Section: Emergency Medicine

Original Research Article

ROLE OF SINGLE BREATH COUNT (SBC) TO PREDICT PROGRESSION OF DISEASE AMONG MILD/ ASYMPTOMATIC COVID- 19 PATIENTS- A RETROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Majority of the COVID-19 patients are either asymptomatic or have mild severity, highlighting the need for a bedside tool to manage these cases effectively and prevent unnecessary hospitalizations. The present study was designed to assess the utility of Single breath count (SBC) for predicting clinical worsening of mild / asymptomatic COVID-19 patients. **Materials and Methods:** A retrospective observational study was undertaken from the records of the adult patients who were tested positive RT-PCR for SARS CoV-2 to the emergency department (ED). A total of 299 patients were enrolled and followed on alternate days (Days 1, 3, 5, and 7) via telecommunication. The Single breath count test was performed on alternate days. This was used to the find the association with outcome in terms of improvement or required admission based on signs of clinical severity. **Result:** 56.9% of the patient population were admitted to the hospital, and the rest 43.1% were sent for home isolation. The mean SBC of patient admitted to ward without oxygen requirement on Days 5 and 7 was 41.3 ± 9.5 and 41.1 ± 12.3, respectively. The mean SBC for admitted and non-admitted patients was 39.6 ± 7.6 and 42.5 ± 2.5, respectively. Patients requiring admission until Day 7 had a mean SBC of 16.1 ± 0.4, whereas those not requiring admission had a mean SBC of 42.2 ± 7.4. **Conclusion:** SBC is a simple and effective tool for monitoring mild or asymptomatic COVID-19 patients at home or in the emergency ward, aiding in timely patient disposition.

INTRODUCTION

As of recent global estimates, over 567 million confirmed cases of COVID-19 and more than 6.3 million related deaths have been reported. In India alone, since the emergence of the pandemic, there have been 43,938,764 confirmed cases and 526,167 deaths attributed to the disease.[1] COVID-19 primarily affects the respiratory system, and based on the severity of pulmonary symptoms, patients are stratified into mild, moderate, or severe categories.[2] The majority of patients (approximately 80%) exhibit mild symptoms, such as fever, cough, sore throat, nasal congestion, malaise, and headache, without clinical signs of breathlessness or hypoxia. A smaller proportion (about 20%) progress to hypoxic respiratory failure, requiring escalating levels of oxygen therapy.[3]
Pneumonia is the most common complication observed in COVID-19, and the clinical outcomes remain highly unpredictable due to the substantial heterogeneity in disease presentation. Key manifestations of COVID-19 pneumonia include severe dyspnea, increased respiratory rate with shallow breathing, and a decline in oxygen saturation.[4] While patients with mild symptoms can typically be managed in outpatient settings, vigilant monitoring is imperative, as clinical deterioration may occur abruptly—often within the first week of symptom onset. A particularly concerning phenomenon is "silent hypoxemia," where patients exhibit significantly low oxygen levels in the absence

of dyspnea. This delays the recognition of respiratory compromise and the timely initiation of supportive interventions.[5]

In this context, the need for a simple, rapid, and cost-effective clinical tool becomes evident—one that can be easily employed by both healthcare providers and patients to detect early signs of deterioration. Such a tool would support emergency physicians in making timely decisions about the level of care required and facilitate efficient allocation of limited healthcare resources. The Single Breath Count (SBC) test, which measures the number of counts a patient can vocalize in a normal speaking voice following a maximal inhalation, offers a promising bedside assessment of respiratory function.[6] Its simplicity enables quick triage of patients with COVID-19 pneumonia, allowing prioritization of those in greater need of intervention, while reducing the burden on diagnostic services.

SBC also allows frequent, real-time assessment of respiratory status, limiting the need for advanced diagnostic testing to only those patients who demonstrate declining performance. The test is non-invasive, requires no specialized equipment, and can be conducted at the bedside or even in resource-limited settings. However, SBC is not without limitations—it is not applicable to patients with aphasia, severe dyspnea, or cognitive impairments that hinder comprehension or cooperation.[7] Nonetheless, despite these constraints, SBC serves as a valuable screening modality that provides a broad overview of the patient's respiratory capacity and overall condition.

