Table 2: Studies reporting LUS findings in patients with COVID-19

Study	Design	N	COVID-19 severity	Ultrasonography probe	B line n/N	Consolidations n/N	Sub-pleural Lesions n/N	Micro Emboli n/N	Other	Sensitivity compared with other modality	Comments
Y Lichter et al.	Retrospective study	120	75- mild 31-moderate 14-severe	(CX 50, Philips Medical Systems	0/120	93/120	100/120	NA	Pleural effusion- 9	LUS cutoff of 18 (Sensitivity=62%, specificity=74%)	Base-line LUS score strongly correlates with the eventual need for invasive mechanical ventilation and is a strong predictor of mortality
S Ottaviani et al	Prospective study	21	NA	Esaote MyLabFive echograph	19	13	NA	NA	Median B score 6, C score 1.	Correlation coefficient of (r=0.935) between LUS and HRCT findings	LUS excellent correlation with lung involvement in HRCT, positive correlation with supplemental oxygen therapy.
Rojatti M et al	Retrospective study	41	All ICU cases	X-porte Fujifilm-Sonosite	NA	NA	NA	NA	Mean LUS score= 11.	LUS and IL-6 correlation(r = 0.52) LUS and oxygen correlation R= 0.3	LUS positively correlated with IL-6 and co2 levels, inverse with oxygen levels, and no correlation with respiratory system compliance.
Zhao et al	Prospective study	35	7 refractory ARDS, 28 non-refractory ARDS	M7 Expert ultrasound system	B line score 4 in refractory, 6.5 in non-refractory	Mean consolidation score of 1 in refractory vs. 0 in non-refractory	NA	NA	NA	LUS cutoff of 32 points for differentiating refractory disease with specificity of 89.4% and a sensitivity of 57%	LUS score helpful in differentiating refractory group vs. non-refractory with cutoff of 32
Bonadia N et al	Prospective	41	16/41 patients in ICU.	ATL s.r.l., Milan, Italy 6-MHz	NA	NA	NA	NA	NA	NA	Patients who died had Lung score of 1.43 and discharged had score of 1, patients requiring ICU admission had median score of 1.36

Table 2: Studies reporting LUS findings in patients with COVID-19

											compared to non-requiring score of 1.
Palmese F et al	Retrospective study	66	NA	NA	63/66	NA	7/66	NA	NA	NA	Lung ultrasound findings showed strong correlation with CT findings in terms of localization and degree of lung involvement
Zieleskiewicz L et al	Retrosepctive study	100	23/100	NA	96/100	32/100	6/100	NA	NA	An LUS score > 23 predicted severe SARS-CoV-2 pneumonia diagnosed by chest CT scan with a Sp > 90% and a PPV of 70%	The LUS score was predictive of pneumonia severity as assessed by a chest CT scan and clinical features
Shumilov et al		18	NA	Venue 50 and Logiq E9, GE	17/18	14/18	16/18	NA	NA	NA	LUS was especially useful to detect interstitial syndrome compared to CXR in COVID-19 patients (17/18 vs. 11/18; p<0.02). LUS also detected lung consolidations very effectively (14/18 for LUS vs. 7/18 cases for CXR; p<0.02).
Gaspardone et al.	Prospective study	70	Group 1: mild(no ventilator support) 27 Group 2: severe (ventilator support) 43	Prosound alpha6 system w/ UST 9123	LUSS score: Anterior areas: mild 21% vs. severe 36% (p=0.21) Posterior areas: mild 48% vs severe	NA	NA	NA	NA	NA	Classified as LUSS (lung ultrasound score).

