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ORIGINAL ARTICLE

Postdischarge outcomes of COVID-19 patients from South Asia: a prospective study

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Background: Coronavirus disease 2019 (COVID-19) may cause clinical manifestations that last for weeks or months after hospital discharge. The manifestations are heterogeneous and vary in their frequency. Their multisystem nature requires a holistic approach to management. There are sparse data from the South Asian region on the outcomes of hospital-discharged COVID-19 patients. We assessed the posthospital discharge outcomes of a cohort of Sri Lankan COVID-19 patients and explored the factors that influenced these outcomes.

Methods: Data were prospectively collected from patients who were discharged following an admission to the Nawaloka Hospital, Sri Lanka with COVID-19 from March to June 2021. At discharge, their demographic, clinical and laboratory findings were recorded. The patients were categorised as having mild, moderate and severe COVID-19, based on the Sri Lanka Ministry of Health COVID-19 guidelines. Following discharge, information on health status, complications and outcomes was collected through clinic visits and preplanned telephone interviews. A validated (in Sri Lanka) version of the Short Form 36 health survey questionnaire (SF-36) was used to assess multi-item dimensions health status of the patients at 1, 2 and 3 mo postdischarge.

Results: We collected data on 203 patients (male, n=111 [54.7%]). The level of vaccination was significantly associated with disease severity ($p<0.001$). Early recovery was seen in the mild group compared with the moderate and severe groups. At 3 mo, on average 98% of mild and 90% of moderate/severe patients had recovered. Based on the SF-36, physical functioning dimensions, role limitation due to physical and emotional health, energy/ fatigue, emotional well-being, social functioning, pain and general health were significantly different in the moderate/severe vs mild COVID-19 groups at 1, 2 and 3 mo postdischarge ($p<0.05$). Twenty-three patients developed complications, of which the most common were myocardial infarction with heart failure (n=6/23; 26.1%), cerebrovascular accident (n=6/23; 26.1%) and respiratory tract infections (n=3/23; 13.01%) and there were six deaths.

Conclusions: In our cohort, receiving two doses of the COVID-19 vaccine was associated with reduced disease severity. Those with mild disease recovered faster than those with moderate/severe disease. At 3 mo posthospital discharge, >90% had recovered.

Keywords: COVID-19, outcome, SARS-CoV-2, SF-36, vaccination

Introduction

Coronavirus disease 2019 (COVID-19), due to the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) virus, has affected >230 million people worldwide and has led to adverse health and economic impacts.[1,2] In addition to several novel treatment strategies proposed for its treatment, vaccination is an important preventive strategy for the reduction of

morbidity and mortality in COVID-19.[3–5] A range of symptoms may persist following acute COVID-19 and the effective management of these may put further pressure on already stretched healthcare systems.[6–10] The short- and long-term outcomes in such patients and the patterns of recovery postacute COVID-19 may vary in different regions of the world. Delineation of such patterns would allow countries to put into place optimal plans for such patients and to more efficiently allocate limited health resources. The multisystem nature of the manifestations would require a holistic approach to management and this may prove to be a challenge in many low- and middle-income countries.[6,11]

Information on the varied postacute and long-term effects of COVID-19 is currently gathered in several settings.[12] Early reports suggest there may be prominent residual effects of the infection with a resultant decline in quality of life.[13,14] In addition, thromboembolic events have been noted to occur post-COVID-19, and may contribute to both morbidity and mortality. As of yet, the outcomes and disease patterns post-COVID-19 are poorly defined and studied among South Asian patients.[15] There are hardly any data on outcomes of discharged COVID-19 patients in this region. Our objective was to assess multidimensional postdischarge outcomes of a cohort of hospitalised COVID-19 patients and to determine the factors that affect these outcomes.

Materials and Methods

Study design

A prospective study was conducted on adults who were discharged following hospitalisation for COVID-19. The patients were hospitalised at Nawaloka Hospital, Sri Lanka, from March to June 2021.

