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CHEST

Evaluation of Left Ventricular Diastolic Function by the Intensivist

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VIDEO

The assessment of left ventricular diastolic function is an important element of advanced critical care echocardiography. Standard methods of evaluating diastolic function that are routinely performed on an elective basis in the cardiology echocardiography laboratory may be difficult to apply in the critical care unit. In this article, we review methods of measuring diastolic function with echocardiography that are of relevance to the intensivist and present two options for measurement: the standard cardiology method and a simplified approach.

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Competence in assessing left ventricular (LV) diastolic function is a required element of advanced critical care echocardiography (ACCE) as defined in the American College of Chest Physicians/Société de Reanimation de Langue Francaise Statement on Competence in Critical Care Ultrasonography[1] and in the International Statement on Training in ACCE.[2] It follows that intensivists with interest in developing competence in ACCE seeks to become skilled at the evaluation of diastolic function at a level similar to their cardiology colleague with emphasis on clinical applications that relate to critical care medicine.[3] This article will review the use of ACCE for evaluation of LV diastolic function and will serve as a companion article to the two-part series on the subject that was previously featured in *CHEST*.[4,5] Throughout this article, diastolic function will refer to left-sided cardiac diastolic function.

Relevance of LV Diastolic Function to the Critical Care Clinician

A regular challenge to the frontline intensivist is the patient on ventilatory support with bilateral opacities on chest radiography and diffuse bilateral B-lines on lung ultrasonography. Does the patient have lung disease because of an elevation in left atrial pressure (LAP), from primary lung injury (eg, ARDS), or both? Absent the ability to answer the question with a pulmonary artery catheter, echocardiography allows the intensivist to estimate LAP, which is a key component in the hemodynamic evaluation of the patient.

ABBREVIATIONS: 2D = two-dimensional; ACCE = advanced critical care echocardiography; AP4 = apical four; ASE = American Society of Echocardiography; CFD = color flow Doppler; CW = continuous wave; e′ = peak velocity of the mitral valve annulus; EACI = European Association of Cardiovascular Imaging; LA = left atrial; LAP = left atrial pressure; LV = left ventricular; LVEF = left ventricular ejection fraction; MR = mitral regurgitation; MV = mitral valve; PW = pulsed wave; TDI = tissue Doppler imaging; TEE = transesophageal echocardiography; TR = tricuspid regurgitation; TTE = transthoracic echocardiography

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Although identification of an elevation in LAP in association with respiratory failure has major therapeutic implications, it has other uses as well. A new elevation of LAP during a spontaneous breathing trial indicates a load-related failure of the trial with the possibility of therapeutic intervention.[6,7] Elevation of LAP in any circumstance requires consideration of the mechanism for the elevation. Our opinion is that the estimation of LAP is a primary application of interest to the intensivist in evaluating diastolic function.

In addition to estimation of LAP, echocardiography allows the intensivist to identify normal diastolic function and to categorize the grade of diastolic dysfunction when it is present. Diastolic dysfunction in patients with sepsis occurs with a prevalence of 20% to 57%[8-11] and is associated with increased mortality.[9,10,12-15] Diastolic dysfunction has also been shown to be associated with mechanical ventilation liberation outcomes, and its presence is an independent risk factor for liberation failure.[16-18] The presence of diastolic dysfunction in the critically ill patient who is hemodynamically stable may not result in any immediate change in management; however, it cautions the intensivist of potential problems. For example, its presence may predict the risk of developing cardiogenic pulmonary edema with changes in cardiac loading conditions such as volume resuscitation, hypertension, tachycardia, or inadequate dialysis treatment. The patient with diastolic dysfunction may be at increased risk for hypotension related to hypovolemia and/or tachycardia.

Diastolic Function

Diastole is the interval of the cardiac cycle between the closure of the aortic valve and the closure of the mitral valve. This interval consists of four phases: isovolumic relaxation, early diastolic filling, diastasis, and late diastolic filling (Fig 1). There are numerous factors that influence diastolic function, including ventricular relaxation, ventricular compliance, ventricular recoil, ventricular suction effect, atrial compliance, atrial contractility, and mitral valve function. Added to these are the effects of pericardial pressure, intrathoracic pressure, right ventricular function through interventricular dependence, and LV systolic function with its derivatives. To further complicate matters,

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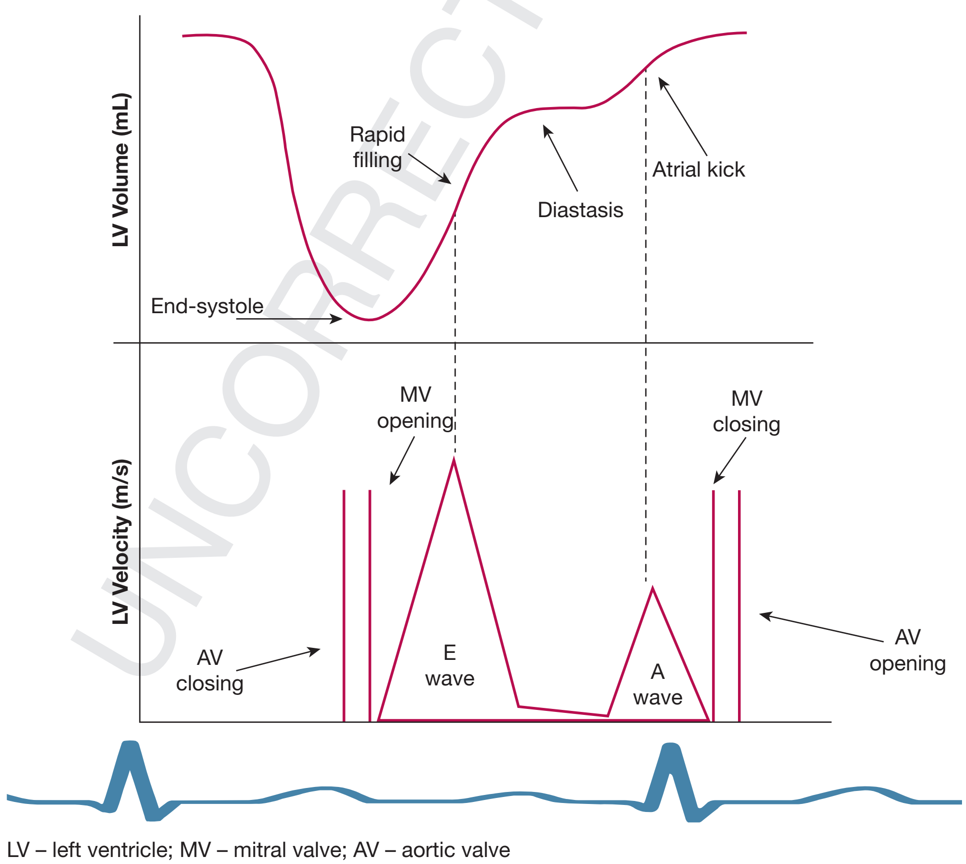

Figure 1 – *Diastolic filling curve. AV = atrioventricular; LV = left ventricular; MV, mitral valve.* Q9 Q12

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