Post-ICU COVID-19 Outcomes

A Case Series

To the Editor:

Patients critically ill with coronavirus disease 2019 (COVID-19) spend significant time on mechanical ventilation and have prolonged hospitalization duration.[1] Whether these patients have immediate pulmonary and neurocognitive recovery following discharge is unknown.

Methods

Patients were admitted to the University of Virginia (UVA) Medical Center ICU with COVID-19 and underwent follow-up at the UVA Post-COVID-19 ICU clinic approximately 6 weeks following discharge. Lung function and exercise capacity were assessed by using spirometry, lung volumes, diffusion capacity, and the 6-min walk test. Depression, cognitive function, and insomnia were assessed by using the Patient-Reported Outcomes Measurement Information System Depression 8a-Short Score, the Quality of Life in Neurological Disorders adult cognitive function version 2.0 score, the Montreal Cognitive Assessment (MOCA) score, and the insomnia severity index. The study was approved by the UVA Institutional Review Board.

Results

As of July 30, 2020, a total of 102 patients with COVID-19 were admitted to the UVA ICU. Fifty-nine patients (57.84%) were discharged alive, 22 (21.57%) died, and 21 (20.59%) remained hospitalized. Every discharged patient is contacted to follow up in the UVA Post-ICU COVID-19 clinic. The first patient was seen on June 2, 2020. Twenty-eight of the 29 scheduled patients attended the clinic as of July 30, 2020 (Table 1), resulting in a 96% show-rate. The remaining discharged patients are scheduled but have not yet been seen. Seven (25%) and 10 (57.14%) patients self-identified as African American and non-white Hispanic, respectively. The median age was 56 years (interquartile range [IQR], 47.5-65.75 years); 24 patients (85.71%) required mechanical ventilation, and the median number of days on mechanical ventilation was 11 (IQR, 3.25-15 days). The mean Sequential Organ Failure Score, the Acute Physiology and Chronic Health Evaluation II score, and the Simplified Acute Physiology Score II were 6 ± 2.5, 14 ± 6.2, and 32 ± 12.4, respectively. Seventy-five percent were diagnosed with delirium in the ICU. Median ICU and hospital length of stay were 14 (IQR, 6-21.5) days and 22 (IQR, 11.5-31) days, respectively. Two patients were discharged on antipsychotic agents or opiates.

The median number of days to follow-up in the clinic posthospital discharge was 39.5 (IQR, 36-41 days). Results of prior lung function tests were not available for comparison. At follow-up, 16 patients (61.54%) had normal lung function, four (15.38%) had obstruction, five (19.23%) had restriction, one (3.85%) had mixed obstruction and restriction, and seven (26.92%) had reduced diffusion capacity. The mean 6-min walk distance was 315 ± 85.4 m, and mean percent predicted was 65.5 (IQR, 51.5-76.5). None of the patients required supplemental oxygen.

None of the patients had clinically diagnosed depression, cognitive impairment, or insomnia prior to admission. At follow-up, seven patients had mild to moderate depression. Assessment of mild cognitive impairment was more frequent according to MOCA (n = 16 [57.14%]) but not according to the Quality of Life in Neurological Disorders (n = 6 [22%]) score. All but one patient (96%) performed activities of daily life without difficulty. Five of 23 patients who completed the insomnia severity index had moderate to severe insomnia. Detailed patient information is given in Table 1, and Figure 1 shows representative examples of the visuospatial/executive MOCA test.

Discussion

To the best of our knowledge, this analysis is the first case series of outpatient follow-up visits for patients who were hospitalized in the ICU with COVID-19. We found a low prevalence of obstruction and restriction, similar to previously published data in ARDS.[1,2] The prevalence of diffusion impairment in this cohort was lower

