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Diagnosis of Diffuse Pulmonary Hemorrhage by Ultrasonography: A Case Report

Ultrasonografi ile Diffüz Pulmoner Hemoraji Tanısı: Olgu Sunumu

Nalan Kozacı, İsmail Erkan Aydın, Tuğçe Erşahin, Büşra Taşkıran

Abstract

A 72-year-old male patient was admitted to the emergency department with a complaint of a rash covering his entire body and shortness of breath. Aside from the petechial rash covering his body, the patient was also found to have bleeding in the mouth and gums, and tachypnea. A bedside point-of-care ultrasound (POCUS) revealed multiple and confluent B lines, a pleural line abnormality, the disappearance of A-lines, a subpleural hypoechoic area, hepatization, shred sign and pleural effusion, predominantly in the 3rd, 4th and 5th zones of the right lung and the 3rd and 4th zones of the left lung. A stratosphere sign was detected in M Mode. The patient was diagnosed with diffuse pulmonary hemorrhage with POCUS and clinical findings.

Keywords: *Diffuse alveolar hemorrhage, diffuse pulmonary hemorrhage, point-of-care ultrasound, POCUS.*

Öz

Yetmiş iki yaşında erkek hasta acil serviste vücutta yaygın döküntü ve nefes darlığı şikayetleri ile başvurdu. Takipneik ve dispneik olan hastanın tüm vücudunda peteşial tarzda döküntüleri, ağız içinde ve diş etlerinde kanama görüldü. Hastaya yatak başı nokta bakım ultrasonu (POCUS) yapıldı. POCUS'da sağ akciğer 3. 4. 5. ve sol akciğerde 3. ve 4. zonda ağırlıklı olmak üzere multiple ve confluent B çizgileri, plevral çizgide düzensizlik, A çizgilerinde kaybolma, subplevral hypoecoik alan, hepatizasyon, shred sign ve plevral effüzyon tespit edildi. Plevral çizgide düzensizlik, subplevral hypoecoik alan, hepatizasyon, shred sign bulgularının olduğu alanlarda M Mod'da stratosfer bulgusu saptandı. Olgunun POCUS ve klinik bulguları birlikte değerlendirilerek diffüz pulmoner hemoraji tanısı konuldu.

Anahtar Kelimeler: *Diffüz alveolar hemoraji, diffüz pulmoner hemoraji, nokta bakım ultrasonu, POCUS.*

Department of Emergency Medicine, Alanya Alaaddin Keykubat University, Facult of Medicine, Antalya, Türkiye

Alanya Alaaddin Keykubat Üniversitesi, Tıp Fakültesi, Acil Tıp Anabilim Dalı, Antalya

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Correspondence (İletişim): İsmail Erkan Aydın, Department of Emergency Medicine, Alanya Alaaddin Keykubat University, Facult of Medicine, Antalya, Türkiye

e-mail: erkan.aydin@alanya.edu.tr

Acute dyspnea is a common cause of admission to the emergency department (ED), and is a common symptom in a broad variety of diseases, including cardiorespiratory, and infectious and oncological diseases. Correct and rapid diagnosis and appropriate management by emergency physicians are necessary for survival. The standard approach to dyspnea is based primarily on radiological and laboratory results, however, the time spent transporting the patient to the imaging department for computed tomography (CT) or waiting for bedside chest X-rays are a serious disadvantage for unstable patients, preventing the early initiation of appropriate treatment (1,2).

Ultrasonography (US) can be used to view many parts of the body, is easily accessible, does not rely on ionizing radiation and is more portable than conventional radiography devices. Thoracic ultrasound is widely used in the emergency department in patients presenting with respiratory symptoms and trauma (2–5). In the last 10 years in particular, point-of-care ultrasound (POCUS) has gained popularity following an increase in POCUS training (6). Studies have reported that US has equivalent or often better sensitivity and specificity than conventional radiography (chest X-ray), and have reported that US can help in the differential diagnosis of pathologies that are undetectable on X-ray (7,8).

Diffuse pulmonary hemorrhage (DPH) is a rare clinicopathological syndrome. Intraalveolar bleeding occurs as a result of the disruption of the alveolar-capillary membrane. DPH occurs due to immunological and nonimmunological reasons. Anticoagulant and antiplatelet therapy, coagulation disorders are among the nonimmunological causes. A detailed history, physical examination and laboratory tests are required for the determination of the underlying cause of DPH, while imaging methods are used to diagnose the disease and to determine its severity (9).

