

**SpO<sub>2</sub>/FiO<sub>2</sub> and PaO<sub>2</sub>/FiO<sub>2</sub> for Predicting Intensive Care Admission in Wheezy Children: An Observational Study**

**Rakhi Beniwal, Prerna Batra, Vikram Bhaskar, Deepika Harit**

*Departments of Pediatrics, University College of Medical Sciences and Guru Teg Bahadur Hospital, Delhi, India*

*Correspondence to:* Dr Prerna Batra, Director Professor, Department of Pediatrics University College of Medical Sciences and Guru Tegh Bahadur Hospital, Delhi, India. *Email:* [drprernabatra@yahoo.com](mailto:drprernabatra@yahoo.com)

Received: Jan 08 2024; Initial review: Feb 14, 2024; Accepted: Apr 17, 2024

**PII: S097475591600642**

**Note:** This early-online version of the article is an unedited manuscript and under editorial revision. It has been posted to the website for making it available to readers, ahead of its publication in print. This version will undergo copy-editing, typesetting, and proofreading, before final publication; and the text may undergo minor changes in the final version.

**ABSTRACT**

**Objective:** To determine the sensitivity of cut-off of SpO<sub>2</sub>/FiO<sub>2</sub> (SF ratio) < 300 at hospital admission for predicting the need for admission in the pediatric intensive care unit (PICU) in wheezy children. Secondary objectives were to determine the sensitivity of cut-off of SF ratio < 300 for predicting in-hospital mortality and that of PaO<sub>2</sub>/FiO<sub>2</sub> (PF ratio) < 200 for predicting intensive care admission and in-hospital mortality. We also ascertained the correlation between SF ratio and PF ratio in the above population.

**Methods:** This observational study was conducted on 315 wheezy children aged 6 months to 12 years requiring admission in the pediatric emergency department. Oxygen saturation (SpO<sub>2</sub>) and fraction of oxygen in inspired air (FiO<sub>2</sub>) were recorded at admission while the partial pressure of oxygen (PaO<sub>2</sub>) was measured using arterial blood gas analysis performed within half an hour of admission. All children were managed as per protocol and followed up during hospital stay. Outcome was defined as the need for admission in the pediatric intensive care unit (PICU) or in-hospital mortality.

**Results:** Cut-offs of SF ratio < 300 and PF ratio < 200 was able to determine the need PICU admission with a sensitivity of 97.30% and 62.16% respectively. The best cut-off of SF ratio for predicting PICU admission was < 178.79 [AUC (95% CI) 0.841 (0.767 - 0.914)], while that for PF ratio was < 201.81 [AUC (95% CI) 0.849 (0.775 - 0.924)]. Cut-offs of < 300 for SF ratio and < 200 of PF ratio, were able to predict in-hospital mortality with sensitivity of 100%, but specificity of only 3.33% and 46.67%, respectively. There was only a fair correlation between SF ratio and PF ratio ( $r = 0.44$ ,  $P < 0.001$ ).

**Conclusion:** SpO<sub>2</sub>/FiO<sub>2</sub> cut-off of < 300 had a good sensitivity in determining need for PICU admission. SF ratio has only a moderate correlation with PF ratio.

**Keywords:** Asthma, Emergency, Oxygen saturation, Pediatric, Wheezing

**INTRODUCTION**

Approximately 25-30% of children have at least one episode of wheezing during infancy, which increases to 40% by 3 years and 50% by 6 years of age [1]. Worldwide, the prevalence of asthma, the most common cause of recurrent wheeze, is reported to be 18%. International Study of Asthma and Allergies in Childhood (ISAAC) estimated the prevalence of childhood asthma to be around 7% in children aged 6-14 years in India, with a male predominance [2]. This emphasizes the need for timely identification of high-risk wheezy children in emergency to aid focussed utilization of resources and thus, improve the outcomes.

Ratio of percentage oxygen saturation (SpO<sub>2</sub>) and fraction of oxygen in inspired air (FiO<sub>2</sub>) i.e., SpO<sub>2</sub>/FiO<sub>2</sub> (SF ratio) has been used in various studies as a marker of severity of disease. Colunga et al observed that SF ratio could be a useful non-invasive outcome predictor in children with acute respiratory failure [3]. Rice et al demonstrated a linear relation between the SF ratio and the ratio of partial pressure of oxygen (PaO<sub>2</sub>) and FiO<sub>2</sub> (PF ratio) in adults with acute lung injury or acute respiratory distress syndrome [4]. The results are particularly useful considering that PaO<sub>2</sub> values might not be available in a large number of cases. Leteure et al concluded that SF ratio had the potential to replace PF ratio when predicting the Pediatric Index Mortality 2 (PIM2) score in children admitted in the pediatric intensive care unit (PICU) with respiratory failure [5].

We planned this study with the primary objective of determining the sensitivity of a cut-off of SF ratio < 300 at hospital admission for predicting the need for admission to pediatric intensive care unit (PICU) in

wheezy children. Our secondary objectives were to determine the sensitivity of PF ratio cut-off of < 200 for predicting admission to PICU. We also aimed to assess the performance of SF ratio and PF ratio in predicting in-hospital mortality in these children. We also ascertained the correlation between SF ratio and PF ratio.

## METHODS

This observational study was conducted in the pediatric emergency and the PICU of a tertiary care teaching hospital in north India, over a period of 20 months, from January 2021 to August 2022. The study was approved by the institutional ethics committee.

