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Abstract

Ultrasound-guidance has become the standard of care for bedside thoracentesis. This manuscript describes the importance of utilizing point-of-care-ultrasound (POCUS) and color Doppler in avoiding an unusual, but potentially catastrophic aortic puncture during thoracentesis. The case describes a 70 year-old man who presented with one week of shortness of breath. He was found to have a large left-sided pleural effusion on imaging studies. During a bedside POCUS examination, he was found to have a hyperechoic linear structure in his posterior left hemithorax. Ultrasound application of color Doppler revealed a pulsatile flow, confirming visualization of the aorta. The site of needle insertion for thoracentesis was placed more laterally to avoid aortic puncture. The thoracentesis was performed successfully with removal of about 1000ml of sanguinous fluid. This clinical case demonstrates the importance of considering anatomic variants when performing a thoracentesis. As in this patient's case, ultrasonography and color Doppler during thoracentesis can be useful in avoiding a potentially life-threatening puncture of the aorta.

Keywords

Doppler; Ectasia; Hyperechoic; Jellyfish Sign; Plankton Sign; Pleural Effusion; Thoracentesis; Thoracic Aorta

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Abstract

Ultrasound-guidance has become the standard of care for bedside thoracentesis. This manuscript describes the importance of utilizing point-of-care-ultrasound (POCUS) and color Doppler in avoiding an unusual, but potentially catastrophic aortic puncture during thoracentesis. The case describes a 70-year-old man who presented with one week of shortness of breath. He was found to have a large left-sided pleural effusion in imaging studies. During a bedside POCUS examination, he was found to have a hyperechoic linear structure in his posterior left hemithorax. Ultrasound application of color Doppler revealed a pulsatile flow, confirming visualization of the aorta. The site of needle insertion for thoracentesis was placed more laterally to avoid aortic puncture. The thoracentesis was performed successfully with the removal of about 1000ml of sanguinous fluid. This clinical case demonstrates the importance of considering anatomic variants when performing a thoracentesis. As in this patient's case, ultrasonography and color Doppler during thoracentesis can be useful in avoiding a potentially life-threatening puncture of the aorta.

Keywords: Doppler; Ectasia; Hyperechoic; Jellyfish Sign; Plankton Sign; Pleural Effusion; Thoracentesis; Thoracic Aorta

Abbreviations: CT (Computed Tomography); POCUS (Point-of-care-Ultrasound); T4 (Fourth Thoracic Vertebra)

Introduction

Thoracentesis is a common procedure in the United States with more than 132,000 performed at 234 university hospitals over 3 years.[1] In the past two decades, the use of ultrasound-guidance has become the standard of care when performing thoracentesis.[2] Ultrasound-guidance is associated with increased success rates, decreased complication rates, and lower costs of hospitalization,[2,3,4] Additionally, ultrasonography can help estimate the pleural fluid volume, characterize the effusion as simple or complex, identify an optimal needle insertion site, and reduce the need for post-procedural chest radiographs.[2] Ultrasound guidance can also assist in preventing uncommon complications during thoracentesis. In this case report, we describe the importance of point-of-care-ultrasound (POCUS) in avoiding an unusual, but potentially catastrophic aortic puncture during thoracentesis.

Case

A 70-year-old male presented to the emergency room with pre-syncopal symptoms and was found to have a left-sided pleural effusion on chest x-ray. The internal medicine procedure team was consulted for bedside ultrasound-guided thoracentesis. The ultrasound exam demonstrated a large pleural effusion with swirling punctate echogenicity ("plankton sign") suggesting an exudative or hemorrhagic fluid (Figure 1).[5] A hyperechoic linear structure was noted in the posterior left hemithorax. Application of color Doppler demonstrated pulsatile flow, which was confirmed to be the aorta with pulse wave Doppler (Figure 2). The needle entry site for the thoracentesis was marked well lateral to this vascular structure. The thoracentesis was completed successfully with the removal of 1000 mL of sanguinous fluid. The patient tolerated the procedure without complication. Fluid studies confirmed a hemorrhagic effusion with cytology negative for malignant cells. As part of his evaluation, a computed tomography (CT) was performed and demonstrated "extensive atherosclerotic vascular disease with multifocal ectasia of the thoracic and abdominal aorta" in addition to a large pericardial effusion (Figure 3). Prior chest x-ray and CT exams had also noted a tortuous aorta with areas of ectasia (Figures 4 & 5). The patient was referred to pulmonology for further evaluation and monitoring.

