



## COVID-19 Waterfall

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Received 2021 July 31; Accepted 2021 August 01.

**Keywords:** SARS-Cov2, Critical Care, Respiratory Failure, Infectious Disease, Vaccine

### Dear editor,

Since the coronavirus disease 2019 (COVID-19) pandemic was officially announced as a global threat by the World's Health Organization in March 2020, many studies have been conducted to find out more about this new infection (1). Nevertheless, to date (June 2021), no definite or fully effective treatment has been found, and all treatments are based on experience and observations. The intensive care unit (ICU) is designated to care for patients with life-threatening conditions, such as respiratory distress. Admission to ICU can be crucial for the patient as long as it is considered in the early stages of disease using standard indications. Otherwise, when it comes to severe stages of infection, it might not have many health benefits and even leads to untimely use of hospital resources, occupy ICU beds, and increase work pressure on the medical staff. Yazdanpanah reported that identifying patients and admitting them to a hospital in time can improve survival rates and has a reverse effect on the mortality rate (2).

We visualized the process of the COVID-19 disease as a river that starts as a narrow stream uphill and gradually increases in size and current and becomes more dangerous, and eventually reaches a steep waterfall (Figure 1). Attempting to save a drowning man in this instance represents treating a COVID-19 patient. When the stream heads downhill and reaches areas with a steady current, which represents patients with different levels of severity of symptoms who seek help from medical professions, some cases will be admitted to hospitals. While the river continues to flow steadily, the in-patients receive treatments, such as oxygen therapy, corticosteroids, antiviral drugs, and nutritional therapy, and other supportive care. As a result of these treatments, a group of in-patients will be recovered and discharged. Unfortunately, a considerable number of patients do not respond to these standard

treatments and end up in ICUs. The next stage, where the river rapidly approaches the waterfall, represents the ICU. Out of many patients who reach this stage (waterfall), only a handful can be saved. In this example, the speed, at which each patient approaches the waterfall is different, and we can only save those with lower speeds; in other words, patients with lower inflammatory indicators, better oxygenation and response to treatments, lower age, and lack of underlying health issues.

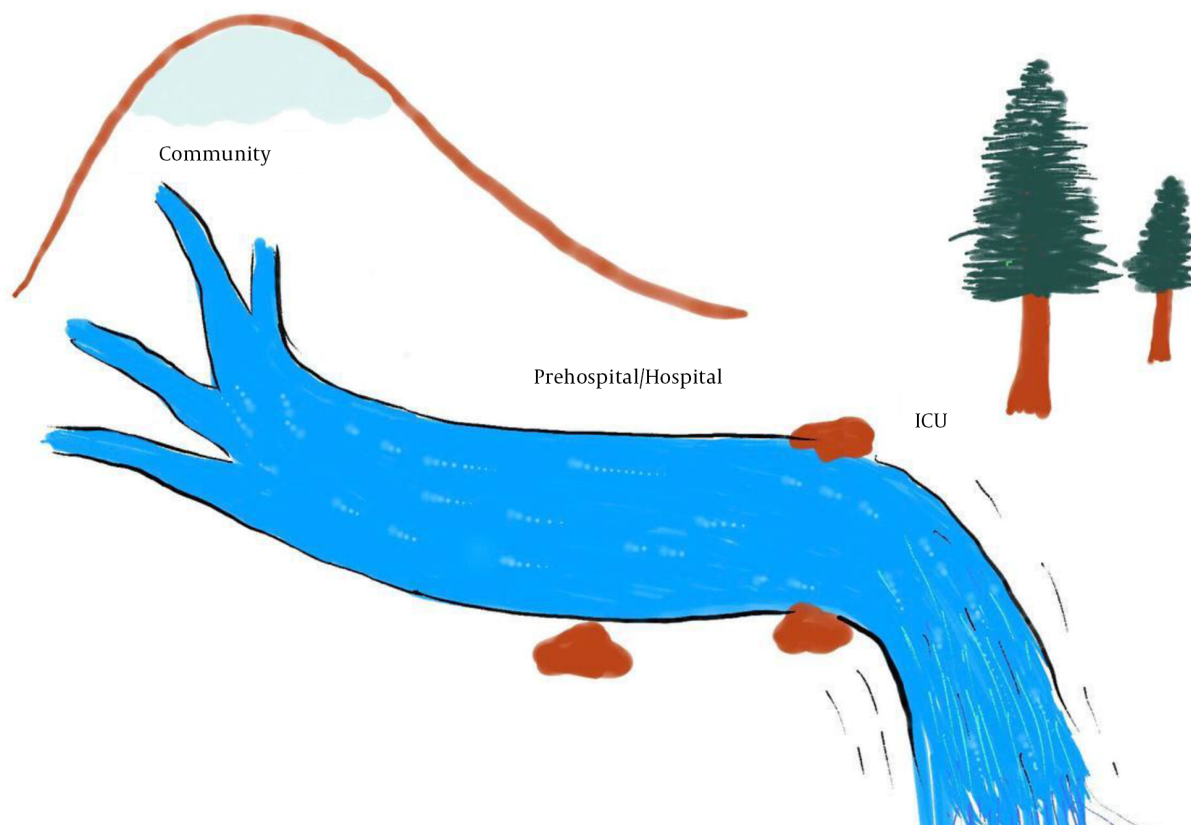
Attempting to treat some patients admitted to ICU in the late stages of COVID-19 has been like trying to save them on the verge of a waterfall. During this pandemic and managing thousands of patients in ICU, we came across some noteworthy cases, which perhaps could be beneficial for health professionals around the globe who are working to bring an end to this pandemic.

