

Measure the Gap! A Proposed Simplified Approach for Measuring the Descent of the Base of the Left Ventricle

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The evaluation of left ventricular systolic function is a common request for performing an echocardiogram.¹ Several parameters for the quantitative evaluation of left ventricular systolic function have been proposed.² One of these quantitative measurements is the descent of the base of the left ventricle. Although based on a simple truth, the steps required to measure the descent of the base during a routine echocardiographic examination are rather tedious and time consuming. This article will provide a brief review of the principle of the descent of the base of the left ventricle, explain the current echocardiographic methods of measuring the descent of the base, and propose a simplified measurement approach that may be incorporated into the recommended echocardiographic evaluation of left ventricular systolic function.

PRINCIPLE OF THE DESCENT OF THE BASE OF THE LEFT VENTRICLE

During ventricular contraction, the cardiac apex remains relatively fixed while the base of the heart descends toward the cardiac apex ejecting blood as it moves downward. The left ventricle has little counterclockwise rotation during ventricular systole and therefore relies significantly on effective longitudinal fiber contraction.³ This longitudinal fiber contraction, referred to as the descent of the base of the left ventricle, provides important quantitative information concerning the state of left ventricular systolic function.³

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ECHOCARDIOGRAPHIC METHODS FOR MEASURING THE DESCENT OF THE BASE OF THE LEFT VENTRICLE

Essentially there have been two proposed methods for measuring the descent of the base. Alam et al.³ recommended acquiring the apical four-chamber view and then aiming an M-mode cursor in such a way as to intercept the atrioventricular plane along the interventricular septum and along the lateral wall of the left ventricle (Figure 1). The magnitude of the descent of the base is measured on the M-mode from the lowest to the highest point of motion during systole (Figure 1). The displacement of the anterior and inferior atrioventricular plane may similarly be recorded using the apical two-chamber view. Alam et al. found that a descent of the base of 10 mm or greater indicated a normal ejection fraction.

Pai et al.⁴ and Simonson et al.⁵ measured the descent of the base of the left ventricle by acquiring an apical four-chamber view, and, by using frame-by-frame replay of the videotape, the descent of the base of the lateral margin of the mitral anulus was measured from the video screen as the distance between its highest point and its lowest point during ventricular systole (Figure 2). The systolic excursion of the medial margin of the left ventricle was also measured in the same manner. The same steps could be followed to measure the anterior and inferior systolic excursion of the left ventricle with the use of the apical two-chamber view. Simonson et al. found that a descent of the base of 8 mm or greater represented a normal ejection fraction.

A PROPOSED SIMPLIFIED APPROACH FOR MEASURING THE DESCENT OF THE BASE

The American Society of Echocardiography recommends routinely using the biplane method of discs for quantifying left ventricular volumes and ejection fraction.⁶ To calculate left ventricular end-systolic volume, end-diastolic volume, and ejection fraction by the method of discs, the sonographer acquires an

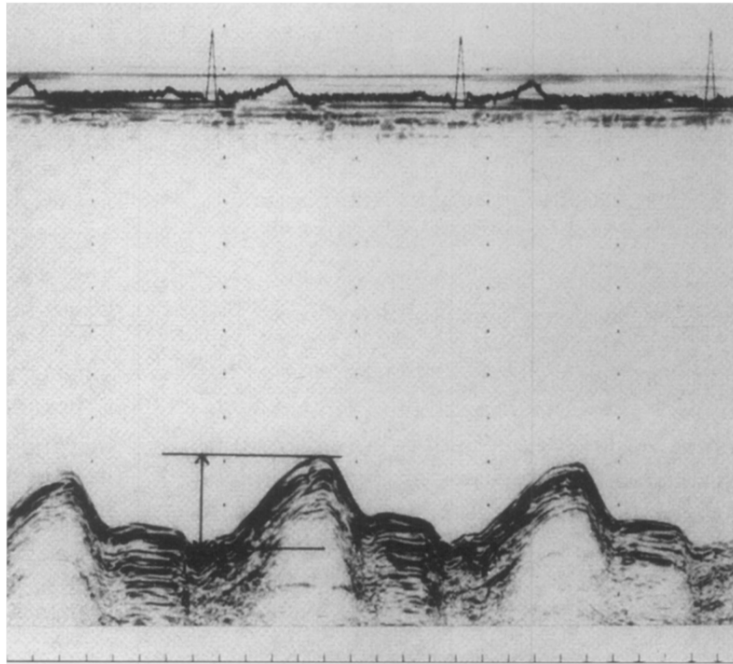


Figure 1 Apical four-chamber view showing the two sites of the atrioventricular plane, septal and lateral. An M-mode cursor is placed at the septal border of the atrioventricular plane. The systolic displacement of the atrioventricular plane is shown on the *right* side. (Reprinted with permission from the American Society of Echocardiography. From Alam M, Rosenhamer G. J Am Soc Echocardiogr 1992:427-33.)

