Six-minute walk test and its predictability in outcome of COVID-19 patients

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Abstract:

BACKGROUND: The world is worsely hit by the COVID-19 pandemic resulting in increased morbidity and mortality. Increased mortality has been observed in older adults with multiple comorbidities. Six-minute walk distance (6MWD) at admission can help us to guide the requirement of oxygen during hospital stay that can be used to determine which patient can be managed at home.

MATERIALS AND METHODS: This study was a prospective observational study conducted on COVID-19 patients admitted at AIIMS, New Delhi, from October to December 2020. Patients aged more than 60 years were included in the study and underwent 6-min walk tests. Polypharmacy and multimorbidity were also assessed along with dyspnea which was measured on BORG scale. $P < 0.05$ was considered statistically significant. Statistical software STATA (version 14.2) was used for all the analyses.

RESULTS: The mean age of the study population was 68.76 (7.4). Oxygen saturation prior to the 6-MWT was normal and has significantly higher than the post test ($P \leq 0.001$). 6MWD was significantly correlated with pre values of oxygen saturation. 6MWD was observed more in patients who did not require oxygen during hospital stay. Self-reported dyspnea, pulse rate, oxygen saturation, and systolic blood pressure were significantly associated with the patients who had an oxygen requirement during the hospital stay.

CONCLUSION: Self-reported dyspnea after 6MWT was found to be associated with oxygen requirement during hospital stay. Patients who have covered more distance in 6-min walk test have less oxygen requirement during hospital stay hence can be managed at home. This will reduce the health-care burden and will help to tackle the outburst during the ongoing pandemic.

Keywords:
COVID-19, oxygen requirement, six-minute walk test

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Received: 22-04-2021
Revised: 20-06-2021
Published: 26-02-2022

Introduction

COVID-19 has resulted in an increased burden to hospitals and health-care professionals.[1] A rapid surge in cases of COVID-19 has been noted in India which has resulted in very difficult and desperate situations. To have a better outcome, the case burden should be less than the treatment capacity of the health-care delivery system. Its adverse outcome is seen in older people with chronic illnesses and multiple comorbidities.[2] Increased age and multiple comorbidities had been seen to be associated with increased hospital stay, intensive care unit (ICU) admission, and mortality among older people. COVID-19 has been found to involve multiple organs, but pneumonia is the most common clinical presentation and it ranges from mild asymptomatic cases to respiratory failure.[3] Reduced lung reserve[4] and compliance resulted in poor outcomes of COVID-19 infection in older people.

Six-minute walk test is done to measure the aerobic capacity and endurance in people. Distance covered during 6 min of the walk can be used to compare performance capacity and hence outcome in COVID-19 patients. Six-minute walk distance (6MWD) has been seen to be used as a predictor of mortality in the outcome of idiopathic pulmonary fibrosis (IPF) patients. Both 6MWD and change in 6MWD are independent predictors of mortality in patients with IPF.[5] Values of 6MWD <330 m and <70% of predicted value were associated with lower survival time in IPF patients.[6]

Although vaccination against COVID-19 has been started, vaccination of all individuals across the world is tedious. By the time everyone is vaccinated, we should practice the COVID-appropriate behavior to curtail its spread and break the chain of its spread.[7] The use of clinical tests at the time of admission of COVID patients in the hospitals can reduce the burden and also results in the early discharge of admitted patients. It can also be used as a deciding factor which patients can be managed at home. Considering the above situation, this study is designed to check whether a 6-min walk test can be used as a predictor in the outcome of COVID-19 patients. The 6-min walk test has been conducted according to ATS protocol[8-10] on those patients who consented to participate in the study.

Materials and Methods

Study design and settings
A prospective observational study was conducted at All India Institute of Medical Sciences, New Delhi, India. The aim of the study was to evaluate the role of the 6-min walk test as a predictor of outcomes in older patients with COVID-19 infections. All the patients aged 60 or more presenting with severe acute respiratory illness due to COVID-19 during a specific time period of mid-October to mid-December 2020 were included in the study. Patients who are on oxygen at the time of admission, with acute joint pain, and did not consent to participate in the study were excluded.

Data collection tools and technique
Baseline demographic characteristics were obtained from the hospital records at the time of admission, and history regarding previous comorbidities was also taken. Accordingly, a baseline 6-min walk test has been conducted to look for its association with the outcome of COVID-19-hospitalized patients. Vitals were recorded at the time of admission as well as both before and after 6-min walk tests. BORG scale for dyspnea had been used at both pre and post 6-min walk tests to look for breathlessness. The usage of five or more drugs was used as the criteria for the diagnosis of polypharmacy. The patients were monitored for their outcomes such as oxygen requirement, ICU stay, or ventilatory requirement during their hospital stay. Final outcomes such as discharge or death and duration of stay in hospital have also been recorded.