Study population

We included 203 patients (aged >18 y) with SARS-CoV-2 infection confirmed by RT-PCR from a nasopharyngeal swab (AccuPower SARS-CoV-2 RT-PCR kit; Bioneer, South Korea).[16] Positive test results were reanalysed with RealStar SARS-CoV-2 RT-PCR Kit 1.0 (Altona diagnostics, Germany)[17] for confirmation. The flowchart of patient recruitment and follow-up is shown in Supplementary Figure 1.

We used a validated (in Sri Lanka) version of the Short Form 36 health survey questionnaire (SF-36) to assess multi-item dimensions health status of the hospital-discharged COVID-19 patients at 1, 2 and 3 mo following discharge.[18,19] The eight dimensions of the SF-36 were physical functioning, role limitation due to physical health, role limitation due to emotional health, energy/fatigue, emotional well-being, social functioning, pain and general health.[18,19] Additional information on health status, complications and outcomes was obtained through clinic visits and preplanned telephone interviews. Patients were categorised as having mild, moderate and severe COVID-19 based on the national guidelines, "Provisional clinical practice guidelines on COVID-19 suspected and confirmed cases" of the Ministry of Health, Sri Lanka.[20]

Data collection

Demographic, laboratory and health survey data

Demographic, clinical and laboratory information was obtained by a trained study team member from the patient and their medical records. The SF-36 was completed when the patients attended a COVID-19 clinic and at preplanned telephone interviews.

Data analysis

Continuous variables were described using mean and standard deviation values. Continuous data were compared using one-way and repeated modal ANOVA and categorical data were compared using the χ^2 test. $p<0.05$ was considered statistically significant. Data were analysed using Statistical Package for Social Sciences 16 (SPSS 16.0, Chicago, IL, USA) and STATA version 12 (TX, USA).

Results

Table 1 shows the demographic characteristics and vaccine status (at the time of hospital admission) in the study population. COVID-19 disease severity was significantly associated with the level of COVID-19 vaccination. Of 29 patients who had received both vaccine doses, 2 (6.8%) got severe COVID-19. In those who had still not received a vaccine dose or had received a single dose, 26.5% (n=18) and 25.4% (n=27) had severe COVID-19, respectively. Among the fully vaccinated group, the highest cyclic threshold value (mean [SD]) upon admission (at a median of 3 d) was 24.6±3.5 d and the shortest length of hospital stay was 11.9±2.2 d.

Table 2 shows a comparison of the different dimensions of the SF-36 scores between mild, moderate and severe COVID-19 patients at 1, 2 and 3 mo following hospital discharge. There was a significant difference in the following SF-36 dimensions: physical functioning, role limitation due to physical health, role limitation due to emotional health, energy/fatigue, emotional well-being, social functioning, pain and general health between those who had mild and moderate/severe COVID-19 and this was noted at each time point ($p<0.05$). Earlier recovery was achieved by those with mild disease compared with those in the moderate/severe groups.

Table 3 shows the observed complications in the patients, subgrouped according to COVID-19 severity and vaccination status. In total, 23 complications were observed during a 3-mo postdischarge interval. These were myocardial infraction with heart failure (n=6/23; 26.1%), cerebrovascular accident (n=6/23; 26.1%), respiratory tract infections (RTIs) (n=3/23; 13.01%), pulmonary embolism (n=2/23; 8.7%), acute kidney injury (n=1/23; 4.3%), intracranial haemorrhage (n=2/23; 8.7%), gastrointestinal bleeding (n=2/23; 8.7%) and deep vein thrombosis (n=1/23;4.3%). There were six deaths and all occurred in

Table 1. Demographic characteristics of the study population and the association with vaccine status