Table 2: Studies reporting LUS findings in patients with COVID-19

					32% (p=o.21) Other areas no statisticall y significant difference seen.						
Youssef et al.	Prospective study	75	PCR + (n=3) 4% PCR – (n=72) 96%	NA	NA	NA	NA	NA	Lung Ultrasound normal in all patients.	Ultrasound Sensitive in symptomatic patients(no changes seen in pregnant asymptomatic patients) Not useful as a screening tool.	Pregnant women (median age 34, range ,24-48yrs) (median gestational age 38 weeks, range 25-40wks) Followed for median of 7 days (range 3-9 days)
Yael lichter et al.	Retrospective study	120	75: mild 31: moderate 14: severe	CX 50 Philips systems, phased-array probe.	0(0%)	NA	Sub-pleural consolid ations Severe: 53(71%) Moderat e: 27(87%) Mild:13 (93%) P=0.04	NA	Pleural thickening Severe: 57 (71%) Moderate: 27 (87%) Mild: 13(93%) P=0.009	Higher LUSS associated with worsening disease.	Quantitative LUSS score.
Lu W et al.	Retrospective study	30	Severe : (>19 points) Moderate (8-18	NA	27/30 (90%): B-lines. [15/30:	6/30 (20%) pulmonary consolidatio n	NA	NA	3/30 (10%) pleural thickening, 1/30 (3.3%)	NA	Distribution: 22/30 (73.3%): multiple distributions,

Table 2: Studies reporting LUS findings in patients with COVID-19

			points) Mild (1-7 points)		coalescent B-lines 5/30 : widely spaced B-lines (>7mm) 3/30 diffusely coalescent B-lines]				minimal pleural effusion 1/30(3.3%): pneumothorax .		5/30 (16.7%): Focal distribution. 22/30(73.3%) bilateral involvement 5/30(1.6%) unilateral involvement Majority distribution: Sub-pleural and peripheral zones, with the lower & dorsal regions.
Soldati et al.	Case series	3	Divided into: 1. Asymptomatic. 2. Non-severe 3. severe	RS85 system equipped with 3.6-5Mhz transducer	Patient 1: B/L anterior & posterior patchy vertical B lines. Patient 2: inhomogeneous vertical patchy B-lines in lateral & Posterolateral areas Patient 3: Separate vertical B lines anteriorly, confluent	Patient 1: Left basal Large consolidation w/ air bronchograms. Patient 2: bibasal large consolidations w/air bronchograms Patient 3: large left posterobasal consolidation	Patient 1: Small sub-pleural consolidation. Patient 2: small subpleural consolidations Patient 3: small subpleural consolidations	NA	Patient 2: minimal b/l pleural effusions	NA	Scanned B/L bases, posterior and lateral regions.

Table 2: Studies reporting LUS findings in patients with COVID-19

					B lines						
Aiosa G et. Al	Prospective study	11	Noncritical patients	Fujifilm sonosite edge II color UD device with convex array probe	9/11(81.8 %) B lines (separate, confluent, bundled)	3/11 (27.2%) consolidation	8/11 (72.7%) sub-pleural infiltrates (patchy, strips, nodule consolidation w/ air bronchograms)	NA	2/11 (18.1%) hepatization 1/11 (9.09%) Abscess 1/11 (9.09%) atelectasis 5/11 (45.4%) pleural effusion 9/11(81.8%) irregular b/l parietal pleura thickening	2/11 (18.1%) negative swabs and negative LUS findings. 9/11 (81.8%) with typical COVID-19 LUS findings. 3/11 (27.2%) nasopharyngeal swab PCR(+) 2/11 (18.1%) positive swab on pleural fluid. 6/11 (54.5%) remained negative.	Scanned 6 areas in each hemithorax (anterior, lateral & posterior) each area into superior & inferior. A total of 12 areas.
Jung EM et al.	Case series	11	11/11(100%) severe	CEUS B mode w/ multi-frequency probe	11/11(100%) B lines (various forms irregular, fragmented, multiple, focal coalescent)	11/11(100%) consolidations (Peripherally pronounced)	-	6/11 perfusion defects (irregular pleural enhancement w/ central devascularization, marginal hyperenhancement)	11/11 (100%) pleural hyperemia 2/11 atelectasis 6/11 perfusion defects	NA	(48 to 78 years, mean 61.8±8.7 years, 3 women)
Nouvenne A, et al	Prospective study	26	Stable patients as	convex 3.5–5 MHz and	Distinct B line 7	Parenchymal	Sub-pleural		Bilateral involve	NA	LUS score was significantly correlated