TABLE 1] Epidemiologic and Clinical Characteristics of Patients

Patient No.	Age, y	Sex	Self-Reported Ethnicity	Lowest Po_2/Fio_2	Days on MV	Received Paralysis and Proning	Evidence of Delirium[a]	ICU LOS	Hospital LOS	Days From Discharge to Visit	Spirometry	Diffusion Capacity (% Predicted)	6MWD (m)/% Predicted	PROMIS Depression 8a T Score[b]	Neuro-QoL Adult Cognitive Function T Score[c]	MOCA Score[d]	Insomnia Severity Index[e]	SOFA[f]/APACHE II[g]/SAPS II[h]
1	59	F	African American	118	14	Yes	Yes	17	32	36	Mixed obstruction and restriction	Reduced (59%)	362/76%	38.2	40.9	26	NA	10/15/11
2	54	M	Hispanic	128	7	No	Yes	9	13	36	Normal	Normal (97%)	168/38%	44.7	64.2	22	15	3/8/34
3	67	M	African American	212	5	No	No	6	14	40	Normal	Normal (83%)	390/67%	44.7	50.9	27	NA	7/22/46
4	74	F	White	66	15	No	Yes	22	34	41	Normal	Normal (70%)	350/78%	38.2	48.3	20	16	3/11/21
5	71	M	Hispanic	138	3	No	No	5	15	30	Normal	Normal (99%)	378/85%	38.2	42.9	18	7	4/13/42
6	75	M	White	111	27	Yes	Yes	38	39	36	Unable to perform	Unable to perform	NA	47.5	48.3	22	22	5/25/56
7	69	M	African American	150	18	Yes	Yes	22	31	40	Restriction	Reduced (58%)	327/57%	38.2	50.9	18	7	9/21/52
8	65	F	Asian Indian	47	15	Yes	Yes	17	26	41	Obstruction	Unable to perform	201/46%	55.1	43.9	27	2	8/19/44
9	66	F	African American	RA	0	None	No	2	2	43	Normal	Normal (80%)	311/87%	59.4	48.3	28	NA	NA
10	59	M	African American	170	7	No	Yes	9	13	40	Obstruction	Normal (83%)	352/72%	38.2	48.3	29	11	8/13/33
11	43	M	Hispanic	143	6	No	No	13	20	35	Obstruction	Reduced (62%)	50/1%	64.9	46	19	19	4/4/27
12	30	F	Hispanic	42	16	Yes	Yes	23	31	38	Obstruction	Normal (107%)	345/83%	56.8	56.3	18	12	7/10/15
13	60	F	Hispanic	NA	0	No	No	3	6	31	Restriction	Reduced (67%)	NA	38.2	n.a	23	25 (known OSA)	4/21/35
14	41	M	Hispanic	88	14	Yes	Yes	16	23	41	Normal	Normal (115%)	325/52%	38.2	48.3	24	NA	8/12/36
15	70	M	Hispanic	146	15	No	Yes	25	38	40	Normal	Normal (90%)	250/59%	63.9	35	11	NA	8/20/48
16	58	F	White	180	22	No	Yes	23	46	39	Normal	Reduced (69%)	287/54%	58.5	38.9	29	13	7/16/34
17	51	M	Hispanic	80	12	Yes	Yes	18	28	39	Restriction	Normal (106%)	268/50%	38.2	64.2	27	NA	8/9/23
18	64	F	African American	115	26	Yes	yes	27	33	40	Normal	Normal (79%)	203/52%	38.2	50.9	24	14	7/15/45
19	51	M	Hispanic	70	10	Yes	yes	11	19	35	Normal	Normal (85%)	386/63%	38.2	59	21	3	9/12/27
20	50	M	White	92	16	Yes	Yes	20	28	42	Restriction	Reduced (69%)	325/50%	55.3	44.9	26	16	9/20/38
21	59	M	Hispanic	100	9	No	No	12	25	44	Restriction	Reduced (62%)	326/69%	37.1	64.2	23	0	8/28/38

(Continued)

TABLE 1] (Continued)

Patient No.	Age, y	Sex	Self-Reported Ethnicity	Lowest $P_{O_2}/F_{I_{O_2}}$	Days on MV	Received Paralysis and Proning	Evidence of Delirium[a]	ICU LOS	Hospital LOS	Days From Discharge to Visit	Spirometry	Diffusion Capacity (% Predicted)	6MWD (m)/ % Predicted	PROMIS Depression 8a T Score[b]	Neuro-QoL Adult Cognitive Function T Score[c]	MOCA Score[d]	Insomnia Severity Index[e]	SOFA[f]/ APACHE II[g]/ SAPS II[h]
22	52	M	Hispanic	100	14	Yes	Yes	15	21	43	Normal	Normal (114%)	400/87%	43.3	64.2	23	1	4/12/34
23	51	F	Hispanic	200	3	No	Yes	4	6	40	Normal	Normal (103%)	340/64%	37.1	39.9	17	10	3/12/21
24	39	M	Hispanic	NA	0	No	No	6	11	35	Normal	Normal (86%)	350/59%	37.1	52.4	23	0	2/6/11
25	47	F	African American	138	3	No	No	4	11	32	Normal	Normal (90%)	304/95%	49.8	47.1	29	2	3/6/33
26	49	M	Hispanic	104	15	Yes	Yes	20	27	42	Unable to perform	Normal (110%)	444/75%	53.4	56.3	22	2	9/13/24
27	36	F	Hispanic	NA	0	No	No	6	9	38	Normal	Normal (114%)	339/69%	37.1	64.2	24	3	3/11/11
28	44	M	Hispanic	95	4	No	No	7	9	38	Normal	Normal (101%)	418/72%	43.4	52.4	19	1	5/12/29
Mean ± SD	55.5 ± 11.9			118 ± 45	10.6 ± 7.7			14.3 ± 8.6	21.8 ± 11.5	38.4 ± 3.6			315 ± 85)/ 63%	45.4 ± 9.24	50.8 ± 8.4	23 ± 4	9 ± 8	6 ± 2.5/ 14 ± 6.2 /32 ± 12.4

6MWD = 6-min walk distance; APACHE = Acute Physiology and Chronic Health Evaluation; F = female; LOS = length of stay; M = male; MOCA = Montreal Cognitive Assessment; MV = mechanical ventilation; NA = not available; Neuro-QoL = Quality of Life in Neurological Disorders; PROMIS = Patient-Reported Outcomes Measurement Information System; RA = room air; SAPS = Simplified Acute Physiology Score; SOFA = Sequential Organ Failure Assessment.

