

## Mechanical Ventilation Strategies of Suspected COVID-19 Patients in Pediatric Intensive Care Unit

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### Abstract

**Background:** Paediatric patients with COVID-19 often require specialized mechanical ventilation (MV) approaches, particularly when presenting with respiratory complications. This work aimed to assess different ventilation strategies in pediatric intensive care for COVID-19 sufferers.

**Methods:** A prospective work had been performed on 120 paediatric patients (1-72 months) admitted to the Paediatric Intensive Care Unit, had been allocated into six groups depending on their clinical conditions and ventilation strategies: COVID-19-suspected on conventional MV (Group I) or high-frequency oscillatory ventilation (HFOV) (Group II), non-COVID ARDS on conventional MV (Group III) or HFOV (Group IV), and non-COVID/non-ARDS on conventional MV (Group V) or HFOV (Group VI).

**Results:** COVID-19 patients showed significantly higher Oxygenation Index (OI) and Oxygen Saturation Index (OSI) compared to non-COVID groups. The  $PaO_2/FiO_2$  (P/F) and  $SpO_2/FiO_2$  (S/F) ratios were significantly lower in COVID-19 groups. The S/F ratio demonstrated predictive value for ventilation duration (cutoff >165, sensitivity 64%, specificity 60%) and mortality (cutoff >176, sensitivity 72%, specificity 64%).

**Conclusions:** COVID-19 pediatric patients exhibit distinct ventilation parameters compared to non-COVID patients, with the S/F ratio serving as a potential indicator for ventilation duration and fatality.

**Key words:** COVID-19, mechanical ventilation, pediatric intensive care, oxygenation index, high-frequency oscillatory ventilation.

### Introduction

Pediatric patients with confirmed or suspected COVID-19 often require specialized approaches to mechanical ventilation (MV), particularly when presenting with respiratory consequences particularly pediatric acute respiratory distress syndrome (PARDS) [1, 2]. MV strategies must balance effective oxygenation with minimizing the risk of ventilator-induced lung injury (VILI) [3, 4]. The unique physiology and clinical presentation of children necessitate adaptations of adult ventilation practices to pediatric contexts, integrating both conventional and advanced modalities to achieve optimal outcomes [5].

The modes of MV are broadly categorized into conventional and non-conventional techniques [5, 6]. Conventional modes include pressure-controlled and volume-controlled, pressure support and synchronized intermittent mandatory ventilation methods [7, 8]. These approaches prioritize maintaining effective tidal volumes ( $V_t$ ), ensuring adequate oxygenation, and preventing barotrauma [6, 9]. Non-conventional strategies, such as high-frequency oscillatory ventilation (HFOV), offer potential advantages in cases of severe lung injury, emphasizing alveolar recruitment and minimizing VILI [5].

COVID-19 in pediatric patients presents unique epidemiologic and clinical patterns. While most children experience asymptomatic or mild disease, a subset may develop severe complications, including multisystem inflammatory syndrome in children (MIS-C) and PARDS [10, 11]. MIS-C represents a hyperinflammatory state that often manifests weeks after the acute phase of SARS-CoV-2 infections, characterised by persistent fever, gastrointestinal symptoms, rash, and myocardial dysfunction [12, 13].

PARDS poses significant challenges in pediatric intensive care. Defined by criteria such as OI and OSI, it

reflects severe alveolar-capillary barrier disruption, often necessitating invasive MV [14, 15]. However, MV itself can exacerbate lung injury if not meticulously managed [3, 4]. Strategies for PARDS focus on lung-protective ventilation, including low Vt settings and the utilisation of positive end-expiratory pressure (PEEP) to optimize alveolar recruitment without overdistension [6, 16, 17].

The integration of advanced respiratory support modalities, such as extracorporeal membrane oxygenation, is reserved for refractory cases where conventional methods fail to achieve adequate gas exchange [18].

Despite these advances, significant gaps remain in the evidence base for pediatric MV during COVID-19. Therefore, this work aimed to address recommendations for managing MV support of COVID-19 patients in the paediatric intensive care unit (PICU).

