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CASE REPORT

Walking test as clinical assessment for unmasking occult hypoxemia in COVID-19: A case series

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Abstract SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2) infection is a respiratory infection initially identified in Wuhan, China, in December 2019. Some of the patients have been found to show no signs of respiratory distress; however, when oxygen saturation levels are measured, they are abnormally lower than expected in relation to their clinical condition. This is why we collected a series of cases from patients diagnosed with COVID-19 (Coronavirus disease 2019) who underwent a 2-min walking test during the initial evaluation in the emergency department. A drop in oxygen saturation below 90% was considered a positive result. Eighty-five percent of patients with a positive walking test required in-hospital management and 70% required oxygen supplementation during hospitalization. This clinical tool could help determine which of these patients might require in-hospital care due to occult hypoxemia, considering the current epidemiological situation and high bed occupancy rates.

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Introduction

The coronavirus 2019 disease is the name given to the pathology caused by the acute respiratory infection developed by SARS-CoV-2. Described initially in Wuhan (China) it spread rapidly causing around 1.85 million deaths worldwide and approximately 121 thousand in Colombia until August 2021.

Physiopathologically, the sensation of dyspnea occurs when there is an imbalance between the central neuronal stimulus of the respiratory center, located at the level of the medulla oblongata, and the pons at the level of the brainstem. The main stimuli to affect the respiratory drive are chemical changes captured by peripheral chemoreceptors, in addition to mechanoreceptors at the level of the lung parenchyma, which are activated and transformed into afferent signals in the presence of hypercapnia, hypoxemia, or parenchymal lung disease. These afferent signals are transmitted through the vagal nerve to the central nervous system, responsible for the process of generating dyspnea. It has been hypothesized that SARS-CoV-2 modifies the function of different neurological areas due to the virus’s own neurotropism; being an example of this is the presentation of anosmia and ageusia as cardinal symptoms in the absence of important catarrhal symptoms.1-3

It has been interesting to observe that patients with COVID-19 with pulmonary compromise rarely manifest with a feeling of breathlessness, even with low oxygen saturations; this is what has been called “silent hypoxemia” or “happy hypoxemia.” This has made it somewhat challenging to identify patients who could potentially complicate and require inpatient management and even in a highly dependent unit.

It has been difficult to predict the need for admission to inpatient care due to the exponential rise of the COVID-19 cases and the lack of tools during the first evaluation of those patients without a significant respiratory compromise. Given the socio-economic conditions of our country, the high demand and little relative availability of hospital beds, it is necessary to design a method to identify patients who have a potential risk of complications, oxygen requirements, and need for a high dependency unit and who it can be applicable from triage, attention in emergency services of any level of complexity, ambulatory programs, and outpatient monitoring for the administration of the health resource.

Previous studies have described the walking or exercise test (6 min walk) as an easy measure for decision-making at emergency rooms and ambulatory care. The following article describes a case series of patients, observed in a tertiary-level hospital in the city of Medellin, Colombia, who were admitted with a diagnosis of COVID-19 without clinical signs of respiratory distress, neither requirement of oxygen supplementation to achieve a SatO₂ more than 92%, given the reference value for the altitude of the city.

Hereby, this case series presents the data of the patients that followed the walking test during medical attention exposing the plausibility of the utilization (in all areas, starting with triage up to high dependency services) for early establishing which patients could benefit from inpatient care.

Case series

We obtained the data of 27 patients with COVID-19, diagnosed by reverse transcription polymerase chain reaction (RT-PCR) through nasopharyngeal aspirate. They were admitted to the emergency department in a tertiary-level hospital in Medellin (Colombia), without oxygen requirement (Sat > 92%) and with hemodynamic stability (no requirement for vasoactive support to achieve mean arterial
Table 1  Demographic and clinical characteristics.

| Variable                                      | Walking test          |
|-----------------------------------------------|-----------------------|
|                                               | Positive (n=20)       | Negative (n=7)         |
| Gender                                        |                       |                       |
| Female                                        | 5  25%                | 2  40%                |
| Male                                          | 15  75%               | 3  60%                |
| Age (years)                                   | 51 ±13                | 38 ±15                |
| Comorbidities                                 |                       |                       |
| Arterial hypertension                         | 6  30%                | 0  0%                 |
| Diabetes mellitus                             | 4  20%                | 0  0%                 |
| COPD/Asthma                                   | 3  15%                | 2  40%                |
| PaO2/FiO2 (n)                                 | 292 ±39               | 304 ±66               |
| Required hospitalization                      | 17  85%               | 2  40%                |
| Length of stay (days)                         | 6  ±4                 | 4  ±4                 |
| Required high dependency unit                 | 2  10%                | 0  0%                 |
| Required supplemental oxygen during hospitalization | 14  70%             | 2  40%                |

pressure >90 mmHg and adequate peripheral perfusion). The demographic data, rest vital signs and posttest vital signs were collected from electronic medical history.

During the medical evaluation, a walking test was performed. The test consisted of asking the patient to walk around the room for 2 min long. A positive result was considered as a drop in the oximetry below 90% after the walking test.

The categorical variables were expressed with absolute frequency and percentual distribution. The continuous variable reported with median and standard deviation (SD), according to the data distribution using the Shapiro-Wilk test.

This report was made following the CARE guidelines (Consensus-based Clinical Case Reporting Guideline Development).

