



## Research Brief

# Post covid assesment of right and left ventricular global longitudinal strain

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## 1. Introduction

Cardiac dysfunction has been reported in SARS-CoV2 infection.<sup>1</sup> Most studies of ventricular function in covid patients were during the acute infection and there are very few studies during post covid convalescence.<sup>2</sup> Two Dimensional echocardiography(2D ECHO) is mandatory in all dyspnoeic post covid patients to look for persistent or new onset overt cardiac dysfunction as evidenced by reduced ejection fraction(EF) or a subtle cardiac dysfunction as determined by global longitudinal strain(GLS), even after they have turned covid negative. GLS has been proven to be a sensitive determinant of myocardial dysfunction and antedates the reduction of ejection fraction(EF).

## 2. Methods

**Aim-** To assess if subclinical myocardial dysfunction indicating a smouldering myocarditis, could be identified by GLS in post COVID19 patients who have become covid negative.

**Study cohort** – 100 patients.

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**Inclusion criteria** - Covid 19 patients admitted with breathlessness.

**Exclusion criteria** - Patients with poor ECHO window.

All patients underwent at admission, routine 2D ECHO to detect ventricular dysfunction, Inflammatory markers like C reactive protein(CRP), serum Ferritin, D Dimer, Neutrophil lymphocyte ratio(NLR), serum albumin and CT chest, in addition to routine tests. Interleukin(IL)6 and troponin I were assayed when indicated.

Two weeks later, after they had become covid negative, they underwent another 2D ECHO along with determination of left ventricular(LV) and right ventricular(RV) GLS to detect subtle cardiac dysfunction.

ECHO was done with Vivid T8 Echo machine and 3.5 Mhz transducer. EF <50% was taken as overt LV systolic dysfunction. Tricuspid annular plane systolic excursion(TAPSE) < 15 mm was taken as overt RV dysfunction. The GLS was determined by speckle tracking and normal LVGLS was taken as –18% and above and normal RV GLS as –24% and above.

## 3. Results

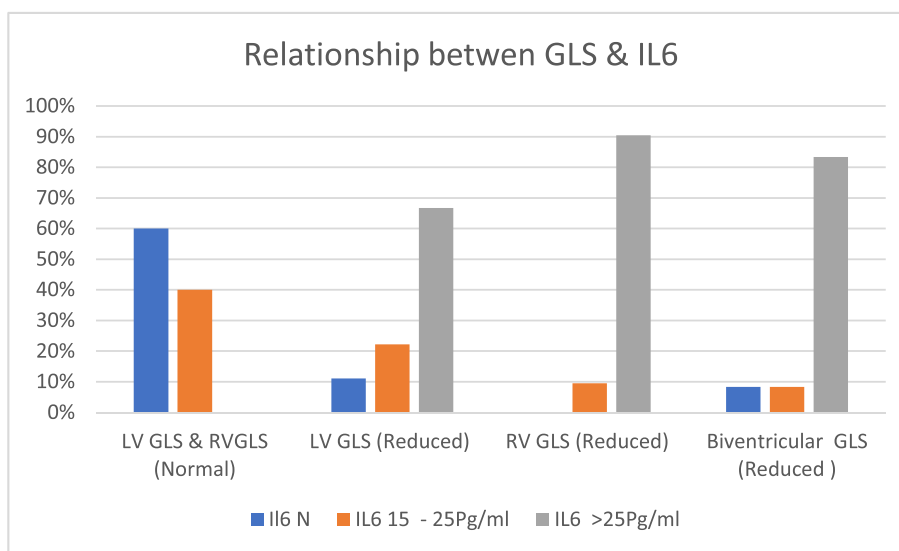
Initial ECHO in these patients revealed overt LV systolic dysfunction in 4%, LV diastolic dysfunction in 57% and overt RV dysfunction in 2%. 2D ECHO, 2 weeks later revealed that 51% had reduced GLS viz; 18%, 21% and 12% had reduced LV GLS, reduced RV