#### **Patient and method:**

A prospective work had been performed on 120 pediatric patients aged one to 72 months, who were admitted to the PICU at Tanta University Hospital. The research spanned from September 2020 to June 2022 and received approval from the ethics committee of the Faculty of Medicine at Tanta University. Informed consent had been gathered from the guardians of all participating patients.

The subjects had been categorized into six groups depending on their clinical conditions and ventilation strategies. Group I included 20 patients suspected of COVID-19 managed on conventional MV, while Group II consisted of 20 COVID-19-suspected patients managed on HFOV. Group III and Group IV each comprised 20 individuals with ARDS owing to non-COVID-19 causes, managed on conventional MV and HFOV, respectively. Group V and Group VI included 20 patients each who were ventilated for reasons other than COVID-19 or ARDS, with Group V managed on conventional MV and Group VI on HFOV.

Patients requiring non-ventilated patients and those with brain death were excluded.

Each participant had been submitted to a comprehensive clinical evaluation, that include detailed history-taking with emphasis on the onset, severity, duration, and progression of respiratory symptoms, as well as travel or contact history related to COVID-19. A thorough clinical examination was performed, focusing on vital signs, general appearance, and chest and cardiac findings. Disease severity had been evaluated utilising the Pediatric Risk of Mortality Score (PRISM III) within the first 24 hours and the Pediatric Sequential Organ Failure Assessment (pSOFA) score at admission, 24 hours, and 48 hours.

Laboratory tests involved full blood picture, erythrocyte sedimentation rate, C-reactive protein, blood culture, arterial blood gases, sputum culture, serum albumin, liver enzymes, urea, serum creatinine, electrolytes, D-dimer, serum ferritin, and interleukin-6 (IL-6) levels. Chest imaging was conducted using initial X-rays and computed tomography (CT) scans, with follow-up imaging performed as clinically indicated. Lung ultrasound (LUS) was utilized for monitoring lung lesions, with a scoring system ranging from 0 to 36 points depending on aeration patterns.

The inferior vena cava (IVC) distensibility index (DI) was measured using bedside ultrasonography to assess volume status in mechanically ventilated patients. Measurements were taken in the supine position using a 2–5 MHz convex probe, with the IVC diameter recorded during inspiration and expiration.

Therapeutic interventions included circulatory support with intravenous fluids, inotropes, and vasopressors. MV was initiated based on the severity of lung pathology and oxygenation status. Conventional ventilation was performed using various modern ventilators, with settings tailored to individual patient needs. HFOV was employed as a rescue therapy for refractory hypoxemia or in cases of moderate to severe ARDS. Ventilator settings for HFOV included mean airway pressure (MAP), pressure amplitude, and frequency, with continuous monitoring of PaCO<sub>2</sub> and SpO<sub>2</sub>.

Adjunctive therapies included prone positioning for at least 16 hours in half of the patients in each group and the administration of neuromuscular blocking agents (cisatracurium) during the first 24–48 hours. Adequate sedation was maintained using midazolam IV infusion to ensure patients were asleep but easily arousable.

#### **Statistical analysis**

Data went through processing and analysis utilising IBM SPSS version 20 (IBM Corp, NY: Armonk). The Kolmogorov-Smirnov test was employed to evaluate the normality of the data. Qualitative data were expressed numerically employing frequencies and percentages, while quantitative data had been displayed employing mean, standard deviation (SD). Statistical significance was determined at the 5% level. Analyses included the Chi-square test for categorical parameters, Fisher's Exact, and Student's t-test and ANOVA (with Tukey's Post

Hoc) for normally distributed quantitative parameters. Diagnostic measures included specificity, sensitivity, positive and negative predictive values, and accuracy, calculated as the rate of agreement between true positives and negatives relative to the total sample.

