ACCURACY OF M-MODE ECHO MEASUREMENTS OF THE LEFT VENTRICLE.

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Although the minor diameter of the LV can be measured from an M-mode echo, criteria for measuring end diastolic diameter (EDD) & end systolic diameter (ESD) are controversial. Therefore, we simultaneously recorded an M-mode echo & sonomicrometer crystal signals & measured the LV in 12 instrumented open chested dogs. Crystals were placed on the endocardial surface of the septum & the LV posterior wall at the chordal level. An M-mode echo of the septum & posterior wall was obtained from the same level. M-mode echo EDD was measured at the onset of the QRS (EDD-Q), at the peak of the R-wave (EDD-R), & as the largest diameter (EDD-L). M-mode echo ESD was measured from the posterior motion of the septum (ESD-VS), from the anterior motion of the posterior wall (ESD-PW), and as the smallest diameter (ESD-S). Fractional shortening for all pairs of EDD & ESD was compared to crystal fractional shortening. EDD-Q (mean ± SD; 4.04±.6) and EDD-R (4.02±.6) were the same as crystal EDD (4.02±.7). However, EDD-L (4.34±.6) was larger than crystal EDD ($p < 0.01$). ESD-VS (3.25±.6) was the same as crystal ESD (3.28 ±.7). However, ESD-PW (3.21±.6) and ESD-S (3.0±.6) were smaller than crystal ESD ($p<0.05$ & $p<0.01$). Fractional shortening using EDD-Q or EDD-R with ESD-VS or ESD-PW was not different from crystal fractional shortening (.19 ± .05). All fractional shortening measurements using EDD-L or ESD-S were larger than crystal fractional shortening ($p<0.01$). CONCLUSION: M-mode echo EDD-Q or EDD-R and ESD-VS are best for estimating LV dimension & fractional shortening. These data support the recommendations of the American Society of Echocardiography in attempting to quantitate LV minor axis dimensions from the M-mode echo.

COLD PRESSOR ECHOCARDIOGRAPHY

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M-Mode echocardiography has found wide application for the detection of resting left ventricular dysfunction (LVD). Although exercise (Ex) has also been found useful in evaluating patients with latent LVD, it has not found wide application because of technical difficulty. Recently Cold Pressor (CP) radionuclide ventriculography (RNV) has been proposed as an alternative to ExRNV and found to have a $>$ 90% sensitivity and specificity for detecting latent LVD. A normal CPRNV is a $<$ .03 absolute decrease in LV ejection fraction (EF) from a resting value of $\geq$ .50 and no wall motion abnormality. The same criteria for a normal CP echo was used, calculating LVEF by the Teichholtz formula. Ten patients were evaluated by both CP Echo and CPRNV. Both CP Echo and CPRNV were normal in 3 and abnormal in 5 patients. Two patients had abnormal CP Echo but normal CPRNV, 1 with ergonovine proven coronary artery spasm of the left circumflex artery and the other with constrictive pericarditis, mitral valve prolapse, and normal coronary arteries. Thus, CP Echo may be a useful technique for detecting latent LVD without many of the technical difficulties encountered with Ex echocardiography.

SIMULTANEOUS CONTRAST TWO-DIMENSIONAL ECHOCARDIOGRAPHY AND CONTRAST VENTRICULOGRAPHY: DISCREPANCIES IN LEFT VENTRICULAR VOLUME

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Previous non-simultaneous studies demonstrate the left ventricular volume (LVV) by two-dimensional echocardiography (2D Echo) differs significantly from that obtained by contrast ventriculography (CV). To investigate this problem, we performed simultaneous contrast 2D Echo and CV on 19 cardiac cycles in 8 patients. CV was recorded in the 30° right anterior oblique view simultaneous with contrast 2D Echo in the apical long axis view during a power injection of 45 cc of 76% Renografin. Independent observers traced the ventricular outlines in each technique and simultaneous beats were then matched. All perimeters of ventricular size were underestimated by 2D Echo compared to CV: Cavity length by 16.0% ± 2.9 (M ± SEM) ($p<.001$) endocardial area by 32.6% ± 3.5%, ($p<.001$) and ventricular volume by 40.5% ± 5.4, ($p<.001$). Linear regression analysis yielded a good correlation of stroke volume ($r=0.88$, SEE=15.6 cc) and ejection fraction ($r=0.90$, SEE=.08) between 2D Echo and CV. Since there was no fluctuation in LVV between studies and excellent endocardial definition by contrast 2D Echo, none of these errors can be attributed to these sources. However, previous studies in phantom hearts have shown 2D Echo increases apparent wall thickness with consequent reduction in cavity size. This reduction in cavity size may account for the observed differences in LVV between these two techniques. Conclusion: Simultaneous contrast imaging shows 2D Echo underestimates ventricular volume by 40% compared to contrast ventriculography. Regression equations permit an accurate calculation of stroke volume and ejection fraction by 2D Echo.

INFERIOR VENA CAVAL ULTRASONAGRAPHY: ITS USE IN THE ASSESSMENT OF RIGHT HEART FUNCTION

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We studied the inferior vena cava (IVC) as an index of right heart function. A two-dimensional echo sector visualized the IVC and its M-mode cursor generated a time-motion record of IVC size and pulsation. In 10 normal patients, small presystolic ("A") and systolic ("V") waves were recorded; the normal "A" wave was <125% and the normal "V" wave <140% end diastolic IVC dimension. Inspiration normally caused >50% decrease in IVC dimension. Seventy patients with mitral valve disease, coronary artery disease, or atrial septal defect had right heart catheterization, contrast RV angiography, and/or radionuclide RV angiography. The "A" wave was absent in the 31 patients with atrial fibrillation. When normalized for body surface area, end diastolic IVC dimension correlated with RA pressure ($R=0.72$, $P\leq 0.001$). An "A" wave $\geq$125% end diastolic IVC dimension occurred in 9 of 12 patients with RV end diastolic pressure $\geq$10mmHg, but in none <10mmHg ($P<0.001$). A "V" wave$\geq$140% end diastolic IVC dimension occurred in 8 of 11 patients with significant tricuspid insufficiency, but in no patient with mild or no tricuspid insufficiency ($P<0.001$). Lack of respiratory variation in end diastolic IVC dimension occurred in severe RV dysfunction (radionuclide RV ejection fraction <25%); inspiratory decrease of IVC dimension correlated with RV ejection fraction ($R=0.75$, $P<0.001$). We conclude that echocardiographic assessment of IVC size and pulsation is an important index of right heart function: (1) IVC size correlates with RA pressure, (2) a large "A" wave predicts a high RV end diastolic pressure, (3) a large "V" wave predicts significant tricuspid insufficiency, and (4) lack of respiratory variation in IVC size predicts severe RV dusfunction.