BRIEF REPORT

Characteristics and Outcomes of People With Gout Hospitalized Due to COVID-19: Data From the COVID-19 Global Rheumatology Alliance Physician-Reported Registry

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Objective. To describe people with gout who were diagnosed with coronavirus disease 2019 (COVID-19) and hospitalized and to characterize their outcomes.

Methods. Data on patients with gout hospitalized for COVID-19 between March 12, 2020, and October 25, 2021, were extracted from the COVID-19 Global Rheumatology Alliance registry. Descriptive statistics were used to describe the demographics, comorbidities, medication exposures, and COVID-19 outcomes including oxygenation or ventilatory support and death.

Results. One hundred sixty-three patients with gout who developed COVID-19 and were hospitalized were included. The mean age was 63 years, and 85% were male. The majority of the group lived in the Western Pacific Region (35%) and North America (18%). Nearly half (46%) had two or more comorbidities, with hypertension (56%), cardiovascular disease (28%), diabetes mellitus (26%), chronic kidney disease (25%), and obesity (23%) being the most common. Glucocorticoids and colchicine were used pre-COVID-19 in 11% and 12% of the cohort, respectively. Over two thirds (68%) of the cohort required supplemental oxygen or ventilatory support during hospitalization. COVID-19-related death was reported in 16% of the overall cohort, with 73% of deaths documented in people with two or more comorbidities.

Conclusion. This cohort of people with gout and COVID-19 who were hospitalized had high frequencies of ventilatory support and death. This suggests that patients with gout who were hospitalized for COVID-19 may be at risk of poor outcomes, perhaps related to known risk factors for poor outcomes, such as age and presence of comorbidity.

INTRODUCTION

Gout is the most common inflammatory joint disease (1) and is caused by monosodium urate crystal deposition leading to episodic arthritis (gout flare), tophus formation, and joint destruction. Gout is associated with male gender, advanced age, and several comorbidities, including cardiovascular disease, chronic kidney disease, and obesity (2). These demographic factors and comorbidities are also associated with death related to coronavirus...
SIGNIFICANCE & INNOVATIONS

- The outcomes of patients with gout who develop coronavirus disease 2019 (COVID-19) have not been described well in the literature to date.
- Patients with gout often have significant comorbidity and therefore could be expected to be at risk of poor outcomes from COVID-19.
- This report describes the characteristics of and outcomes in 163 patients with gout who developed COVID-19 and were admitted to hospital and were reported to the COVID-19 Global Rheumatology Alliance physician registries.
- Patients with gout who were hospitalized commonly also had comorbidity, and a majority required oxygen therapy, noninvasive ventilation, or mechanical ventilation, with a high proportion of subsequent death.

Characteristics of people with gout and COVID-19 have not been comprehensively described. A recent study using data from the UK Biobank explored the association between gout and COVID-19 diagnosis and death (14). In this study, 117 people with gout were diagnosed with COVID-19, but their rheumatic disease clinical characteristics and medication exposure were not specifically described.

This study aims to characterize hospitalized people with gout and COVID-19 by their demographics, comorbidities, medication exposure, COVID-19 treatment, and outcomes, using data from the COVID-19 Global Rheumatology Alliance (C19-GRA) registry (15,16).

MATERIALS AND METHODS

Population and databases. All adult patients with the C19-GRA registry with rheumatology physician-diagnosed gout who were hospitalized for COVID-19 between March 12, 2020, and October 25th, 2021, were included in the analysis. Patients who had an additional rheumatic disease or those who were on disease-modifying antirheumatic drugs (DMARDs) were excluded from the analysis.

Providers entered data on patients with rheumatic diseases and COVID-19 into the C19-GRA registry via two parallel online portals, the European Alliance of Associations for Rheumatology (EULAR) COVID-19 portal, which was limited to European countries (hosted by The University of Manchester, UK), and the C19-GRA portal, which included all other countries (hosted by the University of California, San Francisco, California). The design and development of these registries has been described elsewhere (15,17).

