thank those who collaborated in the spreading and design of this survey. Also, thanks to all those who participated in the survey. This study falls within the framework of a doctoral thesis conducted at Universidad Autónoma de Barcelona Medical School, Barcelona, Catalonia, Spain.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.medin.2021.08.010.

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Use of thoracic ultrasound in the assessment and follow-up of seriously ill children due to pediatric inflammatory multisystemic syndrome: Observational prospective study☆

Utilidad de la ecografía torácica en la valoración y seguimiento del niño grave por síndrome inflamatorio multisistémico pediátrico: estudio prospectivo observacional

To the Editor,

In adults, the infection due to the new variant of SARS-CoV-2 coronavirus manifests as severe pneumonia and/or acute respiratory distress syndrome. In this group, thoracic ultrasound has proven extremely useful.[1–3] In children, its use for the management of Pediatric Multisystem Inflammatory Syndrome Temporally Associated with SARS-CoV-2 (PIMS-TS) was first described back in May 2020.[4] It can start as a severe illness including the development of myocarditis and cardiogenic shock. Respiratory symptoms in PIMS-TS are present in 30%–60% of the cases[4] and the use of imaging modalities like x-rays or ultrasounds is a common thing.

The objective of this study is to describe the observations made through thoracic ultrasound of a cohort of patients diagnosed with PIMS-TS. The possible clinical, therapeutic, and analytic correlate adds to this description with an intention to assess its possible utility. This was an observational, prospective, and descriptive study conducted from August 2020 through March 2021 in a tertiary hospital pediatric intensive care unit (PICU). All patients under 18 years with a diagnosis of PIMS-TS admitted during this period were included. The study has been approved by the center research ethics committee. No funding whatsoever was received to conduct the study.

After including the patient, before signing the informed consent, a thoracic ultrasound was performed within the first 24 h after admission, 48 h later, and before hospital discharge. In those patients who needed some kind of respiratory support, the ultrasound was performed after starting this support. Ultrasounds were performed by the lead investigator. The Sonosite M-Turbo® ultrasound sys-

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tem with high-frequency linear probe was used (6—13 MHz). A total of 12 areas were assessed (6 due to hemithorax) were assessed: 8 anterolateral, and 4 posterior (Appendix B; figure 1 of the electronic supplementary data). The scoring scale used was based on the study conducted by Smith et al.[5] Each area assessed received a maximum of 3 points, and the sum of each one of them defined the final score (Appendix B; figure 2 of the electronic supplementary data).

Data on demographics and therapeutics, care-related interventions, additional tests, and quantitative (score) and qualitative results (presence or absence of damage to anterior fields, pleural effusion, subpleural consolidations, interstitial pattern, white lung, pleural disorders) of the ultrasound were collected.

Categorical variables were described as absolute frequencies. Quantitative variables did not follow a normal distribution, and the median was used as a centrality measure, and the range as a dispersion measure. Data analysis was performed using non-parametric tests (Spearman correlation coefficient and Mann-Whitney U test). P values < .05 were considered statistically significant.

A total of 15 patients—10 males—without a significant past medical history were included. The RT-PCR tested positive for SARS-CoV-2 in 2/15 patients (both IgG-positive), and IgG-SARS-CoV-2 was found in 14/15 patients. Clinical-demographic characteristics are shown on Table 1. No patient died.

The median score in the ultrasound within the first 24 h was 14 points (3–27), and it was positively associated with the length of stay at the PICU setting (*P* = .038,

Table 1 Overall characteristics and data associated with admission.

	Median	Range
Age (years)	11	3.7—15.5
Days of evolution prior to admission	5	2—7
Length of stay [ICU (days)]	4	2—8
Length of stay [Hospital (days)]	9	6—20
PRIMS score (within first 24 h)	4	0—11
O_2 saturation at admission (%)	98	97—100
Heart rate at admission (bpm)	118	97—159
Mean arterial pressure (percentile)	P5—50	P5—50
Respiratory rate at admission (bpm)	28	18—41
$SatO_2/FiO_2$ at admission	350	260—460

PRIMS, Pediatric Risk Mortality Score[8]; $SatO_2/FiO_2$, oxygen saturation as measured by pulse oximetry (Spo2)/fraction of inspired oxygen (Fio2) (SF) ratio.

