Non-ST Segment Elevation Myocardial Infarction in a Patient with COVID-19

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ABSTRACT

Coronavirus disease 2019 (COVID-19) is associated with a wide spectrum of cardiovascular (CV) manifestations. Primary cardiac manifestations of COVID-19 disease include acute coronary syndrome (ACS), myocarditis, and arrhythmias. Secondary cardiac involvement is usually due to a systemic inflammatory syndrome and can manifest as acute myocardial injury/biomarker elevation and/or heart failure (congestive heart failure). Elevated cardiac biomarkers indicate an unfavorable prognosis. Health-care systems of the world are rapidly learning more about the manifestations of COVID-19 on the CV system, as well as the strategies for the management of infected patients with CV disease. There is still a paucity of literature on the management of non-ST-segment elevation ACSs in the current literature. Herein, we report the case of a 53-year-old male patient, who presented with severe COVID-19 pneumonia deteriorating into adult respiratory distress syndrome requiring mechanical ventilation. The patient had a history of coronary artery disease. During the course of treatment, he developed sudden cardiac arrest with diffuse ST-segment depression, which was treated by percutaneous coronary intervention to the left anterior descending artery. The patient had a favorable outcome with excellent recovery from the disease.

Key words: Adult respiratory distress syndrome, COVID-19, non-ST segment elevation myocardial infarction, percutaneous coronary intervention, sudden cardiac arrest

INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which is the cause of coronavirus disease 2019 (COVID-19), was first reported to the World Health Organization (WHO) as pneumonia in Wuhan, China, on December 31, 2019.[1]

Systemic inflammation as well as increased shear stress due to increased coronary blood flow can precipitate plaque rupture resulting in acute myocardial infarction (MI). Prothrombotic milieu created by systemic inflammation further increases the risk.[2]

In 8%–25% of overall COVID-19-infected population, concomitant cardiovascular (CV) conditions are observed in a higher proportion of those who die.[3-6] There has been increased morbidity and mortality in COVID-19 patients with preexisting CV disease.[6]

Troponin elevation in patients with COVID-19 infection has been observed to be lower than in most cases of acute coronary syndromes (ACS) or acute myocarditis. If there is marked elevation of troponins in a patient who is not critically ill, myocarditis, Takotsubo...
syndrome, spontaneous coronary dissection, or Type 1 MI should be suspected. Elevated cardiac biomarkers indicate an unfavorable prognosis.

The occurrence of ACS in COVID-19 patients may have significant implications both for patient care and caregiver safety. The use of coronary angiography for COVID-19 positive patients with elevation in cardiac troponin (cTn) should be restricted to those in whom Type 1 MI is suspected.

While the general management of ACS has been well-defined in international guidelines, reports of ACS in COVID-19 patients are scarce, and there is no clear recommendation as regard to optimal treatment in such patients.

High-risk patients or hemodynamically unstable patients should be managed by early invasive strategy (<24 h), as in all patients with non-ST segment elevation MI (NSTEMI). A noninvasive or medical approach would be best for low-risk patients.

CASE PRESENTATION

A 53-year-old male patient presented to our emergency department (ED) on June 10, 2020, with an 8-day history of fever, dry cough, and myalgia. He had a 3-day history of progressive shortness of breath, and a day before admission, he had vomiting four times associated with nonspecific epigastric discomfort. He denied chest pain. There is no history of recent travel or contact with suspected or confirmed COVID-19 infection patients.

He had several CV risk factors, including Type-2 diabetes mellitus and hypertension. He suffered from inferior MI in 2015 when he was offered coronary angiography, but he refused and was lost to follow-up.

On arrival to the ED, he was in severe distress, tachypneic with respiratory rate of 32/min, tachycardiac with heart rate of 130 bpm, normotensive, and O₂ saturation of 93% on continuous positive airway pressure (CPAP) with 100% FIO₂. Body temperature was normal.

Shortly after admission, the patient became severely breathless and hypoxic (SpO₂ 88%). On physical examination, he was tachypneic, with crackles in both lung fields. Cardiac examination was normal. No significant repolarization abnormality was observed on electrocardiogram (ECG) except 1 mm ST elevation at lead V3 [Figure 1].

Echocardiography showed severe left ventricular systolic dysfunction, estimated left ventricular ejection fraction of 35% with segmental wall motion abnormalities. The chest X-ray showed bilateral patchy consolidative changes and air space opacities at mid and lower lung zones more at the left retrocardiac region [Figure 2]. The patient was intubated and placed on mechanical ventilation for adult respiratory distress syndrome (ARDS) secondary to pneumonia and acute heart failure.

He was treated as acute heart failure secondary to community-acquired pneumonia with possible ACS. He was started on intravenous nitrates, diuretics, and antibiotics. He received 300 mg of oral aspirin, 600 mg of clopidogrel, and 60 mg of enoxaparin. He was kept on small dose of noradrenaline 0.5 mcg/kg/min as the systolic blood pressure had dropped after he had been placed on mechanical ventilation.

Because of high suspicion of COVID-19 in patients with respiratory failure and fever, polymerase chain reaction was performed on a nasopharyngeal swab and returned positive for CoV-2. In addition, blood tests showed a biological inflammatory syndrome (leukocytes 12.8 12.8 × 10³/uL, lymphocytes 0.5, and C-reactive protein 150 mg/L [N < 6 mg/L]), ferritin 1979 ug/L

Figure 1: Electrocardiogram recorded on arrival to the emergency department. Minimal ST-segment elevation is present in lead V3, sinus tachycardia
Figure 2: Chest X-ray recorded on arrival to the emergency department (a), and after endotracheal intubation (b) showing bilateral patchy consolidative changes and air space opacities at mid and lower lung zones more at the right lower lobe, with bilateral pulmonary congestion.

