



MULTIPLE RIB FRACTURES, PLEURAL EFFUSION AND RIGHT-SIDED DIAPHRAGMATIC HERNIATION OF THE COLON INTO THE CHEST ASSOCIATED WITH CHRONIC COUGH AFTER COVID-19

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Received: 09/02/2023 Accepted: 02/03/2023 Published: 13/03/2023

Conflicts of Interests: The Authors declare that there are no competing interests.
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How to cite this article: Chetana Shanmukhappa S, Malik MA, Akula N, Shaukat F. Multiple rib fractures, pleural effusion and right-sided diaphragmatic herniation of the colon into the chest associated with chronic cough after COVID-19. *EJCRIM* 2023;10:doi:10.12890/2023_003812.

ABSTRACT

Rib fractures are an infrequent consequence of severe cough. In some patients, undetected rib fractures can lead to life-threatening outcomes. The case of a 73-year-old man who presented with shortness of breath and a worsening dry cough from a SARS-CoV-2 infection for 4 weeks is described. In the emergency department, he was found to be hypoxic and hypotensive. Imaging studies revealed a large right pleural effusion, multiple rib fractures, and right-sided herniation of the colon into the chest. He was admitted to the cardiothoracic intensive care unit where he underwent a flexible bronchoscopy, right video-assisted thoracoscopic surgery, evacuation of a haemothorax, complete decortication, and repair of a diaphragmatic hernia. This case is an unusual presentation of an amalgamation of rare complications resulting from an unrelenting, poorly controlled SARS-CoV-2 infection cough that prompted rapid recognition and swift action.

KEYWORDS

COVID, cough, hemothorax, respiratory failure, diaphragmatic hernia

LEARNING POINTS

- Physical examination and plain radiography frequently miss costal arch fractures if no bone pathology or history of trauma is present.
- Controlling cough is important, and decreases the chances of complications and rupture of organs.
- New-onset chest pain with a background of chronic cough makes cough-induced rib fracture a probable differential diagnosis. Pleural effusion in a patient presenting with cough and a rib fracture should make clinicians suspect haemothorax.



INTRODUCTION

Cough is one of the most common symptoms for which patients seek medical assistance in the outpatient setting in the USA^[1]. Cough is a notorious symptom of SARS-CoV-2 infection that can persist for weeks or months^[2]. The most frequently documented complication of violent/persistent cough is rib fractures. Other rare but grave complications include pneumothorax, haemothorax, intercostal pulmonary hernia, and diaphragmatic rupture and herniation^[3]. Here we present the case of a 73-year-old man who had a persistent, uncontrolled cough from a COVID-19 infection that resulted in a series of life-threatening, rare consequences requiring rapid action, surgical intervention and management in the cardiothoracic intensive care unit.

CASE DESCRIPTION

The patient was a 73-year-old man with a medical history significant for coronary artery disease, hypertension and hyperlipidaemia, who presented to the hospital with excessive dry cough of several weeks' duration, right-sided chest pain, and progressively worsening shortness of breath. He had two hospitalizations prior to this visit for similar complaints.

Nearly 1 month previously, he presented to an outside hospital with complaints of a non-productive dry coughing fits for 2 days. He reported feeling a popping sensation on the right side of his chest, with subsequent severe pain. He reported no history of trauma, falls or accidents. He underwent a CT pulmonary angiogram there which was negative for pulmonary embolism, rib fractures and pleural effusion (only the report was available to us). He tested positive for SARS-CoV-2 at that hospitalization but was saturating well on room air. He was discharged home only on pain medications.

He presented to a different hospital a couple of days after discharge with severe bruising in the right flank area and a persistent cough. At this admission, he was found to have a saturation of 80% on room air. He also underwent a CT of the abdomen and pelvis (only the report was available to us) which revealed right-sided posterolateral and anterolateral soft tissue stranding. There was also a new anterior abdominal wall hernia with the colon protruding through the defect. He received treatment for SARS-CoV-2 infection. He was discharged home on home oxygen after 8 days of admission with instructions for outpatient surgery follow-up to ventral hernia repair.

