

# Identifying heart failure in the emergency room

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## Abstract

Acute dyspnea is a frequent diagnostic challenge for physicians. Ultrasound lung comets, also called B-lines, are a simple marker viewable by lung ultrasound that can help in the differential diagnosis between cardiac dyspnea and pulmonary dyspnea. B-lines reliably indicate a cardiac origin in patients presenting with acute dyspnea in the emergency room, with accuracy comparable to cardiac natriuretic peptides. The single most frequent source of false positives is represented by the so-called “dry B-lines,” which are visible in interstitial lung disease or lung fibrosis, but these B-lines can be distinguished from watery B-lines because the latter increase with exercise and decrease with diuretics. This innovative, low-cost imaging tool has been recently recognized by the 2016 European Society of Cardiology heart failure guidelines, which assign a class II a, level of evidence C, to lung ultrasound with B-lines for diagnosis of cardiac origin of acute dyspnea in the emergency room. ■ *Heart Metab.* 2017;74:37-39

**Keywords:** B-line; emergency room; heart failure; lung comet

## Lung comets in heart failure

Counting of ultrasound lung comets (also called B-lines), first proposed in 2004, is an attractive method for assessing pulmonary congestion.<sup>1,2</sup> They are a useful, practical, appealingly simple way to detect extravascular lung water, a key yet elusive parameter helpful in prognostic stratification and therapy tailoring in heart failure patients.<sup>3</sup> B-lines, as shown in *Figure 1*, are described as “discrete laser-like vertical hyperechoic reverberation artifacts that arise from the pleural line..., extend to the bottom of the screen without fading, and move synchronously with lung sliding.”<sup>4</sup> A total of 28 chest sites are scanned from the second to sixth intercostal space, and the total number of B-lines is recorded as the B-lines score.<sup>3</sup>



**Fig. 1** Six B-lines (indicated by white arrows) departing from the horizontal pleural line in a lung ultrasound scan taken at the third intercostal space in the right hemithorax of a patient with acute dyspnea.

Up to five B-lines can be counted in normal subjects. In pulmonary congestion of cardiac origin, more than 30 B-lines can be counted. A B-line-based score has been proposed in which pulmonary congestion would be graded mild when six to 15 B-lines are counted, moderate when 16 to 30 B-lines are counted, and severe when more than 30 B-lines are counted.

Pulmonary congestion-related B-lines are a very dynamic marker that changes within minutes or seconds: they decrease during dialysis or after diuretic challenge and may increase during exercise, especially in the presence of stress-induced left ventricular dysfunction.<sup>5</sup> Several studies have confirmed the presence of B-lines in heart failure patients at rest, the negative prognostic impact of B-lines, and their agreement with established markers of severity, such as increased plasma concentration of cardiac natriuretic peptides, elevated pulmonary artery systolic pressure, and decreased exercise capacity.<sup>3</sup>

### Lung comets in the emergency room

A recent systematic meta-analysis of seven studies for a total of 1075 patients showed 94% sensitivity and 92% specificity of B-lines for the identification of pulmonary congestion of cardiac origin in patients presenting with acute dyspnea in the emergency room.<sup>6</sup> The single most frequent source of false positives is represented by interstitial lung disease or lung fibrosis; however, it is possible to distinguish between such B-lines and watery B-lines, as only the latter change rapidly with posture (increasing in the supine position versus the upright position), stress (increasing with exercise), or therapy with diuretics or dialysis. In patients admitted with acute dyspnea and pulmonary congestion, B-lines are significantly correlated with N-terminal pro-B-type natriuretic peptide (NT-proBNP) values. The accuracy of B-lines in predicting the cardiac origin of dyspnea is high and comparable to cardiac natriuretic peptides.<sup>7</sup>

### Take-home message

B-lines are a reliable and inexpensive tool for the assessment of pulmonary congestion in patients with heart failure, both at rest and during exercise. By counting B-lines, the reduction in exercise capacity due to increasing extravascular lung water can easily be differentiated from that due to other causes,

including interstitial lung disease, physical deconditioning, and anemia, for example. Patients with 30 or more B-lines during stress usually have greater functional impairment at baseline and during stress and a greater chance of transition to acute decompensated heart failure and other events within a short-term follow-up period.<sup>5</sup>

B-lines can be easily evaluated in patients, both at rest and after a dynamic challenge, such as posture change, exercise, or diuretic therapy. Lung B-lines allow the noninvasive detection, in real time, of even subclinical forms of pulmonary edema with a low-cost, radiation-free approach. Given the recent endorsement by 2016 European Society of Cardiology (ESC) guidelines on heart failure, assessment of B-lines is expected to gain in popularity among cardiologists and emergency room specialists, who frequently face the difficult challenge of identifying the cause of acute dyspnea. Given the low cost, the high diagnostic and predictive value, the easy access to echo machines, and the short learning curve for sonographers, assessment of ultrasound B-lines promises to quickly become an essential method to evaluate patients with acute dyspnea.<sup>8,9</sup> The large-scale validation of B-lines in patients at rest and after stress is currently in progress with large-scale, multicenter, international effectiveness studies targeted to show the outcome impact of B-line-driven intervention versus standard therapy in heart failure patients.<sup>10</sup> ■

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