When performing long-term follow-up in clinical practice, we are often misled into believing that we know everything about our patients. We report a case of initially overlooked empyema that we were able to correctly diagnose by a comprehensive review of diagnostic images.

A 64-year-old man was hospitalized due to fever and dyspnea. He experienced three months of repeated episodes of acute respiratory failure due to *Pseudomonas aeruginosa* pneumonia and acute exacerbation of chronic heart failure. At the time of admission, vital signs were as follows: blood pressure, 170/118 mmHg; heart rate, 134 beats/min (irregular); respiratory rate, 20 breaths/min; body temperature, 37.7°C; and, Glasgow Coma Scale, E4V5M6. A chest X-ray and computed tomography (CT) examination showed bilateral widespread ground-glass opacity, massive consolidation on the left lung with bronchiectasis, and bilateral pleural effusion. An initial diagnosis of pneumonia and heart failure with bilateral effusion was made. We started intravenous meropenem for pneumonia and intravenous furosemide and nitroglycerin for heart failure, and oxygen administration at a flow rate of 15 liters per minute in the Intensive Care Unit.

However, a detailed review of the diagnostic images in the infectious diseases consultation at the 2nd hospital day revealed an overlooked “split pleura sign” (Fig.1a, white arrows) that had already been shown by CT one month prior (Fig.1b, white arrows). The typical sign had not been detected by non-contrasted CT three months prior (Fig.1c). We performed thoracentesis and the results of turbid pleural fluid (Fig.2) were PH 6.629, cell count 123,217 /μl (neutrophil 85.4 %), LDH 8,100 U/L, protein 4.4 g/dl and glucose 2 mg/dl. Also, a culture of the pleural fluid, sputum and blood was positive for *P. aeruginosa*.

We suspected that the pleural effusion detected three months prior might have been a transudative effusion from heart failure and/or an exudative effusion due to pneumonia. The repeated bouts of pseudomonas pneumonia on bronchiectasis had finally caused empyema and secondary bacteremia. We continued the drainage and antibiotic treatment with meropenem followed by cefepime, and the patient was discharged with oral ciprofloxacin.

A split pleura sign is defined as a thickened separated visceral and parietal pleura revealed by CT [1]. This sign is a characteristic of empyema and is found in most empyema cases [1]. As the progression of inflammation in the interpleural space, a fibrin peel coats the surface of both pleura, followed by the ingrowth of capillaries and fibroblasts [2]. Finally, a thickened visceral and parietal pleura are detected by CT. Although contrast-enhanced CT is preferable [1],

Abbreviations: CT, computed tomography; *P. aeruginosa*, *Pseudomonas aeruginosa*. 
this sign is often detected by non-contrast CT [3]. In our case, early recognition of the signs would have prompted a more appropriate surgical approach.

The cause of diagnostic delay in our case was “under reading”, which is the most common type of error found in the past literature [4]. A number of factors could have helped cause the delayed diagnosis in our case, including a lack of in-hospital radiologists, failure to provide adequate clinical information to the outsourcing radiologists who overlooked the radiological abnormalities, and clinician bias. In our case, the primary physicians assumed that the patient had recurrent pneumonia and heart failure because the pleural effusion was bilateral.

Physicians tend to see what they expect in clinical images. In our case, abnormalities in the images were only detected following consultation with other specialists. To reduce radiologic diagnostic delay and errors, a double reading [5] of images by the attending physicians and other specialists, specialized checklists depending on the body part imaged [5,6] and cognitive debiasing [6] might be effective.

INFORMED CONSENT: Informed consent was obtained from the patient.

CONFLICTS OF INTEREST: The authors have no conflicts of interest to declare.

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Fig. 1. “Split pleura sign” (white arrows) was detected by a second review (1a), in a computed tomography image that had been obtained one month prior (1b). This sign had not been present three months prior (1c).

Fig. 2. Drained turbid pleural fluid.