Most of the patients were masculine (74%), with a ratio of 2:1 man to woman and a mean age of 48 years (±14). The main comorbidities of the patients were arterial hypertension (25.9%), followed by diabetes and COPD/asthma with 14% and 18.5%, respectively. Along with the patients that had positive walking test results, 30% had arterial hypertension, 20% diabetes mellitus, and 15% COPD/Asthma.

The mean of the oxygenation index (PaO2/FiO2) was 291 mmHg ± 43.

Of the patients with a positive walking test, 85% required inpatient care, 70% required oxygen supplementation, and 10% were admitted to a high dependency unit during the hospital care. The mean length of stay was six days, and most of the patients had a minimum stay of 48 h.

Table 1 shows patients characteristics according to the walking test results.

Discussion

The infection from SARS-CoV-2 has a broad spectrum of clinical presentations in terms of severity. It has been possible to characterize approximately that 81% of cases have been mild, 14% severe, and critical in a 5%. In the study of Guan et al., they report that only 18.7% of 1099 hospitalized patients from COVID-19 manifested dyspnea despite being hypoxemic, having significant radiographic compromise, and requiring supplemental oxygen. Considering the preceding and given that the number of cases of SARS-CoV-2 infection is on the rise, it is considered necessary and pertinent to propose a clinical tool that helps to identify patients who may potentially require in-hospital treatment, to allow the establishment of early therapeutic measures from ambulatory or emergency services in order to improve the prognosis and ensure better clinical follow-up.

In the literature, there are tests such as the 2-min walking test as a reference, which has been used in different pulmonary pathologies with interstitial involvement (ILD, P. Jiroveci pneumonia, among others), with positive results that have helped clinical decision making, so we think it can be extrapolated to SARS-CoV-2 infection. Several publications recommend or suggest the use of a walking test or exercise in patients with SARS-CoV-2 infection. Mantha et al. argue that using a 6-min walk test in patients under 70 years of age on day 4 or 5 of the disease helps to stratify their risk and whether they will potentially require inpatient management. This was also proposed by Abolhasani et al., who propose that the deterioration in oxygenation during the 6-min walk can be used to identify those patients who should be referred for inpatient management. In the case of Pandit et al., they recommend that the use of the same test can be used for outpatient or hospital supervision, carried out even by the same patient under the supervision of a family member or health professional, to identify patients who require other therapeutic measures earlier.

In the collected cases, it was observed that from the second minute of the walking test, the patients already had a drop in SaO2 %, which we suppose led to the suspension of the maneuver. It is reasonable, understanding the context of low functional capacity of the COVID19 patient, not to extend the test until 6 min.

In this case, the goal was to adopt these recommendations and observe the behavior of the patients who had
a positive walk test with confirmed SARS-CoV-2 infection. When analyzing the data, it was observed that the patients who had a positive test required hospitalization in 85% and a hospital stay greater than 48 h. It draws attention and justifies that the patients who had a positive test needed closer monitoring since 70% required oxygen supplementation during hospitalization. Another important characteristic of this study is, compared with the recommendations that have emerged in the literature, the data analysis showed this test could be applied to patients under 60 or 70 years of age in the context of COVID-19. It was observed that this strategy was applied in patients with an average age of 51 years. These patients were observed to have more comorbidities, consistent with a higher risk of deterioration and complications. It is clarified that although there are recommendations regarding the application of the walking or exercise test in the context of COVID-19, they are extrapolations of its use in other pulmonary pathologies, and there is no study to date that validates the use of this strategy.

Concerning the above, this study intends to propose a cost-effective and easy-to-use resource to all kinds of institutions in outpatient and inpatient care settings that help health care professionals make decisions related to the management of those patients, like hospitalization or oxygen supplementation. Thanks to the concluded results of the case series, the emergency department from which the data were taken included the walking test in its standard-of-care as part of its initial medical evaluation for COVID-19 patients.

Given that there has been an overflow of patients with this pathology, saturating health services, this strategy could help reduce the costs and take better advantage of the health care staff.

Hypoxia is an independent factor associated with higher mortality in the context of SARS-CoV-2 infection; therefore, its recognition is necessary. Multiple models and classification scales have been developed, which try to stratify and predict the possible adverse outcome and mortality in this group of patients and validated for their use in this context. Between them, the NEWS 2, MEWS, REMS, Carr final, qSOFA, CURB65, among others.

In the study by Gupta et al., 22 prognostic models were applied in 411 patients with SARS-CoV-2 infection, reviewing the validity of the different prognostic scores. However, the unvariable predictors that achieved to predict the most accurate clinical outcome and mortality were the oxygen desaturation by pulse oximetry and age, demonstrating that any other prognostic model could offer a greater benefit than these two predictors.

There is still no study with adequate methodological rigor to determine how the walking test manages to discriminate the possibility or risk of clinical deterioration in patients with SARS-CoV-2 infection. Therefore, this study intends to consider the walking test for the creation of prognostic models and to validate it as a possible independent factor of paraclinical parameters in patients with COVID-19.

**Conclusion**

Given the infection rates by SARS-CoV-2, associated with the high occupation percentages and the increase in health resources consumption, it is necessary to create clinical tools that allow the detection of patients who require in-hospital treatment. A simple-to-perform walking test is presented, which could help to identify patients with occult hypoxemia. Studies with greater methodological rigor are required to validate its performance.

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**Conflict of interest**

The authors declare that there is no potential conflict of interest related to the execution of the research work or the publication of the article.

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