

Which single echo parameter is the best marker of left ventricular filling pressure?

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Background: Estimation of left ventricular filling pressure (LVFP) is highly relevant in clinical practice. Invasive pressure remains the gold standard, but a number of echocardiographic parameters that correlate with LVFP are used as non-invasive markers of pressure.

Purpose: We investigated how different echocardiographic parameters correlated with invasively measured LVFP, and how accurately those parameters could differentiate between normal or elevated LVFP.

Method: We performed a prospective, multicenter, multinational and multivendor study in an all comer population of 322 patients with suspected heart failure or other cardiovascular disease. 194 patients had EF $\geq 50\%$ and 129 had EF $< 50\%$. LVFP was measured by right- or left heart catheterization, as pulmonary capillary wedge pressure or pre-A LV diastolic pressure, respectively.

When excluding all special patient populations defined in the 2016 recommendations for echocardiographic evaluation of LV diastolic function, 213 patients remained. Of these 135 had EF $\geq 50\%$ and 74 had EF $< 50\%$.

Echocardiography was performed within 1 day of catheterization. Previ-

ously recommended cut-off values for established parameters were used to determine the accuracy of classifying LVFP as normal or elevated. For left atrial (LA) reservoir strain, based on ROC analysis, a cut-off value of $< 18\%$ was used as marker of elevated LVFP.

Results: LA reservoir strain and the ratio of peak mitral early flow velocity (E) and LA reservoir strain (E/LA strain) showed the best correlations to LVFP (Table 1, Figure 1). They also had the highest accuracy, 75% for both, in classifying LVFP as normal or elevated in the whole patient population. E/LA reservoir strain provided no additional diagnostic value to using LA reservoir strain alone.

In HFpEF patients accuracy was essentially similar for LA strain, E/LA strain and E/e', whereas in HFrEF patients the two former tended to be better than E/e'.

Conclusion: Parameters containing LA reservoir strain showed the best correlation to LVFP. This indicates that LA reservoir strain may have a role in evaluation of LVFP.

Table 1

Echo parameter	Correlation to LVFP (r-value)	Cut-off value for elevated LVFP	Accuracy in whole population	Accuracy without special populations
E/LA reservoir strain	0.61*	> 4.1	75%	74%
LA reservoir strain	-0.58*	$< 18\%$	75%	73%
E/e'	0.45*	> 14	68%	70%
LA volume	0.36*	$> 34\text{ml/m}^2$	68%	67%
GLS	-0.50*	$< 16\%$	63%	64%
TR velocity	0.25*	$> 2.8\text{m/s}$	62%	69%

*p<0.001.

Figure 1 Correlation between LA reservoir strain and LVFP in whole population. The coloured area shows patients that were correctly classified using a cut-off value of $< 18\%$ for LA reservoir strain as a marker for elevated LVFP.