**Table 1**  
Distribution of Overt & Covert LV & RV dysfunction.

REDUCED LV GLS (18%)		REDUCED RV GLS (21%)		REDUCED BIVENTRICULAR GLS (12%)			
NORMAL EF	REDUCED EF	NORMAL TAPSE	REDUCED TAPSE	NORMAL EF	REDUCED EF	NORMAL TAPSE	REDUCED TAPSE
18%	0	21%	0	8%	4%	10%	2%

**Table 2**  
Relation of GLS to CRP levels.

GLS	Crp<10 mg/L	CRP 11–50 mg/L	CRP 50–100 mg/L	CRP>100 mg/L
LV GLS & RVGLS(Normal)49	11(22.4%)	28(57.2%)	10(20.4%)	0
LV GLS (Reduced) 18	1(5.6%)	3(16.7%)	2(11.1%)	12(66.7%)
RV GLS (Reduced) 21	0	0	3(14.3%)	18(85.7%)
RV & LV GLS (Reduced)12	0	1(8.3%)	0	11(91.7%)



**Fig. 1.** Relation between GLS & Interleukin 6 levels(IL6).

**Table 3**  
Relation between D Dimer levels and GLS.

GLS	D DIMER NORMAL	D DIMER 250 - 400	D Dimer 400-2000	D Dimer >2000
LV GLS & RVGLS (Normal) 49	13(26.5%)	36(73.5%)	0	0
LV GLS (Reduced) 18	1(5.6%)	2 (11.1%)	1(5.6%)	14(77.7%)
RV GLS (Reduced) 21	0	2(9.5%)	1(4.8%)	18(85.7%)
RV & LV GLS (Reduced) 12	0	1 (8.3%)	1(8.3%)	10(83.4%)

**Table 4**  
Relation between Serum ferritin & GLS.

GLS	ferritin NORMAL	ferritin 251- 500	Ferritin >500
LV GLS &RVGLS(Normal)49	18(36.7%)	31(63.3%)	0
LV GLS (Reduced) 18	2 (11.1%)	2 (11.1%)	14(77.8%)
RV GLS (Reduced) 21	3(14.3)	2 (9.5%)	16 (76.2%)
RV & LV GLS (Reduced)12			12(100%)

GLS and reduced biventricular GLS respectively. 36% had pulmonary hypertension of varying severity. [Table 1](#).

The GLS was compared to the inflammatory marker levels.

81.4% with reduced GLS had CRP >100 mg/L. [Table 2](#).

60% with normal LV & RV GLS had normal IL6, while 66.7% with reduced LVGLS, 90.5% with reduced RVGLS and 83.3% with reduced biventricular GLS had IL6 >25 pg/ml([Fig. 1](#)).

Patients with normal RV & LV GLS had D Dimer <400 ng/ml 77.7% with reduced LVGLS, 85.7% with reduced RV GLS and 83.4% with reduced biventricular GLS had D Dimer >2000 ng/ml([Table 3](#)).

36.7% with normal LV & RV GLS had normal serum ferritin, while 63.3% had serum ferritin between 250 and 400 ng/ml 77.8% with reduced LV GLS, 76.2% with reduced RV GLS and 100% with reduced biventricular GLS had serum ferritin >500 ng/ml([Table 4](#)).