Data quality was assessed by the University of California, San Francisco, and the University of Manchester, UK, who both confirmed that there were no duplicate data entries. Data were entered anonymously into both registries, so the GRA and EULAR are unable to trace data back to individual patients. It was therefore determined by the local institutional review boards that patient consent was not required.
Variables and outcomes. Demographic data included age at COVID-19 diagnosis, sex (male or female), ethnicity, and region based on World Health Organization category (Africa, the Americas, Eastern Mediterranean, Europe, Southeast Asia, and Western Pacific), with the Americas further divided into North and South. Number of comorbidities was recorded as none, one, and two or more. Specific comorbidities were recorded as categorical variables (yes or no) including hypertension, cardiovascular disease, diabetes mellitus, chronic kidney disease, interstitial lung disease (ILD), lung disease (chronic obstructive pulmonary disease, asthma, or other conditions other than ILD), cancer, obesity (body mass index >30), and smoking status (never or ever).

Gout disease activity was categorized as in remission, low, moderate, or high (physician global assessment). Baseline (preinfection) use of colchicine and glucocorticoids were extracted and reported as categorical variables. Daily prednisone-equivalent glucocorticoid doses at the time of COVID-19 diagnosis were further categorized as 0 mg/day, 1 to 5 mg/day, 6 to 9 mg/day, and 10 mg/day or more.

For the COVID-19 diagnostic method, clinicians selected from the following options: polymerase chain reactions, antibody testing, metagenomic testing, computed tomographic scan, laboratory assay, or a presumptive clinical diagnosis. Date of COVID-19 diagnosis was categorized into the following three time periods: June 15, 2020, and earlier; from June 16 to September 30, 2020; and October 1, 2020, onward. These cutoffs were chosen as the Oxford University RECOVERY Trial released data demonstrating the efficacy of dexamethasone in COVID-19 treatment on June 16, 2020 (18). COVID-19 severity was classified based on requirement for oxygenation or ventilatory support as follows: no oxygenation, any oxygenation, mechanical ventilation or extracorporeal membrane oxygenation (ECMO), and death.

Statistical analysis. Descriptive statistics were used to characterize people with gout and COVID-19. Categorical variables were reported as number and percentage and continuous variables as mean and SD. Glucocorticoid dose was additionally reported as median and interquartile range. Missing data were reported as separate categories. Prevalence of death, a major COVID-19-related outcome, was reported for the overall cohort and stratified by number of comorbidity (none, one, and two or more). The data were further compared with the prevalence of death in hospitalized people with rheumatoid arthritis (RA) and systemic lupus erythematosus (SLE), also stratified by number of comorbidities, from the C19-GRA registry during the same time frame. Statistical analyses were conducted using R version 4.0.2.

RESULTS

We identified 348 people diagnosed with gout and COVID-19 in the C19-GRA registry. One hundred eighty-one patients were not hospitalized and therefore, were excluded (Supplementary Table 1). Four patients were excluded because of concomitant rheumatic diseases and/or DMARD use. The final cohort consisted of 163 hospitalized patients with physician-diagnosed gout. The demographics and clinical characteristics

### Table 1. Baseline characteristics of the people diagnosed with gout and hospitalized with COVID-19

| Characteristics                          | Results (N = 163) |
|------------------------------------------|------------------|
| **Demographics**                         |                  |
| Age, y, mean (SD)                        | 63.0 (16.0)      |
| Female, n (%)                            | 25 (15.0)       |
| Race or ethnicity, n (%)                 |                  |
| White                                    | 63 (38.6)       |
| East Asian                               | 45 (27.6)       |
| South Asian                              | 20 (12.3)       |
| Hispanic                                 | 14 (8.6)        |
| Black                                    | 9 (5.6)         |
| Southeast Asian                          | 3 (1.8)         |
| Unknown                                  | 9 (5.6)         |
| **Regions, n (%)**                       |                  |
| Western Pacific region                   | 87 (53.7)       |
| North America                            | 30 (18.5)       |
| Eastern Mediterranean region             | 21 (13.0)       |
| South America                            | 16 (9.9)        |
| South-East Asia                          | 4 (2.5)         |
| Europe                                   | 3 (1.8)         |
| Africa                                   | 2 (1.2)         |
| **Time period of COVID-19 diagnosis, n (%)** |                  |
| June 15, 2020, or earlier                | 80 (49.1)       |
| June 16, 2020, to September 30, 2020     | 32 (19.6)       |
| October 1, 2020, to October 25, 2021     | 51 (31.3)       |
| **Number of comorbidities, n (%)**       |                  |
| None                                     | 42 (25.8)       |
| One                                      | 46 (28.2)       |
| Two or more                              | 75 (46.0)       |
| **Comorbidities, n (%)**                 |                  |
| Hypertension                             | 91 (55.8)       |
| Cardiovascular disease                   | 45 (27.6)       |
| Diabetes mellitus                        | 42 (25.8)       |
| Chronic kidney disease                   | 41 (25.1)       |
| Obesity                                  | 38 (23.3)       |
| Lung diseasea                            | 25 (15.3)       |
| Cancer                                   | 15 (9.2)        |
| Interstitial lung disease                | 0 (0.0)         |
| Smoking (ever), n (%)                    | 73 (44.8)       |
| **Gout disease activity, n (%)**         |                  |
| Remission                                | 95 (58.3)       |
| Low                                      | 34 (20.9)       |
| Moderate                                 | 14 (8.6)        |
| High                                     | 11 (6.7)        |
| Unknown                                  | 9 (5.5)         |
| Death, n (%)                             | 26 (15.9)       |
| **Ventilation status, n (%)**            |                  |
| No oxygenation                           | 45 (27.6)       |
| Supplemental oxygenation or noninvasive ventilation | 89 (54.6) |
| Invasive ventilation or ECMO             | 21 (12.9)       |
| Not reported                             | 8 (4.9)         |