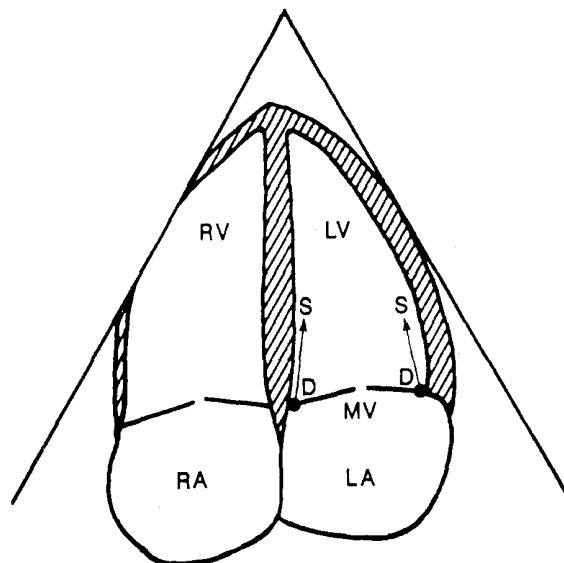


Figure 2 Method of measuring the descent of the base of the left ventricle. From the apical four-chamber view, the systolic excursion of the medial and lateral parts of the mitral annulus are measured from the highest point in diastole (point *D*) to the lowest point in systole (point *S*) by frame-by-frame playback of the videotape. *LA*, Left atrium; *LV*, left ventricle; *MV*, mitral valve; *RA*, right atrium; *RV*, right ventricle. (Reprinted with permission from Excerpta Medica. From Pai R, Bodenheimer M, Pai S, et al. Usefulness of systolic excursion of the mitral annulus as an index of left ventricular systolic function. Am J Cardiol 1991:222-4.)

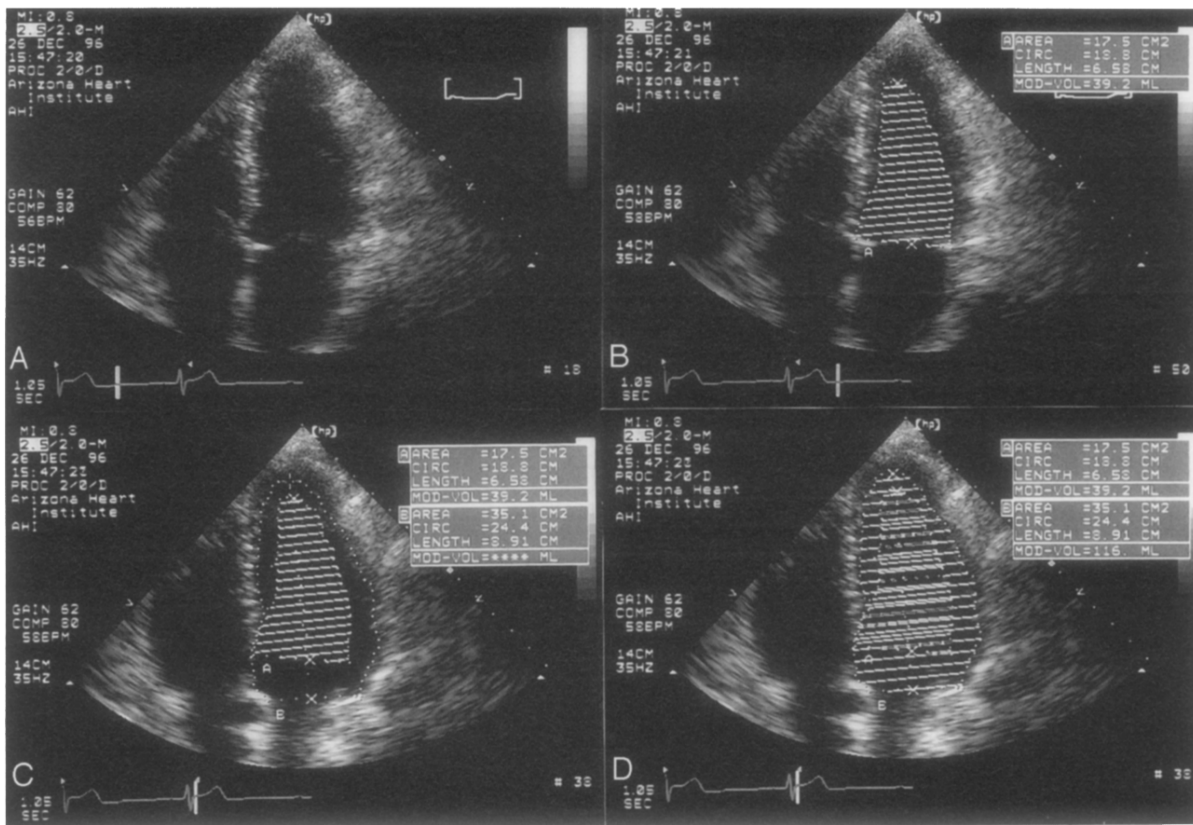


Figure 3 Steps involved in calculating ventricular volumes and ejection fraction by the method of discs. **A**, Apical four-chamber; **B**, systolic frame; **C**, end-diastolic trace just before the addition of the discs; **D**, end-systolic and end-diastolic frame with discs and volumes shown.