Table 2: Studies reporting LUS findings in patients with COVID-19

			critically ill patients and requiring ICU were excluded	linear 4–8 MHz probes	(27). Confluent B lines 17 (37).	consolidation 13 (50)	consolidation 17(73).		26(100). LUS 15+_5		with CT visual scoring ($r = 0.65$, $p < 0.001$) and oxygen saturation in room air ($r = –0.66$, $p < 0.001$).
Tan G, et al	Prospective study	12 with COVID 20 with CAP.	moderate type (4), severe type (4) Critical type (4)	-3.5–5 MHz convex array probe - 2–5 MHz	Rocket signs 4(12) Partially diffuse B lines 12(12). Completely diffuse B lines 10 (12)	0 (12)	5 (12)		Waterfall sign 4(12)	NA	The MLUS score could be used to evaluate severity and ttt of COVID. MLUS and HRCT were increasing with severity of disease and there is correlation in between.
Møller-Sørensen, Hasse et al.	Prospective study	10	Critical patients on ventilator and ECMO.	2 mHz linear probe (L12)	NA	NA	NA		NA	NA	LUS score was associated to CRP ($R = 0.34$; $p < 0.03$) and compliance ($R = 0.60$; $p < 0.0001$), with the strongest correlation to compliance
Yasukawa K, et al	Retrospective study	10	Mild to moderate cases. None required ventilator	Sonosite Edge II, Fujifilm Sonosite, Bothell,WA, with P19 transducer	Glass rocket 10(10) Septal rocket 2(10)	1(10)	5(10)		Birolleau Variant 5(10)	NA	. LUS is more sensitive than CXR in detection of interstitial findings.
Li S et al	Retrospective study	91	Severe and critical**		59/91 had scattered	48/91	6/91 pleural thickeni	NA	20/91 had pneumothorax	Not compared to other tests	Findings support the use of LUS for monitoring response to therapy in

Table 2: Studies reporting LUS findings in patients with COVID-19

					B lines 56/91 Confluent B lines		ng 39/91 had pleural effusion				sever and critical COVID-19
Pare et al	Retrospective cohort study	43 (27 positive Covid -19)	Not Specified	-	All patients were tested for B lines 24/27	10/27	21/27	NA	NA	Compared to CXR, LUS sensitivity: (88.9%, 95% confidence interval (CI), 71.1-97.0) CXR sensitivity: (51.9%, 95% CI, 34.0-69.3; p = 0.013). LUS specificity: 56.3% (95% CI, 33.2-76.9) CXR specificity: 75.0% (95% CI, 50.0-90.3	LUS was statistically significant Higher sensitivity: p = 0.013 Lower Specificity: p = 0.453 LUS considered positive if have B-lines
Mafort et al	Cross−sectional study	409	All symptomatic without mentioning the severity	Not mentioned	297/409 (72.6%) of participants had B-lines >2, 148/409 (36.2%) had coalescent B-lines	33/409 (8.06%)	NA	NA	NA	Ultrasound has a sensitivity and specificity of 89% and 94%, respectively, for the identification of parenchymal consolidation	The aeration score differed significantly regarding the presence of cough (P = .002), fever (P = .001), and dyspnea (P < .0001). The finding of sub-pleural consolidations in the LUS showed significant differences between participants with or without dyspnea

Table 2: Studies reporting LUS findings in patients with COVID-19

										(P < .0001) B−lines are the most common ultrasound sign, sub-pleural consolidations are those that most impact the respiratory condition
Yusuf et al.	Case series	3	Mild (home isolation)	POCUS butterfly	Not mentioned	3	3 1 had pleural effusion	3	NA	NA	Unique because of the use Contrast enhanced US for detecting micro infarctions secondary to COVID micro thrombi
Narinx et al.	Retrospective study	93	Not specified	Philips Sparq ultrasound system	Did not detail LUS findings.	Did not detail LUS findings.	Did not detail LUS findings.	Did not detail LUS findings.	NA	Compared with RT-PCR, POCUS lung demonstrated outstanding sensitivity and NPV (93.3% and 94.1% respectively) while showing poor values for specificity, PPV, and accuracy (21.3%, 19.2%, and 33.3% respectively).	NA
Yassa M et al.	Prospective study	8	Mild, moderate and Critical.	Convex transducers on a regular obstetric preset (EA720; Esaote SpA, Genoa, Italy).	NA	NA	NA	NA		Chest radiographic findings were negative and were not consistent with the LUS findings, chest CT showed similar findings as and was consistent with the LUS.	NA
Calvo-Cebrián A et al.	Prospective study	61	Moderate symptoms	MyLab 6 (convex transducer; Esaote SpA,	Coalescent B−lines 54.1%	Consolidation 31.1%	Not specified	Not specified	Irregular pleural line 27.9%	There was a significant association between the proposed LUS severity scale and the CXR severity scale: the	NA