Variable	All (n=203) N (%)	Non vaccination (n=106) N (%)	Only first dose of vaccination (n=68) N (%)	First and second doses of vaccination (n = 29) N (%)	p
Age (y)					
<30	12 (5.9)	8 (7.5)	2 (2.9)	2 (2.9)	χ^2_8=10.61
31 to 40	20 (9.9)	14 (13.2)	3 (4.4)	3 (10.3)	p=0.225
41 to 50	44 (21.7)	18 (17.0)	16 (23.5)	10 (34.5)	
51 to 60	40 (19.7)	21 (19.8)	13 (19.1)	6 (20.7)	
>60	87 (42.9)	45 (42.5)	34 (50.0)	8 (27.6)	
Gender					
Male	111 (54.7)	62 (58.5)	36 (52.9)	13 (14.8)	χ^2_2=1.84
Female	92 (45.3)	44 (41.5)	32 (47.1)	16 (55.2)	p=0.399
Marital status					
Married	152 (74.9)	74 (69.8)	57 (83.6)	21 (79.4)	χ^2_6=7.383
Never married	40 (19.7)	23 (21.7)	10 (14.7)	7 (24.1)	p=0.287
Divorced	7 (3.4)	6 (5.7)	0	1 (3.4)	
Widow	4 (2.0)	3 (2.8)	1 (1.5)	0	
Educational level					
School education only	146 (71.9)	76 (71.7)	51 (75)	19 (65.5)	χ^2_4=4.069
Higher education	57 (28.1)	30 (28.3)	17 (25)	10 (34.5)	p=0.667
Employment status[1]					
Public employees	50 (24.6)	24 (22.6)	15 (22.1)	11 (37.9)	χ^2_6=8.593
Private employees	77 (37.9)	43 (40.6)	24 (35.3)	10 (34.5)	p=0.198
Employers	56 (27.6)	25 (23.6)	25 (36.8)	6 (20.7)	
Own account workers	20 (9.9)	14 (13.2)	4 (5.9)	2 (6.9)	
Monthly income (SLR)[2]					
<51 862	14 (6.9)	11 (10.4)	3 (4.4)	0	χ^2_4=8.22
51 863 to 81 371	131 (64.5)	60 (56.6)	49 (72.1)	22 (75.9)	p=0.084
>81 372	58 (28.5)	35 (33.3)	16 (23.5)	7 (24.1)	
Severity[3]					
Mild	75 (36.9)	29(27.4)	24(35.3)	23(79.3)	χ^2_4=23.59
Moderate	80 (39.4)	50(47.2)	26(38.2)	4(13.8)	p=0.001
Severe	48 (23.6)	27(25.4)	18(26.5)	2(6.8)	
Cyclic threshold value on median day 3 (upon admission) Mean±SD[4]	21.36±3.5	21.18±3.6[a]	20.75±3.03[a]	24.45±3.45[b]	$F_{2,200}$=6.686 p=0.002
Length of stay (d) Mean±SD[4]	13.23±2.22	13.45±2.08	13.44±2.26	11.89±2.22	$F_{2,200}$=6.397 p=0.002

Abbreviation: SLR, Sri Lankan rupee.
[1]Department of Census and Statistics, Sri Lanka, 2018.
[2]Based on income quintiles of Household Income and Expenditure Survey, Sri Lanka, 2016.
[3]Provisional clinical practice guidelines on COVID-19 suspected and confirmed cases - Ministry of Health, Sri Lanka, 2020.
[4]One-way ANOVA and post-hoc test (Tukey).
[a,b]Means having a superscript with the same letter are similar.

those who developed a complication. Among the three patients who had a lower RTI, one patient each had Aspergillosis species, Acinetobacter species and methicillin-resistant *Staphylococcus aureus* lung infections. Table 4 shows the characteristics of the post-COVID-19 patients who developed complications (n=23). The length of hospital stay was significantly longer among post-COVID-19 patients with complications who died compared with those who recovered. Mean cycle threshold value on median day 3 (i.e. upon admission) was significantly lower in those with post-COVID-19 complications who died in comparison with those who recovered. Low vaccination coverage was found in those who died.