We present here a case report of a patient with complaints of shortness of breath and a rash over his entire body who was diagnosed with diffuse pulmonary hemorrhage (DPH) based on bedside POCUS in the ED.

CASE

A 72-year-old male patient was admitted to the ED with a complaint of rash over his entire body and shortness of breath. The patient had a history of heart failure and furosemide, aldactazide, bisoprolol and acetylsalicylic acid use. An operation was planned for a left inguinal hernia and enoxaparin was started 1 week ago. The patient reported that the rash had developed 3 days earlier, along with blood in his mouth and urine. On physical examination, the patient's general condition was poor, and he was confused. His vital signs were blood pressure: 100/70 mmHg, pulse: 64 beats/min, respiratory rate: 30/min, O_2 saturation: 77% and body temperature: 37.5 °C. Bleeding was noted in the mouth and gums, and bilateral rales were detected on chest auscultation. Bedside arterial blood gases were pH: 7.36, pCO_2: 45 mmHg, pO_2:39 mmHg, Lactate: 7.1 mmol/L and HCO_3: 23 mmol/L, while a laboratory analysis revealed thrombocytopenia (65,000/uL) and anemia (RBC: 3.48 106/uL Hb: 11 g/dL), WBC: 10.33 was 103/uL, and an impaired coagulation profile (INR: 2.58, PT: 29.9 sec. aPTT: 54.6 sec.).

The patient was monitored and 8 L/min O2 support was started, but he was subsequently endotracheally intubated due to a lack of response to oxygen support. It was observed that there was bleeding towards the endotracheal tube, and continuous blood flow was observed upon the aspiration of the endotracheal tube, and so positive pressure mechanical ventilation support was started. POCUS was performed by the emergency physician while the patient was being mechanically ventilated. revealing multiple and confluent B lines, a pleural line abnormality, the disappearance of A-lines, a subpleural hypoechoic area, hepatization, shred sign and pleural effusion, predominantly in the 3rd, 4th and 5th zones of the right lung, and the 3rd and 4th zones of the left lung (Figure 1, 2, 3). "Stratosphere signs" were detected in M Mode in the zones with pleural line abnormalities, subpleural hypoechoic areas, hepatization and shred sign (Figure 4). The patient was diagnosed with DPH based on his POCUS and clinical findings, and the ventilator mode and parameters were adjusted according to DPH. After undergoing CT imaging, the patient was admitted to the intensive care unit. A thorax CT of the patient revealed bilateral widespread areas of consolidation, primarily in the central lobe of the right lung, and bilateral pleural effusions, primarily in the right lung (Figure 5). These findings were found not to have abated during a chest X-ray on the 2nd day of patient follow-up (Figure 6). The patient, whose follow-up continued on a mechanical ventilator, died on the 2nd day of hospitalization.

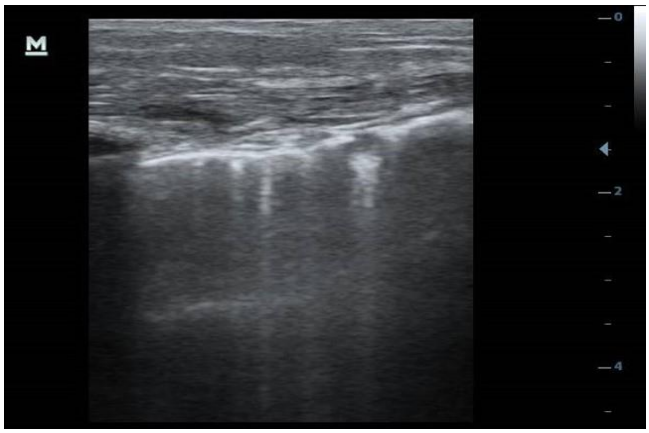

Figure 1: Multiple and confluent B lines, pleural line abnormality, disappearance of A lines

