. Patients admitted to the hospital or those presenting to the emergency department with signs or symptoms consistent with COVID-19 (eg, fever, sore throat, dyspnea, cough), those with known exposure to subjects who were COVID-19 positive, or those who had a high index of clinical suspicion of infection were tested. Veterans with COVID-19 were classified into 3 groups: those requiring mechanical ventilation for respiratory failure, those admitted to the hospital but not requiring mechanical ventilation, and those who were evaluated in the emergency department and discharged to home isolation. Patient demographics, chronic medical conditions, medications, presenting signs and symptoms, treatment, and outcomes were recorded from the hospital's electronic medical record system.

Descriptive statistics were used to characterize each group of patients. Categorical variables were compared using chi-square or Fisher exact probability test as appropriate. Continuous variables were compared using one-way analysis of variance followed by application of Student *t* test with Bonferroni correction for multiplicity. The null hypothesis was rejected when the probability value was less than 0.05.

Table 1. Demographics, Vital Signs, and Presenting Symptoms

	Mechanical Ventilation	Hospital Admission	Home Isolation	Total
Number (%)	14 (14.7%)	50 (52.6%)	31 (32.6%)	95
Men/women	14/0	47/3	27/4	88/7
Age (years)	678	7±11	57±14[a,b]	65±13
Height (cm)	180±6	178±8	178±10	178±8
Weight (kg)	96±22	94±22	99±25	96±23
Body mass index (kg/m^2)	30±6	29±6	31±7	30±6
Racial Ethnicity				
White (%)	4 (28.6%)	22 (44.0%)	8 (25.8%)	34 (35.8%)
African American (%)	10 (71.4%)	28 (56.0%)	22 (71.0%)	60 (63.2%)
Asian American (%)	0 (0.0%)	0 (0.0%)	1 (3.2%)	1 (1.1%)
Vital Signs				
Heart rate (beats per minute)	103±16	92±17[a]	85±13[a,b]	92±17
Systolic arterial pressure (mmHg)	133±24	136±20	143±26	137±23
Diastolic arterial pressure (mmHg)	79±17	76±12	81±12	78±13
Respiratory rate (breaths per minute)	28±11	22±7[a]	18±3[a,b]	22±8
Oxygen saturation (%)	86±9	94±5[a]	97±2[a,b]	94±6
Presenting Symptoms				
Fever (%)	8 (57.1%)	33 (66.0%)	12 (38.7%)[b]	53 (55.8%)
Chills (%)	3 (21.4%)	15 (30%)	9 (29.0%)	27 (28.4%)
Cough (%)	7 (50%)	30 (60%)	20 (64.5%)	57 (60.0%)
Dyspnea (%)	12 (85.7%)	27 (54.0%)[a]	12 (38.7%)[a]	51 (53.7%)
Malaise (%)	7 (50%)	20 (40%)	8 (25.8%)	35 (36.8%)
Myalgias (%)	5 (35.7%)	6 (12%)	15 (48.4%)[b]	26 (27.4%)
Headache (%)	2 (14.3%)	12 (24%)	10 (32.3%)	24 (25.3%)
Gastrointestinal complaints (%)	3 (21.4%)	11 (22.0%)	10 (32.3%)	24 (25.3%)
Loss of smell or taste (%)	1 (7.1%)	6 (12.0%)	5 (16.1%)	12 (12.6%)

Data are numbers (percentages) or mean±standard deviation.
[a]Significantly ($P<0.05$) different from mechanical ventilation.
[b]Significantly ($P<0.05$) different from hospital admission.

