International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

The Analysis of Global Longitudinal Strain in Moderate Aortic Stenosis

Dr. R Anand Jeeva Swamy[1], Dr. N Swaminathan[2], Dr. R Anand Jeeva Swamy[3]

[1]MD, Senior Resident, Madras Medical College
Mobile no. 7358187187

[2]MD, DM, Professor, Madras Medical College
Mobile no. 9841366633

[3]MD, Senior Resident, Madras Medical College
Corresponding author Email: *anandjeevambbs[at]gmail.com*
Mobile no. 7358187187

Abstract: ***Left ventricular (LV) ejection fraction (EF)is the most commonly used measure of LV function. It is used in the risk stratification of patients with aortic stenosis. Recent studies indicate the prognosis of moderate AS with systolic dysfunction is poor. This underscores the importance of detecting mild degree of LV systolic dysfunction in patients with moderate AS.LV global longitudinal strain (GLS) is a more sensitive marker for LV systolic function than LVEF and provides more prognostic information than LVEF in patients with moderate aortic stenosis.***

Keywords: moderate aortic stenosis, global longitudinal strain, Echocardiography, cardiology, LV Ejection fraction

1. Introduction

Moderate AS is associated with decreased survival compared with normal population. AS severity progress slowly over a period of years and LV pressure over load increases. The compensatory mechanism including concentric hypertrophy of LV reduces the LV systolic wall stress and maintain LV ejection fraction. However, it causes myocardial oxygen supply mismatch resulting in sub endocardial ischemia. With time myocardial fibrosis ensures. The development of LV myocardial fibrosis is one of the main pathophysiology for reduction of LV systolic function. As cardiac structural changes occur in parallel with increasing AS severity, LV fibrosis is considered to be a strong predictor of clinical outcomes in patient with aortic stenosis. LV myocardial fibrosis is reliably detected by Left ventricular global longitudinal strain

Objective

1) To estimate the LV systolic function in patients with Moderate AS by GLS
2) To estimate the association of GLS and symptoms in patients with moderate AS

2. Methodology

We prospectively identified 50 consecutive patients with moderate aortic stenosis diagnosed by echocardiography at cardiology OP in Madras medical college. Moderate AS was defined as aortic Vmax of 3-3.9 m/sec, mean aortic gradient 20-39 mmHg and aortic valve orifice area of >1 cm^2 to 1.5 cm^2 by continuity equation. Detailed symptomatic history of the patients were asked and was defined as Prescence of any one of the following: shortness of breath, angina, syncope. LV ejection fraction was calculated by modified Simpsons method and LV filling pressure was assessed by mitral inflow velocity (E) and early diastolic tissue velocity of the medial and lateral annulus (e'). Global longitudinal strain was calculated as the averaged strain curve generated from all segments.

Sample Size:
50 participants

Inclusion Criteria:

1) Patients with moderate aortic stenosis
2) Age >18 years

Exclusion Criteria:

1) Previous aortic valve surgery
2) Active infective endocarditis
3) Significant LV outflow tract obstruction
4) More than mild aortic regurgitation
5) More than mild mitral stenosis or regurgitation
6) Atrial fibrillation
7) Not willing to participate in study

3. Statistical Analysis

The data collected were entered into Microsoft excel 2019 and the master chart was created. The qualitative variable was expressed using frequency and percentage and the quantitative variable using mean and standard deviation. To compare the distribution of qualitative variables between GLS ≤ -16% and GLS>-16%, chi square test was used. To compare the mean between GLS ≤ -16% and GLS>-16%`, independent samples T test was used. A P value of less than 0.05 was considered to be statistically significant.

4. Results

The mean age among the participants was 67.04 ± 5.05 years. 70% were males. 32% complained of shortness of breath, 6% of angina and 2% of syncope. The mean E/E'

Licensed Under Creative Commons Attribution CC BY

was 12.18 ± 1.97. 22% had E/e' >14. The mean AVA was 1.31 ± 0.13 cm^2. The mean gradient was 30.78 ± 3.90 mmHg. The mean ejection fraction was 60.28 ± 3.44 %. The mean GLS was -17.01 ± 1.60 (Table 1).

