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Co-Occurring Dehydration and Cognitive Impairment During COVID-19 in Long-Term Care Patients

To the Editor:

COVID-19 is associated with high morbidity and mortality in nursing home (NH) residents.1–3 Although most of the literature on COVID-19 has focused on the pathogenesis and management of hypoxic respiratory failure from pneumonia, less well described are geriatric complications such as dehydration, delirium, and falls. The objective of this study was to describe the frequency of dehydration and intravenous hydration during COVID-19 in NH residents and examine its interaction with delirium, dementia, and other complications.

Methods

The study setting was a 514-bed NH in New York City. Subjects were all symptomatic NH residents with a positive COVID-19 PCR or antibody test between March 1 and June 1, 2020. We reviewed medical, nursing, and other clinical notes to ascertain illness and treatment characteristics up to 30 days after symptom onset. Dehydration was defined as any blood urea nitrogen (BUN)—creatinine ratio greater than 20.4 Free water deficit4 was calculated in those with sodium (Na) > 145 mmol/L.

We compared the occurrence of delirium, falls, hospitalization, and death between residents with dehydration and those without using chi-square tests. We quantified the association between dehydration and cognitive impairment from dementia and/or delirium using multivariable logistic regression, using SPSS version 24 (IBM, Inc). Institutional review board approval was obtained from the NH and affiliated medical school.

Results

Among 314 NH residents with symptomatic COVID-19, the most common symptoms documented were fever (79%), cough (59%), loss of appetite (43%), and shortness of breath (28%) (Table 1). Among 261 residents with COVID-19 who had BUN and creatinine measured, the mean maximum BUN-creatinine ratio was 23.9 (SD = 9.2, range 4.6-58.5), and 154 (59%) had dehydration according to a threshold of 20. Among those who had Na measured, 45 residents (18.2%) had Na levels > 145 mmol/L and the calculated average free-water deficit was 2.92 L (SD = 1.67; range 0.93-6.86).

The relative risk of dehydration in residents with either moderate–severe cognitive impairment or COVID-19—associated delirium was 1.37 relative to residents with neither [95% confidence interval (CI) 1.11–1.59; P = .003]. This relationship remained significant after adjusting for demographic and clinical characteristics. Intravenous (IV) fluids were provided to 113 residents in the nursing home for an average of 4.9 days (SD = 4.3; range 1–31). Along with 50 who received IV fluids in the hospital prior to admission to the nursing home, the total number who received IV fluids during their COVID-19 illness was 163 (51.9%).

In bivariate associations, dehydration was significantly associated with higher risk of falling (relative risk 1.65, 95% CI 1.06–2.58; P = .022) and death (relative risk 2.39, 95% CI 1.09–5.25; P = .022). Overall, 90.8% of residents with COVID-19 were managed in the NH and 9.2% were transferred to the hospital. Mortality within 30 days was 13.7%.

Discussion

In this study, 59% of NH residents with symptomatic COVID-19 experienced dehydration. Dehydration was much more common in this group than in a pre-pandemic NH cohort who had urinary, skin, and respiratory infections, in which 9.1% experienced dehydration.5 Reasons for the greater incidence of dehydration with COVID-19 include (1) higher and more persistent fever, a known risk factor for dehydration in NH residents,4 and (2) difficulty maintaining oral hydration, even with human assistance, from acute declines in alertness and strength. Dehydration was clinically significant as demonstrated by the frequent requirement for IV fluids and the association between dehydration and increased falls and death.

Almost all cases of COVID-19 in this study were managed in the NH, including those with dehydration. Prior work has suggested that NH residents with infection may be better managed in the NH than in the hospital when consistent with goals of care, with fewer pressure sores, and lower mortality.6 Overall 30-day mortality in

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Table 1

| Features of COVID-19 in Nursing Home Residents Between Symptom Onset and 30-Day Follow-Up | n (%) or Mean (SD) |
|---------------------------------------------|-------------------|
| Symptoms, n (%)                            |                   |
| Fever >99°F                                 | 250 (79.6)        |
| Cough                                      | 187 (59.6)        |
| Loss of appetite                            | 133 (42.4)        |
| Shortness of breath                         | 86 (27.4)         |
| Diarrhea                                    | 25 (8.0)          |
| Vomiting                                    | 20 (6.4)          |
| Sore throat                                 | 18 (5.7)          |
| Headache                                    | 12 (3.8)          |
| Geriatric syndromes, n (%)                 |                   |
| Delirium                                    | 105 (33.4)        |
| Fall (>1)                                   | 82 (26.0)         |
| Weight loss (>5%)                           | 76 (24.2)         |
| Pressure sore (>1 stage 2 or greater)       | 36 (11.4)         |
| Dehydration* (BUN-creatinine ratio >20), n (%) | 154 (59.0)        |
| Free-water deficit (L), mean (SD)           | 2.92 (1.67)       |
| IV fluids received (any), n (%)             | 163 (51.9)        |
| Duration of IV fluids (d), mean (SD)        | 4.9 (4.3)         |
| Hospital transfer, n (%)                    | 289 (92.0)        |
| Mortality*, n (%)                           | 38 (13.7)         |

*Among those with laboratory values available (n = 261).

4Free water deficit = fraction total body water (male = 0.5; female = 0.45) × weight (in kilograms) × [sodium/140 – 1]; only calculated for n = 39 with BUN-creatinine ratio > 20, Na level > 145, and available weight.

5Among those with known vital status (n = 279).
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