An 87-Year-Old Man With Progressive Breathlessness and a Complex Chest CT Scan

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An 87-year-old man with a background of slow atrial fibrillation (treated with a single-chamber pacemaker) and urinary bladder carcinoma was admitted to the hospital following a fall at home. The initial chest radiograph revealed a large hiatus hernia, fractured left seventh and eighth ribs, and a left pleural effusion (Fig 1A). The patient underwent CT scanning of the chest, which confirmed the presence of hiatus hernia, a trace of left side pleural effusion, and no pneumothorax (Fig 1B). Review of previous radiology studies, including a barium meal (Fig 2), confirmed that the hernia was long-standing and not traumatic.

Five months later, the patient was readmitted with progressive dysphagia and dyspnea. Physical examination revealed reduced breath sounds bilaterally with no added sounds, pedal edema, or congested neck veins. Results of his initial blood tests showed a hemoglobin level of 12.5 g/dL, with a mean corpuscular volume of 109 fL and normal folate and vitamin B₁₂ levels. Electrolyte analysis showed raised creatinine (1.87 mg/dL) and urea.

Figure 1 – A, Chest radiograph postero-anterior view showing large retro-cardiac rounded opacity with air fluid level representing a large hiatal hernia, as well as fractures in the seventh and eighth ribs. B, CT scan of the thorax (axial section in the mediastinal window) showing the hiatal hernia and trace of left pleural effusion.
(99 mg/dL) levels, which normalized with hydration; his C-reactive protein level was 8 mg/L. The patient underwent a chest radiograph that suggested a possible increase in the left side pleural effusion. He later had a chest CT scan, which confirmed the left side effusion, with difficulty in assessing the size of the effusion due to the proximity of the hiatal hernia contents (Fig 3). Thoracic ultrasound (TUS) examination of the left hemithorax was conducted (Video 1).

Question: What does the video show?
Answer: The video shows systematic examination of the left hemithorax starting from the lowermost intercostal space where the diaphragm is identified, followed by three more superior intercostal spaces where different sections of the hernial sac are shown. The atelectatic lung is seen on examination of the highest intercostal space. TUS shows clear differentiation in the echogenicity between the pleural fluid and the hernial sac wall with its contents of fluid and viscera (Fig 4).

TUS examination of the right hemithorax revealed a trace of pleural effusion, with a large portion of the hiatal hernia seen. Thoracentesis was performed on the left side under real-time ultrasound guidance to avoid accidental injury to the nearby hernial sac (Video 2). The pleural fluid was straw-colored, and the fluid pH was 7.39. Biochemical analysis revealed it to be an exudate (pleural fluid protein, 3 g/dL; serum protein, 5.4 g/dL; pleural fluid lactate dehydrogenase, 291 IU/L) with negative results on cultures. Results of the initial cytological analysis were negative, but due to rapid recurrence, pleural aspiration was repeated; subsequent cytologic analysis showed atypical cells that were positive to CK-MNF116, GATA3, CK7, CDX2, and p63 on immunohistochemistry, favoring a diagnosis of metastatic urothelial carcinoma.

Discussion

The use of TUS to guide intervention in the pleural space is strongly recommended,1 as it has been shown to reduce the incidence of traumatic pneumothorax and injury to nearby viscera.2,3 In addition to confirming the presence and location of pleural fluid, TUS is vital in identifying the position of the diaphragm, which is necessary prior to performing thoracentesis or insertion of a chest drain for pleural effusion or pneumothorax.4

Additional information that can be obtained during TUS examination of pleural effusion is the sonographic characteristics of the fluid; namely the degree of echogenicity of the fluid (which is useful in suggesting potential etiologies)5 and the presence and extent of septations of the fluid.6 TUS is superior to CT imaging in delineating the latter.1

The presented case shows how TUS examination helped in deciphering the complex CT images (Fig 3) by showing clear distinction between the pleural fluid, which appeared echogenic, and the hernial sac, which contained anechoic fluid (Fig 4). Furthermore, it facilitated safer intervention into the pleural space by allowing real-time execution of thoracentesis (Discussion Video).

TUS-guided thoracentesis in real-time is not indicated for all procedures; a TUS-assisted approach is usually sufficient. However, a TUS direct-guided approach during pleural procedures, albeit more demanding in terms of time and expertise, is strongly recommended when there is relatively small effusions where the risk of harm to vital structures could be higher.1 The study patient went on to have an indwelling pleural catheter inserted due to rapid recurrence of the pleural effusion; TUS was again used to guide the different steps of this procedure (Discussion Video).

Reverberations

1. TUS is an excellent tool in pleural effusion characterization in terms of echogenicity and the presence of septations, which have important clinical bearings.
2. TUS examination is an essential step prior to thoracentesis to ensure the safety of the procedure.
3. Direct-guided pleural intervention using TUS is necessary in cases in which there is a potential risk of accidentally causing iatrogenic injury to nearby structures.

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Additional information: To analyze this case with the videos, see the online version of this article.

References