Ethical consideration
Ethical clearance was taken from the local ethics body of the institution (permission number IEC/748/07.08.2020, RP 03/2020).

Statistical analysis
Values obtained by the study of each qualitative variable were expressed as absolute and relative frequencies, whereas continuous variables were organized as mean (standard deviation [SD]) and/or median (range).

Table 1: Demographic characteristics of the study population

Characteristics	Number (*n*=60), *n* (%)
Sex	
Female	25 (41.67)
Male	35 (58.33)
Locality	
Rural	18 (30.00)
Urban	42 (70.00)
Education	
Illiterate	12 (20.00)
Up to class 10	19 (31.67)
Undergraduate	24 (40.00)
Postgraduate	58.33
Caretaker	
Family members	60 (100)
Self	0
COVID-19 itself as an independent risk factor for stress	49 (81.67)
Able to walk	
Independent	57 (95.00)
Walk with use of stick	3 (5.00)
Hypertension	35 (58.33)
Diabetes	28 (46.67)
Coronary artery disease	10 (16.67)
Osteoarthritis	2 (3.33)
Chronic obstructive airway disease	8 (13.33)
Benign prostatic hyperplasia	2 (3.33)
Hypothyroidism	5 (8.33)
Comorbidities	
No illness	7 (11.67)
MDR tuberculosis	2 (3.33)
Chronic kidney disease Stage 4 and above	3 (5.00)
Cerebrovascular accident	2 (3.33)
Malignancy	4 (6.67)
Urine incontinence	2 (3.33)
Atrial fibrillation	2 (3.33)
Others	6 (10.00)
Past history of surgery	16 (26.67)
Polypharmacy	23 (38.33)

MDR=Multi drug resistant

To find the association between two qualitative variables, Chi-square test or Fisher's exact test was applied, and to compare the quantitative variables between two groups, *t*-test or Wilcoxon rank-sum test was used according to the distribution of the data. To determine the statistically significant differences between three or more independent (unrelated) groups, analysis of variance was used. To measure the correlation between quantitative variables, Pearson correlation or Spearman rank correlation was used as required. *P* < 0.05 was considered statistically significant. Statistical software STATA-SE (version 14.2) (StataCorp, College Station, TX, U.S.A) was used for all the analyses.

Results

The mean (SD) of the study population is 68.76 (7.4) and comprises 41% of the female population. About one-third of the study population belongs to rural backgrounds and 80% of the population were literate. All the older adults included in the study were taken care of by their family members. Eighty-two percent of the study population considered that COVID-19 is itself a risk factor for stress among them. Further, out of the total, 57 of the older adults who participated in the study can walk independently, whereas 3 were using sticks to walk. Hypertension (58%) and diabetes (46%) were the two most common comorbidities found in the study population. Other common comorbidities were chronic obstructive pulmonary disease (COPD), coronary artery disease, and osteoarthritis. Disease comorbidities profiles are mentioned in Table 1. Again, 11% of the patients have no comorbidities at the time of presentation. Polypharmacy was seen in 33% of the study population.

Oxygen saturation prior to the 6-min walk test was normal and has a higher value than the post 6-min walk test (*P* ≤ 0.001) [Table 2]. Systolic blood pressure (BP) after the 6-min walk test was significantly higher than the pre test (*P* = 0.005) [Table 2], however, diastolic BP was not significantly higher than pre value. Further, the pulse rate after the 6-min walk test was significantly higher than the pre 6-min walk value (*P* = 0.002). BORG scale score was also significantly higher in the post 6-min walk test (*P* ≤ 0.001) [Table 2].

We correlate the distance covered during the 6-min walk test with pre values of oxygen saturation, pulse rate, dyspnea measured on BORG scale, systolic BP, and diastolic BP. A significant association was found with BORG scale (*P* ≤ 0.001) [Table 3].