33 (66%) had GLS score of less than or equalto -16% and 17 (34%) had GLS of more than -16% (Fig 1). The mean age among those with GLS ≤ -16% was 65.33 ± 4.24 years and the mean age among those with GLS >-16% was 70.35 ±4.97. The mean age was significantly more among those with GLS > -16% than those with GLS ≤ -16%. Among those with GLS ≤-16%, 72.7% were males and among those with GLS >-16%, 64.7% were males. The distribution of sex was similar between GLS ≤ -16% and GLS >-16%. Among the participants who had reported symptoms, the proportion was 18.2% and 58.5% in GLS ≤ -16% and GLS > -16%, respectively. The proportion of participants with shortness of breath was more (58.58%) among those with GLS >-16% than those with GLS ≤ -16% (18.2%). The distribution of angina and syncope were found to be similar between the two categories of GLS with P value of more than 0.05.

The mean E/E' among those with GLS ≤ -16% was 11.23 ± 1.64 and among those with GLS >-16%, the mean was 14.02 ± 1.05. The mean E/E' was more in GLS >-16% than those with GLS ≤ -16%, The mean AVA was 1.34 ± 0.12 cm^2 and 1.23 ± 0.13 cm^2 among those with GLS ≤ -16% and GLS>-16%, respectively. The mean AVA was significantly lesser among those with GLS > -16% than those with GLS ≤ -16%. The mean Gradient was 29.88 ± 3.60 mmHg and 32.53 ± 3.98 mmHg among those with GLS ≤ -16% and GLS > -16%, respectively. The mean gradient was higher among those with GLS >-16% than those with GLS ≤ -16% (P value < 0.05). The mean ejection fraction was 60.33 ± 3.64 and 60.18 ± 3.10 among those with GLS ≤ -16% and GLS > -16%, respectively. The mean ejection fraction was similar between the two GLS categories (Table 2). Among the participants with GLS ≤ -16%, 6.1% had E/e' >14 while among those with GLS > -16%, the proportion was 52.9%. The proportion of participants with increased E/e' was significantly more among those with GLS > -16% than those with GLS ≤ -16% with P value less than 0.05

Table 1: Baseline characteristics among the participants

Variable		n (%)
Age		67.04 ± 5.05
Sex	Male	35 (70)
	Female	15 (30)
Symptoms	Angina	3(6)
	Shortness of breath	16 (32)
	Syncope	1(2)
E/E'		12.18±1.97
Diastolic dysfunction	Yes	11 (22)
	No	39 (78)
AVA (cm^2)		1.31 ± 0.13
Gradient (mmHg)		30.78 ± 3.90
Ejection fraction (%)		60.28±3.44
Global longitudinal strain		-17.01±1.60

Table 2: Comparison of variables between the groups with GLS ≤ -16% and GLS >-16%

Variable		GLS≤ -16%	GLS>-16%	P value
Age (in years)		65.33 ± 4.24	70.35±4.97	0.001
Sex	Male	24 (72.7)	11 (64.7)	0.558
	Female	9 (27.3)	6 (35.3)	
Symptomatic	Yes	6(18.2)	10(58.5)	0.004
	No	27 (81.8)	7 (41.2)	
Angina	Yes	2 (6.1)	1 (5.9)	0.980
	No	31 (93.9)	16 (94.1)	
Shortness of breadth	Yes	6 (18.2)	10 (58.8)	0.004
	No	27 (81.8)	7 (41.2)	
Syncope	Yes	1 (3)	0	0.468
	No	32 (97)	17 (100)	
E/E'		11.23 ± 1.64	14.02 ± 1.05	0.001
AVA (cm^2)		1.34 ± 0.12	1.23 ± 0.13	0.005
Gradient (mmHg)		29.88±3.60	32.53±3.98	0.021
Ejection fraction		60.33± 3.64	60.18 ± 3.10	0.880