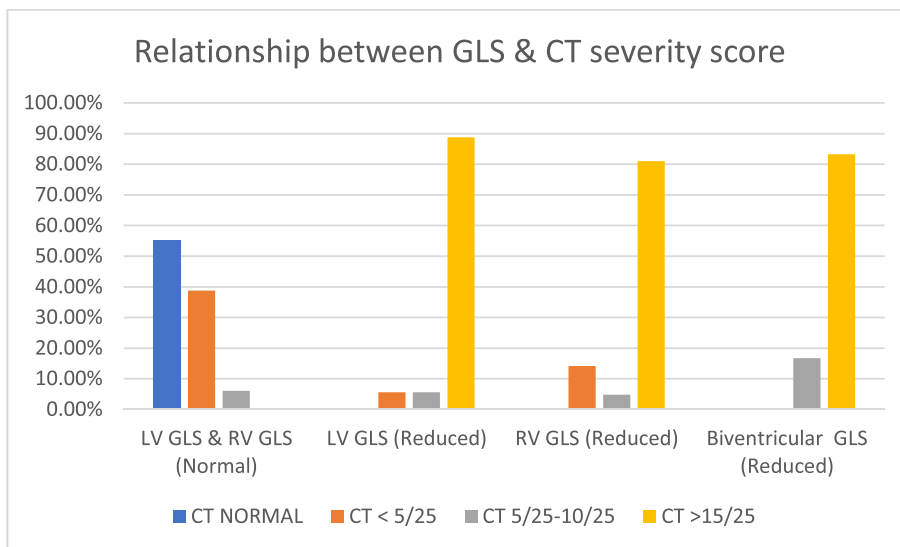


Fig. 2. Relationship between GLS & CT severity score.

Table 5 Relationship between GLS & Neutrophil lymphocyte ratio(NLR).

GLS	NLR <3.5	NLR >3.5–5	NLR 6-9	NLR >10
LV GLS & RVGLS(Normal)49	15(30.6%)	32(65.4%)	1(2%)	1(2%)
LV GLS (Reduced) 18	0	0	0	18(100%)
RV GLS (Reduced) 21	1(4.7%)	3 (14.3%)	3 (14.3%)	14(66.7%)
RV & LV GLS (Reduced)12	0	1(8.3%)	1(8.3%)	10(83.4%)

84.4% with reduced GLS had CT severity scores >15/25. Fig. 2. The NLR was <3.5 in 30.6% and 3.5–5 in 65.3% with normal LV & RV GLS. 100% with reduced LV GLS, 66.7% with reduced RV GLS and 83.4% with reduced biventricular GLS had NLR >10(Table 5).

51% with normal LV & RV GLS had normal serum albumin levels in contrast to 77.8%, 81% and 91.7% of patients with reduced LV GLS,

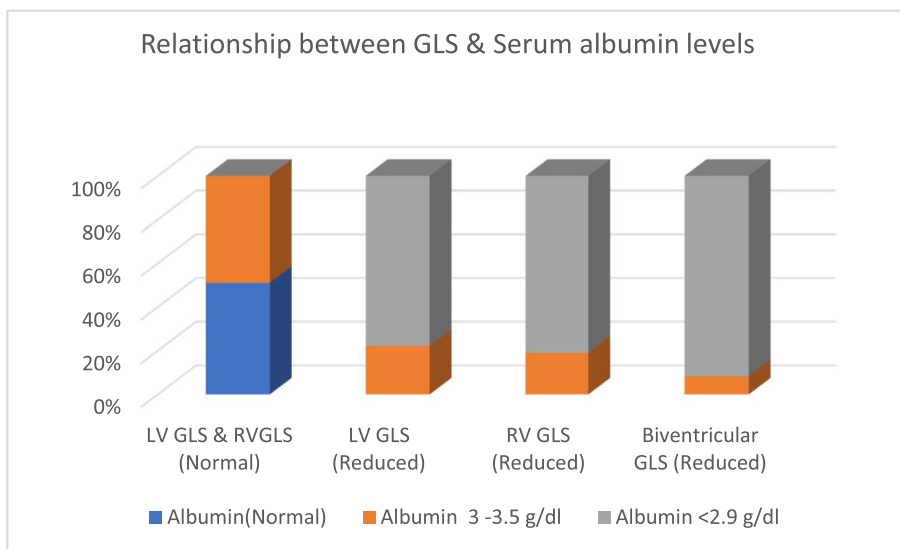


Fig. 3. Relationship between Global longitudinal strain (GLS) & Serum albumin levels.

