

# Pulmonary Contusion Similar to COVID-19 Pneumonia

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The Coronavirus disease 2019 (COVID-19) has rapidly spread across the world and caused a pandemic. It can be transmitted by an infected person or an asymptomatic carrier and is a highly contagious disease. Prevention and early identification of COVID-19 are important to minimize the transmission of COVID-19. Chest computed tomography (CT) has a high sensitivity for detecting COVID-19, but relatively low specificity. Therefore, chest CT may be difficult to distinguish COVID-19 findings from those of other infectious (notably viral types of pneumonia) or noninfectious disease. Pulmonary contusion has also a lot of similarities on chest CT with COVID-19 pneumonia. We present trauma patients with pulmonary contusion whose CT scans showed findings similar to those of COVID-19, and we report our experience in the management of trauma patients during the COVID-19 pandemic.

**Keywords:** COVID-19; Pulmonary contusion; Computed tomography; Pneumonia

## INTRODUCTION

Coronavirus disease 2019 (COVID-19) is an infectious spreading disease caused by severe acute respiratory syndrome coronavirus 2. It was first identified as the cause of a cluster of pneumonia in December 2019 in Wuhan, a city in the Hubei Province of China, and is rapidly spreading around the world, resulted in pandemic declaration by World Health Organization [1-3]. COVID-19 can be transmitted by an infected person or an asymptomatic carrier and is a highly contagious disease [1,2]. Most infected individuals have few or mild symptoms; however, some have serious and critical ill-

ness, such as pneumonia or respiratory failure [4,5].

Chest computed tomography (CT) is highly sensitive for diagnosis COVID-19 infection; however, guidelines do not recommend using it for routine screening of COVID-19 [6]. Despite its high sensitivity for diagnosis for COVID-19, chest CT may be difficult to distinguish COVID-19 findings from those of other disease [7]. In particular, pulmonary contusion, which is a bruise of the lung, caused by thoracic trauma, has a lot of similarities on findings of COVID-19 on chest CT, including peripheral subpleural consolidation and ground-glass opacity (GGO) [8,9].

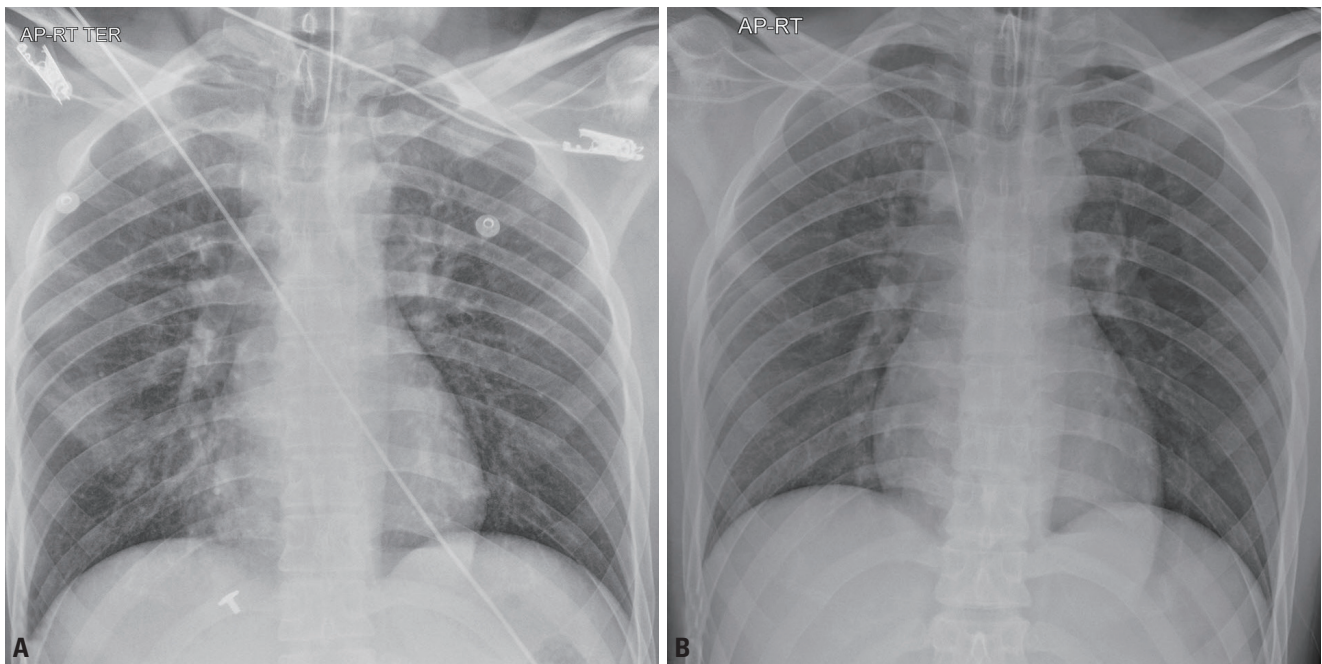
In this paper, we present trauma patients with pulmonary contusion whose CT scans showed findings similar to those of COVID-19, and we report our experience in the management of trauma patients during the COVID-19 pandemic.

