Table 1: Studies reporting ECHO findings in patients with COVID-19

Study	Design	N	COVID-19 severity	LV parameters (EF/ Mass index/ LVOT VIT/ Takotsubo)	RV parameters (TAPSE/FAC/ RV/LV ratio/PAP/ IVC parameters)	LV strain	Strain analysis RV global/free wall strain-	Other	Comment
Long Li et al	Retrospective	49	Severe and very severe	LVEF severely reduced in severe COVID-19	IVC Max and Min significantly increased in severe COVID-19.	NA	NA	NA	TAPSE is more impaired in severe ARDS as compared to mild ARDS
D`Alto et al	Prospective	94	Severe	No significant difference in any of the LV parameters between patients who survived and those who did not	TAPSE, PASP, TAPSE/PASP ratio, and IVC were significantly different in patients who survived vs those who did not	NA	NA	NA	TAPSE/PASP ratio(RV uncoupling) and PaO2/FiO2 ratio are independent predictors of mortality of patients with severe COVID-19
Giustino et al	Multicenter retrospective	305	Varying severity	In patients with elevated troponins, regional WMA was more frequently encountered. Apical WMA followed by mid segments were most common. LVEDV, Septal wall thickness, Pw thickness were significantly increased in those with myocardial injury	RV function was significantly more impaired in those with elevated cardiac biomarkers	NA	NA	NA	Patients with COVID-19 with myocardial injury and WMA have a poorer prognosis than those without WMA
Szekely et al.	Prospective study	100	Mild, moderate, severe	LV systolic dysfunction n=10, EF <50% LV diastolic dysfunction n=16	RV dilation/dysfunction, n=39	NA	NA	NA	In COVID19, LV systolic function is preserved, but diastolic and RV function are impaired. Elevated troponin and poorer clinical grade are associated with worse RV function.
Edgar Garcia et al.	Cross sectional study	82	Severe, ICU admission	11/82 EF <50%	23/82 had RV basal	NA	NA	NA	The ORACLE protocol is fast way to evaluate covid-

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Study	Study type	N	Severity/Setting	LV findings	RV findings				Conclusion
					diameter >41mm 22/82 had TAPSE <17mm				19 patients. The most frequent ultrasonographic findings were elevated pulmonary artery systolic pressure (69.5%), E/e' ratio > 14 (29.3%), and right ventricular dilatation (28%) and dysfunction (26.8%)
Beyls et al.	Cross sectional study	54	Severe, ICU	NA	Median RV FAC was 43.6% (33.3% to 52.8%), median RV GLS was -24.7% (-22.6% to -28.5%) median TMADlat was 23.5 mm (19.0 to 27.9 mm)	NA	NA	NA	TMAD can be used and is reproducible in assessment of RV function in patients with COVID-19 related ARDS and prone positioned.
Stobe et al.	Cross sectional study	18	14/18 severe, 4/18 mild	Left-ventricular mass index (g/m2) 97±19.0 Left-ventricular ejection fraction (%) 62±6.5	NA	NA	Reduced longitudinal strain in more than one basal LV segment 10/14	Right-ventricular GLS (%) −26.9±5.8 (for 10 severe, 4 mild)	Study shows myocardial involvement is highly prevalent in patients with COVID-19.
Argulian et al.	Retrospective study	33	14(ventilated) 19 (not ventilated)	10/33 had decreased EF	13/33 RV enlargement	NA	NA	RV /LV parameters not provided	Ultrasonic agents are safe and increase diagnostic yield of bedside echo
Churchill et al.	Cross sectional study	125	85/125 ICU	28/125 decreased EF (<50%)	NA	NA	NA	NA	LV dysfunction is common in patients with elevated troponin
Demerck et al.	Prospective study	1216	NA	19/1216 takotsubo decreased EF 455/1216	313/1216	NA	NA	RV/LV parameters not provided	In this global survey cardiac abnormalities were detected with ECHO in patients with ECHO
Garcia cruz et al.	Retrospective study	15	Severe ICU, intubated	6/15 decreased EF via low MAPSE	Mean TAPSE 17.8mm,	NA	NA	NA	Transesophageal echo is feasible in patients that are