#### Case 1: Late presentation and referral

A 35-year-old woman at week 21 of pregnancy, visited a hospital's emergency room with COVID-19 respiratory symptoms, was hospitalized for 2 days, and then discharged. A few days later, she returned and was examined as an outpatient, and went home. Once again, a few days later, she returned with severe respiratory distress and was admitted to ICU, immediately. She then was intubated and received ventilatory support. The late referral was reported previously for disease exacerbation (3).

#### Case 2: Ignoring disease

Another pregnant woman attended a general practitioner and received some treatments. She was treated similar to a common cold, and once she developed severe respiratory distress, she visited a hospital's emergency room and was admitted to ICU, immediately. After a few days of intensive care, she was transferred to the general ward. In this case, the symptoms were not taken seriously in the early stages by their family. Misinterpreting or ignoring



**Figure 1.** The process of the coronavirus disease 2019 (COVID-19) that is visualized as a river

disease evidence may have dire consequences (4).

### **Case 3: Underestimating**

An elderly man visited a general practitioner's office and was diagnosed with a cold and was told that he has not a serious medical disease. Two weeks later, the patient has difficulty in breathing and was taken to a hospital but passed away shortly after. This was a case of not taking the disease seriously in the early stages by medical professionals. It was revealed that ignoring the scientific advice during the COVID-19 by politicians or even medical experts may result in the failure to control the disease and facing catastrophe (5).

### **Case 4: Misdiagnosis**

An over 60-year-old patient was admitted to a hospital for a CT scan with regards to his inflammatory indicators and old age. During the hospital triage, he was told that he had no problems and there is no need for a CT scan. However, a CT scan was done and sent to us. The CT scan showed a 30% infection with COVID-19. We tried to admit the same patient in our hospital, where once again the patient was told he had no problems. We followed this up and sent the

patient to an inflammation clinic where he was treated as an outpatient with antiviral and anti-inflammatory drugs. He was eventually admitted to a ward and discharged once he was recovered. This was a case of not diagnosing the disease even by medical professionals. Misdiagnosis may lead to failure in the early isolation of patients and putting society at risk of contamination (6). Thus, COVID-19 should be always the first on the differential diagnosis list when we faced the symptoms (dry cough, fever, myalgia, and headache) (7).

### **Case 5: Incorrect believes**

The patient was at home with low oxygen saturation (SPO<sub>2</sub>) and refused to get admitted. When we asked for the reason, the patient responded "those patients who are taken to a hospital do not come back alive". This was a case of incorrect beliefs by the general public.

### **Case 6: Late referral to ICU**

A colleague who is a specialist in infectious diseases referred a patient to ICU with the consultation report "patient has received multiple treatments, including a few pulses of corticosteroids and antiviral therapy but does not

responds to treatments, refer patient to ICU". This is a case of insisting on treating the patients in wards.

A significant number of patients arrive in the ICU very late. Some of the reasons were as follows: the fear of hospital admission, putting symptoms down to a cold, being misled by normal blood oxygenation, being reassured by a doctor that there is nothing to worry about, trying home remedies or traditional medicine to treat themselves or following different protocols, and relying on negative PCR (polymerase chain reaction) test result. Each patient that is referred to ICU, not in time faces a great chance of an undesirable outcome. Only a small percentage of those who arrive at ICU with severe COVID-19 symptoms ever recover from it.

The best way to picture the process of COVID-19 disease is to picture little streams of water, which would later join one another and make a river that picks up current as it goes on and finally reaches a waterfall. The little streams of water represent individual COVID-19 patients throughout society. The river with an insignificant current represents patients who are receiving treatment in outpatient clinics. The end part of the river before it reaches the waterfall represents in-patients being treated in the wards, and finally, the last stage is ICU, where it is too late to save the patient who is drowning in the waterfall. ICU is at the end of this route, where the staff is using various techniques to save critically ill patients when it is too late. Naturally, the solution seems to be to turn back the clock, to return to the upstream, where the drowning man can be saved and where the patient is far from a very dangerous part of the waterfall, the ICU.

Vaccination seems to be the best and most efficient way to combat the COVID-19 pandemic and reduce the speed of this horrible waterfall. It is understandable that vaccination may not exactly reduce the incidence of disease, but it will definitely reduce mortality rate, hospitalization, and finally ICU admission. Owing to accelerating vaccination in all countries, it can be expected to see a significant reduction in mortality rate and hospitalization due to COVID-19.

## Footnotes

**Authors' Contribution:** M.M., S.M. conceived and designed the evaluation and drafted the manuscript. H.A.V. participated in designing the evaluation, performed parts of the statistical analysis and helped to draft the manuscript. M. M., S.M. re-evaluated the clinical data, revised the manuscript and revised the manuscript. M. M. , H.A.V. collected the clinical data, interpreted them and revised the manuscript. All authors read and approved the final manuscript.

**Conflict of Interests:** There was no conflict of interest to declare.

**Funding/Support:** This letter did not receive any funding.

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