He presented to our hospital 16 days after discharge with worsening shortness of breath, persistent cough, dizziness, and right-sided abdomen and chest pain. He was haemodynamically unstable with increasing oxygen requirements. His physical examination was significant for bruising along the right upper abdominal wall extending below the umbilicus as well as mid to lower back. A CT of the chest with IV contrast was ordered emergently. Significant findings included the presence of a large right pleural effusion (Fig. 1) and a large upper right ventral hernia (Fig. 2).

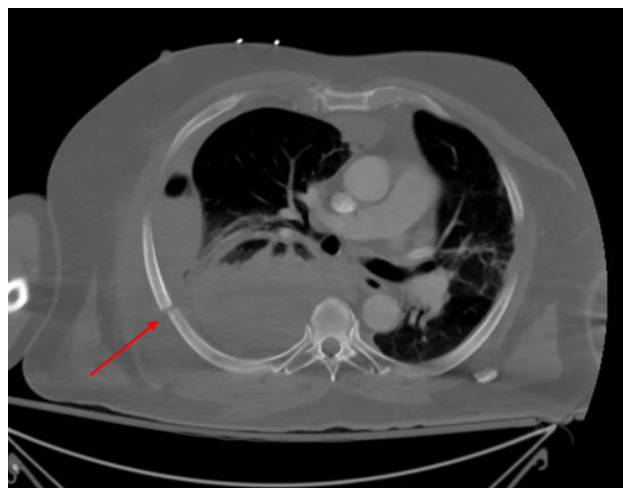


Figure 1. Contrast-enhanced computed tomography of the chest. The arrow points to the right seventh rib fracture. A large pleural effusion is also seen



Figure 2. Contrast-enhanced computed tomography of the chest. The arrow points to the right-sided ventral hernia

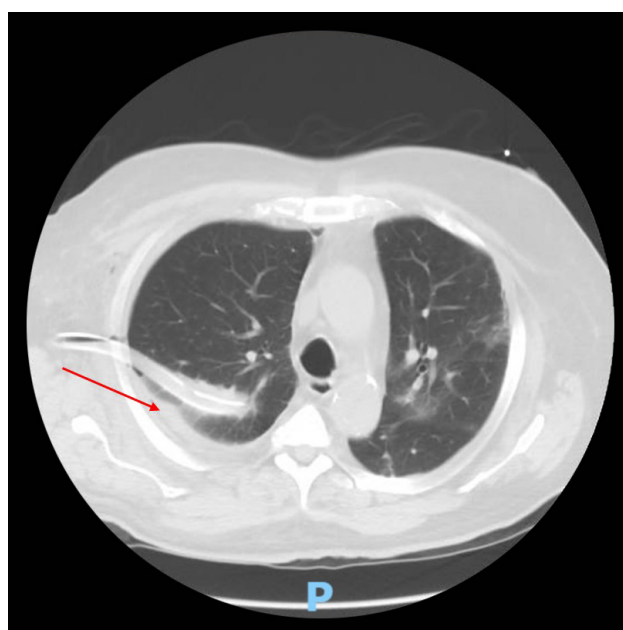


Figure 3. Non-contrast computed tomography of the chest showing right-sided chest tube placement. The arrow points to the residual effusion



Figure 4. Non-contrast computed tomography of the abdomen/pelvis. The arrow points to the right-sided diaphragmatic defect



Figure 5. Non-contrast computed tomography of the abdomen/pelvis. The arrow points to the herniation of mesenteric fat and hepatic flexure of the colon into the chest

Given the patient's history and evidence of severe bruising, we strongly suspected rib fractures as the cause of haemothorax. We contacted Radiology to ascertain the presence of rib fractures. In an addended report, the patient was noted to have fractures of the right sixth and seventh ribs along the mid-axillary line (Fig. 1).

He underwent thoracentesis which returned 1.5 l of blood. He was emergently transferred to a higher level of care for cardiothoracic surgery intervention. A right-sided chest tube was placed with a return of 1.7 l of dark red blood (Fig. 3). A repeat CT of the chest and abdomen after the evacuation of the haemothorax revealed a large complex hernia involving the anterior right hemidiaphragm and right upper quadrant

abdominal wall with a large amount of mesenteric fat and the hepatic flexure of the colon herniated into the chest (Figs. 4 and 5).