Abbreviations: COVID-19, coronavirus disease 2019; ECMO, extracorporeal membrane oxygenation.

aLung disease includes chronic obstructive pulmonary disease, asthma, and other conditions, excluding interstitial lung disease.
of patients are shown in Table 1. The cohort was predominantly male (85%), and the mean age was 63 years (SD = 16.0 years). The majority of people were from the Western Pacific region (54%), followed by North America (19%) and the Eastern Mediterranean region (13%). Hypertension was the most common comorbidity (56%) followed by cardiovascular disease (28%), diabetes mellitus (26%), chronic kidney disease (25%), and obesity (23%). More than 46% of patients had two or more comorbidities. Gout disease activity was reported as in remission or low activity in the majority of the cohort (79%), with the remaining 21% reported as having moderate or high disease activity (Table 1). Medication exposure in the cohort is shown in Table 2. Twenty people (12%) were taking colchicine. Eighteen people (11%) were taking glucocorticoids, with the majority at daily dosages of prednisone 10 mg or higher (11/18 people, 61%). Over half of people with gout hospitalized for COVID-19 required oxygenation or noninvasive ventilation (55%) (Table 1). Invasive ventilation or ECMO was required in 21 (13%) people. Twenty-six deaths (16%) were reported overall (Table 3). When stratified by the number of comorbidities, 25% of people with two or more comorbidities died compared to 2% in those without comorbidity and 13% in those with one comorbidity. The overall prevalence of death in the gout cohort (16%) was comparable to hospitalized people with RA (18%) and SLE (17%) during the same period. In the subgroup of patients with gout who died, 73% had two or more comorbidities. However, the prevalence of having two or more comorbidities was 49% in hospitalized people with RA and 39% in hospitalized people with SLE who died of COVID-19.

**DISCUSSION**

We have characterized hospitalized patients diagnosed with gout and COVID-19 from an international provider-reported registry. The following characteristics of the cohort were as expected from prior studies of people with gout: older people, mostly men, with multiple comorbidities, including hypertension, cardiovascular disease, obesity, and chronic kidney disease (2,19). Similar to the general gout population, nearly half of individuals in our cohort had two or more comorbid conditions. These data from the C19-GRA registry support the hypothesis that people with gout and COVID-19 requiring hospitalization have several risk factors for poor COVID-19 outcomes, particularly older age (mean 63 years) and multiple comorbidities.

The majority (67%) of this hospitalized cohort required at least oxygen therapy, indicating at least moderate COVID-19. Invasive ventilatory support was required in 13% of the gout cohort, which was comparable to the general inpatient COVID-19 populations (13%–14%) (20,21), as well as patients with RA (13%) and those with connective tissue disease (11%) from the C-19-GRA registry (4). The percentage of patients who died (16%) in our cohort of hospitalized people with gout was similar to the prevalence of death in RA (18%) and SLE (17%) cohorts collected during the same period (Table 3), as well as the prevalence of death in the general inpatient COVID-19 populations (16%–18%) (22,23). The majority (73%) of those who died in our gout cohort had two

| Table 2. Baseline medications used by people with gout who were hospitalized for COVID-19 |
|------------------------------------------|----------------------------------|
| Medications                              | Results              |
| Colchicine, n (%)                        | 20 (12.3)           |
| Glucocorticoids, n (%)                   | 18 (11.0)           |
| Glucocorticoid dosage in people taking glucocorticoids (n = 18) |                        |
| Mean (SD)                                | 18.3 (16.0)         |
| Median (min, max)                        | 15 (2, 60)          |