Figure 3: Electrocardiogram recorded immediately after the return of spontaneous circulation has been achieved. Diffuse ST-segment depression is present in most leads with ST-segment elevation in leads aVR and V1, sinus tachycardia.

Figure 4: Coronary angiography. (a) Totally occluded of the dominant proximal right coronary artery (b) Left coronary artery. Tight stenosis of the proximal left anterior descending artery (white arrow). Severe stenosis of the distal left circumflex artery, bifurcating with a large obtuse marginal branch (with arrowhead). (c) Left coronary artery after stent implantation in the left anterior descending artery (white arrowheads).
(N 30–553 ug/L), troponin-T high sensitive 527 ng/L (N < 15 mg/L), N-terminal-proB-type natriuretic peptide (722 pg/mL), and lactic acid of 7.2 mmol/L (N <1.6 mmol/L).

He was admitted to an intensive care unit at the COVID-19 facility. Serial ECG showed biphasic T wave in V2, V3, and inverted T waves in V4–V6. Peak cTn was 1806 at 24 h after the admission.

On the 2nd day, he showed good response to medical therapy and mechanical ventilation, with less oxygen requirement. On the 3rd day at 9:34 am, he became severely agitated, then developed hypotension with severe bradycardia, followed by asystole, then he achieved a return of spontaneous circulation in <2 min of standard cardiopulmonary resuscitation.

The patient developed worsening in lactic acidosis, a pH of 6.8 with a lactate concentration of 19 mmol/L (N < 1.6 mmol/L), and oxygen saturation of 60% on 100% FIO2. ECG showed diffuse ST depression with ST elevation in the lead aVR [Figure 3].

He was taken to the cath lab (tertiary care center) 6 h after the cardiac arrest for emergent coronary angiography. Tight stenosis of the mid-portions of the left anterior descending artery (LAD) was found, with normal (thrombolysis in MI coronary grade flow 3) flow. In addition to the culprit LAD stenosis, tight ostial stenosis of the obtuse marginal branch and totally occluded mid-right coronary artery were observed. An everolimus-eluting stent was deployed at the LAD lesion [Figure 4]. No attempt was made to stent the other lesions. The ECG changes had significantly improved after the percutaneous coronary intervention (PCI).

Due to severe sepsis with bilateral pneumonia, he was kept on mechanical ventilation with a small dose of noradrenaline till June 20 when he was stable enough to be weaned successfully from mechanical ventilation and vasopressors.

To treat pneumonia, he received multiple antibiotics (clarithromycin, piperacillin/tazobactam, and ceftriaxone), antivirals (lopinavir/ritonavir and favipiravir), plasma protein fraction, and hydroxychloroquine.

During his admission, he developed multiple complications (acute kidney and acute liver injuries). He had complete recovery of renal and liver function; inflammatory markers also normalized before discharge.

On July 3, he was discharged home in good condition.

**DISCUSSION**

COVID-19 is a viral infection caused by the SARS-CoV-2 and was declared a global pandemic by the WHO in March 2020. COVID-19 is associated with higher morbidity and mortality in patients who are known to have CV disease.[11]

Secco et al.[12] reported 31 patients affected by SARS-CoV-2 admitted with suspected ACS. All patients presenting with ACS were subjected to urgent coronary angiography and PCI except two patients who had severe hypoxemia with the unstable hemodynamic condition were treated noninvasively.

Twenty-one cases had diffuse ST-segment depression, whereas in the remaining cases, four had anterior and six had inferior ST-segment elevation. PCI was performed in all cases except two having no obstructive disease were diagnosed as myocarditis and three patients had apical ballooning at ventriculography diagnostic for Takotsubo syndromes. Two patients having severe hypoxemia and unstable hemodynamics treated conservatively eventually died. All patients undergoing PCI survived except one requiring endotracheal intubation died on Day 6. For respiratory support, five patients required endotracheal intubation, whereas in the remaining cases, CPAP was used. The authors concluded that urgent PCI for ACS is often required in SARS-CoV-2 patients improving the prognosis in all but the most advanced patients.[12]

In the present case, the decision for coronary angiography was made in conditions of urgency as the patient had NSTEMI with acute heart failure and cardiogenic shock with dynamic ECG changes and significantly elevated cardiac markers.

COVID-19-positive or probable patients with a NSTEMI presentation should be managed medically and only taken for urgent coronary angiography and possible PCI in the presence of high-risk clinical features (Global Registry of Acute Coronary Events score >140) or hemodynamic instability.

Our patient, when presented, had a mixed picture. He had signs of infection and cardiac ischemia. It was not easy to decide which was contributing more to his acute presentation.

The decision was made to treat him medically for both etiologies; he did very well initially with mechanical ventilation and conservative therapy. When he suffered from cardiac arrest, he was in a very critical condition, hypoxic, and hypotensive with severe metabolic acidosis. It was a difficult decision to transfer him to another hospital (cardiac center) for doing coronary intervention with this critical condition and severe COVID-19 symptoms. Despite all this, the decision was taken to transfer him to the cardiac center for coronary intervention, which significantly had improved his cardiac condition.

**CONCLUSION**

NSTEMI in a COVID-19 patient with ARDS is a lethal combination. Timely management with PCI can save lives in these high-risk patients. Preventing the
dissemination of COVID-19 among the health-care workers is the priority; therefore, a conservative strategy is often the first choice. However, in patients who are strongly indicated for an invasive strategy, PCI should be performed after weighing the benefit/risk ratio carefully. As long as the standard operating procedures are strictly followed, the protection is stratified and guaranteed; an optimal result can be anticipated.

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Conflicts of interest
There are no conflicts of interest.

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