**Results:**

Demographic data were comparable between groups. Table 1

**Table 1:** Demographic Data of the Studied Groups

	Group I	Group II	Group III	Group IV	Group V	Group VI	P value
Age (months)	22.35 ± 9.49	23.65 ± 14.04	21.70 ± 17.23	17.98 ± 14.86	27.45 ± 21.10	23.00 ± 16.70	0.597
Height (cm)	79.70 ± 20.97	74.65 ± 14.95	74.65 ± 19.09	71.80 ± 14.76	79.55 ± 21.84	72.25 ± 17.15	0.617
Weight (kg)	19.18 ± 11.06	17.43 ± 9.04	14.90 ± 6.49	14.45 ± 5.41	17.70 ± 12.57	13.48 ± 8.28	0.321
Sex	Male	15 (75%)	11 (55%)	12 (60%)	12 (60%)	13 (65%)	0.792
	Female	5 (25%)	9 (45%)	8 (40%)	8 (40%)	7 (35%)	

Data are presented as mean ±SD or frequency (%).

The OI measurements revealed a substantially greater OI in Group I contrasted to Groups III and V among those on conventional MV, and a substantially greater OI in Group II contrasted to Groups IV and VI among those on HFOV, at admission and after 24 and 48 hours. Table 2

**Table 2:** Comparison of OI between the studied groups on admission, 24 hours, and 48 hours after admission.

	Group I	Group II	Group III	Group IV	Group V	Group VI	P value
On admission	12.28 ± 5.83	31.33 ± 15.05	7.75 ± 2.85	18.82 ± 5.93	4.18 ± 0.83	3.36 ± 0.29	0.001*
24 h.	13.00 ± 6.50	30.00 ± 13.38	7.86 ± 3.18	18.00 ± 5.04	4.78 ± 1.59	3.50 ± 0.28	0.001*
48 h.	13.40 ± 6.92	28.16 ± 13.36	7.56 ± 4.59	15.45 ± 5.60	4.00 ± 0.55	3.50 ± 0.24	0.001*

Data are presented as mean ±SD. \*: Statistically significant at  $p \leq 0.05$ .

The OI demonstrated a significant positive association with the pSOFA score, ventilation duration, length of stay (LOS), PEEP, peak inspiratory pressure (PIP) on admission, driving pressure ( $\Delta P$ ), MAP, OSI on admission, CO-RADS staging on chest CT, IL-6, D-dimer, and serum ferritin. Conversely, OI showed a significant negative correlation with lymphocyte count, dead space fraction index (DI),  $PaO_2/FiO_2$  (P/F) ratio,  $SpO_2/FiO_2$  (S/F) ratio, and  $V_t$  on admission. No significant correlations were observed between OI and other parameters. Table 3

**Table 3:** Correlation of OI on admission with other significant parameters

		OI on admission
DI%	r	-0.348
	p	<0.001*
Lymphocytes %	r	-0.232
	p	0.011*
IL-6 (pg/mL)	r	0.356
	p	<0.001*
D-DIMER ( $\mu g/mL$ )	r	0.215
	p	0.019*
S. Ferritin ( $\eta g/dL$ )	r	0.337
	p	<0.001*
CO-RAD staging on CT chest	r	0.503
	p	<0.001*

OSI on admission	r	00.818
	p	<0.001*
PaO2/FiO2 ratio on admission (mmHg)	r	-0.679
	p	<0.001*
SpO2/FiO2 ratio on admission	r	-0.642
	p	<0.001*
PIP on admission (cm H2O)	r	0.395
	p	0.002*
PEEP on admission (cm H2O)	r	0.532
	p	<0.001*
Vt on admission(ml/kg)	r	-0.407
	p	0.001*
MAP (cm H2O)	r	0.281
	p	0.030*
ΔP	r	0.509
	p	<0.001*
PRISM score	r	-0.136
	p	0.300
LOS (days)	r	0.428
	p	<0.001*
Ventilation duration	r	0.418
	p	<0.001*
pSOFA score	r	0.478
	p	<0.001*
Prone position	r	-0.029
	p	0.756

DI: distensibility index, ΔP: amplitude (variation around MAP) FiO2: fraction of inspired oxygen, IL-6: interleukin 6, µg/ml: Microgram per milliliter, MAP: mean airway pressure, OI: Oxygenation index, OSI: Oxygen Saturation index, pg/ml: Pico grams per milliliter, PRISM: Pediatric Risk Of Mortality Score, PIP: peak inspiratory pressure, PEEP: Positive End Expiratory Pressure, PaO2: measures the partial pressure of oxygen, SpO2: oxygen saturation, pSOFA: Sequential Organ Failure Assessment Score, Vt: tidal volume. r : correlation, \*: Statistically significant at  $p \leq 0.05$ .

