



**Non-Invasive Estimation of Left Ventricular Filling Pressure
Based on Left Atrial Area Strain Measured With
Transthoracic 3-Dimensional Speckle Tracking
Echocardiography in Patients With
Coronary Artery Disease**

Tomoyuki Banno, MD; Kazuaki Wakami, MD; Shohei Kikuchi, MD;
Hiroshi Fujita, MD; Toshihiko Goto, MD; Hidekatsu Fukuta, MD;
Yoshihiro Seo, MD; Nobuyuki Ohte, MD

Supplementary Table 1. Univariate Correlation Analyses Between 3D-Derived 2D Strain Parameters and LVEDP or mLVDP in Patients With vs. Without CAD, LCx Lesion, or PMI

Variable	LVEDP				mLVDP			
	All patients		Patients with LVEF \geq 50%		All patients		Patients with LVEF \geq 50%	
	Correlation coefficient	P value	Correlation coefficient	P value	Correlation coefficient	P value	Correlation coefficient	P value
GLAS-r (%)	-0.63	<0.001	-0.60	<0.001	-0.70	<0.001	-0.66	<0.001
With CAD (n = 62)	-0.59	<0.001	-0.53	<0.001	-0.68	<0.001	-0.61	<0.001
Without CAD (n = 13)	-0.69	<0.001	-0.69	0.009	-0.79	<0.001	-0.79	0.001
With LCx lesion (n = 34)	-0.45	0.008	-0.42	0.021	-0.60	<0.001	-0.48	0.007
Without LCx lesion (n = 41)	-0.74	<0.001	-0.69	<0.001	-0.78	<0.001	-0.79	<0.001
With PMI (n = 27)	-0.60	0.001	-0.54	0.017	-0.76	<0.001	-0.66	0.002
Without PMI (n = 48)	-0.52	<0.001	-0.52	<0.001	-0.58	<0.001	-0.58	<0.001
With lateral PMI (n = 6)	-0.27	0.60	NA	NA	-0.79	0.064	NA	NA
Without lateral PMI (n = 69)	-0.62	<0.001	-0.56	<0.001	-0.67	<0.001	-0.64	<0.001
GLAS-ct (%)	0.65	<0.001	0.62	<0.001	0.70	<0.001	0.69	<0.001
With CAD	0.65	<0.001	0.62	<0.001	0.70	<0.001	0.68	<0.001
Without CAD	0.65	<0.001	0.65	0.017	0.64	<0.001	0.64	0.018
With LCx lesion	0.56	0.001	0.52	0.003	0.64	<0.001	0.56	0.001
Without LCx lesion	0.73	<0.001	0.73	<0.001	0.74	<0.001	0.80	<0.001
With PMI	0.79	<0.001	0.82	<0.001	0.82	<0.001	0.91	<0.001
Without PMI	0.51	<0.001	0.51	<0.001	0.58	<0.001	0.58	<0.001
With lateral PMI	0.77	0.074	NA	NA	0.93	0.007	NA	NA
Without lateral PMI	0.62	<0.001	0.59	<0.001	0.66	<0.001	0.67	<0.001

gALS-r	-0.41	<0.001	-0.34	0.006	-0.54	<0.001	-0.44	<0.001
With CAD	-0.37	0.003	-0.29	0.039	-0.49	<0.001	-0.35	0.010
Without CAD	-0.56	0.047	-0.56	0.047	-0.74	0.004	-0.74	0.004
With LCx lesion	-0.23	0.18	-0.18	0.34	-0.45	0.008	-0.29	0.12
Without LCx lesion	-0.58	<0.001	-0.50	0.002	-0.62	<0.001	-0.56	<0.001
With PMI	-0.38	0.051	-0.32	0.19	-0.58	0.002	-0.40	0.09
Without PMI	-0.28	0.051	-0.28	0.054	-0.39	0.006	-0.39	0.007
With lateral PMI	0.11	0.83	NA	NA	-0.51	0.30	NA	NA
Without lateral PMI	-0.43	<0.001	-0.36	0.004	-0.51	<0.001	-0.46	<0.001
gALS-ct	0.49	<0.001	0.45	<0.001	0.55	<0.001	0.52	<0.001
With CAD	0.50	<0.001	0.45	0.001	0.54	<0.001	0.50	<0.001
Without CAD	0.43	0.14	0.43	0.14	0.54	0.055	0.54	0.055
With LCx lesion	0.36	0.039	0.30	0.10	0.51	0.002	0.40	0.027
Without LCx lesion	0.60	<0.001	0.59	<0.001	0.58	<0.001	0.62	<0.001
With PMI	0.49	0.01	0.38	0.11	0.52	0.005	0.43	0.07
Without PMI	0.42	0.003	0.42	0.004	0.50	<0.001	0.50	<0.001
With lateral PMI	0.15	0.78	NA	NA	0.54	0.27	NA	NA
Without lateral PMI	0.50	<0.001	0.48	<0.001	0.53	<0.001	0.53	<0.001
gACS-r	-0.58	<0.001	-0.52	<0.001	-0.65	<0.001	-0.60	<0.001
With CAD	-0.57	<0.001	-0.52	<0.001	-0.64	<0.001	-0.57	<0.001
Without CAD	-0.48	0.10	-0.48	0.095	-0.69	0.009	-0.69	0.009
With LCx lesion	-0.48	0.005	-0.45	0.014	-0.57	<0.001	-0.46	0.010
Without LCx lesion	-0.67	<0.001	-0.61	<0.001	-0.72	<0.001	-0.74	<0.001
With PMI	-0.61	0.001	-0.56	0.013	-0.73	<0.001	-0.68	0.001