RESULTS

A total of 95 patients (88 men, 7 women) tested positive for COVID-19 and were included in this evaluation (Table 1). Fourteen patients required mechanical ventilation, whereas 50 and 31 patients were treated in the hospital without ventilation or were discharged to home isolation, respectively. Discharged patients were younger (age 57 years +/- 14 years) than those who were intubated (age 67 years +/- 8 years) or hospitalized (age 70 years +/- 11 years). The majority of patients with COVID-19 were African American (63.2%); no differences in racial ethnicity were observed between treatment groups. COVID-19-positive patients receiving mechanical ventilation had higher initial heart rate and respiratory rate and lower oxygen saturation (assessed coincident with COVID-19 testing) than those who did not have respiratory failure (103±16 beats/minute, 28±11 breaths/minute, and 86±9% vs 92±16 beats/minute, 22±7 breaths/minute, and 94±5%, respectively; $P<0.05$ for each). Hospitalized patients had similar derangements in vital signs compared with those who were discharged. No differences in systolic or diastolic arterial pressure were observed between treatment groups. COVID-19 patients who subsequently required mechanical ventilation were more likely report dyspnea as a presenting symptom (85.7%) than those who did not. Patients released to home isolation were less likely to present with fever but more likely to complain of myalgias versus those who were hospitalized. No differences in other presenting symptoms were observed between groups.

COVID-19 patients who required mechanical ventilation

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were more likely to have a history of hypertension and hyperlipidemia than their counterparts who were discharged to home isolation (85.7% and 78.6% vs 48.4% and 45.2%, respectively; $P < 0.05$ for each, Table 2). No differences in other medical or psychiatric comorbidities were observed between treatment interventions. Hospitalized patients were more likely to be chronically treated with beta blockers, angiotensin converting enzyme inhibitors/angiotensin receptor blockers (ACEi/ARB), and insulin than those who were discharged. Treatment of COVID-19-positive patients with antibiotics and antiviral and antimalarial medications was similar and independent of the need for intubation and mechanical ventilation (Table 3). Ventilated patients were more likely to be initially treated with humidified high-flow nasal cannula oxygen therapy (Vapotherm, Exeter, New Hampshire) and receive systemic anticoagulation than those who did not require endotracheal intubation. The duration of mechanical ventilation was 186 ± 149 hours. Hospital length-of-stay and mortality were greater for COVID-19-positive patients who were ventilated compared with those who were not (16 ± 8 days and 28.7% vs 7 ± 4 days and 0%, respectively; $P < 0.05$ each).

Table 2. Medical History and Medications

	Mechanical Ventilation	Hospital Admission	Home Isolation	Total
Medical history				
Coronary artery disease (%)	5 (35.7%)	10 (20.0%)	2 (6.5%)	17 (17.9%)
Hypertension (%)	12 (85.7%)	42 (84.0%)	15 (48.4%)[a,b]	69 (72.6%)
Hyperlipidemia (%)	11 (78.6%)	28 (56.0%)	14 (45.2%)[a]	53 (55.8%)
Diabetes mellitus (%)	9 (64.3%)	26 (52.0%)	11 (35.5%)	46 (48.4%)
Peripheral vascular disease (%)	3 (21.4%)	4 (8.0%)	1 (3.2%)[b]	8 (8.4%)
Stroke (%)	1 (7.1%)	1 (2.0%)	0 (0.0%)	2 (2.1%)
Chronic kidney disease (%)	3 (21.4%)	15 (30.0%)	1 (3.2%)	19 (20.0%)
COPD (%)	4 (28.6%)	5 (10%)	2 (6.5%)	11 (11.6%)
Obstructive sleep apnea (%)	6 (42.9%)	13 (26.0%)	5 (12.3%)	24 (25.3%)
Obesity (%)	5 (35.7%)	25 (50.0%)	9 (29.0%)	39 (41.1%)
Tobacco use disorder (%)	10 (71.4%)	37 (74.0%)	22 (71.0%)	69 (72.6%)
Psychiatric disorder (%)	9 (64.3%)	26 (52.0%)	18 (58.1%)	53 (55.8%)
Medications				
Beta blocker (%)	7 (50%)	24 (48.0%)	4 (12.9%)[a,b]	35 (36.8%)
ACE/ARB (%)	8 (57.1%)	24 (48.0%)	8 (25.8%)[a]	40 (42.1%)
Calcium channel blocker (%)	4 (28.6%)	22 (44.0%)	7 (22.6%)	33 (34.7%)
Diuretic (%)	2 (14.3%)	6 (12.0%)	4 (12.9%)	12 (12.6%)
Nitrate (%)	2 (14.3%)	3 (6.0%)	0 (0.0%)	5 (5.3%)
Hydralazine (%)	1 (7.1%)	2 (4.0%)	0 (0.0%)	3 (3.2%)
Insulin (%)	4 (28.6%)	15 (30.0%)	2 (6.5%)[b]	21 (22.1%)
Oral hypoglycemic (%)	7 (50%)	17 (34.0%)	8 (25.8%)	32 (33.7%)
Statin (%)	8 (57.1%)	32 (64.0%)	13 (41.9%)	53 (55.8%)
Inhaled bronchodilator (%)	7 (50%)	16 (32.0%)	15 (48.4%)	38 (40.0%)

