E/e' Ratio: An Index of LV Filling Pressures Revisited

Sherif F. Nagueh, MD, FASE

Methodist DeBakey Heart and Vascular Center, Houston

There is a clinical need for the assessment of cardiac function in patients who present with symptoms and signs of pulmonary and systemic congestion. Echocardiography has been utilized over the years to answer this question. It is possible to study left ventricular (LV) systolic and diastolic function as well as pulmonary artery pressures and right ventricular function using this technique. With respect to LV diastolic function, an ideal assessment includes evaluation of LV relaxation and LV filling pressures. There are several parameters that when properly acquired and analyzed can predict the 2 fundamental aspects noted above of LV diastolic function. The mitral annulus early diastolic recoil velocity (e') recorded by tissue Doppler imaging (TDI) was introduced as an index of LV relaxation. Further, e' velocity is combined with mitral peak velocity E to predict LV filling pressures.1 I will discuss the supporting literature for the last statement and point to the limitations in its application.

There are a number of animal2, 3 and human4-6 studies that have shown a significant relation between e' velocity and LV relaxation as assessed invasively by the time constant of LV relaxation (tau). Importantly, there are other variables that determine e' velocity which include LV preload and elastic recoil2, 3. The effect of preload depends on the presence or absence of abnormal LV relaxation such that in normal hearts there is a significant positive relation between LV filling pressures and mitral e' velocity. On the other, this effect is much less in the presence of impaired LV relaxation. Likewise, there are human studies showing that e' velocity is affected by factors that affect function at the cellular level as beta-adrenergic receptors7, tumor necrosis factor-alpha and inducible nitric oxide synthase8.

Given the predominant effect of LV relaxation on e' velocity in the presence of cardiac disease, we reasoned that it can be used to correct for the effects of LV relaxation on mitral E velocity and thus E/e' ratio can be used as an index of LV filling pressures.1 E/e' ratio was evaluated in several cardiac diseases including heart failure (patients with reduced EF and those with normal EF), cardiomyopathy and atrial fibrillation.1, 5-11. In addition to diagnostic applications, there are many studies that have reported on its ability to predict clinical events including single center and epidemiologic studies (see reference 12 for a summary of these studies). Furthermore, E/e' ratio has been acquired by CMR and validated against echocardiography and cardiac catheterization.12

Notwithstanding the established utility of this index, there are a number of limitations to its use. These include the presence of mitral valve disease, moderate to severe mitral annular calcification, left bundle branch block, pacemaker rhythm, constrictive pericarditis12, 14 and the ratio cannot be applied in normal hearts as e' is heavily dependent on LV filling pressures in this setting. Overall and specifically in these conditions it is important to use a comprehensive approach12 and other novel indices of LV diastolic function as time delay between mitral E and annular e', LV and left atrial diastolic strain rates, and LV untwisting ratio14, 16-11 can be considered.

References

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Correspondence to:
Sherif F. Nagueh, MD, FASE 6550 Fannin, SM-677
Houston, Texas, 77030
Phone: 713-441-2850 Fax: 713-793-7034
snagueh@tmhs.org