Case Report

Blunt and penetrating chest trauma with concomitant COVID-19 infections: Two case reports

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ABSTRACT

Background: We present two patients: one with a blunt and one with a penetrating chest trauma mechanism and both with concomitant COVID-19 infections.

Findings: The first patient is a 23 year old previously healthy male who presented to a Level 1 trauma center following a motor vehicle collision with blunt chest trauma and respiratory failure. The second patient is a 30 year old previously healthy male who presented to a Level 1 trauma center for a stab wound to the anterior chest with a right ventricular injury. Both patients were incidentally found to be COVID positive. We discuss the impact of COVID positivity on management considerations in these trauma patients.

Conclusion: Concurrent COVID infection in trauma patients with respiratory failure after pulmonary trauma can obscure the cause of the respiratory failure. At the time of this writing, management of both is similar, COVID-specific therapeutic agents are being investigated, and steroids carry the best evidence. Superimposed bacterial co-infections should be treated. Although timing of tracheostomy is institution-specific, when indicated it is still performed. COVID infection is often associated with a hypercoagulable state in trauma patients who are already at higher thrombotic risk. In keeping with normal practice after hemorrhagic resuscitation in trauma patients, an early aggressive initiation of prophylactic anticoagulation continues to be prudent. The benefit of empiric therapeutic anticoagulation is not yet known.

Case Description.

Blunt chest trauma with concomitant COVID-19 infection: does COVID obscure or exacerbate respiratory failure and change management?

A 23 year old healthy male presented to a trauma center following a vehicle collision with hypoxia and chest pain. Chest radiograph revealed bilateral pneumothoraces with subcutaneous emphysema, pulmonary contusions, and rib fractures (Fig. 1). Bilateral thoracostomy tubes were placed. The patient was persistently hypoxic and was intubated. Initial computed tomography (CT) of the chest revealed extensive lung contusions and rib fractures (Fig. 2). The lung parenchyma demonstrated diffuse peripheral ground-glass opacities in the nondependent regions bilaterally.

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At the time of admission, all trauma admissions underwent COVID screening, and the patient tested positive. He had no contacts or symptoms. The patient was admitted to the COVID intensive care unit, a combined medical & surgical ICU. Chest radiography continued to show severe bilateral pulmonary contusions. CT chest on day five of admission revealed interval worsening of extensive parenchymal consolidation in the dependent bilateral lower lobes and persistent scattered regions of nodular and ground glass opacities throughout the bilateral upper lobes. Respiratory cultures revealed a MRSA co-infection, for which he received a course of Vancomycin. On day eight of admission, the patient underwent tracheostomy for persistent respiratory failure. He was weaned off the ventilator and transferred out of intensive care one week later. The patient made remarkable ambulatory progress working with physical therapy, was decannulated, and discharged home on the 21st day of admission (Fig. 3).

Penetrating anterior chest trauma with concomitant COVID-19 Infection: coagulopathy of trauma and COVID infection

The second patient is a 30 year old healthy male who presented to a trauma center for multiple stab wounds, including one to the anterior chest. Bedside ultrasound was negative for pericardial effusion but positive for a left pneumothorax. A left thoracostomy tube was placed. Due to persistent hypotension, he was taken to the operating room. A pericardial window was positive and a median sternotomy was performed. A right ventricular laceration was primarily repaired. The patient was extubated and taken to the COVID ICU for monitoring.

A routine preoperative rapid COVID test sent preoperatively was found to be positive intraoperatively. He too had no contacts or symptoms. At that point in time, inflammatory markers were being sent routinely on COVID positive patients, including ferritin, fibrinogen, C-reactive protein, and lactate dehydrogenase. None were elevated, and the patient had no radiographic findings suspicious for COVID on chest radiography taken throughout the hospital stay. He was started on prophylactic enoxaparin. Inflammatory markers were serially measured in COVID patients, and the D-dimer (which was first measured on the third day of admission) level steadily rose to a peak of 24.08 mg/L fibrinogen equivalent units (FEU) on postoperative day eight. Because of the continuous rise, imaging studies were obtained and were negative for deep vein thrombosis and pulmonary embolism. Collective discussion with colleagues from Hematology led to the initiation of oral apixaban at prophylactic levels, to be continued for one month. The patient was discharged and had no documented thromboembolic events at home.

Discussion

The treatment of 2019 Novel Coronavirus (SARS-CoV-2) continues to evolve. Both of these cases involve chest trauma with concomitant incidental COVID-19 infections.