Table 2. Comparison of dimensions of SF-36 scores between mild and moderate/severe COVID-19 patients following hospital discharge at 1, 2 and 3 mo

	1 mo posthospital discharge(n=186)			2 mo posthospital discharge(n=175)			3 mo posthospital discharge(n=168)		
Dimensions of SF-36	Mild[1] (mean±SD) (n=75)	Moderate[2] (mean±SD) (n=80)	Severe[3] (mean±SD) (n=31)*	Mild[4] (mean±SD) (n=70)[$]	Moderate[5] (mean±SD) (n=80)	Severe[6] (mean±SD) (n=25)**	Mild[7] (mean±SD) (n=69)[$$]	Moderate[8] (mean±SD) (n=75)[$$$]	Severe[9] (mean±SD) (n=24)***
Physical functioning	88.3±2.3[a]	63.9±3.4[b]	61.9±8.8[b]	94.2±4.5[a]	83.4±4.3[b]	80.3±5.1[b]	98.8±0.2[a]	94.4±3.2[b]	92.4±6.1[b]
Role limitation due to physical health	13.6±2.1[a]	70.1±4.5[b]	74.4±1.5[b]	8.2±2.2[a]	37.5±3.2[b]	40.5±2.1[c]	4.3±0.3[a]	10.2±1.1[b]	13.7±4.2[b]
Role limitation due to emotional health	11.3±4.6[a]	70.3±3.2[b]	72.5±8.5[b]	7.2±3.3[a]	29.8±3.4[b]	32.6±1.2[b]	2.3±0.1[a]	10.1±2.1[b]	15.2±2.7[c]
Energy/fatigue	81.3±6.1[a]	54.1±5.2[b]	52.2±8.4[b]	92.3±2.2[a]	77.6±4.6[b]	73.8±7.9[c]	98.1±0.2[a]	94.3±3.7[b]	89.4±8.1[c]
Emotional well-being	84.5±4.3[a]	57.2±4.3[b]	54.3±4.7[b]	93.1±2.7a	85.4±4.2[b]	81.2±6.4[c]	99.1±0.01[a]	94.3±2.9[b]	92.2±4.5[b]
Social functioning	87.3±2.1[a]	61.2±4.6[b]	58.5±1.9[c]	95.4±3.2a	80.6±4.3[b]	76.3±2.2[c]	98.4±0.2[a]	95.6±4.6[b]	90.3±5.6[b]
Pain	12.1±3.1[a]	80.1±6.1[b]	83.7±2.1[c]	7.3±1.2a	36.7±3.6[b]	42.2±6.4[c]	2.1±0.09[a]	10.3±2.1[b]	16.7±3.6[c]
General health	87.8±2.0[a]	60.2±4.8[b]	56.9±1.9[c]	94.2±2.1a	82.3±3.2[b]	78.3±2.7[b]	98.9±0.08[a]	96.7±4.5[b]	93.2±2.5[b]

[1, 4] and [7] Mean values of patients who had mild COVID-19 symptoms on first, second and third months were compared with repeated measure ANOVA (between groups): $F(2,68)=29.13$, $p<0.001$.
[2, 5] and [8] Mean values of patients who had moderate COVID-19 symptoms on first, second and third months were compared with repeated measure ANOVA (between groups): $F(2,74)=32.23$, $p<0.001$.
[3, 6] and [9] Mean values of patients who had severe COVID-19 symptoms on first, second and third months were compared with repeated measure ANOVA (between groups): $F(2,23)=32.23$, $p<0.001$.
The mean SF36 scores of mild, moderate and severe groups in each month were compared with one-way ANOVA. There was a statistical significant difference ($p<0.05$) for all the dimensions within groups in each month.
[a, b] and [c] Significant categories within the month based on post-hoc tests (Tukey).
*3 patients died and 14 patients were lost to follow-up within 1 mo.
**3 patients died and 3 patients were lost to follow-up within 1–2 mo of discharge.
***1 patient lost to follow-up within 3 mo of discharge.
[$]5 lost to follow-up.
[$$]1 lost to follow-up.
[$$$]5 lost to follow-up.

