

**ECHO ROUNDS Section Editor: Edmund Kenneth Kerut, M.D.**

## The Mitral L-Wave: A Relatively Common but Ignored Useful Finding

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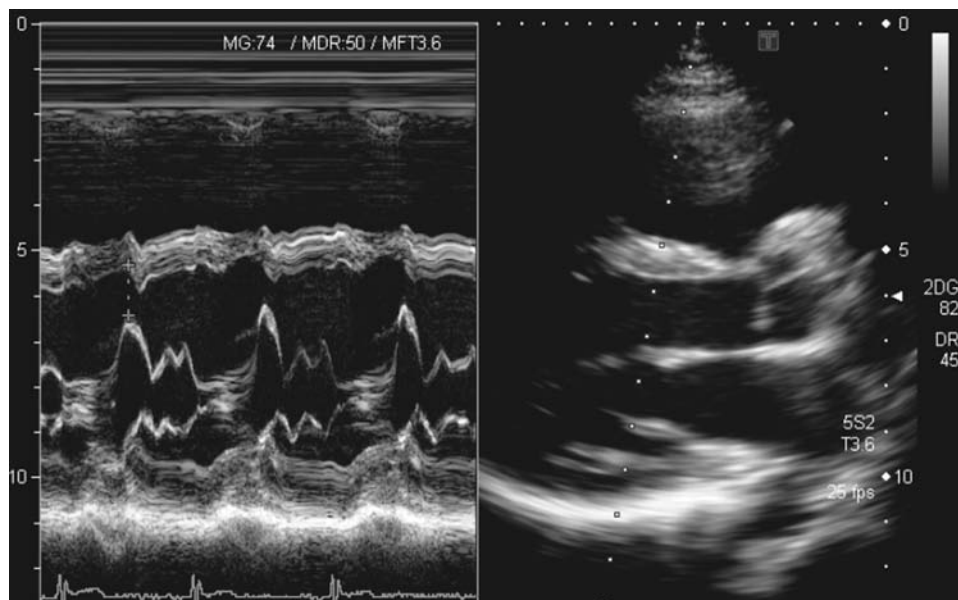
An L-wave is recorded as mid-diastolic flow across the mitral valve by M-mode echocardiography or pulsed-wave Doppler.<sup>1</sup> Recently, a tissue Doppler correlate (L') has also been described.<sup>2</sup> The term "L-wave" was coined, as it follows the "J-" and "K-"waves of pulmonary

vein flow (systolic and diastolic flow waves). Mitral valve L-waves may be evident in healthy patients with relatively low heart rates (Fig. 1). First described using echocardiography by Keren et al., it has been attributed to continued pulmonary vein flow through the left atrium (LA), and into the left ventricle (LV) after early rapid filling.<sup>3</sup>

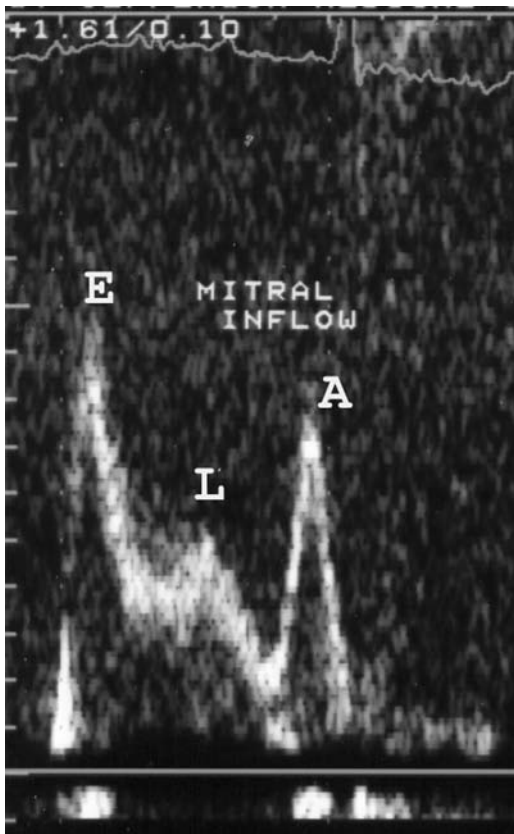
Computer models of mitral flow suggest that pathologic reduced LV diastolic active relaxation in conjunction with increased LV stiffness cause a pronounced oscillation of the diastolic LA-LV pressure gradient, even if LA filling

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**Figure 1.** M-mode with two-dimensional guidance of the mitral valve in a 20-year-old normal female. The heart rate was 65/minute. Early mitral inflow (E) and late (A) waves are noted. An L-wave between the E- and A-waves is also seen. This is a normal finding in normal patients with relatively low heart rates.