Previous studies have demonstrated that SBC correlates well with standard measures of pulmonary function and has been proposed as a useful indicator of respiratory compromise in both acute and chronic clinical settings.[8,9] However, to the best of our knowledge, no study has assessed the utility of SBC in the Indian population for the early identification and management of mildly symptomatic or asymptomatic COVID-19 patients. In light of this, the present study is designed to evaluate the effectiveness of SBC as a predictive tool for clinical deterioration in patients with mild COVID-19 infection.

MATERIALS AND METHODS

A retrospective observational study was conducted utilizing the medical records of adult patients who tested positive for SARS-CoV-2 via reverse transcription polymerase chain reaction (RT-PCR) and presented to the Emergency Department (ED) of the All-India Institute of Medical Sciences, Rishikesh, Uttarakhand, during the period from September 2020 to December 2020. Patients aged between 18 and 65 years, of either gender, and classified as having mild or asymptomatic COVID-19 were included in the study. Exclusion criteria comprised patients who did not provide informed consent and those who were pregnant.

In accordance with institutional emergency protocols, patients presenting to the ED were triaged and managed by emergency physicians following the guidelines issued by the Ministry of Health and Family Welfare. The Single Breath Count Test (SBCT) was administered by instructing each subject to take a maximal inhalation and count aloud in their usual voice, at a rate of approximately two counts per second, while seated in bed. The procedure was explained clearly to all participants prior to initiation. Follow-up was performed telephonically on alternate days (Day 1, 3, 5, and 7) from the day of presentation to assess for clinical deterioration [Figure 1].

Patients exhibiting signs of worsening clinical status—including but not limited to dyspnea, tachypnea or shallow breathing, cyanosis, chest pain or pressure, altered mental status, or inability to tolerate oral intake—were referred to the nearest designated COVID care center for further evaluation. Admitted patients were monitored closely for progression. Demographic data including age, gender, and the presence of comorbidities were documented alongside serial SBCT values. The primary outcome measure was clinical progression, defined by respiratory parameters such as a respiratory rate ≥24 breaths per minute and an oxygen saturation (SpO_2) <94% on room air.

Data were collected in accordance with a pre-designed standardized template and extracted from both digital and physical medical records. Data confidentiality was maintained throughout the study period. The compiled dataset was organized using Microsoft Excel, and appropriate statistical analyses were conducted following data filtration. Descriptive statistics were applied to summarize baseline characteristics—categorical variables were expressed as frequencies and percentages, while continuous variables were reported as mean ± standard deviation. Logistic regression analysis was employed to identify predictors of clinical deterioration, and independent t-tests were used to compare SBCT values between patients who improved and those who worsened clinically.

All procedures were conducted in strict adherence to institutional guidelines governing patient data usage. The confidentiality of patient information was rigorously maintained.

RESULTS

Out of total 299 subjects, 56.9% of the patient population were admitted to the hospital, and the rest 43.1% were sent for home isolation. The male preponderance was observed in the study and the male: female population was 2.4:1. The mean age of the admitted and non-admitted patients was 45.4 ± 15.1 years and 34.9 ± 10.5 years respectively. 39.6 ± 7.6 and 42.5 ± 2.5 was the mean SBC of the admitted and non-admitted patients respectively. The

Respiratory rate (RR) of the admitted patients and non- admitted patients was 18.0 ± 2.7 breaths/min and 15.2 ± 2.4 breaths/min respectively [Table 1]. The oxygen saturation of the admitted patients was 97 ± 1.6. whereas for non-admitted patients, the oxygen saturation was 98 ± 1.0. Overall, among the admitted patients the oxygen support was essential for 13.5% of the patients [Table2]. 96.5% of the patients were admitted to ward and the rest 3.5% were into the Intensive care unit (ICU). (Table 3). The overall mortality rate observed in the entire study conducted in mild or asymptomatic patient population was 1.0%.

Table 1: Baseline characteristics of the patients enrolled in the study.