Table 3. Outcomes based on severity of disease and the association with vaccine status

Disease status	Post discharge 1 mo N (%)	Type of complication and outcome	Post discharge 1–2 mo N (%)	Type of complication and outcome	Post discharge 2–3 mo N (%)
Mild COVID-19					
(n=75)	0	N/A	0	N/A	0
Non-vaccinated	0		0		0
1st dose only	0		0		0
Both doses					
Moderate					
COVID-19	3 (3.75)[1,2,3]	1 MI & HF – recovered	0	N/A	0
(n=80)	1 (1.25)[4]	2 MI & HF – recovered	0		0
Non-vaccinated	0	3 MI & HF – recovered	0		0
1st dose only		**4 PE - died**			
Both doses					
Severe COVID-19		1 MI & HF – recovered		1 CVA -	
(n=48)	10	**2 MI & HF – died**	5 (10.4)[1 to 5]	recovered	0
Non-vaccinated	(20.8)[1 to 10]	3 MI & HF – recovered	1 (2.1)[6]	with L/side	0
1st dose only	3 (6.3)[11,12,13]	4 CVA - recovered with	0	body	0
Both doses	0	L/side body weakness		weakness	
		5 CVA - recovered with		2 CVA-	
		R/side body weakness		recovered	
		6 CVA - recovered with		with L/side	
		R/side body weakness		body	
		7 RTI - fungal infection		weakness	
		with sepsis - died*		3 CVA -	
		8 RTI - bacterial infection		recovered	
		with sepsis - recovered**		with L/side	
		with lung fibrosis		body	
		9 RTI - bacterial infection		weakness	
		with sepsis-recovered***		**4 ICH - died**	
		with lung fibrosis		**5 ICH - died**	
		10 PE – recovered		**following**	
		11 AKI - recovered		**LRTI with**	
		12 GI bleeding – gastric		**sepsis**	
		ulcer – recovered		**6 DVT lower**	
		13 GI bleeding - gastric		**limb sepsis**	
		ulcer – recovered		**and died**	

Complications (n=23): myocardial infractions with heart failure (MI & HF) (n=6/23; 26.1%), cerebrovascular accident (CVA) (n=6/23; 26.1%), respiratory tract infections (RTI) (n=3/23; 13.01%), pulmonary embolism (PE) (n=2/23; 8.7%), acute kidney injury (AKI) (n=1/23; 4.3%), intracranial haemorrhage (ICH) (n=2/23; 8.7%), gastrointestinal (GI) bleeding (n=2/23; 8.7%), deep vein thrombosis (DVT) and sepsis (n=1/23;4.3%).
*Aspergillosis species.
**Acinetobacter species.
***Methicillin-resistant *Staphylococcus aureus*.
Proportion of deaths from the complication after discharge: 6/23 (26.1%).
Bold words show the post COVID deaths.
[1 to 13]Shows the outcome of post discharged severe COVID patient after one month.

Discussion

There is a scarcity of data from South Asia on the short- and long-term outcomes among COVID-19 patients following hospital discharge. We found cardiovascular complications predominated in our cohort during the first 3 mo posthospital discharge. Using the SF-36 to assess health status among the discharged COVID-19 patients, we found those with mild disease to have less adverse health effects compared with those with moderate or severe disease. Furthermore, early recovery was significantly more common in those with mild compared with moderate or severe cases. However, it was apparent that most of those with moderate or severe COVID-19 also recovered within the 3-mo period. We found non-receipt of a single dose of the COVID-19 vaccine to be significantly associated with severe COVID-19. Following hospital discharge, those who had mild

Table 4. Clinical characteristics of the post-COVID-19 patients who developed complications

