

Emergency department diagnosis of massive pleural effusion causing right ventricular diastolic collapse using bedside ultrasonography

David C. Riley · Cini Thayil · David R. Anthony

Received: 21 April 2010 / Accepted: 26 May 2010 / Published online: 30 June 2010
© Springer-Verlag 2010

Abstract

Introduction A 75-year-old man with a 150-pack-year smoking history presented to the emergency department with progressively worsening shortness of breath, dyspnea on exertion, cough with white sputum and right-sided chest pain with right shoulder radiation for 1 week. Chest X-ray and bedside ultrasonography revealed a massive pleural effusion. Bedside subcostal ultrasound examination of the heart showed diastolic collapse of the right ventricle, a tamponade-like picture, that corrected after thoracentesis and pleural fluid removal.

Conclusion Bedside emergency department ultrasonography was used to assist in the diagnosis of massive pleural effusion causing right ventricular diastolic collapse.

Keywords Ultrasound · Massive pleural effusion · Right ventricle diastolic collapse

Case report

A 75-year-old man with a 150-pack-year smoking history presented to the emergency department with progressively worsening shortness of breath, dyspnea on exertion, cough with white sputum and right-sided chest pain with right

shoulder radiation for 1 week. He also complained of losing 15 lb over the past few months. His ED vital signs were temperature 97.5°F, blood pressure 150/94 mmHg, respiratory rate 20 bpm, room air oxygen saturation 96%. Electrocardiogram revealed normal sinus rhythm with a heart rate of 111 bpm. His physical examination was notable for a thin man with decreased breath sounds on the right side and no leg edema or tenderness to palpation. Portable chest X-ray showed an extensive right pleural effusion. Initial laboratory studies were normal.

An initial ED bedside ultrasound was performed of the chest and heart (see Video Clips S1, S2 and S3 available as supporting information in the online version of this paper). Examination of the right chest with both low frequency curved array and high frequency M-mode sonography revealed a massive pleural effusion with collapsed lung (Figs. 1, 2, 3). Subcostal bedside ultrasound examination of the heart showed diastolic collapse of the right ventricle with minimal pericardial effusion (Fig. 4). Subcostal evaluation of the inferior vena cava revealed marked inspiratory collapse (Fig. 5). Emergency department right chest thoracentesis was performed given the cardiac subcostal ultrasound findings of impending cardiac tamponade with diastolic collapse of the right ventricle, coupled with the patient becoming progressively more short of breath in the ED. The patient immediately felt better and less short of breath, with a decreased heart rate of 91 bpm, after the removal of 1.75 l of straw colored fluid. The fluid was a non-infectious exudate with a pH of 7.29. Repeat post-thoracentesis ED bedside subcostal sonography revealed normal right ventricular filling with no diastolic collapse of the right ventricle (Fig. 6 and see Video Clips S4 and S5 available as supporting information in the online version of this paper). The patient showed signs of improved hemodynamics as subcostal evaluation of the inferior vena cava

Electronic supplementary material The online version of this article (doi:10.1007/s13089-010-0032-5) contains supplementary material, which is available to authorized users.

D. C. Riley (✉) · C. Thayil · D. R. Anthony
Emergency Medicine Department,
Columbia University Medical Center,
622 West 168th Street, PH 1-137,
New York, NY 10032, USA
e-mail: dr499@columbia.edu

