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

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**Abstract**

**BACKGROUND**

Spontaneous diaphragmatic herniation of 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 enzymes (ACE) inhibitors that may cause diaphragmatic rupture due to a sudden increase in transdiaphragmatic pressure. We presented a case of ACE-inhibitor associated spontaneous herniation of liver mimicking pleural mass.

**CASE SUMMARY**

80-year-old women presented with dry cough for one month and sudden onset of cramping abdominal pain for one day. She denied history of trauma, prior surgeries, smoking, alcohol drinking, or illicit drug use. She has history of diabetes and was started on ACE inhibitors 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 opacity suspected right pleural mass. Chest CT scan ruled out pleural mass, however, revealed herniated right lobe of live (3.9×3.6×3.4 cm) into the thoracic cavity through the posterolateral diaphragmatic defect. Laparoscopic repair of

the diaphragmatic defect was performed, and ACE inhibitors were stopped. Patients' symptoms completely resolved on follow-up.

## CONCLUSION

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

## 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 10,000 births<sup>[1]</sup>. Acquired rupture of the diaphragm is most commonly caused by high-velocity blunt or penetration abdominothoracic trauma and postsurgical diaphragmatic defect that may result in herniation of abdominal contents into the thoracic cavity<sup>[2, 3]</sup>. Spontaneous diaphragmatic herniation is an uncommon subtype of acquired hernia without history of trauma. Commonly herniated abdominal organs are the stomach, small or large intestine, mesentery, and spleen<sup>[2, 4, 5]</sup>. 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 has been reported<sup>[4, 6, 7]</sup>.

Clinical presentation of diaphragmatic hernias is 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 patient remains asymptomatic in case of a small defect in the diaphragm<sup>[8]</sup>. 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 presented a case of cough induced spontaneous diaphragmatic herniation of the liver due to the use of angiotensin converting enzymes (ACE) inhibitor.

## **CASE PRESENTATION**

### ***Chief complaints***

An 80-year-old female presented for evaluation of dry cough for four weeks.

### ***History of present illness***

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

### ***History of past illness***

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

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### ***Personal and family history***

Family history was unremarkable.

### ***Physical examination***

On examination, the patient was afebrile (98.6 F), tachycardiac (112/minute), 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 sign, or skin bruises. The lower border of liver was non-palpable; however, a percussion dullness was noted at the right fourth intercostal space of 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 (LFTs), and basic metabolic panel were unremarkable except for low hemoglobin and hematocrit (Table 1).

### ***Imaging examinations***

Ultrasound abdomen showed normal echotexture of liver without evidence of liver lesions, cholelithiasis, acute cholecystitis, 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 suspicion for pleural malignancy, a high-resolution CT-scan of chest was performed which revealed a defect in the posterolateral aspect of the right diaphragm with herniated right lobe of liver into the thoracic cavity representing mass measuring 3.9×3.6×3.4 cm (figures 2-4).

### **FINAL DIAGNOSIS**

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

### **TREATMENT**

Laparoscopic surgical repair of the diaphragmatic defect was performed after 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 with calcium channel blockers (verapamil) for the management of hypertension.

### **OUTCOME AND FOLLOW-UP**

On eight weeks follow up patients' symptoms 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. An ACE inhibitor is a common medication used for the management of hypertension and congestive heart failure. Approximately 5%-35% of patients develop ACE inhibitors associated dry cough with reported onset within hours to months after initiation of therapy<sup>[9-11]</sup>. Cough causes an opposing force on the diaphragm due to the discoordination of muscles of respiration. Abdominal muscle contraction causes upward pushing force on the diaphragm against the downward and inwards movement of ribs<sup>[12]</sup>. Sustained cough increases transdiaphragmatic 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 ACE inhibitor associated cough that caused a sudden increase in transdiaphragmatic pressure and induced liver herniation through a diaphragmatic defect. The herniated liver closely mimicked a pleural mass suspecting 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* presented a similar case of liver herniation mimicked lung malignancy due to gastrointestinal reflux associated sustained cough<sup>[13]</sup>.

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<sup>[14]</sup>. Helical CT chest and abdomen is the radiological imaging of choice with 73% sensitivity and 90% specificity in the identification of diaphragmatic defect, herniated abdominal organs, and differentiating them from pulmonary mass<sup>[15]</sup>. Small

diaphragmatic defects may be difficult to locate on CT scan. In these cases, MRI, diagnostic thoracoscopy or laparoscopy may assist in the identification of diaphragmatic defects and for the planning of surgical repair<sup>[8]</sup>. Surgical reduction of herniated abdominal contents and repair of the diaphragmatic defects is the treatment of choice. Laparoscopic and/or thoracoscopic repair is preferred over open laparotomy or thoracostomy because of less risk of morbidity and mortality with these minimal invasive modalities<sup>[8]</sup>.

## **CONCLUSION**

Spontaneous diaphragmatic herniation of liver may mimic the pleural/pulmonary mass. A high index of clinical suspicion is required for early identification of nontraumatic 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 may result in liver herniation. Early diagnosis with cross-sectional radiological imaging, surgical repair, and addressing triggering factors improves patient outcome.

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