Without PMI	-0.47	0.001	-0.47	0.001	-0.52	<0.001	-0.52	<0.001
With lateral PMI	-0.31	0.54	NA	NA	-0.75	0.09	NA	NA
Without lateral PMI	-0.58	<0.001	-0.52	<0.001	-0.62	<0.001	-0.59	<0.001
gACS-ct	0.61	<0.001	0.58	<0.001	0.66	<0.001	0.65	<0.001
With CAD	0.60	<0.001	0.57	<0.001	0.64	<0.001	0.63	<0.001
Without CAD	0.58	0.038	0.58	0.038	0.64	0.019	0.64	0.019
With LCx lesion	0.56	<0.001	0.53	0.002	0.61	<0.001	0.54	0.002
Without LCx lesion	0.66	<0.001	0.64	<0.001	0.70	<0.001	0.75	<0.001
With PMI	0.74	<0.001	0.79	<0.001	0.77	<0.001	0.88	<0.001
Without PMI	0.46	0.001	0.46	0.001	0.53	<0.001	0.53	<0.001
With lateral PMI	0.66	0.15	NA	NA	0.74	0.09	NA	NA
Without lateral PMI	0.57	<0.001	0.54	<0.001	0.62	<0.001	0.63	<0.001

LV, left ventricular; EDP, end-diastolic pressure; mLVD, mean left ventricular diastolic pressure; CAD, coronary artery disease newly diagnosed in this study; LCx, left circumflex coronary artery; PMI, prior myocardial infarction; EF, ejection fraction; GLAS-r and GLAS-ct, global left atrial area strain during reservoir phase and during contraction phase, respectively; gALS-r, global left atrial longitudinal strain during reservoir phase; gALS-ct, global left atrial longitudinal strain during contraction phase; gACS-r, global left atrial circumferential strain during reservoir phase; gACS-ct, atrial circumferential strain during contraction phase; NA, not available.

Supplementary Table 2. Logistic Regression Analyses for Diagnosing Both Elevated LVEDP and mLVDP in all Patients

Variable	LVEDP ≥16 mmHg									mLVDP ≥12 mmHg										
	Univariate			Multivariate						Univariate			Multivariate							
	OR	95% CI	P value	Model 1			Model 2			OR	95% CI	P value	Model 3			Model 4				
				OR	95% CI	P value	OR	95% CI	P value				OR	95% CI	P value	OR	95% CI	P value		
Age	1.00	0.95–1.05	0.96									0.98	0.91–1.05	0.49						
Male	1.17	0.43–3.16	0.76									0.93	0.21–4.10	0.93						
Hypertension	1.00	0.37–2.75	0.99									1.67	0.32–8.74	0.54						
Diabetes	0.84	0.32–2.17	0.71									1.20	0.29–4.89	0.80						
Dyslipidemia	1.35	0.37–4.97	0.65									0.64	0.12–3.52	0.60						
CAD	4.53	0.93–22.2	0.06									-	-	-						
PMI	1.69	0.65–4.42	0.28									0.88	0.20–3.82	0.86						
Paroxysmal Af or AFL	0.50	0.05–5.05	0.56									-	-	-						
E (per 10 cm/s increase)	1.76	1.24–2.50	0.002									1.93	1.25–2.99	0.003	1.76	1.09–2.83	0.02			

E/A ratio (per 0.1 increase)	1.45	1.14–1.83	0.002	1.74	1.22–2.48	0.002			1.49	1.11–2.01	0.009							
DT (per 10 ms increase)	0.93	0.85–1.01	0.099						0.88	0.76–1.01	0.07							
E/ mean e' ratio (per 1 increase)	1.18	1.01–1.39	0.04						1.23	1.01–1.49	0.04							
LAVI (per 1 ml/m ² increase)	1.09	1.00–1.03	0.003						1.08	1.01–1.15	0.03							
LVMI (per 1 g/m ² increase)	1.01	1.00–1.03	0.19						1.01	0.99–1.03	0.30							
RWT (per 0.1 increase)	0.79	0.46–1.35	0.38						0.53	0.22–1.27	0.15							
GLAS-r (per 10% increase)	0.43	0.29–0.63	<0.001	0.35	0.21–0.58	<0.001	-	-	-	0.48	0.29–0.80	0.004	0.54	0.32–0.89	0.015	-	-	-
GLAS-ct (per 10% increase)	4.70	2.35–9.40	<0.001	-	-	-	4.70	2.35–9.40	<0.001	4.92	1.79–13.6	0.002	-	-	-	4.92	1.79–13.6	0.002

Model 1: E/A ratio, E/mean e', LAVI, and GLAS-r were selected as possible independent variables

Model 2: E/A ratio, E/mean e', LAVI, and GLAS-ct were selected as possible independent variables

Model 3: E velocity, E/mean e', LAVI, and GLAS-r were selected as possible independent variables

Model 4: E velocity, E/mean e', LAVI, and GLAS-ct were selected as possible independent variables

OR, odds ratio; CI, confidence interval; Af, atrial fibrillation; AFL, atrial flutter; E and A, early and late peak velocity of mitral inflow, respectively; DT, deceleration time of E wave; mean e', the averaged value of peak velocities obtained at both the septal and lateral annual corners during early diastole; LAVI, left atrial volume index; LVMI, left ventricular mass index; RWT, relative wall thickness; other abbreviations as in Supplementary Table 1.