Table 2: Studies reporting LUS findings in patients with COVID-19

				Genoa, Italy) and Butterfly iQ (Hitachi Medical Systems, Tokyo, Japan	Multiple separated B−lines 45.9%				Mild pleural effusion 6.6% Location of LUS findings: Bilateral 65.6%. Multifocal unilateral 6.6%. Unifocal 18%.	higher the grade of US involvement, the higher the grade of radiologic involvement.	
Smargiassi A et al.	Prospective study	38	19 in hospital and 19 isolated at home.	Wireless ultrasound (US) systems (ATL Srl, Milan, Italy), MyLabAlpha (Esaote SpA, Genoa, Italy), and Mindray DC−70 X−Insight (Mindray, Shenzhen, China).	NA	NA	NA	NA	NA	NA	NA
Alharthy A et al.	Prospective study	89	Severe	Phased array (2–4−MHz), convex (2−6−MHz), and linear (10–15−MHz) transducers connected to portable US machines	Separated B−lines 67.4% Confluent B−lines 78.6%	Consolidations 61.7% Lung parenchymal hepatization pattern (22.4%).	Sub-pleural consolidations (26.9%)	NA	Pleural line irregularities in >6 lung areas 78.6% Pleural effusions 22.4%	Did not compare to other imaging modalities	NA

Table 2: Studies reporting LUS findings in patients with COVID-19

						A "starry sky" pattern of consolidation (bright infiltrates) 49.4%			Small pneumothoraxes 3.37% Pericardial effusions 13.4% DVT 16.8%		
Castelao J et al.	Prospective	63	severe acute respiratory syndrome coronavirus 2 active infection	Lumify system (Philips Healthcare, Amsterdam, The Netherlands)	B7 pattern in 203 (26.8%). B-lines ≥7 mm apart B3 pattern in 143 (19%). B-lines, 3 mm or less apart.	C pattern in 159 (21%). Anterior alveolar consolidation(s).	NA	NA	A small unilateral pleural effusion was observed in 3 patients (4.8%).	Did not compare to other imaging modalities	NA
Fonsi GB et al	Prospective study	63 patients (44 COVID positive)	46 (73%) patients had moderate and 17 (27%) had severe symptoms.	Convex and linear vascular transducers (2.5–5 and 7.5–12 MHz, respectively) connected to a portable echograph (MyLab 25 Gold; Esaote SpA, Genoa, Italy).	≤2 nonconfluent or confluent 20% ≥3 nonconfluent or confluent 80%	Consolidation 45%	NA	NA	Air bronchogram 39% Pleural effusion 18% Pericardial effusion 0%	The sensitivity, specificity, PPV, and NPV of LUS for COVID−19 pneumonia were 68%, 79%, 88%, and 52%, respectively. Whereas for chest CT they were 93%, 90%, 85%, and 95%, respectively.	NA

Table 2: Studies reporting LUS findings in patients with COVID-19

									Thickened pleural line 86%		
Bar S et al.	Prospective study	100 adults of whom 31 had a positive SARS−CoV−2 RT−PCR	ARDS n=9 (29%), Admission to ICU n=8 (26%), Death n=6 (19%)	convex array transducer and ultrasound system (C5−2s™ and TE7, Mindray™; Shenzhen, China	Upper and lower anterior: Confluent B−lines n=3 (10%) Posterolateral: Confluent B−lines n=10 (32%)	Upper and lower anterior N=17 (54%) Posterolateral: n= 18 (58%)	NA	NA	Upper and lower anterior: Thickened pleural line n=24 (77%) Posterolateral: Thickened pleural line n=24 (77%)	NA	NA
Dargent A et al.	Prospective study	10	10 consecutive patients admitted in our ICU with moderate to severe ARDS	Not specified	Monitored LUS score over ICU course	Did not compare to other imaging modalities	NA	NA	NA	NA	NA