apical four-chamber view, traces the left ventricular cavity at end-systole, and then measures the left ventricular end-systolic length from the mid-mitral annulus to the cardiac apex. The preceding steps will yield the left ventricular end-systolic volume (Figure 3). The same steps are repeated at end-diastole for the ventricular end-diastolic volume (Figure 3). The apical two-chamber is then acquired and the same end-systolic and end-diastolic measurements are performed. The calculation of end-systolic volume, end-diastolic volume, and ejection fraction results from the summation of areas from the diameters of 20 cylinders or discs of equal height (Figure 3).

The descent of the base may easily be incorporated into the routine use of the method of discs. The sonographer first makes the end-systolic measurements of the method of discs in the apical four-chamber view, leaves those measurements on the display screen, and then makes the end-diastolic measurements of the method of discs (Figure 4). The descent of the base of the left ventricle will readily be apparent by the gap visualized between the mid-

mitral annulus at end-systole and end-diastole (Figure 4). This gap represents the descent of the base and the sonographer may simply measure the gap to acquire the descent of the base value. The same steps may be followed for the apical two-chamber view. A descent of the base of greater than or equal to 10 mm represents a normal ejection fraction. The descent of the base number may also be useful in confirming the accuracy of the simultaneously acquired method of discs ejection fraction. Additionally, leaving the end-systolic method of discs measurements on the display screen while performing the end-diastolic measurements provides a guide to the sonographer while tracing the end-diastolic left ventricular cavity.

LIMITATIONS

Currently, regardless of which measurement method is used, there are several limitations of using the descent of the base to evaluate global left ventricular systolic function. The heart primarily moves down-

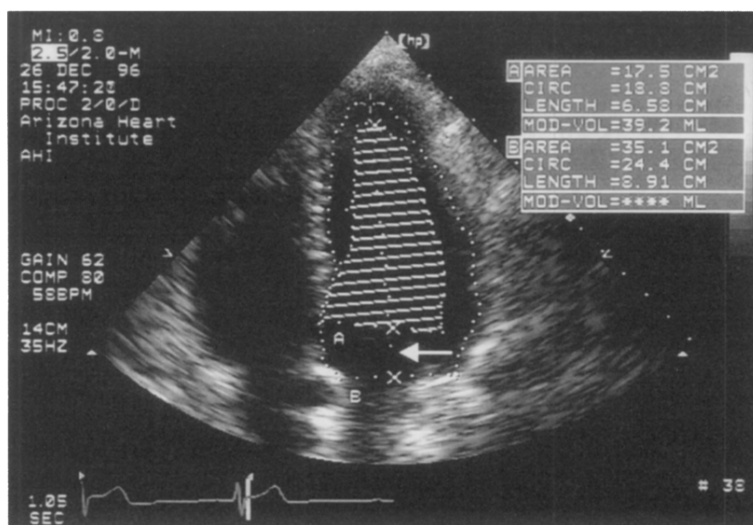


Figure 4 Point at which the descent of the base of the left ventricle is measured during method of discs calculations. The gap depicting the descent of the base may be clearly visualized (arrow).

ward toward the cardiac apex but there is also anterior motion of the entire heart with a slight counterclockwise rotation during ventricular systole which is not accounted for in the descent of the base measurement. The affect of certain pathologies such as constrictive pericarditis, pericardial effusion, and left bundle branch block have on the descent of the base value has not yet been clearly delineated. Finally, the measure the gap approach for determining the descent of the base of the left ventricle has not been clinically validated in a large group of patients.

SUMMARY

The evaluation of left ventricular systolic function represents a common request for an echocardiographic examination. Several parameters have been proposed to quantitate left ventricular systolic function. The descent of the base of the left ventricle is founded on sound principle but currently requires multiple, time-consuming steps to derive during an echocardiographic examination. This article has reviewed the basic tenet of the descent of the base,

reviewed the current required echocardiographic measurements needed to obtain a descent of the base value and has proposed a simplified approach by measuring the gap seen during the routine calculation of left ventricular end-systolic volume, end-diastolic volume, and ejection fraction by the recommended method of discs.

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