| Categories of glucocorticoid dosage in prednisone daily equivalents (n = 18), n (%) |
|-----------------------------------------------------------------------------------|
| No use of glucocorticoids                                                        | 145 (90.0)         |
| 1 to 5 mg/d                                                                      | 6 (3.7)            |
| 6 to 9 mg/d                                                                      | 0 (0.0)            |
| 10 or more mg/d                                                                 | 11 (6.7)           |
| Not reported                                                                      | 1 (1.6)            |

Abbreviation: COVID-19, coronavirus disease 2019.

| Table 3. Prevalence of death in people with gout compared with people with rheumatoid arthritis and systemic lupus erythematosus stratified by number of comorbidities |
|---------------------------------------------------------------------------------------------------------------------------------------------|
| | Outcomes | No comorbidity | One comorbidity | Two or more comorbidities | Total |
|------------------------------------------|----------------|-----------------|---------------------------|-------|
| Gout                                     |                |                 |                           |       |
| Hospitalization, n (%)                   | 42 (25.8)      | 46 (28.2)       | 75 (46.0)                 | 163 (100.0) |
| Death, n (%)                             | 1 (3.8)        | 6 (23.1)        | 19 (73.1)                 | 26 (100.0) |
| Death in the same comorbidity subgroup, % | 2              | 13              | 25                        | 16    |
| Rheumatoid arthritis                     |                |                 |                           |       |
| Hospitalization, n (%)                   | 640 (30.0)     | 707 (33.1)      | 788 (36.9)                | 2135 (100.0) |
| Death, n (%)                             | 74 (18.9)      | 127 (32.4)      | 191 (48.7)                | 392 (100.0) |
| Death in the same comorbidity subgroup, % | 12             | 18              | 24                        | 18    |
| Systemic lupus erythematosus             |                |                 |                           |       |
| Hospitalization, n (%)                   | 220 (39.0)     | 194 (34.3)      | 151 (26.7)                | 565 (100.0) |
| Death, n (%)                             | 26 (27.4)      | 32 (33.7)       | 37 (38.9)                 | 95 (100.0) |
| Death in the same comorbidity subgroup, % | 12             | 16              | 25                        | 17    |
or more comorbid conditions, which was higher than the prevalence in RA (49%) and SLE (39%) in the same registry. However, only 2% of deaths in people with gout were in the no-comorbidity subgroup. These observations provided some support for the hypothesis that COVID-19 mortality in people with gout was driven at least partially by the presence of comorbid conditions.

The association between gout and poor COVID-19 outcomes remains uncertain. Research using data from the UK Biobank did not find statistically significant associations between gout and COVID-19 diagnosis or gout and COVID-19-related death, despite the presence of several risk factors for poor COVID-19 outcomes in the overall UK Biobank gout cohort (14). The UK Biobank cohort is, however, a voluntary cohort of predominantly older White participants in a high-income country, so results are not necessarily generalizable to other settings. The association between gout and other COVID-19 outcomes (e.g., ventilatory support, hospitalization) has not been directly explored. Our data were able to confirm high rates of death and requirement for ventilatory support in a large proportion of people with gout hospitalized for COVID-19 in the C19-GRA registry but could not confirm whether there was a statistically significant association between gout and poor COVID-19 outcomes, owing to the small sample size. A larger data set with more detail is required to answer this question.

The strengths of our study include representation of people with gout from multiple diverse populations and physician confirmation of gout diagnosis. The results of this study, however, should be interpreted with caution because there are limitations to this study that may limit its generalizability. The inception of disease activity assessed by the reporting clinicians and the overall UK Biobank gout cohort (14). The UK Biobank cohort is, however, a voluntary cohort of predominantly older White participants in a high-income country, so results are not necessarily generalizable to other settings. The association between gout and other COVID-19 outcomes (e.g., ventilatory support, hospitalization) has not been directly explored. Our data were able to confirm high rates of death and requirement for ventilatory support in a large proportion of people with gout hospitalized for COVID-19 in the C19-GRA registry but could not confirm whether there was a statistically significant association between gout and poor COVID-19 outcomes, owing to the small sample size. A larger data set with more detail is required to answer this question.
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