Table 2 Findings made on the thoracic x-ray, thoracic ultrasound score within the first 24 h, and maximum respiratory support needed by the patient.

No. of patient	Thoracic Rx at admission	Thoracic ultrasound score (<24 h)	Maximum respiratory support
1	Normal	6.00	Nasal cannula
2	Bilateral perihilar infiltrates, left consolidation in the retrocardiac region. Minimum bilateral pleural effusion	18.00	HFO
3	Normal	12.00	No support
4	Normal	7.00	No support
5	Normal	3.00	Nasal cannula
6	Bibasilar infiltrates with retrocardiac consolidation	18.00	Nasal cannula
7	Normal	14.00	Nasal cannula
8	No x-ray performed	7.00	Nasal cannula
9	Normal	12.00	HFOT
10	Retrocardiac opacity compatible with lower left lobe consolidation	26.00	HFOT
11	Bilateral perihilar peribronchial infiltrates	29.00	HFOT
12	Normal	20.00	Nasal cannula
13	Normal	11.00	No support
14	Consolidation in left lower lobe. Minimum bilateral pleural effusion.	27.00	HFOT
15	Normal	14.00	No support

The maximum respiratory support matches the respiratory support administered at admission.
HFOT, high-flow oxygen therapy; Rx, x-ray.

r = 0.5574). No association was found with the length of stay at the hospital (*P* = .893) (Appendix B; Table 1 of the electronic supplementary data). Damage was bilateral in all the cases, while the presence of «pleural disorders» was the most common finding (14/15) followed by the presence of «B lines» (13/15), «white lung» (12/15), and «subpleural consolidation» patterns (11/15).

Such findings persist on the ultrasound at discharge although in fewer areas, thus reducing the score obtained.

The number of areas with scores ≥2 per ultrasound performed revealed a median of 5 areas (0—11). More areas with scores ≥2 were associated with longer PICU stays (*P* = .008, r = 0.671) being non-significant compared to the length of stay at the hospital (*P* = .879). Damage to the anterior fields of both hemithoraxes and pleural effusion was reported in 10/15 patients, but this was totally unrelated to the length of stay (hospital/PICU).

Thoracic x-rays were performed in 14/15 patients, and disorders were found in 5 of these (Table 2). Regarding the remaining additional tests performed, no association was found between results and the score obtained within the first 24 h or the number of areas with scores ≥2 (Appendix B; Table 2 of the electronic supplementary data).

Upon arrival, 11 patients required some type of ventilation and the need for high-flow oxygen therapy (HFOT) was found in 5 patients (Table 2). No invasive/non-invasive mechanical ventilation was required whatsoever.

HFOT was kept for 5 days (3–8) in those patients who needed it, and overall, some type of ventilation (nasal cannula/ HFOT) was kept for 4 days (1–10). The need for HFOT was associated with higher scores in the ultrasound within the first 24 h, as well as with more areas with scores ≥2 (*P* = .018, and P = .023, respectively). However, it was totally unrelated to damage to the anterior fields or to the presence of pleural effusion (*P* = .439 and *P* = .464, respectively).

Regarding inotropic support, catecholamines were stared at admission in 7/15 patients. Noradrenaline was used in all the cases and changed for milrinone in 2 patients after confirmation of myocardial dysfunction (Appendix B; table 3 of the electronic supplementary data). A correlation was reported between the score obtained within the first 24 h, and the need for catecholamines (*P* = .005).

In the series described, the thoracic ultrasound allowed us to assess the pulmonary parenchyma at bedside in patients with PIMS-TS. In the sample studied ultrasound abnormalities were seen in all the patients even in those without radiographic damage showing greater sensitivity, which may have been interesting in the presence of clinical implications. Five patients showed radiographic damage, a similar finding to that made in in other studies.[6,7] Also, these patients had higher ultrasound scores.

Therefore, in our series, the ultrasound score within the first 24 h was associated with the use of HFOT, the need for inotropic drugs, and the length of stay at the PICU setting. Also, the number of areas with scores ≥2 was also useful and anticipated more days at the PICU, and the need for HFOT.

In conclusion, in the series study, performing a pulmonary ultrasound for the management of PIMS-TS seems to provide information of interest. The low number of cases included limits its external validity, which is a logical reason to keep investigating and developing multicenter trials to confirm our findings.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.medin.2021.08.008.

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