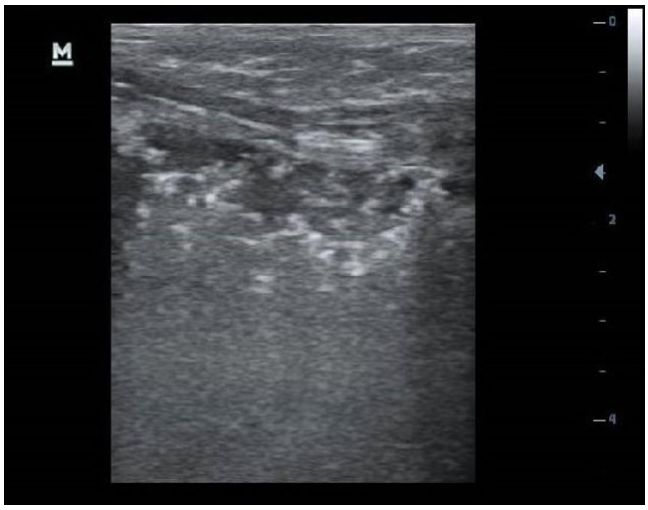

Figure 2: Hepatization and shred sign

Point of care ultrasonography

The POCUS was conducted with 7.5 MHz linear and 3.5 MHz convex probes (Mindray DP-30, Germany) with the patient in the supine position. The thorax was evaluated from the anterolateral aspect, while the hemithorax was evaluated with the midsternal line as right and left. Each hemithorax was divided into six zones in the longitudinal plane with the midclavicular, anterior axillary and posterior axillary line, and in the transverse plane based on the line passing from the nipple level. The zones were numbered from the sternum to the lateral, and each area was visualized in the longitudinal and transverse planes with a linear and convex probe.3 Using the linear probe, all areas were evaluated in B mode and M mode, with normal lung signs evaluated initially in POCUS, after which pathological lung signs were examined. The findings related to each zone are presented on the POCUS form (Table 1). The POCUS took 5 minutes to complete.