## CASE REPORT

A 22-year-old man driver was involved in a rollover motor vehicle accident and transported to the emergency

department (ED) via emergency medical services. It was not clear if he was restrained. He was found in rear seat and unconscious at the scene. Immediately upon arrival to the ED, his initial vital signs revealed a blood pressure of 148/75 mmHg, a pulse of 135 BPM, a temperature of 36.8°C, and an oxygen saturation of 90% on room air. His Glasgow Coma Scale score was 7 (E 1, V 2, M 4), and he was intubated and ventilated. An extended focused assessment sonography for trauma examination was only positive for free fluid in Morrison's pouch and demonstrated normal lung sliding bilaterally. Two large-bore peripheral lines were established, and a cardiac monitor was applied.

On examination, there was an open fracture of the left distal femur with a laceration approximately 6 cm × 2 cm severely contaminated with the patella exposed on the outside of the wound. A portable chest X-ray study showed small patchy infiltrates in the right lower lung base but did not show a pneumothorax or pleural effusion (Fig. 1A). His pelvis X-ray study was normal. Initial laboratory exams were unremarkable except for a mild leukocytosis of 14,920/mm<sup>3</sup> (segment neutrophil of 47.9% and lymphocyte of 46.6%), aspartate aminotransferase of 235 U/L, and alanine aminotransferase of 215 U/L.



**Fig. 1.** Chest radiographic images. (A) The initial anteroposterior chest radiograph shows small patchy infiltrates in the right lower lung base. (B) Three days follow-up chest radiograph shows no active lung lesions.

Brain CT showed hemorrhagic contusions in the left frontal area and fractures in the occipital area. Chest CT scan revealed multifocal GGOs and consolidation with multiple rib fractures in both lungs and small amount pneumothorax in the right lung (Fig. 2). Abdomen and pelvis CT scan showed a grade III liver laceration without active bleeding in segment VIII. X-ray of the left knee revealed comminuted fracture with intraarticular extension of the distal femur.

Despite the CT findings were more suggestive of pulmonary contusion, COVID-19 pneumonia could not be completely ruled out. The patient was transferred in isolation room because epidemiological/clinical information regarding to COVID-19 could not be obtained from the patient and the trauma patient had also potentially high-risk aerosol generating procedures. The real-time reverse transcription polymerase chain reaction (RT-PCR) from nasopharyngeal and oropharyngeal swabs and sputum

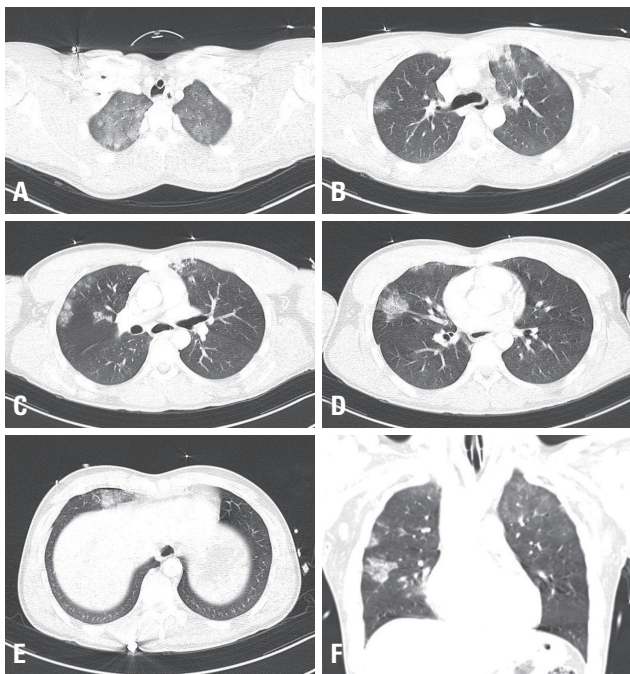
was tested, and it revealed all negative. Subsequently, the patient was released from the negative pressure isolation intensive care unit (ICU) and treated as a non-infected trauma patient. The findings on his chest X-ray gradually improved from the third day of hospitalization (Fig. 1B). He underwent orthopedic surgery for left femur fractures 13 days later and was discharged from the hospital after 15 days without complications. The patient had negative RT-PCR tests before discharge.