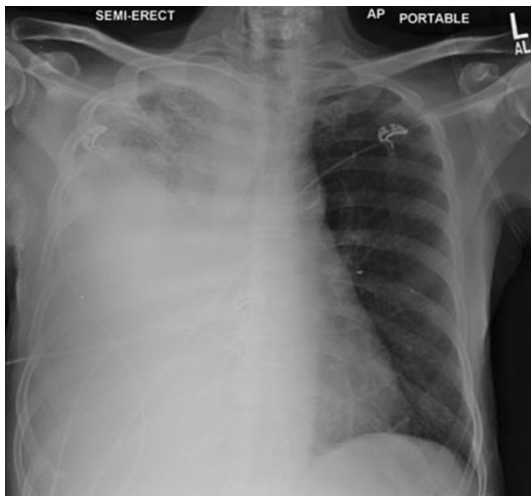


Fig. 1 CXR massive pleural effusion pre-thoracentesis

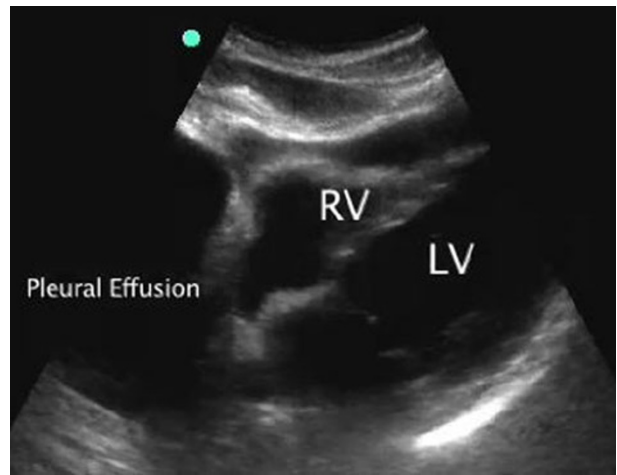


Fig. 4 Pleural effusion caused RV collapse subcostal view

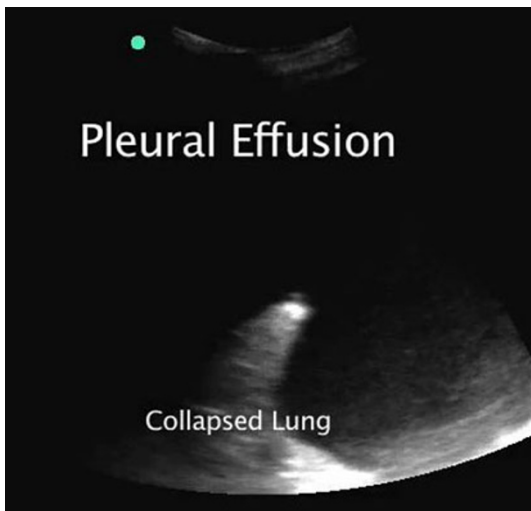


Fig. 2 Massive pleural effusion collapsed lung

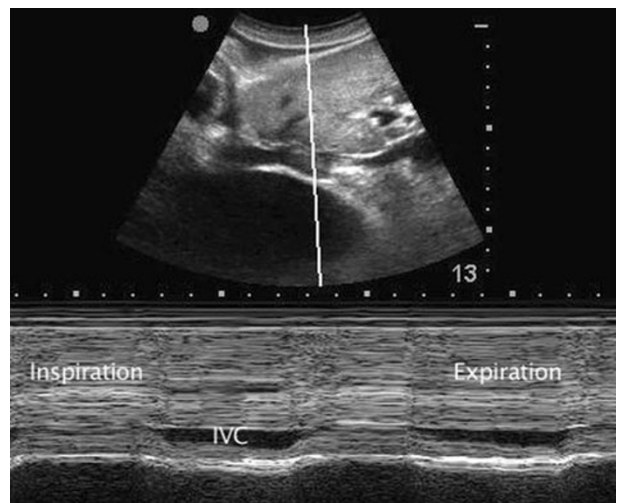


Fig. 5 IVC collapse M-mode pre-thoracentesis

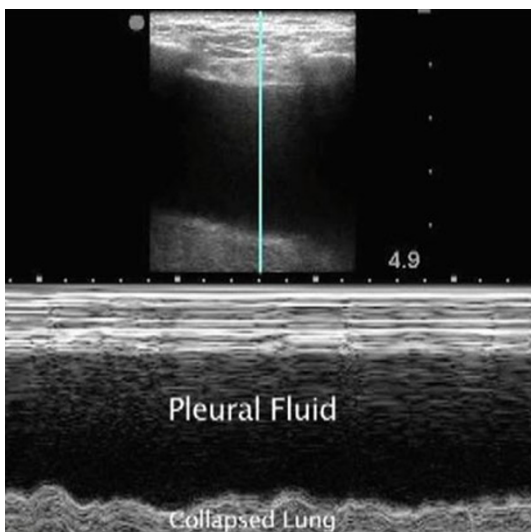


Fig. 3 Massive pleural effusion M-mode

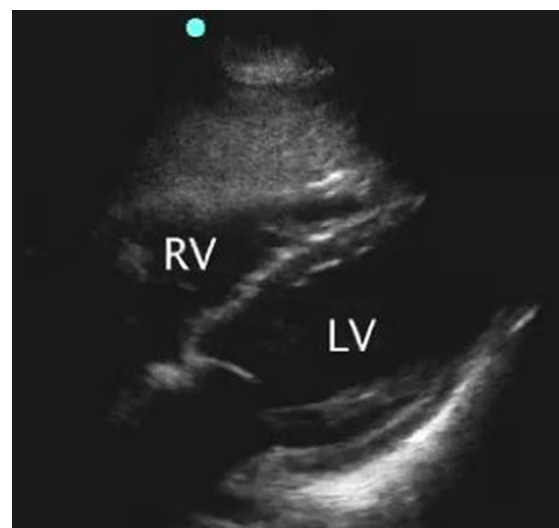


Fig. 6 Post-thoracentesis subcostal view

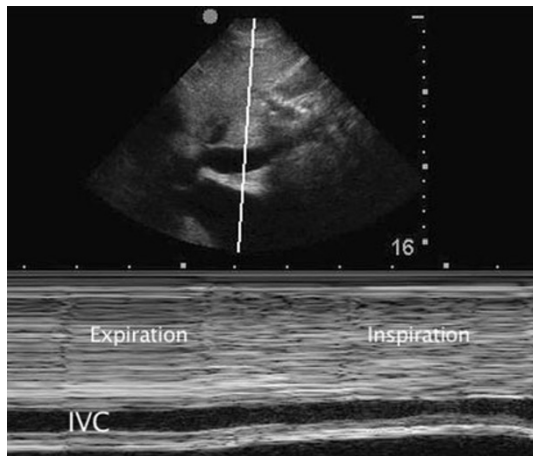


Fig. 7 IVC collapse M-mode post-thoracentesis

revealed minimal inspiratory collapse after the removal of significant intra-thoracic fluid (Fig. 7).

The patient had computed tomography of the chest that showed a large mass, probable cancer, in the right lung. He was admitted to the hospital for pulmonary medicine, oncology and cardiothoracic surgery consultation and care. He was diagnosed with lung adenocarcinoma after bronchoscopy and right lung thoracoscopy and biopsy.

Discussion

Patients with large pleural effusions have been reported to show signs of impending cardiac tamponade with diastolic collapse of the right ventricle and worsening clinical symptoms [1–3]. Echocardiographic diastolic collapse of the right ventricle is considered the most sensitive and specific sign of cardiac tamponade [1–4]. Patients with a large pleural