Variable	All (n=23)	Recovered (n=17)	Died (n=6)	p
Age in y (mean±SD)	61.2±5.4	60.2±6.7	62.4±7.5	0.51*
Gender: male, n (%)	14 (60.8)	9 (64.3)	5 (35.7)	0.23**
Comorbidities, n (%)				
None	8 (34.7)	5 (62.5)	3 (37.5)	0.33**
Diabetes	4 (17.4)	3 (75.0)	1 (25.0)	0.18**
Hypertension	4 (17.4)	4 (100)	0	N/A
Dyslipidaemia	6 (26.1)	5 (83.3)	1 (16.7)	0.03**
Ischaemic heart disease	2 (8.7)	2 (100)	0	N/A
Chronic kidney disease	2 (8.7)	2 (50.0)	0	N/A
Asthma/COPD	2 (8.7)	1 (50.0)	1 (50.0)	N/A
Malignancy	1 (4.3)	1 (100)	0	N/A
Length of hospital stay, d (mean±SD)	15.21±2.1	14.3±2.3	16.7±2.5	0.04*
Vaccination status				
None	13 (56.6)	9 (69.2)	4 (30.8)	0.04**
1st dose	8 (34.7)	6 (75.0)	2 (25.0)	0.04**
2nd dose	2 (8.6)	2 (100)	0	N/A
Cyclic threshold value on median day 3 (upon admission) (mean±SD)	19.4±4.5	20.1±2.6	17.3±3.1	0.04*

Abbreviations: COPD, chronic obstructive pulmonary disease; N/A, not applicable.
*p value obtained through independent sample t-test.
**p value obtained through comparison of proportions.

COVID-19 had fewer complications than those with moderate or severe disease. Three patients had lower RTIs (due to three different organisms) and two had lung fibrosis during the follow-up period. Studies from the West have found a sizeable proportion of patients to have lung fibrosis, interstitial lung diseases and pulmonary hypertension following COVID-19.[21,22] Post-COVID-19 pulmonary fibrosis is a recognised sequel among survivors, where pulmonary architectural distortion and irreversible pulmonary dysfunction contributes to secondary lung infection.[23] Furthermore, secondary lung infection may be associated with older age, male gender and smoking.[24] A possible pathological mechanism of prolonged lung damage includes direct viral cytotoxic damage following binding to ACE2 receptors. This leads to dysregulation of the renin angiotensin aldosterone system, downregulation of ACE2 action and decreased cleavage of angiotensin I and angiotensin II. Tissue injury and remodelling, inflammation, vasoconstriction, increased microvascular permeability, endothelial cell damage leading to endothelitis, apoptosis and thrombo-inflammation, decreased fibrinolysis, increased thrombin production and complement activation may occur. These in turn lead to diffuse alveolar damage and secondary lung infection during post-COVID-19.[25]

Our study did not find a significant association of vaccine status with age, gender, marital status, educational level, employment status or monthly income. However, some other studies have found older people, females and lower education groups to be at a higher risk of COVID-19 due to vaccine hesitancy and refusal.[26] Married males living in urban areas, educated for ≤16 y and with low income were hesitant to be vaccinated against COVID-19.[27,28] Studies also found misleading comments on television, a lack of health education on COVID-19, low income levels, residential area, employment status, family income and higher age to be associated with vaccine hesitancy.[28,29] As lower vaccine hesitancy leads to better clinical outcomes, appropriate health education is important.

Our study found a high rate of recovery from the post-COVID-19 complications. Currently, it is unclear why some patients experience long-term symptoms after COVID-19. Potential causes for different outcomes include viral load as well as host-dependent factors such as genetic susceptibility or induction of anti-inflammatory cells.[30] Increased age, female gender, disease severity and body mass index are known attributes and predictors of persistent COVID-19.[31,32] Prior research has found lower chances of recovery among older COVID-19 patients or those who have underlying diseases such as coronary heart disease or cancer.[33] We recommend that further large cohort studies should be conducted to identify possible factors contributing to recovery from post-COVID-19 complications.