A significant increase in the Oxygenation Saturation Index (OSI) in Group I compared to Groups III and V among patients on conventional MV at admission, as well as after 24 and 48 hours. Similarly, among patients on HFOV, OSI was substantially greater in Group II contrasted to Groups IV and VI at these time points. Furthermore, both OI and OSI were significantly higher in Groups II and IV (on HFOV) contrasted to Groups I and III (on conventional MV). No other significant differences were observed among the studied groups. Table 4

**Table 4:** Comparison of OSI between the studied groups on admission, 24 hours, and 48 hours after admission.

	Group I	Group II	Group III	Group IV	Group V	Group VI	P value
On admission	12.88 ± 5.27	24.32 ± 9.62	7.91 ± 2.84	18.40 ± 6.77	4.00 ± 0.55	3.81 ± 0.53	0.001*
24 h.	14.12 ± 5.09	23.10 ± 7.82	10.38 ± 2.12	20.08 ± 4.54	4.64 ± 1.14	3.80 ± 1.06	0.001*
48 h.	15.07 ± 6.14	25.17 ± 6.38	9.64 ± 2.25	19.80 ± 3.91	4.88 ± 1.12	3.77 ± 1.30	0.001*

Data are presented as mean ±SD. \*: Statistically significant at  $p \leq 0.05$ . ARDS: acute respiratory distress Syndrome, COVID: coronavirus disease 2109, HFOV: high-frequency oscillatory Ventilation, MV: mechanical ventilation, OSI: Oxygen Saturation index.

A significant decrease in the P/F ratio in Group I contrasted to Groups III and V among patients on conventional MV at admission, as well as after 24 and 48 hours. Similarly, among patients on HFOV, the P/F ratio was

substantially lower in Group II contrasted to Groups IV and VI at these time points. No other substantial variations had been demonstrated among the studied groups. Table 5

**Table 5:** Comparison of partial pressure of oxygen over fraction of inspired oxygen (PaO2/FiO2) ratio between the studied groups on admission, 24 hours, and 48 hours after admission.

	Group I	Group II	Group III	Group IV	Group V	Group VI	P value
On admission	127.60 ± 40.85	81.05 ± 29.48	171.65 ± 54.50	119.46 ± 47.24	338.60 ± 30.84	340.70 ± 23.29	0.001*
24 h.	119.95 ± 46.81	91.35 ± 28.20	203.05 ± 48.72	143.30 ± 54.10	330.90 ± 41.03	353.00 ± 33.34	0.001*
48 h.	138.85 ± 35.62	100.25 ± 32.55	186.70 ± 56.15	154.60 ± 51.46	352.00 ± 37.83	370.2 ± 34.69	0.001*

Data are presented as mean ±SD. \*: Statistically significant at p ≤ 0.05. ARDS: acute respiratory distress Syndrome, COVID: coronavirus disease 2109, FiO2: fraction of inspired oxygen, HFOV: high-frequency oscillatory Ventilation, MV: mechanical ventilation PaO2: measures the partial pressure of oxygen.

The P/F ratio showed a significant positive correlation with lymphocyte count, DI, PRISM score, S/F ratio, and Vt on admission. Conversely, it exhibited a significant negative correlation with the pSOFA score, ventilation duration, LOS, PEEP on admission, ΔP, MAP, OSI on admission, CO-RADS staging on chest CT, IL-6, D-dimer, and serum ferritin. No other significant correlations were observed between the P/F ratio and other parameters. Table 6

**Table 6:** Correlation of partial pressure of oxygen over fraction of inspired oxygen (PaO2/FiO2) ratio on admission with other significant parameters