Abbreviations: COPD, chronic obstructive pulmonary disease; ACE, angiotensin converting enzyme; ARB, angiotensin receptor blockers.
Data are numbers (percentages) or mean ± standard deviation.
[a]Significantly ($P < 0.05$) different from mechanical ventilation.
[b]Significantly ($P < 0.05$) different from hospital admission.

Table 3. Treatment of Hospitalized Patients

	Mechanical Ventilation	Hospital Admission	Total
Intensive care unit admission	14 (100%)	16 (32.0%)[a]	30 (31.6%)
Medications and interventions			
Antibiotic (%)	10 (71.4%)	23 (46.0%)	33 (34.7%)
Antiviral (%)	2 (14.3%)	1 (2.0%)	3 (3.2%)
Antimalarial (%)	10 (71.4%)	24 (48.0%)	34 (35.8%)
Inhaled bronchodilator (%)	2 (14.3%)	7 (14.0%)	9 (9.5%)
High-flow nasal cannula (%)	5 (35.7%)	0 (0.0%)[a]	5 (5.3%)
Anticoagulant (%)	5 (35.7%)	0 (0.0%)[a]	5 (5.3%)
Steroid (%)	1 (7.1%)	0 (0.0%)	1 (1.1%)
Mechanical ventilation duration (hours)	186 ± 149	--	186 ± 149
Length of stay (days)	16 ± 8	7 ± 4[a]	9 ± 6
Mortality (%)	4 (28.7%)	0 (0.0%)[a]	4 (4.2%)

Data are numbers (percentages) or mean ± standard deviation.
[a]Significantly ($P < 0.05$) different from mechanical ventilation.

DISCUSSION

The results of our study indicate that COVID-19-positive veterans were predominantly African American men. Individual health factors and medical treatments more often associated with a veteran infected with COVID-19 were hypertension, hyperlipidemia, receiving a beta blocker or an ACEi/ARB. The COVID-19-positive veterans who presented with dyspnea, tachypnea, tachycardia, and hypoxemia were more likely to require endotracheal intubation and mechanical ventilation, had longer hospital length-of-stay, and experienced greater mortality. In contrast, the afebrile COVID-19-positive patients with normal oxygen saturation and myalgias upon presentation were more likely to convalesce and isolate at home.

