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CASE REPORT

Angiotensin converting enzyme inhibitor associated spontaneous herniation of liver mimicking a pleural mass: A case report

Sameer Saleem Tebha, Zain Ali Zaidi, Sehrish Sethar, Muhammad Asif Abbas Virk, Muhammad Nadeem Yousaf

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Abstract

BACKGROUND

Spontaneous diaphragmatic herniation of the liver is a rare entity. It may mimic pulmonary mass especially in the absence of trauma. Cough is a common side effect of angiotensin converting enzyme (ACE) inhibitors that may cause diaphragmatic rupture due to a sudden increase in trans-diaphragmatic pressure. We present a case of ACE-inhibitor associated spontaneous herniation of the liver mimicking pleural mass.

CASE SUMMARY

An 80-year-old woman presented with dry cough for 1 mo and sudden onset of cramping abdominal pain for 1 d. She denied history of trauma, prior surgeries, smoking, alcohol or illicit drug use. She has a history of diabetes and was started on an ACE inhibitor 6 mo ago for the management of hypertension. Examination was remarkable for right upper quadrant tenderness. Lab work-up was unremarkable. Chest X-ray showed a right lower lung opacity suspecting right pleural mass. Chest computed tomography scan ruled out pleural mass, however, revealed herniated right lobe of the liver (3.9 cm × 3.6 cm × 3.4 cm) into the

thoracic cavity through the posterolateral diaphragmatic defect. Laparoscopic repair of the diaphragmatic defect was performed and the ACE inhibitor was stopped. Patients' symptoms had completely resolved on follow-up.

CONCLUSION

ACE inhibitor-associated cough may cause diaphragmatic liver herniation mimicking pleural mass. Early diagnosis, surgical repair and addressing the triggering factors improve patients' outcomes.

Key Words: Diaphragmatic hernia; Liver herniation; ACE-inhibitors; Cough; Non-traumatic diaphragmatic hernia; Case report

Core Tip: Diaphragmatic herniation of the liver secondary to angiotensin converting enzyme inhibitors induced cough is uncommon. Cough is a rare cause of diaphragmatic liver herniation and it may be overlooked. This case illustrates the importance of combining clinical presentation with cross-sectional radiological imaging for early diagnosis and surgical repair of diaphragmatic liver herniation and for better patient outcomes.

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INTRODUCTION

Spontaneous diaphragmatic herniation of abdominal organs into the thoracic cavity is an uncommon entity. A congenital defect in the diaphragm is the most common cause of diaphragmatic hernia with a reported incidence of 0.8-5 per 10000 births[1]. Acquired rupture of the diaphragm is most commonly caused by high-velocity blunt or penetration abdomino-thoracic trauma and postsurgical diaphragmatic defect that may result in herniation of abdominal contents into the thoracic cavity[2,3]. Spontaneous diaphragmatic herniation is an uncommon subtype of acquired hernia without history of trauma. Commonly herniated abdominal organs are the stomach, small or large intestines, mesentery and spleen [2,4,5]. Spontaneous herniation of the liver into the thoracic cavity due to a non-traumatic rupture of the diaphragm is unusual with only a few cases reported[4,6,7].

Clinical presentation of diaphragmatic hernias are variable depending upon the acuity of diaphragmatic rupture, size of the defect and underlying etiology. Majority of patients present with abdominal pain, chest pain, tachycardia, shortness of breath and cough, however, a subset of patients remain asymptomatic in cases of a small defect in the diaphragm[8]. Diaphragmatic liver herniation may mimic pleural malignancy. A high index of clinical suspicion is required for early identification of diaphragmatic hernias and differentiating them from pleural malignancy with a careful review of cross-sectional radiological imaging of chest and abdomen. We present a case of cough induced spontaneous diaphragmatic herniation of the liver due to the use of angiotensin converting enzyme (ACE) inhibitor.

CASE PRESENTATION

Chief complaints

An 80-year-old female presented for evaluation of dry cough for 4 wk.

History of present illness

Patient's cough was severe, persistent, without associated hemoptysis or sputum production. She also reported the sudden onset of upper abdominal pain and mild shortness of breath for 1 d prior to visiting the hospital.

History of past illness

She had past medical history of diabetes mellitus and hypertension and was started on an ACE inhibitor 6 mo ago for the management of hypertension. She denied history of previous surgery or recent trauma.

Personal and family history

Family history was unremarkable.