The first patient suffered blunt chest trauma that resulted in persistent ventilator dependent respiratory failure requiring tracheostomy. Whether COVID pneumonia exacerbated the persistent respiratory failure did not dramatically change management decisions. While the injuries were severe enough to explain his symptoms, the CT findings of diffuse peripheral ground-glass opacities upon admission suggested a subclinical presence of COVID at that time. At the time of the patient's admission, there were no known validated therapeutics for COVID pneumonia. Interval data from the RECOVERY trial showed a mortality decrease in patients who received corticosteroids, and this is among the best evidence for therapeutics at the time of this writing [1].

The superimposed bacterial pneumonia was treated appropriately. In one review of over 3800 COVID-19 patients, 7% had a bacterial co-infection [2]. This percentage was less than in previous influenza pandemics and findings do not support the routine use of prophylactic antibiotics in the management of confirmed COVID-19 infection.

![Fig. 1. Chest radiography on admission after thoracostomy tube placement. Note the extensive bilateral subcutaneous emphysema, bilateral infiltrates, and large left lower opacification.](image-url)
Tracheostomy is an aerosol-generating procedure and poses a risk to healthcare providers. As the authors of the 2020 Lancet consensus article on the subject note, tracheostomy placement in COVID patients may not always be beneficial. Patient selection should reflect weaning potential, and timing should reflect decreased infectivity and stability. Specifically, it may be safest for clinicians to wait until viral shedding has ceased, which favors a later tracheostomy than typically performed [3]. On the other hand, tracheostomy is known to be associated with improved ventilator weaning, which may be beneficial in a hospital system depleted of resources with continuous influx of COVID patients. There is still no clear consensus on when tracheostomy should be performed for COVID-related respiratory failure. We believed the benefits outweighed the risks in this otherwise healthy young patient whose respiratory illness were more consistent with trauma rather than COVID; the tracheostomy was placed in the usual timeline and he subsequently recovered enough to tolerate decannulation by the time of discharge.

The second case promotes discussion of the interplay between the coagulopathy of trauma and the coagulopathy of COVID-19 infection. The patient underwent repair of a ventricular injury and had no apparent involvement of COVID-related respiratory complications. However, the incidence of thrombotic complications in ICU patients with COVID-19 infections is considerably higher than the average ICU or trauma patient. Initial series from multiple countries have cited overall thromboembolic burden ranging from 22% to 31% [4,5]. Early autopsy reports reveal pathological evidence of pulmonary thrombotic phenomena [6]. Tang and colleagues reported that 71.4% of COVID non-survivors, and merely 0.6% of survivors, fulfilled criteria for disseminated intravascular coagulation during their hospital stay [7].

The management of the coagulopathy of trauma involves two phases: prevention of hemorrhage, then prevention of secondary thrombotic events. Of particular interest in trauma surgery in the era of COVID-19 is the question of whether to employ a more aggressive anticoagulation strategy to counter the apparent procoagulant effects of COVID-19. In non-COVID trauma patients, prophylactic anticoagulation is initiated as soon as hemorrhage control is achieved. In COVID trauma patients, there likewise should not be a delay in beginning prophylactic anticoagulation. Whether to initiate therapeutic-level anticoagulation is a separate clinical question. Various D-dimer cutoff values to reflect increased VTE risk, with different specificities, have been proposed. When a value of 3.5 μg/mL was used, one series reported a > 96% specificity [8]. At the time of this writing, the American Society of Hematology recommends therapeutic anticoagulation only in the setting of documented thromboembolism [9]. Three joint multinational adaptive-design trials have recruited patients and published preliminary data but have yet to undergo peer review. They are the largest studies to address the question of therapeutic anticoagulation for COVID coagulopathy, but exclude patients with recent major surgery [10]. Future investigations in trauma patients is a potential area for research.

**Conclusion**

Concurrent COVID infection in trauma patients with respiratory failure after pulmonary trauma can obscure the cause of the respiratory failure. At the time of this writing, management of both is similar, COVID-specific therapeutic agents are being investigated, and steroids carry the best evidence. Superimposed bacterial co-infections should be treated. Although timing of tracheostomy is institution-specific, when indicated it is still performed. COVID infection is often associated with a hypercoagulable state in trauma patients who are already at higher thrombotic risk. In keeping with normal practice after hemorrhagic resuscitation in trauma patients, an early aggressive initiation of prophylactic anticoagulation continues to be prudent. The benefit of empiric therapeutic anticoagulation is not yet known.

Fig. 2. CT Chest on admission. Note the diffuse and peripheral ground-glass opacities in addition to the bibasilar consolidation and pulmonary hemorrhage.
Declaration of competing interest

No relevant conflicts of interest or past presentations to disclose.

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