Table 6 Relationship between Global longitudinal strain (GLS) & time to symptom onset and admission.

LVGLS AND DURATION BETWEEN SYMPTOM ONSET AND ADMISSION		
	<4DAYS	>4 DAYS
LV GLS & RVGLS(Normal)49	49(100%)	0
LV GLS (Reduced) 18	5(27.8%)	13(72.2%)
RV GLS (Reduced) 21	11(52.4%)	10 (47.6%)
RV & LV GLS (Reduced)12	0	12(100%)

reduced RV GLS and reduced biventricular GLS respectively, who had serum albumin <2.9 g/dl (Fig. 3).

There were no comorbidities in 63.3% with normal LV & RV GLS, 61.1% with reduced LV GLS and 61.9% with reduced RVGLS.

100% with normal GLS were admitted within 5 days of symptoms onset in contrast to 73.3% with reduced GLS who were admitted 5 days after symptoms onset (Table 6).

77.6% with normal LV and RV GLS and 61.9% with reduced RV GLS were <50 yrs. 72.2% with reduced LV GLS and 66.7% with biventricular GLS were >50 yrs.

51.2% of males and 50% of females had reduced GLS.

#### 4. Discussion

Subclinical LV dysfunction in ECHO has been observed in 30%–80% of COVID 19 patients.<sup>2</sup> Our study shows that 51%, 2 weeks after diagnosis of covid had reduction of LV or RV or biventricular GLS.

Zhou et al reported higher troponin levels in covid non survivors.<sup>1</sup> All our patients with ECG changes or EF <50% had elevated serum troponin I levels.

A retrospective study of COVID19 patients indicated that CRP is an independent predictor of severe infection.<sup>3</sup> In our study, 81.3% with reduced GLS had CRP >100.

A meta-analysis of 9 studies reported mean IL-6 values 3 times higher in complicated Covid.<sup>4</sup> IL6 >25 pg/ml occurred in 80.1% with reduced GLS.

Significantly higher D- Dimer levels were reported as a prognostic marker in severe covid.<sup>5</sup> 82.2% of our patients with reduced GLS had D Dimer >2000.

Literature reports elevated serum ferritin as an independent indicator of severe covid.<sup>6</sup> In our study 85% with reduced GLS had serum Ferritin values > 500 pg/ml.

CT severity score semi quantitatively estimates lung involvement with a total score from 0 to 25.<sup>7</sup> 84% with reduced GLS in our study had CT score >15/25.

Lymphopenia in COVID19 is an independent prognostic marker. NLR >10 was seen in 83.3% of our patients with reduced GLS.<sup>8</sup>

Hypo albuminemia occurs in severe covid.<sup>9</sup> 83% of our patients with reduced GLS had Serum albumin <2.9 g/dl.

Older age, male sex and co morbidities have been reported as risk factors for cardiac involvement in covid.<sup>10</sup> We did not find any clear difference however.

Literature indicates higher morbidity in patients seeking medical help late.<sup>11</sup> Most of our patients with reduced GLS had sought treatment 5 days or more after onset of symptoms.

The 12% with reduced biventricular GLS, had a stormy course with a 5–9 day ICU stay. Biventricular strain imaging has been

sparsely studied in covid. One study in acute covid reported reduced biventricular strain as predictive of higher mortality.<sup>12</sup>

#### 5. Conclusion

Overt cardiac manifestations seen in covid 19 represent the tip of the iceberg. Incipient cardiac dysfunction, which could have long term cardiac repercussions are more prevalent than known and can be detected by assessment of GLS, even 2 weeks after admission and after the patient became covid negative. The GLS reduction post covid, mandates the need to seek medical help early, even before the reduction of the EF and to follow up adequately, to see if it improves, remains as such or progresses and to prevent acute episodes of overt cardiac dysfunction.

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