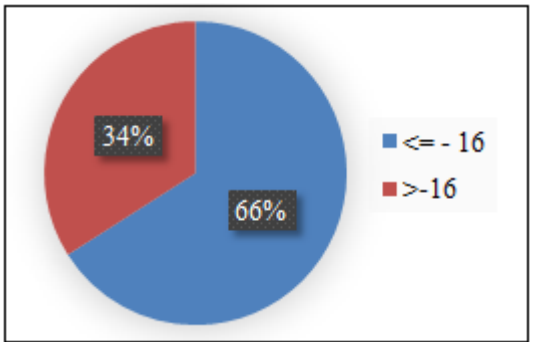

Figure 1: Pie chart showing categories with regard to global longitudinal strain

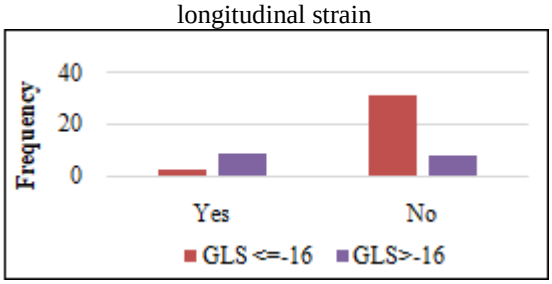

Figure 2: Bar chart showing increased E/e' between GLS ≤ -16% and GLS > -16%.

5. Discussion

Moderate AS has been reported to be associated with decreased survival when compared with the normal population. Strange et al reported that the 5-year mortality was 56% in total of 3315 patients with moderate AS. Conventional echocardiographic measures such as Ejection fraction and fractional shortening may not accurately reflect the complex mechanism of LV function. Zhu et al demonstrated LVEF cannot predict outcomes in patients with moderate AS with preserved LVEF. Speckle tracking echocardiography is a non-Doppler modality, angle-independent, allowing measurement of myocardial deformation. LV GLS is derived from LV apical 2 chamber, 3 chamber and 4 chamber views. With experience LV GLS can be calculated with good feasibility and reduced inter observer variability. The obvious advantage of LV GLS over LVEF lies in the fact that subclinical LV dysfunction, early structural and morphological damage can be detected better. In our study even though LVEF is normal in all patients LV GLS was reduced in 34%. patients with reduced GLS tend to

Licensed Under Creative Commons Attribution CC BY

be older, more symptomatic and had higher filling pressure. Comorbidities, such as CAD, hypertension, diabetes mellitus, obesity, or atherosclerosis, could also contribute to impaired GLS in moderate AS. Jan Stassen et al have demonstrated moderate AS with reduced GLS will have bad prognosis when compared with moderate AS with preserved GLS. Zhu et al showed patients with moderate AS and reduced GLS have higher mortality even after aortic valve replacement.

6. Conclusion

LV global longitudinal strain is a better indicator of LV function than LV ejection fraction in moderate aortic stenosis. Patient with reduced LVGLS tend to be older, more symptomatic and have increased filling pressure. Risk stratification with GLS could therefore improve identification of subgroup of patients who have increased risk of adverse events

References

[1] 1.Zhu D, Ito S, Miranda WR, Nkomo VT, Pislaru SV, Villarraga HR, Pellikka PA, Crusan DJ, Oh JK. Left ventricular global longitudinal strain is associated with long-term outcomes in moderate aortic stenosis.Circ Cardiovasc Imaging. 2020; 13:e009958.doi:10.1161/CIRCIMAGING.119.009958

[2] Strange G, Stewart S, Celermajer D, Prior D, Scalia GM, Marwick T, Ilton M, Joseph M, Codde J, Playford D; National Echocardiography Database of Australia Contributing Sites. Poor long-term survival in patients with moderate aortic stenosis.J Am Coll Cardiol. 2019; 74:1851–1863. doi: 10.1016/j.jacc.2019.08.004

[3] Strange G, Stewart S, Celermajer D, Prior D, Scalia GM, Marwick T, Ilton M, Joseph M, Codde J, Playford D; National Echocardiography Database of Australia contributing sites. Poor long-term survival in patients with moderate aortic stenosis.J Am Coll Cardiol. 2019; 74:1851–1863. doi: 10.1016/j.jacc.2019.08.004

[4] Kearney LG, Lu K, Ord M, Patel SK, Profitis K, Matalanis G, Burrell LM, Srivastava PM. Global longitudinal strain is a strong independent predictor of all-cause mortality in patients with aortic stenosis.Eur Heart J Cardiovasc Imaging. 2012; 13:827–833. doi: 10.1093/ehjci/jes115

[5] Yechoor P, Blaustein AS, Bakaeen FG,Cornwell LD, Coselli JS, LeMaire SA, Chu D. The natural history of moderate aortic stenosis in a veteran population.J Thorac Cardiovasc Surg. 2013; 145:1550-1553.doi:10.1016/j.jtcvs.2012.05.013

Licensed Under Creative Commons Attribution CC BY