Variable	Admitted	Not admitted	Significance (P-value)
Total	170 (56.9%)	129 (43.1%)	--
Male	115	96	--
Female	55	33	--
SBC	39.6 ± 7.6	42.5 ± 2.5	0.0077
Age (years)	45.4 ± 15.1	34.9 ± 10.5	<0.0001
RR (breaths/min)	18.0 ± 2.7	15.2 ± 2.4	0.0111
HR (beats/min)	87.7 ± 10.1	84.4 ± 7.9	0.0016
SpO2 (%)	97 ± 1.6	98 ± 1.0	0.7984
Dead	3	0	0.1294

Table 2: Characteristics of the patients that required admission till day 7 and those did not required admission till day 7.

Variable	Patient that required Admission till day 7	Patient that did not required Admission till day 7	Significance (P-value)
Total	23 (13.5%)	147(86.5%)	--
Male	21	94	--
Female	2	53	--
SBC	16.1 ± 0.4	42.2 ± 7.4	<0.0001
Age (years)	48.1 ± 14.7	44.9 ± 15.1	0.4263
RR (breaths/min)	20.3 ± 1.8	17.7 ± 2.7	0.6468
HR (beats/min)	91.9 ± 10.7	87.1 ± 10.1	0.0737
SpO2 (%)	95 ± 1.7	98 ± 1.6	0.4980
Dead	3	0	<0.0001

Table 3: Characteristics of the admitted patients on the basis of external oxygen support

Variable	No oxygen support (A)	Oxygen support		Significance		
		General ward(B)	ICU(C)	A vs. B	A vs. C	B vs. C
Total	147 (86.5%)	17 (10%)	6(3.5%)	--	--	--
Male	94	15	6	--	--	--
Female	53	2	0	--	--	--
SBC	42.2 ± 7.4	23.5 ± 9.0	23 ± 0.0	<0.0001	<0.0001	0.9933
Age (years)	44.9 ± 15.1	47.6 ± 14.7	49.6 ± 17.3	0.5115	0.4639	0.8982
RR (breaths/min)	17.7 ± 2.7	20.2 ± 2.6	20.3 ± 2.0	0.5627	0.7901	0.9997
HR (beats/min)	87.1 ± 10.1	90.9 ± 11.0	94.7 ± 9.7	0.2661	0.1357	0.6791
SpO2 (%)	98 ± 1.6	95.3 ± 1.8	95 ± 1.3	0.5115	7308	9976
SBC day 5	41.3 ± 9.5	23.9 ± 9.7	19.7 ± 3.1	<0.0001	<0.0001	0.6234
SBC day 7	41.1 ± 12.3	12.8 ± 14.0	10 ± 3.1	<0.0001	<0.0001	0.8104
Discharged	147	17	3	--	--	--
Dead	0	0	3	--	--	--

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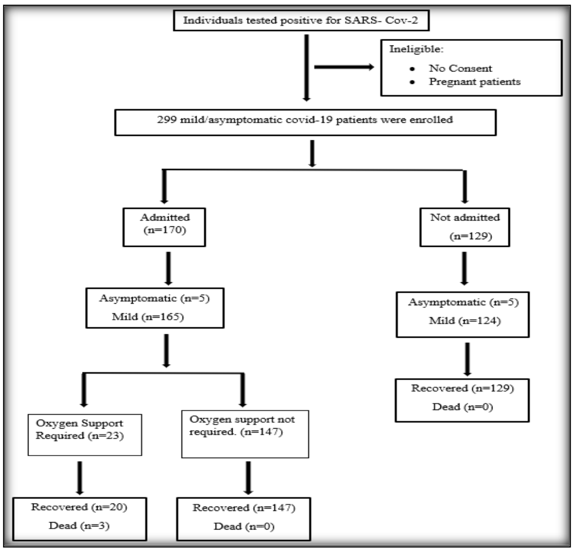

Figure 1: Comprehensive flowchart of study.

