REVIEW

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Determination of Diagnosis and Disease Severity, Hospital and Intensive Care Unit Admission Criteria in COVID-19

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ABSTRACT

The 2019 coronavirus disease (COVID-19) epidemic is currently spreading worldwide; in particular, Turkey has been facing the outbreak since March 11st. Hospital and Intensive Care Unit (ICU) admissions are dependent on the severity of illness and the capacity of the hospitals and ICUs are extremely important because of owerhelmed capacity of beds. In this review determination of diagnosis and disease severity and hospital and intensive care unit admission criteria are written.

Keywords: COVID-19, Diagnosis, Hospital Admission, ICU Admission

Introduction

The 2019 coronavirus disease (COVID 19) pandemic is currently spreading worldwide; in particular, Turkey has been facing the outbreak since March 11st. As the pandemic spreads worldwide, Intensive care unit (ICU) practitioners, hospital administrators, governments, and researchers must prepare for a surge in critically ill patients. Increase in hospital and critical care need, or risk being overwhelmed by the pandemic while considering hospital/critical care triage surges in COVID-19 cases creating the potential for extreme shortages of resources, health care organizations are planning for crisis-level triage, with guidance provided by triage criteria and ethics that aim to allocate scarce resources primarily so as to save the most lives (1,2).

The non-specific clinical features do not easily distinguish severe COVID-19 from other causes of severe community-acquired pneumonia (2). Diagnosis is based on Realtime reverse-transcriptase polymerase chain reaction (RT-PCR) assays for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

Hospital and ICU admissions are dependent on the severity of illness and the capacity of the hospitals. ICUs are extremely important because of owerhelmed capacity of beds. In Italy patients with COVID-19 up to 12% of all positive cases required ICU admission (3,4). Laboratory-confirmed cases for COVID-19 in China, 6 % were classified as critical (respiratory failure, shock, and multiple organ dysfunction or failure) and 14% as severe (dyspnoea, respiratory rate ≥30 breaths per min, oxygen saturation ≤93%, partial pressure of arterial oxygen to fraction of inspired oxygen [PaO2/FiO2] ratio <300 mm Hg, and increase in lung infiltrates >50% with in 24–48 h) (5). So it is very important to select patients who would admit to ICUs.

In this review determination of diagnosis and disease severity of COVID -19, and triage criteria for hospital and intensive care unit will be discussed.

Diagnosis

The non-specific clinical features do not easily distinguish severe COVID-19 from other causes of severe community-acquired pneumonia (2). The possibility of COVID-19 should be considered primarily in patients with new onset fever and/or respiratory tract symptoms (eg, cough, dyspnea). It should also be considered in patients with severe lower respiratory tract illness without any clear cause. Other consistent symptoms include myalgias, diarrhea, and smell or taste aberrancies Although these syndromes can occur with other viral respiratory illnesses, the likelihood of COVID-19 is increased if the patient has A or B or C or D are determined as follows:

A. At least one of the signs and symptoms of fever or acute respiratory disease (cough and respiratory distress) and the clinical condition could not be explained by another cause / disease, being abroad in the previous 14 days before the beginning of symptoms OR
B. Fever or at least one of the signs and symptoms of acute respiratory disease (cough and respiratory distress), and close contact with confirmed COVID-19 cases within 14 days before the onset of symptoms OR
C. At least one of the signs and symptoms of fever and severe acute respiratory infection (cough and respiratory distress), and the presence of the need for hospitalization and the clinical condition could not be explained by another cause / disease OR
D. Cough or shortness of breath with a sudden onset of fever and no runny nose

Possible case definitions have been made to suspect COVID-19, but for the definitive diagnosis of the disease SARS-CoV-2 RT-PCR test should be done. All symptomatic patients with suspected infection should undergo testing; the diagnosis cannot be definitively made without microbiologic testing (6).

Diagnosis of COVID-19 disease is made primarily by clinical evaluation, radiological imaging, and then SARS-CoV-2 PCR test with respiratory tract swab in patients who meet the COVID-19 possible case definition criteria.

RT-PCR assay has been widely used to detect SARS-CoV-2. Ministry of health of Turkey has also considered RT-PCR result as a diagnostic tool for COVID-19.

Taking samples at an early or late stage of infection, improper handling or virus mutation may cause negative RT-PCR test results, especially if only upper respiratory tract samples have been collected. Patients with pneumonia might have falsely negative upper respiratory tract samples . In a study of 205 patients with confirmed COVID-19 infection, RT-PCR positivity was highest in bronchoalveolar lavage specimens (93%), followed by sputum (72%), nasal swab (63%), and pharyngeal swab (32%) (7). Although sampling from the lower respiratory tract is recommended, such as with sputum and endotracheal aspirates,26 this procedures potentially generate aerosol and new samples containing lower respiratory tract must be performed with strict airborne precautions (8,9).