We also explore the relationship of oxygen required/not required patients during hospital stay with age, 6MWD, and BORG scale. No significant difference of age (69.66 [±7.57] vs. 68.61 [±7.44]) in oxygen required and

Table 2: Vitals prior and post 6-min walk test

Characteristics	Prior 6-min walk test	Post 6-min walk test	*P*
Oxygen saturation (SpO$_2$)			
Mean (±SD)	97 (±1.79)	95.45 (±2.58)	<0.001
Median (IQR)	98 (2)	96.5 (4.5)	
Systolic blood pressure			
Mean (±SD)	133.55 (±13.36)	135.98 (±13.56)	0.005
Median (IQR)	133 (12.5)	134 (10)	
Diastolic blood pressure			
Mean (±SD)	80.95 (±6.54)	82.23 (±6.64)	0.086
Median (IQR)	81 (10)	82 (10)	
Pulse rate			
Mean (±SD)	84 (±12.60)	86.47 (±12.76)	0.002
Median (IQR)	81 (10)	86 (12)	
BORG scale			
Mean (±SD)	0.25 (±0.39)	0.97 (±1.17)	<0.001
Median (IQR)	0 (0.5)	0.5 (2)	

SD=Standard deviation, IQR=Interquartile range, Spo$_2$=Oxygen saturation, BORG

Table 3: Association of measured variables pre 6-min walk test with distance covered

Variables	Correlation coefficient	*P*
Spo$_2$	0.281	0.030
Blood pressure		
Systolic	−0.184	0.160
Diastolic	−0.016	0.921
Pulse rate	−0.225	0.083
BORG scale	−0.60	<0.001

Spo$_2$=Oxygen saturation, BORG

oxygen not required was observed (*P* = 0.696) [Table 4]. The 6MWD was lower in the oxygen requirement group (476.67 [±149.33]) as compared to the oxygen not required group (574.01 [±184.88]) and was not statistically significant (*P* = 0.140). Further, BORG score in the oxygen required group (0.444 [±0.30]) was significantly higher than the oxygen not required group (0.216 [±0.403]) (*P* = 0.015).

Discussion

About 82% of the study population considers that COVID is itself a risk factor for stress as this pandemic has resulted in both physical and social isolation. Older adults were restricted to participate in social gatherings, lockdown resulted in limitations of outdoor activities, and increased morbidity and mortality due to COVID resulted in increased stress.[11] Polypharmacy was seen in older adults because of increased comorbidity with increasing age.[12] Hypertension and diabetes were the two most common comorbidity seen in older adults. Hypertension and diabetes are the two most common causes of noncommunicable disease which is also seen in our study. Oxygen saturation prior to the start of 6 min was normal, but it decreased significantly after 6 min

Table 4: Association of outcome (oxygen requirement) with other measured variables

Variables	Mean (±SD)		*P*
	Oxygen requirement (number=9)	Oxygen not required (number=51)	
Distance covered	476.67 (±149.33)	574.02 (±184.88)	0.140
BORG scale	0.44 (±0.30)	0.22 (±0.40)	0.015
Age	69.66 (±2.52)	68.60 (±1.04)	0.696

SD=Standard deviation

of walking, which may be due to decreased respiratory reserve in older people or due to COVID-19 infection.[13] Systolic BP also rises significantly after a 6-min walk which was also seen in a previous study.[14]

Self-reported dyspnea as measured on BORG scale was also more as compared with prior to 6-min walk test. It also showed a significant association with oxygen requirements during hospital stay (P = 0.015). Those subjects who had increased dyspnea after a 6-min walk test are more likely to require oxygen during hospital stay. It has been seen that half of the COVID patients who also developed dyspnea after a 6-min walk test, of which one-third of them have pulmonary embolism, however, the sample size was less in their study.[15]

6MWD was less in patients who required oxygen during hospital stay. It indicates that patients who covered less distance have increased risk of desaturation, so they should be monitored strictly either in hospital stay or in home isolation. However, the values were not statistically significant, but we can conclude that those subjects who covered less distance should be admitted in the hospital and monitored. Six-minute walk test has been used as a predictor of survival in COPD.[16]

Oxygen saturation at the time of admission was also on the lower side in patients who require oxygen during hospital stay and its association was significant. Those subjects who had lower oxygen saturation in the beginning should be strictly monitored during the illness.

This study focuses on older adults with multimorbidity having COVID-19 infection and its outcome. This is probably the first study of its kind which focuses on 6-min walk test and its outcome in older adults having COVID infections. Six-minute walk test can be used as a predictor for outcome of COVID-19 patients. Six-minute walk test can be used as a screening tool for admission of patients.

Limitation

6MWD is not significantly associated with oxygen requirement during hospital stay though the distance covered is less in patients who require oxygen during the hospital stay. Large numbers of sample sizes may be required to establish the significant association.

Conclusion

Self-reported dyspnea after a 6-min walk test has been found to have increased requirement of oxygen during hospital stay. Patients who have distance covered more are likely to have less requirement of oxygen during hospital stay. Oxygen saturation as measured on pulse oximeters is also less in subjects who require oxygen. Chronological age is not associated with oxygen requirement as well as poor outcome in patients with COVID-19 infections.

Conflicts of interest

There are no conflicts of interest.

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