Of note, patient had no known history of osteopenia/osteoporosis. He had no prior history of non-traumatic fractures. His calcium and vitamin D levels obtained at our hospitalization were within normal limits. We reviewed a CT scan of the abdomen/pelvis which was performed a year previously (for other reasons). It was negative for any relevant findings (only the reports were available to us) indicating that this patient's diaphragmatic hernia was new and his presentation was likely a result of the COVID-19 cough and subsequent complications.

He was managed in the cardiothoracic intensive care unit. He underwent a flexible bronchoscopy, a right video-assisted thoracoscopy, evacuation of the haemothorax, complete decortication, and repair of the subacute diaphragmatic rupture. He made a complete recovery and on day 10 of hospitalization was discharged home on room air.

DISCUSSION

Mechanism of rib fractures

Two mechanisms have been proposed. When the force of the cough exceeds the elastic limits of the ribs, there are small cracks in the rib. With recurrent exertional force, the rib fractures at its most vulnerable point at the costophrenic junction. The second probable mechanism is related to opposing forces generated by the serratus anterior muscle and external oblique muscle that interlock at the middle third of the ribs^[4,5]. The most frequently fractured ribs are the fifth to ninth, as seen in our case.

Diagnosis can be made by chest radiography; however, findings can be negative in 60% of the patients. CT scanning has a high sensitivity of 100% to detect rib fractures when radiography does not establish the diagnosis^[5]. However, as with our patient, a high index of suspicion is necessary to pursue a confirmatory diagnosis.

For isolated rib fractures, conservative therapy including analgesia, rest and ice is the treatment of choice. Incentive spirometry prevents lung atelectasis and splinting. When conservative measures fail, or patients have complications such as non-union, chest wall deformity, refractory rib fracture pain, or flail chest, surgery is indicated. If surgery is required, early operative measures lead to better outcomes and decreased incidence of mechanical ventilation^[6].

A retrospective study was done at the Mayo Clinic in Rochester, Minnesota, to define the demographic, clinical and radiological features of 54 patients with cough-induced rib fractures over a 9-year period. Bone densitometry was performed in 26 patients that revealed osteoporosis/osteopenia in 17 patients. The authors concluded that although reduced bone density is a risk factor for cough-induced rib fractures, it can occur in patients with normal bone density^[7].

Mechanism of haemothorax

Haemothorax is a rare complication of non-traumatic rib

fractures. It is likely due to a tear in the chest wall tissue and pleural membrane resulting in bleeding from the intercostal or intramammary artery. An injury to one of the major vessels of the heart can lead to more acute, life-threatening bleeding^[8]. In our patient, the persistent bleeding was likely from an intercostal artery tear.

Video-assisted thoracoscopic surgery (VATS) is recommended if >1.5 l of blood has accumulated and/or there is continuous production of >200ml of blood/hour in a patient with complications such as cardiac tamponade, cardiac injury, great vessel or chest wall injury, or a diaphragmatic rupture. Open thoracotomy can be performed in patients who are not a candidate for VATS^[8,9].

Mechanism of diaphragmatic rupture

Spontaneous diaphragmatic rupture is a rare entity with only a handful of reported cases^[10]. During forced respiratory movements (cough, Valsalva), contrasting actions of the abdominal muscles and the ribs can result in the rupture of the diaphragm^[3]. Right-sided ruptures are extremely rare in adults because the liver protects the right hemidiaphragm. Right-sided ruptures are also associated with higher morbidity and mortality^[4]. Due to the risk of strangulation of abdominal organs, early diagnosis and repair are prudent^[11]. In our patient, prompt surgical intervention led to a successful outcome and recovery.

CONCLUSION

This case is an unusual presentation of an amalgamation of rare complications resulting from an unrelenting SARS-CoV-2 infection cough that has not been previously reported. Cough-related rib fractures, haemothorax and a non-traumatic spontaneous rupture of the right hemidiaphragm are extremely rare entities. Rapid recognition and swift surgical intervention can significantly reduce morbidity and mortality.

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