Physical examination

On examination, the patient was afebrile (98.6 F), tachycardiac (112/min) with an elevated blood pressure (140/80 mmHg) and respiratory rate of 20 breaths/minute. Abdominal examination was remarkable for mild right upper quadrant tenderness without evidence of Murphy's sign or skin bruising. The lower border of the liver was non-palpable; however, a percussion dullness was noted at the right fourth intercostal space of the chest in the midclavicular line. The patient was admitted for further evaluation.

Laboratory examinations

Her baseline blood work including complete blood count, liver function tests and basic metabolic panel were unremarkable except for low hemoglobin and hematocrit (Table 1).

Imaging examinations

Ultrasound of the abdomen showed normal echotexture of the liver without evidence of liver lesions, cholelithiasis, acute cholecystitis or hepatobiliary ductal dilation. Chest radiograph demonstrated a well-defined soft tissue mass noted just above the right hemidiaphragm making an obtuse angle suggesting pleural or extra-pleural mass (Figure 1). Given a suspicion of pleural malignancy, a high-resolution computed tomography (CT)-scan of the chest was performed which revealed a defect in the posterolateral aspect of the right diaphragm with a herniated right lobe of the liver into the thoracic cavity representing a mass measuring 3.9 cm × 3.6 cm × 3.4 cm (Figure 2).

FINAL DIAGNOSIS

Spontaneous liver herniation through the right diaphragm due to an ACE inhibitor associated cough.

TREATMENT

Laparoscopic surgical repair of the diaphragmatic defect was performed after the retraction of herniated liver into the abdominal cavity. The post-surgical hospital course was uneventful. Patient was discharged on day 3 of hospitalization. Her ACE inhibitor was switched to a calcium channel blocker (verapamil) for the management of hypertension.

OUTCOME AND FOLLOW-UP

At the 8-wk follow-up, the patients' symptoms were completely resolved and blood pressure was well controlled on Verapamil.

DISCUSSION

This case illustrates an unusual presentation of spontaneous diaphragmatic herniation of the liver secondary to ACE inhibitor associated cough. ACE inhibitors are common medications used for the management of hypertension and congestive heart failure. Approximately 5%-35% of patients develop ACE inhibitor associated dry cough with a reported onset within hours to months after initiation of therapy[9-11]. Coughing causes an opposing force on the diaphragm due to respiratory muscle discoordination. Abdominal muscle contraction causes an upward pushing force on the diaphragm against the downward and inward movement of the ribs[12]. Sustained cough increases the trans-diaphragmatic pressure gradient that may cause trivial injury to the diaphragm. This phenomenon may result in spontaneous herniation of abdominal organs into the thoracic cavity through diaphragmatic defects.

Our patient had an ACE inhibitor associated cough that caused a sudden increase in trans-diaphragmatic pressure and induced liver herniation through a diaphragmatic defect. The herniated

Table 1 Baseline lab investigations

Lab investigation	Value	Normal range for female
Hemoglobin	9.7 g/dL	11.1-14.5 g/dL
Hematocrit, %	29	35.4-42.0
WBC count	10.1 × 10^9/L	4.0-11.0 × 10^9/L
Platelets	209 × 10^9/L	150-450 × 10^9/L
Urea	17 mg/dL	10-50 mg/dL
Creatinine	0.76 mg/dL	0.6-1.1 mg/dL
Hepatitis B surface antigen	0.357 (non-reactive)	1.0
Hepatitis C virus antibody	0.090 (non-reactive)	1.0
Total bilirubin	0.50	Up to 1.2 mg/dL
Direct bilirubin	0.20	< 0.2 mg/dL
Alanine transaminase	08	< 34 U/L
Alkaline phosphatase	96	44-147 U/L
GGTP	22	< 38 U/L
Aspartate aminotransferase	13	< 31 U/L

WBC: White blood cell; GGTP: Gamma-glutamyl transferase.