The diagnostic yield of bronchoalveolar lavage for COVID-19 might be high,but bronchoscopy should generally be avoided to minimise exposure of health-care workers to SARS CoV2.

The sensitivity of RT- PCR assay for the critically ill is currently unknown. Repeated sampling might be required when initial tests are negative despite suspicious clinical features (10).

COVID-19 infection can also be detected indirectly by measuring the host immune response to SARSCoV-2 infection. The most sensitive and earliest serological marker is total antibodies, levels of which begin to increase from the second week of symptom onset (11).

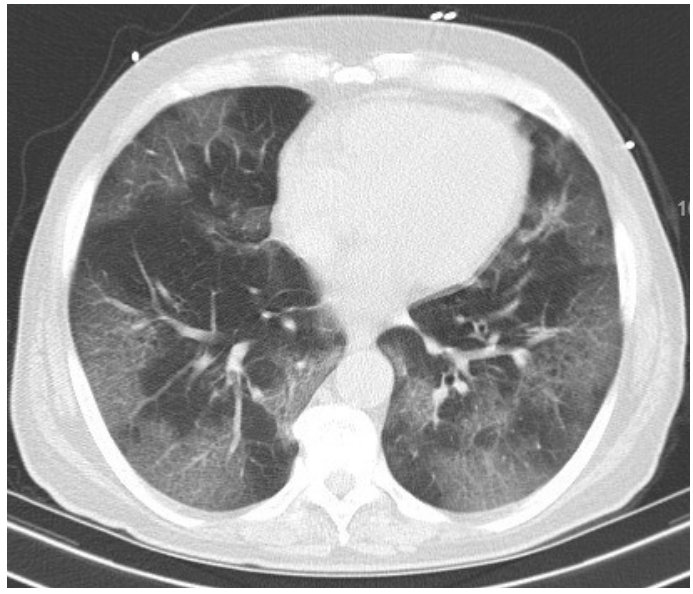

Figure 1. Peripheral distrubution of ground glass opacities

Rapid antibody testing should be administered to patients who are considered clinically and radiologically severe COVID-19 but their PCR tests are negative in repeated samples.

The diagnostic value of molecular testing of non respiratory specimens currently is unclear. And sensitivity of rapid Ab testing is between 30-65%. Diagnosis should be verified with additional radiological tests (computed tomography).

On chest radiography, bilateral pneumonia is the most frequently reported feature (range, 11.8% to 100%) (12,13). Computed tomography is regarded as more sensitive than radiography, with several studies reporting that most patients (77.8% to 100%) had ground glass opacities. Other features commonly reported with COVID-19 on chest computed tomography include a peripheral distribution, fine reticular opacities, and vascular thickening (14) (Figure 1).

Determining severity of COVID-19

COVİD-19 cases can be classified as mild (nonpneumonia and mild pneumonia) severe (dyspnea, respiratory frequency >28/min, blood oxygen saturation <93% in ambient air, PaO_2/FiO_2 ratio <300 and/or lung infiltrates>50% within 24 to 48 hours), and critical (ie, respiratory failure, septic shock, and/or multiple organ failure) (5). There is also a relationship between the disease severity and the levels of proinflammatory cytokines and subsets of immune cells (15,16). It has been suggested that during the response to SARS-CoV-2, the immune dysregulation and the high level of proinflammatory cytokines could be the main cause of tissue injury. However the exact pathophysiologic mechanism of COVID-19 remains unknown.

COVID-19 can induce the exaggerated production of proinflammatory cytokines, the recruitment of proinflammatory macrophages and granulocytes. This results in the cytokine storm (CS) termed as a macrophage activation syndrome (MAS) or secondary hemophagocytic lymphohistiocytosis (sHLH), thus

leading to further tissue damage (17,18). Severe cases may be characterized by a cytokine storm cause to progress to ARDS (19,20).

In determining the severity of disease; development of severe acute respiratory illness (SARI), increased need for oxygen, elevation of inflamatory markers or decreased lymphocyte count are also important and should be followed. Laboratory tests (Complete blood count, urea, creatinine, sodium, potassium, chlorine, AST, ALT, total bilirubin, lactate dehydrogenase, creatine kinase, D-dimer, ferritin, troponine, C-reactive protein (CRP)) should be examined.

All patients with COVID-19 should be screened for hyperinflammation using laboratory trends (eg, increasing ferritin, decreasing platelet counts, or erythrocyte sedimentation rate) and the HScore for MAS (21,22) to identify the subgroup of patients for whom immunosuppression could improve mortality.

SARI cases, patients with hypoxemia, hypotension, change of consciousness and severe pulmonary infiltrations at radiologic imaging and patients in risk of MAS should be hospitalized.