[a]Delirium is assessed by the nursing staff every shift using the Confusion Assessment Method for the ICU.

[b]T score > 45 represents no depression, 40 to 45 represents mild depression, 30 to 40 represents moderate depression, and < 30 represents severe depression.

[c]Neuro-QoL adult cognitive function version 2.0: T score > 45 represents normal cognition, 40 to 45 represents mild cognitive impairment, 30 to 40 represents moderate cognitive impairment, and < 30 represents severe cognitive impairment.

[d]MOCA scores > 25 represent normal cognition; 18 to 25 represent mild cognitive impairment; 10 to 17 represent moderate cognitive impairment; and scores < 10 represent severe cognitive impairment.

[e]Insomnia: scores 0 to 7 represent no clinically significant insomnia; 8 to 14 represent subthreshold insomnia; 15 to 21 represent moderate severity clinical insomnia; and 22 to 28 represent severe clinical insomnia.

[f]Scores on the SAPS II range from 0 to 163; higher scores indicate more severe disease and higher risk of death.

[g]Scores on the APACHE II range from 0 to 71; higher scores indicate more severe disease and higher risk of death.

[h]Scores on the SOFA range from 0 to 24; higher scores indicate more severe disease and higher risk of death.
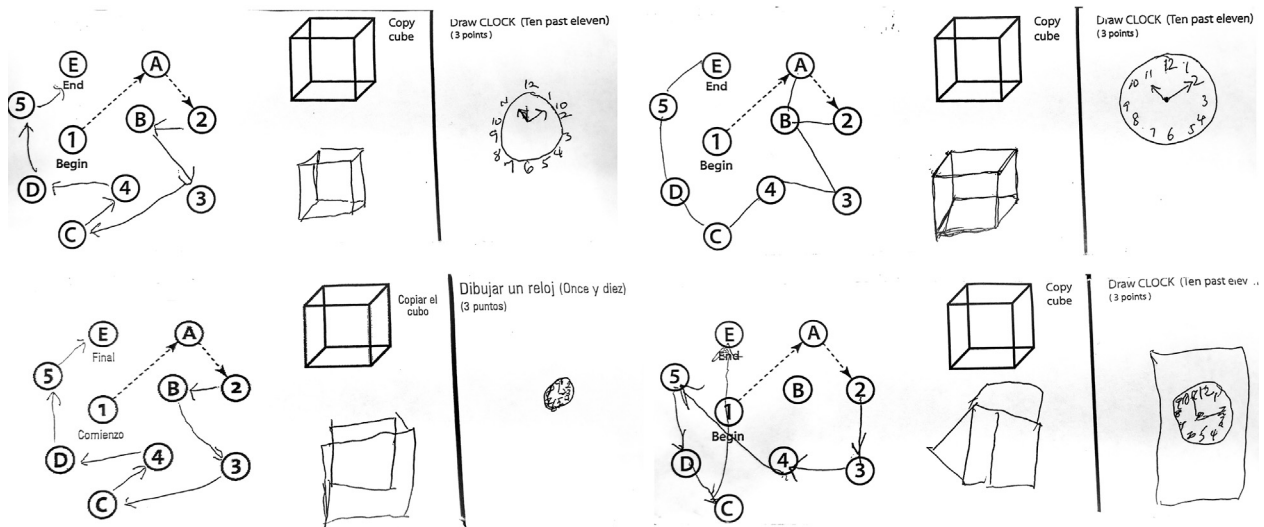
Figure 1 – *Four representative examples of the visuospatial/executive part of the Montreal Cognitive Assessment test. In this component of the test, the patient needs to connect alternating numbers and letters from low to high, copy a three-dimensional cube, and free-draw a clock showing a time of 11:10.*

compared with post-ARDS follow-up.[3] The mean 6-min walk distance in the current cohort was higher compared with what has been reported in prior ARDS studies.[3] Despite significant dosages for sedation and a high prevalence of delirium in the ICU, the majority of the current patients had no or only mild cognitive impairment at 6 weeks following hospital discharge. This observation, and the fact that only one patient still had difficulties with activities of daily life, differs from previous reports of survivors of critical illness.[4] The prevalence of depression and insomnia were comparable with previous post-ICU outcome studies.[5,6] The majority of the post-ICU clinic patients were African American or Hispanic, which is supportive of recent studies that suggest non-white racial/ethnic groups are severely affected by COVID-19.[7]

This was a single-center case series, and we do not have sufficient long-term data to assess how these outcomes change over time. The long-term impact of this disease remains unclear but our study suggests the feasibility of an in-person outpatient clinic for post-ICU COVID-19 patients and a low burden of pulmonary and neurocognitive morbidity at immediate follow-up.

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