

159. Speckle Tracking Echocardiographic Assessment of Left Ventricular Function by Myocardial Strain Before and After Aortic Valve Replacement

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Body

Background & Objectives: In patients of aortic stenosis and regurgitation, pressure and volume effects on left ventricular function are occult and missed by routine echocardiography markers like ejection fraction (EF). Speckle tracking analysis by measuring global longitudinal strain and global circumferential strain seems to ascertain this occult LV function parameters at an early phase in a more comprehensive manner. Limited studies have examined these parameters pre/post aortic valve replacement (AVR).

Methods: 94 consecutive patients with symptomatic severe aortic stenosis (AS) or aortic regurgitation (AR), planned for AVR were included (as per set inclusion criteria) along with 15 normal controls-15 months prospective study. Routine echocardiography and speckle tracking imaging was done at baseline (pre AVR) and post AVR at 1st week, 1st month and 3rd month of follow up.

Results: 90 patients completed study (70 in AS and 20 in AR group). In AS group mean values (± 2 standard deviations) of global longitudinal strain (GLS) improved from a baseline $-10.9\% (\pm 3.9)$ to $-19.4\% (\pm 3.8)$ at 3rd month (p value < 0.0001). Mean values of global circumferential strain (GCS) too improved from $-17.3\% (\pm 4.5)$ to $-21.4\% (\pm 3.6)$ respectively (p value < 0.0001). In AR group too mean values of global longitudinal strain progressed from a baseline $-12.6\% (\pm 3.9)$ to $-19.4\% (\pm 3.4)$ at three months of follow (p value < 0.0001) and mean values of global circumferential strain also progressed from $-15.3\% (\pm 3.4)$ at baseline to $-21.7\% (\pm 3.1)$ respectively (p value < 0.0001).

Conclusion: Magnitude of recovery of GLS and GCS after AVR was more as compared to recovery in EF. Poor GLS/ GCS values at baseline were associated with lesser recovery pressing need for an earlier intervention.

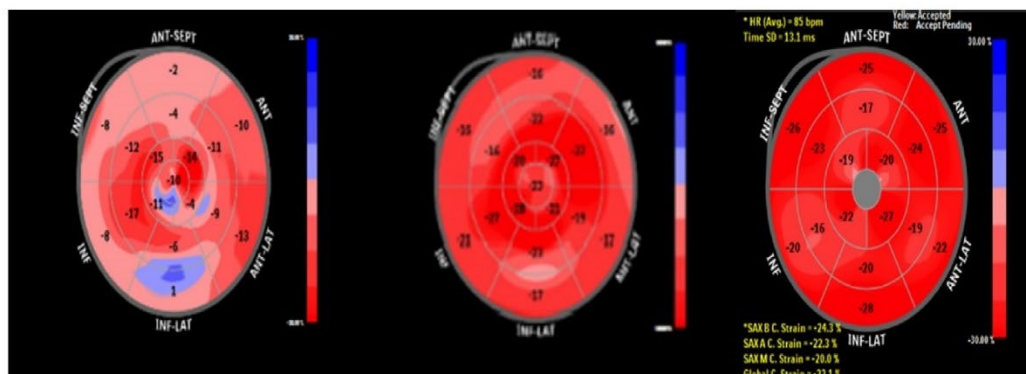


Fig. 8. Bull's Eye plot diagram showing (extreme left image) global longitudinal strain values for each of the 17 segments in a patient with severe AS before aortic valve replacement with average GLS value at baseline of -8.3% (LVEF = 48%, GCS was -14.6%). After undergoing aortic valve replacement (Mid image) average GLS improved to -18.1% and GCS in same patient improved to -22.1% at 3 months follow up, LVEF = 52%.

Table 2. (Results) Echocardiographic findings of patients with severe aortic stenosis, severe aortic regurgitation (pre and post aortic valve replacement-AVR) and normal controls.

Patients with severe aortic stenosis											
	Before AVR		1 week After AVR			1 month After AVR			3 months After AVR		
	Mean	SD	Mean	SD	P-value	Mean	SD	P-value	Mean	SD	P-value
LVEDV	101.6	14.3	94.8	13.8	0.005	92.1	12.9	0.0001	93.5	11.4	0.0003
LVESV	55.7	10.3	53.2	9.9	0.145	49.4	10.1	0.0001	39.8	9.8	0.0001
LVEF	44.2	14.8	42.9	15.1	0.607	45.6	13.1	0.554	48.6	13.4	0.067
GLS	-10.9	3.9	-11.3	3.8	0.539	-14.2	4	0.0001	-19.4	3.8	<0.0001
GCS	-17.3	4.5	-15.6	4.2	0.0223	-18.1	4.4	0.289	-21.4	3.6	<0.0001
Patients with severe aortic regurgitation											
	Before AVR		1 week After AVR			1 month After AVR			3 month After AVR		
	Mean	SD	Mean	SD	P-value	Mean	SD	P-value	Mean	SD	P-value
LVEDV	167.5	16.5	124.2	14.9	0.0001	113.6	13.9	0.0001	109.4	13.8	0.0001
LVESV	93.4	11.2	84.5	10.8	0.014	66.9	10.4	0.0001	54.1	9.9	0.0001
LVEF	42.3	18.2	43.2	17.3	0.874	45.9	15.9	0.51	49.8	14.2	0.155
GLS	-12.6	3.9	-10.2	3.1	0.0377	-11.6	3.5	0.398	-19.4	3.4	<0.0001
GCS	-15.3	3.4	-12.7	3.8	0.0283	-14.6	4	0.554	-21.7	3.1	<0.0001
Normal Controls											
	Baseline		Repeat after 1 week		Repeat after 1month		Repeat after 3 months				
LVEDV (ml)	75.6		75.1		74.9		75.5				
LVESV(ml)	31.8		32.1		32.3		31.9				
LVEF (%)	55		55		55		55				
GLS (%)	-21.3		-21.9		-21.8		-21.7				
GCS(%)	-23.3		-23.9		-23.1		-23.5				

Abbreviations: LVEDV (left ventricular end diastolic volume), LVESV (left ventricular end stroke volume), LVEF (left ventricular ejection fraction), GLS (global longitudinal strain), GCS (global circumferential strain).

Clinical Implications: understand the importance of strain analysis in evaluation of aortic valve disease patients as even asymptomatic patients with normal ejection fraction and moderate aortic valve disease but significantly reduced global longitudinal and global circumferential strain values may be appropriate candidates to receive aortic valve replacement (AVR).