Study	Study type	N	Severity	LVEF / EF	RV / TAPSE	LV GLS	RV GLS	LA	Conclusion
				<13mm					prone positioned in the ICU.
Jain et al.	Retrospective study	72	NA	25/72 had low EF <50%	29/72 decrease RV systolic function	NA	NA	NA	TTE is a valuable tool in guiding management of COVID-19 patients.
Bursi et al.	Retrospective study	49	Mild, mod, severe 11 patients were intubated, 1 was in bilevel positive airway pressure, 17 were in continuous positive airway pressure, 9 were in face mask with high oxygen flow, and 11 were in nasal cannula	LVEF 53 ± 12 %	TAPSE 20 ± 4mm, FAC 41 ± 8 %,	LV GLS −15 ± 4%	RV-GLS −15 ± 5 %	NA	Offline 2D echo with speckle tracking can be used in cardiac evaluation of COVID 19 patients. RV strain and TAPSE are associated with higher mortality, RV dysfunction is also a common finding.
Li S, Qu YL, et al.	Prospective study	91	severe	NA	NA	NA	NA	NA	This study is for the utility of lung US in assessing COVID complications, TTE and cardiac findings were not addressed. Lung US scores not assessed.
Pacileo et al.	Review article	NA	NA	NA	NA	NA	NA	Mainly addressing logistics of doing TTE and TEE in COVID pandemic with no mention on TTE findings or relation to severity	NA
Schott JP et al.	Prospective study	66 , African	Severe	EF by simpson	RV/LV ratio ranged	NA	NA	Increased left	RV dilation is common in

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	American, male, obese, with hypertension, and with diabetes			method 60+-12 12 out of 66 had impaired LVEF not specified how low , out of which 7 previously known to have low EF. Normal LV dimensions in 85%.	from 0.9 ± 0.3. RV function preserved 72% TAPSE 20.9 ± 5.0 S' 12.8 ± 3.3. RV dilated in 81.7% mostly mild in 45% RV base 3.7 ± 0.8. PAP and IVC not properly assessed and were mostly within normal.			ventricular (LV) wall thickness was present in 46 (69.7%) with similar incidence of elevated troponin and average troponin levels compared to normal wall thickness (66.7% vs 52.4%, P = .231; 0.88 ± 1.9 vs 1.36 ± 2.4 ng/mL, P = .772). LV dilation was rare (n = 6, 9.1%), as was newly reduced LV ejection fraction (n = 2, 3.0%).	SARS-CoV-2 but does not correlate with elevated D-dimer levels. Increased LV wall thickness is common, while newly reduced LV ejection fraction is rare, and neither correlates with troponin levels.
Teran F, et al.	Expert opinions	Severe	NA	NA	NA	NA	NA	The article discusses when TEE is of choice compared to TTE , no Echo parameters not discussed , no patient population mentioned , consensus and advisory for TEE	TEE is of choice in when TTE is inadequate in VV ecmo , cardiac arrest and prone ventilation and also for lung eval , no lung US scores.
Edgar García-Cruz et al .	Cross sectional study	14	Severe	6/14 had moderately reduced EF (not specified) , those	The mean TAPSE was 17.8 mm, the RV S wave 11.5 cm/s, and RV basal	NA	NA	NA	The study aim was to prove that TT echocardiographic images can be obtained to measure multiple parameters

				patient had low MAPSE (less than 13) , no other characteristics entioned for LV other than 4/16 had LVOT variability(no numbers)	diameter 36.6 mm. RV/LV ratio was <1 in all patients				during the prone position ventilation
Kerrilynn C. Hennessey et al.	Prospective study	135	NA	NA	NA	NA	NA	NA	TTE triage /deferring and cancelling non ICU patients did not affect the patient care.
Dweck et al.	Prospective study	1216	NA	55/100 – abnormal echo Left ventricular abnormalities were reported in 479 (39%) In those without pre-existing cardiac disease ($n = 901$), the echocardiogram was abnormal in 46%, and 13% had severe disease.	Right ventricular abnormalities - 397 (33%)	NA	NA	new myocardial infarction in 36 (3%), myocarditis in 35 (3%), and takotsubo cardiomyopathy in 19 (2%). Severe cardiac disease (severe ventricular dysfunction or tamponade) was observed in 182 (15%) patients.	Half the patients with COVID 19 had new abnormalities on echocardiogram, it changed management in third of patients
Bleakly et al.	Retrospective study	10 patents received ultrasound enhancing agents on VV ECMO		NA	NA	NA	NA	NA	A zero-flow mode can be used to ensure the bubbles from contrast will not shut down the ECMO system and ensure there is no back flow in the circuit
Giustiniano at el.	Retrospective study	107 prone patients with only 8 of them receiving echocardiog ram while proned	ICU	When prone, 6/18 did not have change in LVEF	When prone RV diameter reduced in 5/8 patients and increased In 2 PAPs decreased in 6/8 patients and	NA	NA	1/8 patients died, he had increased PAP after proning	NA