Our findings in veterans are similar, but not identical to those reported in other populations. Older age, male sex, obesity, congestive heart failure, and chronic kidney disease were previously cited as risk factors in a large analysis of hospitalized COVID-19-positive patients in New York City.[13] A study of COVID-19 patients in Chicago reached conclusions similar to those reported here and merits attention because of Chicago's geographic proximity to the Milwaukee metropolitan area from which most of our veterans originate. Multivariable logistic regression analysis identified age, sex, respiratory rate, oxygen saturation, history of dia-

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betes, and shortness of breath as factors predictive of intubation.[9] Our results confirmed the importance of signs and symptoms of respiratory compromise as risk factors for the need for mechanical ventilation in COVID-19-positive veterans, whereas obesity and diabetes were not uniformly implicated. The association of obesity with outcomes may be due to fundamental alterations in respiratory mechanics[14,15] and the presence of proinflammatory cytokines known to inhibit the immune response.[16,17] Coronary artery disease, diabetes, stroke, and chronic kidney disease were not associated with an increased risk of acquiring COVID-19 in our veteran patients, whereas these diseases have been identified as risk factors for the development of adult respiratory distress syndrome requiring intensive care and mortality in other larger studies.[8,9,13,18] Our results did concur with previous findings suggesting that chronic obstructive pulmonary disease and asthma had less influence on hospitalization rates.[13] It is possible that our relatively small sample size precluded us from distinguishing other reported risk factors, including obesity, that have been observed in larger epidemiological surveys, but we believe the difference may be something unique to our veteran population.

The study from the Chicago area reported an intubation rate of 28% in hospitalized COVID-19 patients, which was very similar to our observation in veterans (14 of 64, 22%). A second report from the New York area described a mortality rate of nearly 10% in hospitalized patients and 24% mortality in mechanically ventilated patients.[8] Our data indicate a mortality rate of 29% in mechanically ventilated patients. Additionally, there was 0% mortality in hospitalized patients not intubated.

Our results also indicated that hypertension and hyperlipidemia were primary risk factors for hospitalization with or without mechanical ventilation in veterans. The proportion of our COVID-19-positive veterans with hypertension (72.6%) substantially exceeded the prevalence of this disease (10%-25%) in other reports[2,19] and has been linked to adverse outcomes.[20,21] Our results further indicated that the use of ACEi/ARB was more frequently associated with the need for mechanical ventilation in veterans. The use of these medications has been linked to upregulation of the membrane receptor angiotensin converting enzyme 2 (ACE2),[22] and acute respiratory distress syndrome associated with another coronavirus results from viral binding to ACE2 expressed on the surface of alveolar endothelium.[23,24] Whether a causative link exists between use of ACEi/ARB and severe COVID-19 respiratory disease has yet to be definitively established.[20,25] This question will need to be addressed in future clinical trials.[26]

Our results should be interpreted within the constraints of several potential limitations. As mentioned, our sample size was relatively small and only included patients treated at a single VA medical center. Whether our findings can be extrapolated to other VA facilities caring for COVID-19 patients cannot be ascertained. Several patients in our population were still hospitalized when our data were analyzed. As a result, final clinical outcomes, including duration of mechanical ventilation, hospital length-of-stay, and mortality could not be established for the purposes of this analysis. The specific criteria for endotracheal intubation and mechanical ventilation was not standardized and differed to some degree between health care providers. We incorporated prone positioning in the treatment of our hospitalized COVID-19 patients when preliminary findings suggested that this intervention was beneficial for oxygen exchange. We did not quantify the number of patients who underwent proning or the duration of prone treatment, nor did we assess the relative efficacy of this technique in our evaluation.

CONCLUSION

Our evaluation describes the clinical features of COVID-19-positive patients treated during a two-and-a-half month period at the Clement J. Zablocki VA Medical Center in Milwaukee. Our results indicated that COVID-19-positive veterans at our facility are predominantly African American men. We found COVID-19-positive patients had a prevalence of hypertension and hyperlipidemia, and many patients were receiving beta blockers or ACEi/ARB. Our COVID-19-positive veterans who presented with dyspnea, tachypnea, tachycardia, and hypoxemia were more likely to require endotracheal intubation and mechanical ventilation, had longer hospital length-of-stay, and experienced greater mortality. In general, our findings mirror those reported in the populations from US hospitals treating the COVID-19 pandemic.

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