Admission criterias for Hospital and Intensive care unit

Patients who develop severe disease (eg.SARI) should be hospitalized. Evaluating disease severity criteria during triage decision (Respiratory rate ≥20 / minute, Oxygen saturation in room air <93%, hypotension, lymphopenia, ferritin >500 ng / ml, D dimer> 1000 ng / ml, bilateral diffuse infiltration on chest x-ray or computed tomography and older adults with comorbidities) are important.

It is important to use CURB - 65 score or pneumonia severity score index (PSI) in COVID-19 patients with pneumonia. These scores can be used to determine the hospitalization indication (23). Patients with CURB - 65 score ≥2 or PSI group 4/5 should be monitored and treated in the hospital.

For the development of MAS, lymphocyte and platelet counts, D-dimer, CRP and ferritin levels are important especially in planning the treatment of patients. Consecutive measurements should be done. Increases in CRP, ferritin, D-dimer values and / or decreases in lymphocyte and platelet counts in measurements, are important to capture developing MAS. Patients with MAS should also be hospitalized and, if necessary, should be followed in intensive care unit (Table 1).

The need for intensive care might differ according to institutions or even countries, depending on the demand and supply ranging from 5% to 32% (24,25).

Decisions regarding admission to ICU during a pandemic should reflect routine intensive care practice. ICU admission should be considered in patients with multiple organ failure, especially in case of acute respiratory failure and hemodynamic failure. ICU admission should be prioritised to those who require specific ICU interventions such as mechanical ventilation. Early administration of COVID-19 patients to ICU will allow to decrease morbidity and mortality. In ICU, patients with multible organ failure, sepsis and ARDS, should be followed and treated with ICU protocols as non COVID- 19 patients (26,27). If ICUs become overwhelmed by COVID-19 despite surge strategies (27-28) critical care triage that prioritises patients for intensive care and rations scarce resources will be required

Table 1. Hospital Triage Criterias

Recommendations for Hospital Admission
• Fever, muscle / joint pain, cough, sore throat symptoms, • Respiratory rate ≥20 / minute, • Oxygen saturation <93% in room air, • Lymphopenia (<1000), ferritin> 500 ng / ml, D-dimer> 1000 ng / ml, • Bilateral diffuse infiltration on chest x-ray or computed tomography, should be administered to hospital.

Table 2. ICU Triage Criterias

Recommendations for Intensive Care Unit Admission
• In case of dyspnea and respiratory distress • Respiratory rate ≥30 / minute, • Oxygen saturation <93% despite nasal oxygen support of 5 liters / minute and above • Partial oxygen pressure <60 mmHg despite nasal oxygen support of 5 liters / minute and above • PaO2 / FiO2 <300 • Bilateral or multilober infiltrations on chest radiography or computed tomography with clinical deterioration or increase in infiltrations compared to previous imaging • Hypotension (systolic blood pressure <90 mmHg, drop from usual systolic blood pressure> 40 mmHg, mean arterial pressure <65 mmHg) or vasopressor requirement • Signs of hypoperfusion in the skin, lactate >2 mmol / L, increase in SOFA score (>2) • Elevation in cardiac enzymes (Troponin) or arrhythmia • Kidney and liver tests abnormalities, thrombocytopenia, • Development of MAS

PaO_2/FiO_2: partial pressure of arterial oxygen to fraction of inspired oxygen, SOFA: Sequential Organ Failure Assessment, MAS: Macrophage activating syndrome

Critical care triage is can cause emotionally bad feelings. It should ideally be provided guidelines for COVID-19 (29,30). A triage policy implemented by clinicians trained in triage or ICU practitioners, complemented by clinical decision support systems, might identify patients who need for ICU s in case of limited beds (27).

In the event of an overwhelming demand for critical care the following principles should be considered for admission to the ICU:

- The decision-making process should be open, transparent and reasonable for patients, their families, ICU and non-ICU staff.
- Similar ICU admission criteria should apply to all patients and equally to patients with pandemic illness and those with other conditions.
- All patients must have a chance to receive treatment (justice)

Finally, more will be learned about community acceptance of crisis triage protocols. Health care organizations should consider current triage plans according to their hospital and ICU capacities. To ensure the trustworthiness of the health system, disability rights advocates and health care leaders should work together to finalize crisis triage plans that save the most lives, protect the equal worth of all persons to heal in the wake of a once-in-a century pandemic.

Conclusion

In the light of the data obtained from COVID-19 pandemic, the needfulness of hospital beds and ICUs with well-organized structure and trained staff, has emerged once again. It is important to diagnose the disease and to determine the severity of disease for hospitalisation of patients. Health care organizations should consider current triage plans according to their hospital and ICU capacities for saving more lives.

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