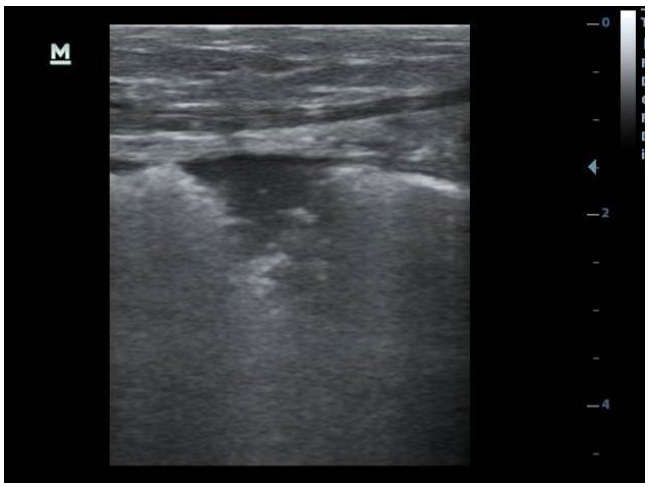

Figure 3: Subpleural hypoecoic area

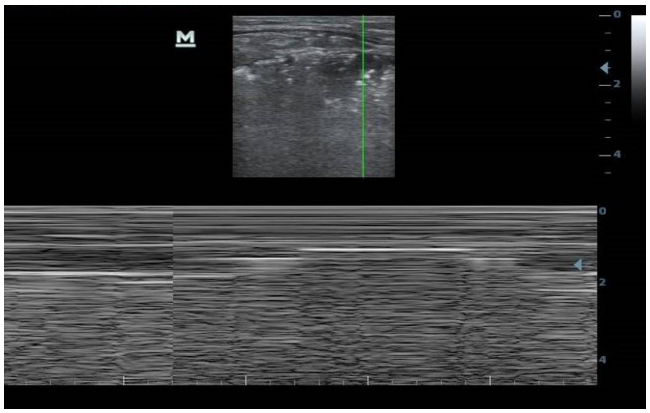

Figure 4: Hepatization, shred sign, and stratosfer sign

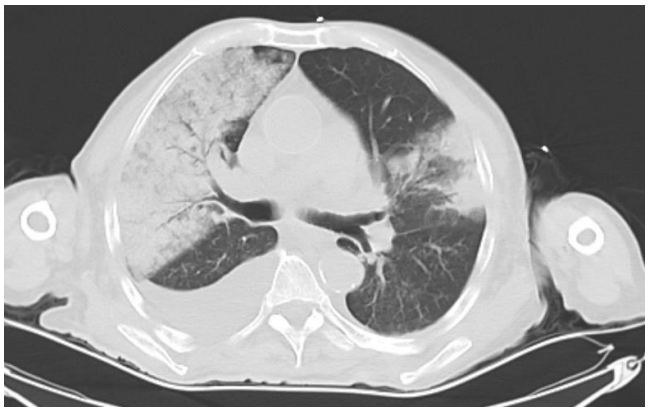

Figure 5: Thorax CT image of the patient

DISCUSSION

Histopathological examinations of DPH reveal intraalveolar RBCs and fibrin accumulation, and while chest X-ray and CT can reveal ground glass densities or focal or widespread irregular alveolar consolidations, they are of limited value in distinguishing between diffuse alveolar bleeding and infection, or other causes of diffuse alveolar opacification (9,10). In studies of neonates investigating specific ultrasonographic findings of pulmonary hemorrhage, lung consolidation, air bronchograms, fluid bronchograms, pleural effusion, shred signs, pleural line abnormalities as well as disappearing A-lines and B-lines have been detected (11,12). These ultrasonographic images are similar to those associated with pneumonia, atelectasis and cardiopulmonary diseases, and so it is necessary to evaluate X-ray, CT and US images together with clinical findings for an accurate diagnosis.

The POCUS images of the case in the present study revealed bilateral, multiple and confluent B lines, an irregularity on the pleural line, disappearing A-lines, a subpleural hypoechoic area, hepatization and shred sign, while stratosphere signs were detected in the M Mode in zones with irregularities on the pleural line and subpleural hypoechoic area, as well as hepatization and shred sign. These findings can be considered important, as they reveal any absence of aeration in pathological areas. The

clinical features of DPH are hemoptysis, anemia and hypoxemia, as well as respiratory failure, although a physical examination of the present case revealed such clinical findings as severe respiratory failure suggestive of coagulation disorder, hematuria, petechial rashes on the skin, bleeding in the gums and blood in the endotracheal tube. The diagnosis of our case was reached based on an evaluation of POCUS images alongside the clinical findings on CT and X-ray. The most life-threatening complication associated with diffuse pulmonary hemorrhage is acute hypoxemic respiratory failure. Patients with macroscopic bleeding in particular are at high risk of mortality, and in such patients, high positive end-expiratory pressure (PEEP) is recommended for the tamponade effect, limiting capillary bleeding (13). In our case, lung injury was systematically visualized with POCUS and the involved lung zones were determined, and predominant pathologies were detected in the 3rd, 4th and 5th zones in the right lung and in the 3rd and 4th zones in the left lung, while the bilateral pleural effusion was detected more prominently in the right lung. These findings indicated that the lung injury was widespread and severe, and severe hypoxia detected in an arterial blood gas analysis supported our diagnosis. Based on the POCUS and clinical findings, the ventilator mode was selected and ventilator parameters were adjusted to provide adequate oxygen support to the patient. POCUS was thus used in both the diagnosis and patient management stages.

As our case was clinically unstable, mechanical ventilation support was started. The bedside POCUS was completed in around 5 minutes, as a result of which, the patient was diagnosed and subjected to appropriate management in a short time.

Figure 5: *Chest X-ray of the patient on the 2nd day*

CONCLUSION

POCUS is a useful alternative imaging method for the imaging of lung pathologies and for the determination of the width of the pathological area. POCUS contributes to the correct diagnosis and management of critically ill patients in the ED in a short time.

CONFLICTS OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

Concept - N.K., İ.E.A., T.E., B.T.; Planning and Design - N.K., İ.E.A., T.E., B.T.; Supervision - N.K., İ.E.A., T.E., B.T.; Funding - T.E., B.T.; Materials - T.E., B.T.; Data Collection and/or Processing - N.K., İ.E.A., T.E., B.T.; Analysis and/or Interpretation - N.K., İ.E.A.; Literature Review - N.K., İ.E.A.; Writing - N.K.; Critical Review - İ.E.A.

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