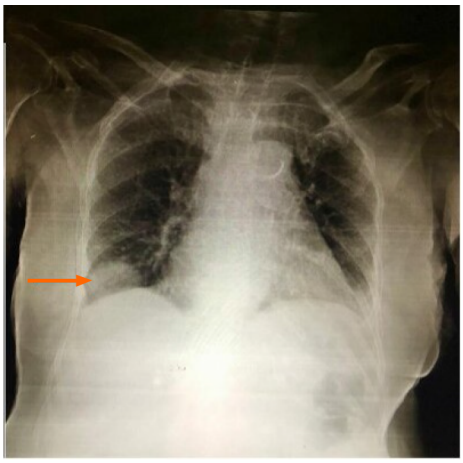

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Figure 1 Chest radiograph demonstrates a well-defined soft tissue mass noted just above the right hemi-diaphragm making an obtuse costophrenic angle suggesting pleural or extra-pleural mass.

liver closely mimicked a pleural mass leading to a diagnosis of suspected malignancy particularly in the setting of new onset of cough and shortness of breath. Our case was initially misdiagnosed as a pleural malignancy due to the rarity of the finding and confusing it with other causes of pulmonary origin. Investigation with chest CT scan ruled out pleural malignancy and revealed diaphragmatic defect with liver herniation. Pataka *et al*[13] presented a similar case of liver herniation which mimicked lung malignancy due to the gastrointestinal reflux associated with sustained cough.

The sensitivity of chest radiography to differentiate diaphragmatic liver herniation from the pulmonary mass is only 17% in right sided and 46% on left sided diaphragmatic defects[14]. Helical CT scan of the chest and abdomen is the radiological imaging of choice with a 73% sensitivity and a 90% specificity in the identification of diaphragmatic defects, herniated abdominal organs and differentiating them from pulmonary mass[15]. Small diaphragmatic defects may be difficult to locate on CT scan. In these cases, magnetic resonance imaging, diagnostic thoracoscopy or laparoscopy may assist in the identification of diaphragmatic defects and in the planning of surgical repair[8]. Surgical reduction of herniated abdominal contents and repair of the diaphragmatic defect is the treatment of choice. Laparoscopic and/or thoracoscopic repair is preferred over open laparotomy or thoracostomy because of less

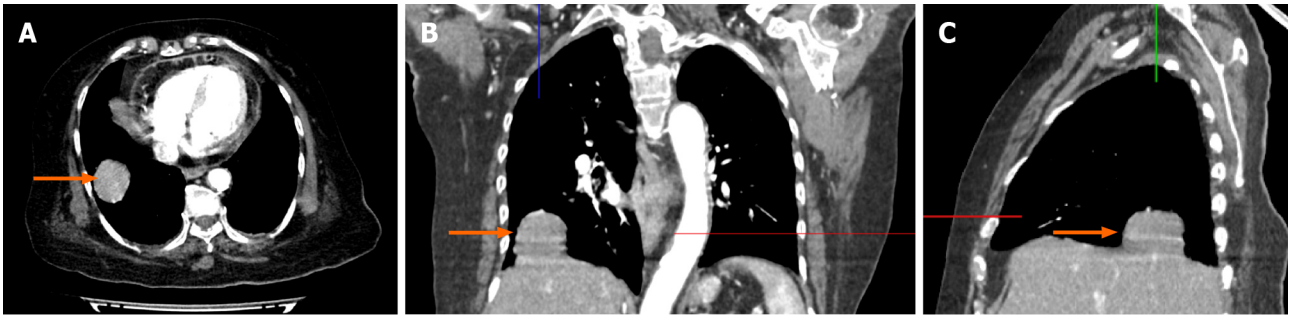

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Figure 2 Chest computed tomography images. A: Axial view showing herniated part of the liver through focal defect in the right hemi-diaphragm (arrow) mimicking a pleural/pulmonary mass; B: Coronal view shows extension of liver parenchyma into the thoracic cavity with hepatic artery within herniated liver (arrow); C: Sagittal view shows nubbin of liver parenchyma herniated through diaphragmatic defect posteriorly (arrow).

risk of morbidity and mortality with these minimally invasive modalities[8].

CONCLUSION

Spontaneous diaphragmatic herniation of the liver may mimic a pleural/pulmonary mass. A high index of clinical suspicion is required for early identification of non-traumatic diaphragmatic liver herniation particularly in individuals at risk of the increased transabdominal pressure gradient. ACE inhibitor associated cough is a known adverse reaction that rarely results in liver herniation. Early diagnosis with cross-sectional radiological imaging, surgical repair and addressing triggering factors improves patient outcome.

FOOTNOTES

Author contributions: Sethar S identified the abnormality and diagnosed the patient; Tebha SS and Zaidi ZA reviewed the literature, found relevant information, and wrote the manuscript; Virk MAA and Yousaf MN proofread, revisions and edits of the manuscript, and overall supervision in finalizing of the manuscript.

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