## DISCUSSION

The COVID-19 has rapidly spread across the world and caused a pandemic, and this situation still continues. While infectious diseases are generally unable to transmit during the incubation period, COVID-19 can show pre-symptomatic transmission [4]. Due to its high transmissibility, prevention and early identification of COVID-19 are important to minimize the transmission of COVID-19.

The standard method of diagnosis is RT-PCR from nasopharyngeal swab and/or oropharyngeal swab [10,11]. However, RT-PCR is time-consuming. Chest CT is fast and highly sensitive to diagnosis in individual with high suspicion of COVID-19 infection [7]; however, guidelines do not recommend using it for routine screening of COVID-19 [6]. Despite its high sensitivity in diagnosing COVID-19, due to its low specificity [12], chest CT may be difficult to distinguish COVID-19 findings from those of other disease or pulmonary contusion.

The typical chest CT findings of COVID-19 pneumonia are bilateral GGOs and consolidation with predominant distribution in posterior and peripheral part of the lungs [13,14]. However, a recent study reported that 56% of early patients with COVID-19 had normal chest CT [15]. Pulmonary contusion is a focal parenchymal injury caused by disruption of the capillaries of the alveolar walls and septa, and leakage of blood into the alveolar spaces and interstitium [9,16]. Pulmonary contusion can appear as geographic, non-segmental areas of GGOs, nodular opacities, or consolidation on chest CT, and it is not restricted to lobar boundaries [9,17]. CT scanning can detect the contusion almost immediately after the injury [18].



**Fig. 2.** Chest computed tomographic images. (A) Axial chest computed tomography (CT) image shows bilateral diffuse ground-glass opacities and reticulation. (B-D) Axial chest CT images show multifocal ground-glass opacities and consolidation in both lungs. (E) Axial chest CT image shows a small amount pneumothorax in the right lung. (F) Coronal chest CT image shows multiple ground-glass opacities and consolidation in both lungs.

Unfortunately, the location of GGO and consolidation cannot be used to conclusively differentiate COVID-19 from pulmonary contusion. Nevertheless, the following radiological findings may be helpful in differentiating between COVID-19 and pulmonary contusion. Pleural thickening is detected in 32% of COVID-19 pneumonia [19], whereas pneumothorax is observed in half of patients with pulmonary contusion and is highly suggestive of pulmonary contusion [20]. Recently, however, there has been a case report of COVID-19 pneumonia accompanied by pneumothorax [21]. Pleural effusion is uncommon in COVID-19; however, large pleural effusion or hemothorax are highly suggestive of pulmonary contusion. Rib and sternal fracture are also commonly found in pulmonary contusion [15,19,20].

Furthermore, clinical course will be useful in differentiating COVID-19 and pulmonary contusion. Most pulmonary contusions occur after diffuse and high energy blunt trauma. Uncomplicated contusions begin clearing within 24 to 48 hours and may resolve after 3–14 days [9,22,23]. In contrast, the lesions of COVID-19 progress rapidly and show concurrently increased number, extent and density of lesions in follow up CT scan [24-27].

Above all, the epidemiological and clinical information can be important clues to differentiate COVID-19 from pulmonary contusion during the initial assessment and management. All trauma patients should be routinely investigated about their exposure history and clinical symptoms related to COVID-19 during pandemic [28,29].

In the present case, we were unable to obtain the epidemiological and clinical information regarding to COVID-19 from the patient due to his altered mental status. Despite CT findings are more suggestive of pulmonary contusion, COVID-19 pneumonia could not be completely ruled out. Because the trauma patient has potentially high-risk aerosol generating procedures, the patient was transferred in isolation room for trauma resuscitation and continued management in the negative pressure isolation ICU until the final negative result was obtained. Attending trauma team wore personal protective equipment (PPE) including N95 respirators, goggles (or face shields), disposable surgical caps, gloves, and disposable fluid-resistant gowns during initial assessment and management according to our guidelines. When

carrying out aerosol generating procedures, such as endotracheal intubation and nasopharyngeal/oropharyngeal swabs, our trauma team wore level D PPE. After primary survey, open wound with fracture of the left distal femur was irrigated with normal saline. Cultures were then obtained. The knee joint was manually reduced to its normal position, and then temporary splint was applied to the left extremity. The RT-PCR test finally revealed negative result. Subsequently, the patient was released from isolation and treated as a non-infected trauma patient.

COVID-19 pneumonia and pulmonary contusion each have characteristic features in chest CT images; however, the typical lesions are inconclusive for differentiation of COVID-19 pneumonia and pulmonary contusion. Patients with radiological findings suspicious for COVID-19 should consider prompt RT-PCR testing even in low clinical suspicion patients. All major trauma patients arriving the emergency department should be assumed that they potentially pose a risk of COVID-19 transmission during pandemic, and immediate and comprehensive approach should be considered to minimize risk for COVID-19 transmission.

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