		P/F ratio on admission
DI%	r	0.502
	p	<0.001*
Lymphocytes %	r	0.285
	p	0.002*
IL-6 (pg/mL)	r	-0.262
	p	0.004*
D-DIMER (µg/mL)	r	-0.209
	p	0.022*
S.Ferritin (ng/dL)	r	-0.406
	p	<0.001*
CO-RAD staging on CT chest	r	-0.604
	p	<0.001*
OI admission	r	-0.679
	p	<0.001*
OSI admission	r	-0.744
	p	<0.001*
SpO2/FiO2 ratio on admission	r	0.956
	p	<0.001*
PIP on admission (cm H2O)	r	-0.228
	p	0.079
PEEP on admission (cm H2O)	r	-0.756
	p	<0.001*
Vt on admission(ml/kg)	r	0.633
	p	<0.001*
MAP (cm H2O)	r	-0.364
	p	0.004*
ΔP	r	-0.431
	p	0.001*

PRISM score	r	0.311
	p	0.016*
LOS	r	-0.323
	p	<0.001*
Ventilation duration	r	-0.271
	p	0.003*
pSOFA score (day 1)	r	-0.492
	p	<0.001*
Prone position	r	0.058
	p	0.527

DI: distensibility index, ΔP: amplitude (variation around MAP) FiO2: fraction of inspired oxygen, IL-6: interleukin 6, μg/ml: Microgram per milliliter, MAP: mean airway pressure, OI: Oxygenation index, OSI: Oxygen Saturation index, pg/ml: Pico grams per milliliter, PRISM: Pediatric Risk Of Mortality Score, PIP: peak inspiratory pressure, PEEP: Positive End Expiratory Pressure, PaO2: measures the partial pressure of oxygen, SpO2: oxygen saturation, pSOFA: pediatric Sequential Organ Failure Assessment Score, Vt: tidal volume. r : correlation, \*: Statistically significant at  $p \leq 0.05$ .

A substantial reduction in the S/F ratio in Group I contrasted to Groups III and V among patients on conventional MV at admission, as well as after 24 and 48 hours. Similarly, among patients on HFOV, the S/F ratio was substantially lower in Group II contrasted to Groups IV and VI at these time points. Additionally, the S/F ratio was significantly lower in Groups II and IV (on HFOV) compared to Groups I and III (on conventional MV). No other substantial variations had been demonstrated among the studied groups. Table 7

Table 7: Comparison of oxygen saturation over fraction of inspired oxygen (SpO2/FiO2) ratio between the studied groups on admission, 24hours and 48 hours after admission

	Group I	Group II	Group III	Group IV	Group V	Group VI	P value
On admission	117.30 ± 17.13	80.25 ± 9.78	138.05 ± 28.06	104.10 ± 18.83	293.65 ± 25.0	301.90 ± 25.52	0.001*
24 h.	125.85 ± 21.23	88.60 ± 9.39	161.20 ± 30.33	100.40 ± 17.38	300.70 ± 37.73	310.85 ± 33.66	0.001*
48 h.	129.90 ± 25.17	89.65 ± 10.92	167.95 ± 26.09	105.20 ± 21.29	324.35 ± 22.37	328.80 ± 26.31	0.001*

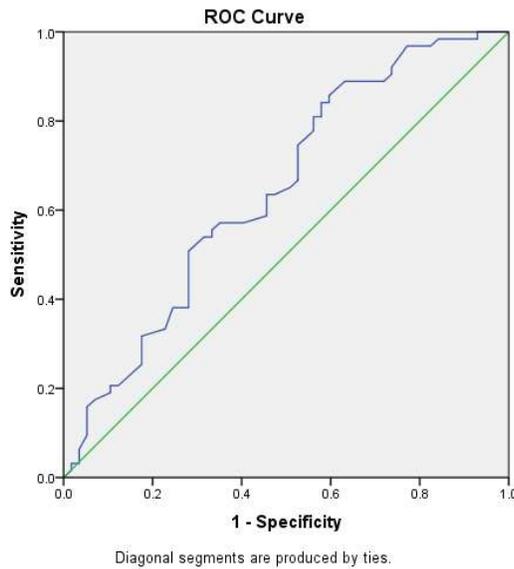
Data are presented as mean ±SD. \*: Statistically significant at  $p \leq 0.05$ . ARDS: acute respiratory distress Syndrome, COVID: coronavirus disease 2109, FiO2: fraction of inspired oxygen, HFOV: high-frequency oscillatory Ventilation, MV: mechanical ventilation, SpO2: oxygen saturation.