Discussion

Ultrasound-guidance has become the standard of care for thoracentesis, especially for identifying and avoiding critical structures during needle insertion.[2] Structures that should be identified throughout the respiratory cycle during the ultrasound exam include the chest wall, pleura, diaphragm, lung, and subdiaphragmatic organs. Attention to identifying the aorta has not been frequently cited, although several case reports have described damage to the aorta with thoracic procedures.[6,7]

Normally, the thoracic aorta begins at the level of the T4 vertebra and courses caudally through the posterior mediastinum. The aorta can be commonly found to the left of the vertebral column but eventually tracks anterior to the lower thoracic vertebral bodies. The descending thoracic aorta can become more tortuous with age, likely due to decreasing elastin and increasing collagen in the aortic wall.[7] Patients over 65 years old also tend to have the location of maximum tortuosity more distal compared to younger patients.[8]

In some cases, the aorta can have a similar appearance to pleural fluid or lung tissue on ultrasound. Vascular walls could potentially be mistaken for collapsed lung tissue or septations, as might be seen in complex effusions. In addition, aortic pulsatility could

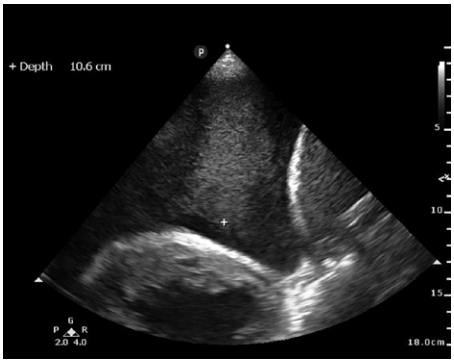

Figure 1. Left Lung, Zone 6

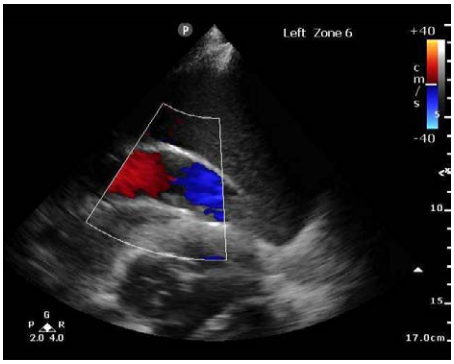

Figure 2. Left posterior lung ultrasound with Doppler

be mistaken for movement of atelectatic lung within an effusion (described as the "jellyfish sign"). Importantly, color and spectral Doppler imaging can help identify vasculature structures which can vastly change the course of a patient's thoracentesis.[9]

Conclusion

In conclusion, this case report emphasizes the importance of considering anatomic variants of the descending thoracic aorta when performing a thoracentesis. We advocate for routine use of color Doppler over the intended needle entry site to avoid potentially life-threatening complications. ■

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Author Contributions

C. Smith and J. Roettger had full access to the data and contributed to the writing of the manuscript.

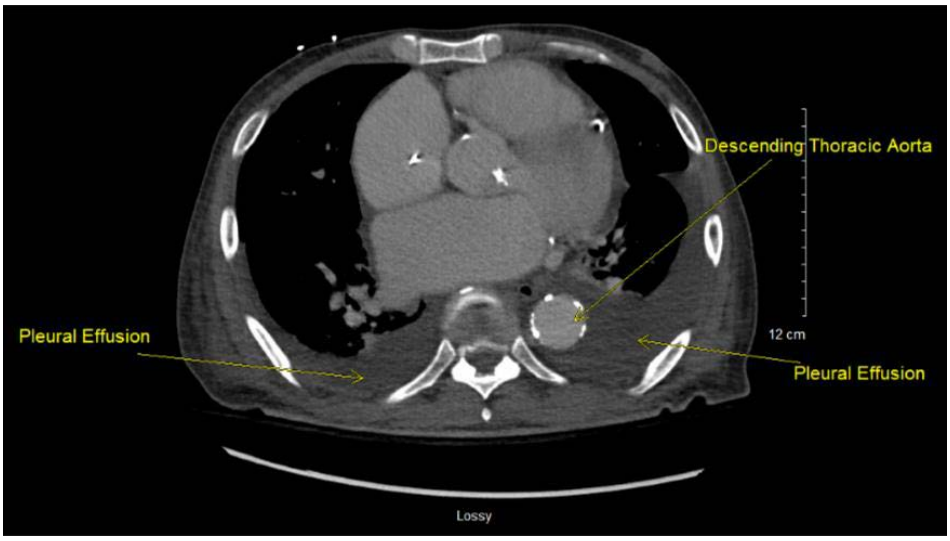

Figure 3. CT Chest with Contrast: Descending Thoracic Aorta

Figures 4 and 5. Anterior-Posterior and Lateral view chest X-ray – "Tortuous Aorta"

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