DISCUSSION

COVID-19, a clinically heterogeneous disease with presentations ranging from asymptomatic to severe illness, has imposed a substantial global healthcare burden. While the majority of affected individuals exhibit mild or uncomplicated symptoms, approximately 14% develop severe disease necessitating hospitalization and oxygen therapy, and nearly 5% require intensive care support. In this context, the early identification of clinical deterioration and timely escalation from isolation wards to intensive care settings remains a crucial component of effective disease management. One potential early diagnostic tool is the Single Breath Count (SBC), a simple, inexpensive, and easily applicable bedside assessment. SBC involves the serial counting of numbers in a normal speaking voice following a maximal inhalation and serves as a proxy for pulmonary function. It has shown promise in identifying patients at risk of progression to acute respiratory failure (ARF), particularly in COVID-19 pneumonia.[10] The present retrospective observational study was undertaken to evaluate the utility of SBC in predicting disease progression among asymptomatic or mildly symptomatic COVID-19 patients.

Among a total of 299 patients, 43.1% remained asymptomatic and were discharged, while 56.9% required hospitalization. In a similar study by Krishnasamy et al., 49.5% of patients were symptomatic at admission, 2.2% developed symptoms later, and 48.5% remained asymptomatic throughout their illness.[11] Of the 170 hospitalized patients in the current study, 96.5% were admitted to general wards, and 3.5% required intensive care. Among ward admissions, 10% necessitated oxygen therapy. The mean SpO_2 levels in patients admitted to the ward without oxygen requirement, with oxygen requirement, and those admitted to ICU were 98 ± 1.6, 95.3 ± 1.8, and 95 ± 1.3 respectively. Correspondingly, the mean SBC in these groups was 42.2 ± 7.4, 23.5 ± 9.0, and 23 ± 0.0 respectively. Longhitano et al. reported SpO_2/FiO_2 values of 431.1 ± 39.1 and 357.8 ± 104.9 in patients not requiring and requiring non-invasive respiratory support (NIRS), respectively.[12]

The mean respiratory rate among patients requiring admission by day 7 was 20.3 ± 1.8 breaths/min, compared to 17.7 ± 2.7 breaths/min in those who did not. Longhitano et al. reported respiratory rates of 21.5 ± 8.1 and 23.1 ± 7.7 breaths/min in NIRS not required and required patients, respectively.[12] The mean SBC among admitted and non-admitted patients was 39.6 ± 7.6 and 42.5 ± 2.5, respectively. For patients requiring admission within seven days, the mean SBC was significantly lower (16.1 ± 0.4) compared to those who did not (42.2 ± 7.4), with a statistically significant difference ($P < 0.0001$).

Among patients admitted without oxygen requirement, the mean SBC on day 5 and day 7 was 41.3 ± 9.5 and 41.1 ± 12.3, respectively. In contrast, those requiring oxygen therapy in the ward demonstrated a marked reduction in SBC values: 23.9 ± 9.7 on day 5 and 12.8 ± 14.0 on day 7. Patients admitted to the ICU had SBC values of 19.7 ± 3.1 on day 5 and 10 ± 3.1 on day 7. These findings highlight the prognostic utility of SBC in early risk stratification. Longhitano et al. similarly reported SBC values of 30.4 ± 6.9 and 24.5 ± 6.4 for NIRS not required and required patients, respectively.[12] Previous studies by Ali SS et al., Ushkow S et al., and Elsheikh et al. have demonstrated the clinical application of SBC in asthma exacerbations.[8,9,13] Elsheikh et al. suggested that an SBC ≥ 25 indicates preserved respiratory muscle function in patients with myasthenia gravis,[9] whereas Juel et al. reported that an SBC ≤ 20 may be indicative of respiratory compromise in the same population.[14] Palaniyandi et al. advocated the use of SBC as a valuable tool for pulmonary assessment in emergency and resource-limited settings.[15]

CONCLUSION

The majority of COVID-19 patients present with mild symptoms or are asymptomatic. However, in many cases, overcautious hospitalization of these patients leads to unnecessary utilization of critical healthcare resources, increased financial burden, and reduced availability of beds for patients with moderate to severe illness. The current findings underscore the potential role of SBC as a simple, effective, and non-invasive bedside tool to monitor asymptomatic or mildly symptomatic COVID-19 patients, particularly in outpatient and emergency care settings. Incorporating SBC into routine assessments can assist in appropriate triage and disposition, thereby optimizing resource allocation

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