The S/F ratio demonstrated a significant area under the curve (AUC) of 0.645 for predicting ventilation duration, with a cut-off value of >165. At this threshold, the S/F ratio exhibited a sensitivity of 64%, specificity of 60%, accuracy of 63%, positive predictive value (PPV) of 62%, and negative predictive value (NPV) of 67%. Table 8, Figure 1

Table 8: Agreement (Sensitivity, Specificity) for oxygen saturation over fraction of inspired oxygen (SpO2/FiO2) ratio with ventilation duration

Ventilation duration (days)	AUC	Cutoff	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
S/F	0.645	> 165	64	60	62	67	63	0.006*

AUC: Area Under a Curve, NPV: Negative predictive value. PPV: Positive predictive value, P/F: PaO2/FiO2 Ratio, S/F: SpO2/FiO2 ratio. \*: Statistically significant at  $p \leq 0.05$ .

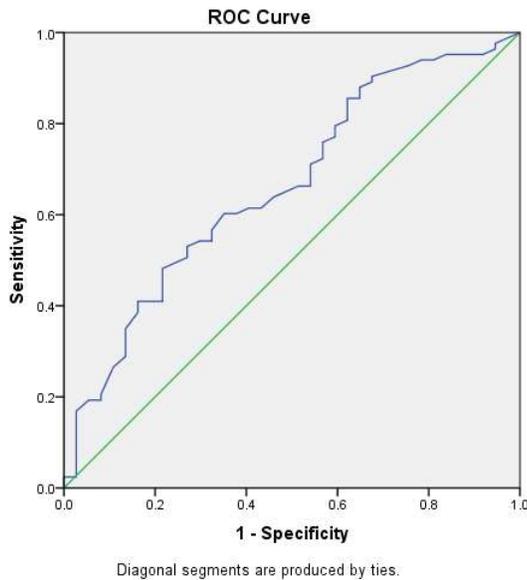


**Figure 1:** Receiver Operating Characteristic (ROC) Curve for S/F Ratio to Predict Ventilation Duration. The S/F ratio demonstrated a significant AUC of 0.663 for predicting mortality, with a cut-off value of >176. At this threshold, the S/F ratio showed a sensitivity of 72%, specificity of 64%, accuracy of 67%, PPV of 72%, and NPV of 65%. Table 9, Figure 2

Table 9: Agreement (sensitivity, specificity) for oxygen saturation over fraction of inspired oxygen (SpO2/FiO2) ratio in relation to mortality

Mortality	AUC	Cutoff	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
S/F ratio	0.663	> 176	72	64	72	65	67	0.004*

AUC: Area Under a Curve, NPV: Negative predictive value. PPV: Positive predictive value, S/F: SpO2/FiO2 ratio. \*: Statistically significant at  $p \leq 0.05$ .



**Figure 2:** Receiver Operating Characteristic (ROC) Curve for oxygen saturation over fraction of inspired oxygen (SpO2/FiO2) Ratio to Predict Mortality.

## Discussion

The advancement of medical science and technology has substantially improved outcomes for critically ill children [19], with PICU focusing on early intervention and quality care to enhance prognoses [20]. The COVID-19 catastrophe posed unprecedented difficulties to healthcare systems worldwide, with SARS-CoV-2 respiratory infections potentially progressing to severe pneumonia and ARDS, often necessitating MV [21].