Studies performed in other regions have found varying time periods (from 3 to 9 mo) for recovery from COVID-19 following

hospital discharge.[34–37] In an Australian study, 80, 90 and 93% recovered by 1, 2 and 3 mo, respectively.[38] On the other hand, in an Italian study of 143 hospital-discharged COVID-19 patients (at a mean of 60 d), 12.6, 32 and 55% were completely free of symptoms, had 1–2 or ≥3 symptoms, respectively.[39] None had fever or features of an acute illness, while the main manifestations were fatigue (53%), dyspnoea (43%), joint pain (27%) and chest pain (22%). Two-fifths reported a poorer quality of life.[39]

Thus there appears to be a variation of outcomes among posthospital-discharged COVID-19 patients in different regions of the world. A few studies have identified factors that are associated with higher rates of complications post-COVID-19, including female gender, respiratory distress during the hospital stay, lethargy and long disease duration.[40] Genetic factors may also play a role[41,42] and need to be better defined. Other studies have reported cardiovascular complications—myocardial injury, thromboembolic events, arrhythmia and heart failure—following COVID-19.[43] Multiple mechanisms may contribute to this including cytokine (such as IL-6) mediated inflammation,[44] direct viral invasion of cardiomyocytes leading to unopposed effects of angiotensin II, increased metabolic demand, immune activation or microvascular dysfunction.[45–47] Furthermore, a study conducted in Israel found an increase in STEMI hospitalisations correlated with the end of the first wave of the COVID-19 pandemic.[48] Research has found a strong association between been in the post-COVID-19 period and acute myocardial infraction (AMI).[49] The increased risk of AMI in individuals post-COVID-19 is likely related to dysregulated inflammatory responses and hypercoagulability. Such pathophysiological mechanisms may also be aggravated by other biological, environmental and psychosocial factors.[50] Some of the potential mechanisms for post-COVID-19-related heart involvement includes direct injury via binding to ACE-2 on cardiac myocytes, the massive cytokine storm, an imbalance in subtypes of T-helper cells and increased apoptosis of cardiac myocytes due to hypoxia-induced excessive intracellular calcium accumulation.[51,52] Among post-COVID-19 patients who developed complications, low vaccine coverage, higher viral loads (low Ct values) and prolonged hospital stay were key factors associated with death. Further studies on initial viral load and post-COVID-19 outcomes need to be carried out in larger cohorts to provide better insights into this aspect.

Study limitations

Our study has some limitations. First, the study was conducted at a single centre and would need to be assessed in multiple centres using larger sample sizes. However, the observed post-COVID-19 effects give an insight into this aspect in a South Asian cohort. Second, the study did not assess the reasons behind the observed vaccine hesitancy in some. We suggest that these factors be considered in future studies. Third, the study sample was from a private hospital in Sri Lanka. As a result, higher proportions of the sampled population reside in urban areas and have higher levels of education. An over-representation of such individuals may lead to an underestimation of vaccine hesitancy.

Conclusion

In our cohort, receiving two doses of the COVID-19 vaccine was associated with reduced disease severity. Those with mild disease recovered faster than those having moderate/severe disease. Over 90% recovery was observed at 3 mo following hospital discharge in this group of COVID-19 patients.

Supplementary data

Supplementary data are available at *Transactions* online.

Authors' contributions: VA, SLS, SDM, APS, RM, TS, AF, CDM and LC conceptualised the study; VA, RSW, SM and PDM collected the data; VA, SLS, SDM, and RM analysed the data; VA, SLS, SDM and RM wrote the manuscript; VA, LC, CDM, SLS, AF and SDM conducted a critical review and editing of the manuscript. All the authors read and approved the final version of the manuscript. VA, SLS and SDM are guarantors of the paper.

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