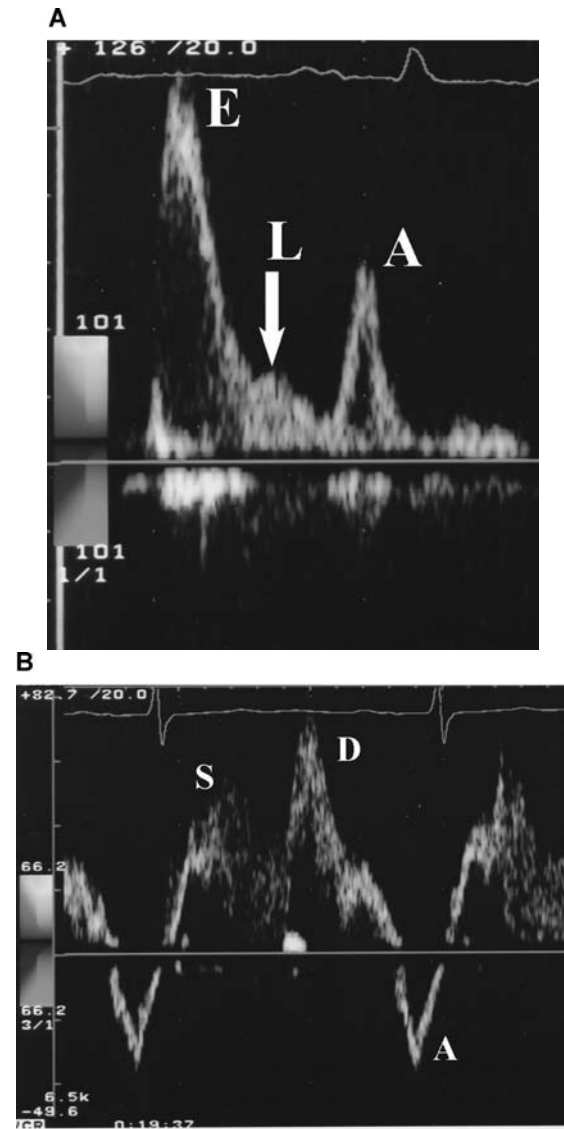


**Figure 2.** Mitral Doppler inflow in a patient with long-standing hypertension and moderate mitral regurgitation (with permission from: Kerut EK, McIlwain EF, Plotnick GD: *Handbook of Echo-Doppler Interpretation*, 2nd Ed. Elmsford, New York, Blackwell Publishing, Inc., 2004, p. 71.)

volumes are not excessive.<sup>4</sup> This becomes evident by detection of LA to LV flow during diastasis, hence the L-wave.

In the dog model, a pathologic L-wave is associated with a greater “oscillatory frequency” of LA–LV pressure profiles than an L-wave found in relatively bradycardic normal individuals. That is, a pathologic L-wave is associated with a shortened duration of early filling (E-wave), and occurs sooner in diastasis (Figs. 2 and 3).<sup>4</sup> To our knowledge, this characteristic of L-waves has not been addressed clinically.

In patients with LV systolic dysfunction, the presence of an L-wave was found to be associated with clinical heart failure at the time of the study, and was predictive of further hospital admissions for heart failure.<sup>5</sup> Additionally, in patients with left ventricular hypertrophy (LVH) and normal ejection fraction, an L-wave was as-



**Figure 3.** (A) Mitral Doppler inflow and (B) pulmonary vein flow in an elderly hypertensive patient with left ventricular hypertrophy. The mitral inflow E/A ratio of >1 and blunted systolic/diastolic (S/D) pulmonary vein flow ratios along with prominent pulmonary vein, atrial wave (A), are all consistent with pseudonormalization. An L-wave, though not as prominent as in Figure 2, is also noted.

sociated with elevated LV filling pressures and more abnormal indices of LV diastolic function, with a higher likelihood of future hospitalization for heart failure.<sup>6</sup>

When noted in the proper context (clinical heart failure, LVH with normal ejection

fraction, or LV systolic dysfunction) our laboratory has found the L-wave to be a good “marker” of mitral inflow pseudonormalization.

Summarizing points include:

- 1) An L-wave is very often an unnoticed finding.
- 2) The L-wave may be seen in relatively bradycardic patients with normal hearts.
- 3) A pathologic L-wave typically is found in patients with delayed active relaxation with increased LV stiffness. In the echo laboratory patients will often have clinical heart failure, LVH with normal systolic function, or LV systolic dysfunction.
- 4) A pathologic L-wave is suggestive of elevated LV preload (pseudonormalization).
- 5) A pathologic L-wave has prognostic value, in that it is predictive of future hospitalizations with heart failure.

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