effusion and right ventricular diastolic collapse may not have hemodynamic compromise; however, early ED thoracentesis can improve patients' symptoms [4]. Interestingly, patients with impending cardiac tamponade with diastolic collapse of the right ventricle who have a small pericardial effusion and a large pleural effusion may benefit from first performing thoracentesis and pleural fluid removal followed by repeat echocardiography evaluation of the heart for diastolic collapse of the right ventricle [3, 4].

Conclusion

Bedside chest and cardiac ultrasonography can assist the emergency and critical care physician in the diagnosis of massive pleural effusion causing right ventricular diastolic collapse.

Conflict of interest None.

References

1. Alam HB, Levitt A, Molyneaux R, Davidson P, Sample GA (1999) Can pleural effusions cause cardiac tamponade? *Chest* 116:1820–1822
2. Kaplan LM, Epstein SK, Schwartz SL, Cao QL, Pandian NG (1995) Clinical, echocardiographic, and hemodynamic evidence of cardiac tamponade caused by large pleural effusions. *Am J Respir Crit Care Med* 151:904–908
3. Klopfenstein HS, Wann LS (1994) Can pleural effusions cause tamponade-like effects? *Echocardiography* 11:489–492
4. Venkatesh G, Tomlinson CW, O'Sullivan T, McKelvie RS (1995) Right ventricular diastolic collapse without hemodynamic compromise in a patient with large, bilateral pleural effusions. *J Am Soc Echocardiogr* 8:551–553