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Bursi F et al.	Prospective study	49	NA	NA	TAPSE, TAPSE/ PASP were significantly reduced in non survivors compared to survivors. No significant difference in RVFAC and PASP	LVGLS was significantly reduced in non survivors compared to survivors	RVGLS and RVFWS were significantly reduced in non-survivors compared to survivors	NA	Both RVFWS and RVGLS are predictive of death in COVID 19 patients (AUC 0.77 ± 0.08 in , $P = .008$, and 0.79 ± 0.04, $P = .004$, and this remained significant after controlling for multiple parameters
Liu et al.	Prospective study	43	ICU	LVSVi and E/E` were significantly reduced in non survivors compared to survivors ($p< 0.01$ and 0.01 respectively)	Non-survivors vs survivors RVDbasal, RVDbasal to apex and PASP were significanly increased (p0.049, 0.049, and 0.02 respectively) TAPSE, S` were significantly less (p<0.001 for both)	NA	NA	the strongest predictor of in-ICU death was decreased cardiac index [hazard ratio (HR), 0.67, 95% confidence interval (CI), 0.45–0.98; P = 0.041	Pericardial effusion (90.7%), increased left ventricular mass index (60.5%), LV mass was increased in 22 patients, however not different between survivals and non- survivals
.Krishnamoorthi P et al.	Prospective study	12	No-intubation or death vs intubated or died	LVEF and LVGLS was not significantly different between both groups (0.71 and 0.52 respectively)	RVGLS and RVFWS were significantly higher in patients who did not need intubation or survived (p= 0.007 for both) RVSP was not significantly different between both groups	NA	NA	NA	LVGLS was reduced in both groups, RVGLS and RVFWS were decreased in patients with poor outcomes.
Hani M. Mahmoud-Elsayed et al.	Retrospective study	35	Patients with cardiac symptoms		Right ventricle (RV) dilatation (41%) and RV dysfunction (27%). RV impairment was	NA	NA	NA	NA

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					associated with increased D-dimer and C-reactive protein levels				
Jain et al.	Retrospective study	72		43 patients had normal LVEF 25 reduced LVEF	RV size was normal in 50 patients and decreased in the rest. 34 patients had reduced RVEF	NA	NA	NA	There is a significance correlation LVEF and HS troponin (ρ = −0.34, P = .006) and LVEF and NT ProBNP (NT-proBNP and LVEF (ρ = −0.29, P = .056)
Evrard et al.	Case series	5 patients underwent TEE in prone position		TEE was more useful in determining eccentricity index	NA	NA	NA	NA	TEE may be more useful in prone patient to diagnose acute cor pulmonale and determine eccentricity index
Sud et al.	Retrospective study	24 patients with significant myocardial injury defined as cardiac toponin more 1ng/ml	10/24 were mechanically ventillated	13/24 patients had LV dysfunction. 11/24 had regional wall motion abnormalities, 4/11 within one single coronary vessel territory	Isolated RV dysfunction in 4/24 patients	NA	NA	Patients with LV dysfunction had median troponin of 12 ng/ml IQR, 5.8–27.0 ng/mL - Troponin was 1.5 ng/mL (IQR, 1.3– 3.1 ng/mL in patients with isolate RV dysfunction	In patients with severe chemical cardiac injury LV dysfunction was observed in almost 50% of patients.
Baycan et al.	Prospective study	100		GLS was more in severe group compared to non-severe and control. LV-GLS: - 14.5 ± 1.8 vs. - 16.7 ± 1.3 vs. - 19.4 ± 1.6, respectively [p <	RV-LS: Severe- 17.2 ± 2.3 vs. non severe - 20.5 ± 3.2 vs. Control - 27.3 ± 3.1, respectively [p < 0.001]	NA	NA	Patients in the severe group, LV-GLS and RV-LS were decreased compared to patients in the non-severe and control groups	LV-GLS and RV-LS are independent predictors of in-hospital mortality in patients with COVID-19.

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	0.001]	(LV-GLS: - 14.5 ± 1.8 vs. - 16.7 ± 1.3 vs. - 19.4 ± 1.6, respectively [p < 0.001]; RV-LS: - 17.2 ± 2.3 vs. - 20.5 ± 3.2 vs. - 27.3 ± 3.1, respectively [p < 0.001])

*: LVSVi (mL/m2): Left ventricular stroke volume index, PASP: pulmonary artery systolic pressure, TAPSE: tricuspid annular plane systolic excursion, LVEF: Left ventricular ejection fraction; LVGLS: Left ventricular global longitudinal strain; RVFWS: Right ventricular free wall strain; RVGLS: Right ventricular global longitudinal strain, RVSP: Right ventricular systolic pressure, WMA: Wall motion abnormality, Pw: posterior wall thickness.