COVID-19 ARDS was associated with significant hematological abnormalities, including lymphopenia and thrombocytopenia, consistent with the findings of Palladino et al. [22]. These abnormalities are likely due to direct viral effects on bone marrow and immune-mediated destruction of platelets. Elevated D-dimer levels, indicative of a hypercoagulable state, were also demonstrated in COVID-19 patients, corroborating the findings of Grasselli et al. [23]. This suggests that thromboembolic complications play a critical role in the pathophysiology of COVID-19 ARDS, necessitating vigilant monitoring and potential anticoagulation therapy. Serum ferritin levels had been substantially elevated in COVID-19 ARDS patients, reflecting a robust inflammatory response. Coomes et al. [24] similarly reported that high ferritin levels are associated with cytokine storm and poor outcomes in COVID-19 sufferers. IL-6, a key mediator of inflammation, was also elevated in COVID-19 ARDS. However, Sinha et al. [25] reported lower IL-6 levels in COVID-19 sufferers contrasted to bacterial ARDS, highlighting the heterogeneity of cytokine responses in different ARDS phenotypes.

Imaging studies revealed that ground-glass opacities predominated in COVID-19 ARDS, as reported by Yoon et al. [26] and Colombi et al. [27]. LUS scores were predictive of mortality and length of PICU stay, with a sensitivity of 83% and specificity of 76% at a cutoff value of 16. This is in line with Sun et al. [28], who found that LUS is a valuable tool for assessing interstitial and alveolar-interstitial lung disease in COVID-19 patients. The study compared conventional MV and HFOV in COVID-19 and non-COVID-19 ARDS patients. COVID-19 ARDS patients on conventional MV had lower P/F ratios compared to non-COVID-19 ARDS patients, consistent with the findings of Shi et al. [29] and Chiumello et al. [30]. This suggests that COVID-19 ARDS is associated with more severe hypoxemia, likely due to pulmonary thromboembolic complications and diffuse alveolar damage.

HFOV was associated with worse oxygenation indices in COVID-19 ARDS patients, as reported by Gattinoni et al. [31]. This may be attributed to the severe lung pathology in these patients, which limits the effectiveness of HFOV. The study also found that higher PEEP levels were required in COVID-19 ARDS patients, particularly those with high CO-RAD staging, as noted by Somhorst et al. [32]. However, Grasselli et al. [23] suggested that lower PEEP levels may be appropriate in COVID-19 ARDS patients with high static compliance, highlighting the need for individualized ventilation strategies.

The DI emerged as a novel predictor of mortality in pediatric COVID-19 ARDS patients. The DI cutoff value of  $>16$  had a sensitivity of 83% and specificity of 76% for predicting mortality. Manzur-Sandoval et al. [33] similarly reported that a DI  $>18\%$  was protective against fatal outcomes in adult COVID-19 patients. This underscores the importance of cautious fluid management in COVID-19 ARDS, as volume overload can exacerbate lung injury and impair cardiac function.

The study found that COVID-19 ARDS patients possess a greater mortality rate contrasted to non-COVID-19 ARDS patients, consistent with the findings of Gattinoni et al. [31] and Grasselli et al. [23]. The mortality rate was positively associated with IL-6 and D-dimer levels, reflecting the role of cytokine storm and thromboembolic events in disease progression. Prone positioning was associated with improved survival, particularly in COVID-19 ARDS patients, as reported by Bain et al. [34]. This suggests that prone positioning should be considered a rescue therapy in pediatric COVID-19 ARDS patients with severe hypoxemia.

Logistic regression analysis identified several predictors of prolonged PICU stay and ventilation duration, including DI, IL-6, serum ferritin, CO-RAD staging, oxygenation indices, and LUS scores. These findings are consistent with Rees et al. [35], who reported that COVID-19 patients in China had longer hospital stays due to severe disease and cytokine storm.

The study's single-center design and relatively small sample size may limit generalizability of findings. The study's observational nature prevents definitive causal relationships from being established. Additionally, the inability to conduct long-term follow-up of ventilation outcomes.

### Conclusion

Pediatric COVID-19 patients exhibit significantly compromised oxygenation parameters compared to non-COVID patients, as evidenced by elevated OI and OSI values, and decreased P/F and S/F ratios. The S/F ratio emerged as a valuable prognostic indicator for both ventilation duration and mortality outcomes. These findings suggest that distinctive ventilation strategies may be necessary for pediatric COVID-19 patients, with careful monitoring of oxygenation indices to optimize respiratory support and improve clinical outcomes.

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**Conflict of Interest:** Nil.

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