All children aged 6 months to 12 years presenting to the pediatric emergency with a wheezy illness were screened for enrolment. Wheeze was identified on the basis of clinical examination performed by the principal investigator at presentation in the pediatric emergency. Children with known structural diseases of the lungs or heart, foreign body aspiration, oxygen saturation < 80% or > 97% measured by pulse oximetry on room air, congestive heart failure and children with wheeze who improved after initial three doses of inhaled salbutamol or levosalbutamol in emergency and were sent home were excluded. A written informed consent was taken from the parents or the caregivers for participation

All children were managed as per the institutional treatment protocol. Children were transferred to the PICU, if any of the criteria were met (i) apnea, (ii) SpO<sub>2</sub> < 92% on room air, (iii) signs of respiratory distress with the use of accessory muscles of respiration (nasal flaring, recession of intercostal muscles, sub-costal recession, supraclavicular and tracheal tug), (iv) inadequate fluid intake or presence of signs of dehydration or inadequate perfusion, (v) those needing supplemental oxygen > 6 L/min or FiO<sub>2</sub> > 50%, (vi) rapidly progressing lower respiratory disease with risk of respiratory failure, (vii) children diagnosed with asthma needing continuous administration of inhaled or nebulised medications.

SpO<sub>2</sub> and FiO<sub>2</sub> were recorded at the time of admission. Arterial blood gas (ABG) was analyzed within half an hour to assess PaO<sub>2</sub>. Both SpO<sub>2</sub> and PaO<sub>2</sub> were measured while on oxygen therapy and FiO<sub>2</sub> was noted for calculation of SF and PF ratios. SpO<sub>2</sub> was measured using a pulse oximeter (Edan Nelcor IM 70) with appropriately sized probe on a finger or a toe. PaO<sub>2</sub> was measured through ABG estimation by ABG analyzer (I-STAT Wireless Analyzer-ABOTT). Modified Allen's test was done in all the children before taking arterial blood sample. FiO<sub>2</sub> was calculated as follows: (i) simple oxygen mask - 35-60% FiO<sub>2</sub> at oxygen flow rate of 6-10 litre per minute (lpm); with every litre increase in oxygen flow, FiO<sub>2</sub> increases by 10%, (ii) nasal cannula at oxygen flow rate of 1, 2, 3 and 4 lpm gives FiO<sub>2</sub> of 24%, 28%, 32% and 36%, respectively, (iii) aerosol mask at oxygen flow rate of 8 lpm gives - 40%. (iv) venturi mask - 24-50%. (v) non-breathing mask with reservoir bag - 100% [3]. FiO<sub>2</sub> was measured using FiO<sub>2</sub> INMED analyser. In non-invasive and invasive ventilators, FiO<sub>2</sub> was measured as delivered by ventilator.

Sample size was calculated based on a study by Kwack et al which revealed that SF ratio < 300 could determine intensive care admission among patients in the respiratory ward with a sensitivity of 78.8% [7]. Considering 10% absolute precision on either side and 95% confidence level, and based on data from our PICU, wherein 20% of wheezy children presenting to pediatric emergency need admission to PICU, we needed to enrol 305 wheezy children. Considering, a attrition rate of 3%, we decided to enrol 315 children in our study.

*Statistical analysis:* The data were analyzed using SPSS version 25. Normality of data were ascertained using Shapiro Wilk test. The baseline variables including SF ratio and PF ratio at admission were expressed as means (standard deviation) or median (IQR) which were compared between the children needing and not needing PICU admission, using Student's t-test (unpaired) and Mann-Whitney U-test, respectively. Qualitative data was expressed in percentage and statistical difference between the proportions were tested by Chi-square test or Fisher's exact test.  $P < 0.05$  was considered significant. Sensitivity and specificity of SF ratio and PF ratio at cut-offs of  $< 300$  and  $< 200$  respectively was calculated to predict PICU admission and mortality. The diagnostic performance of SF and PF ratio was determined using area under curve (AUC) obtained from the receiver operating characteristic (ROC) curve; the best cut-offs of SF and PF ratios for predicting PICU admission were determined. Correlation between SF ratio and PF ratio was expressed in terms of Pearson's correlation coefficient ( $r$ ).  $r > 0.7$  was considered a strong correlation and between 0.4 to 0.7 as fair correlation.

## RESULTS

We enrolled 315 children aged between 6 months and 12 years, out of which 37 (12%) required admission in the PICU and 278 (88%) were transferred to the pediatric ward. Majority of children were diagnosed as wheeze associated lower respiratory tract infection ( $n = 190$ , 60.3%) followed by asthma ( $n = 67$ , 21.2%) and bronchiolitis ( $n = 58$ , 18.4%). The baseline demographic and anthropometric profile of the enrolled patients is shown in **Table I**. Eight patients (2.5%) expired out of total 315 patients, of which 7 were admitted in the PICU. Death was observed more in PICU admitted group ( $P < 0.01$ ). On the other hand, 96% of patients admitted in ward got discharged as against 81.1% from those in PICU. **Table II** depicts the oxygenation and ABG parameters of patients admitted in PICU versus ward. Median (IQR) values of FiO<sub>2</sub> requirement were significantly higher while PaO<sub>2</sub>, SF ratio and PF ratio significantly lower among patients admitted in PICU as compared to those admitted in ward.

Out of 37 children admitted to PICU, 36 (97.3%) had SF ratio of  $< 300$  and 23 (62.2%) had PF ratio of  $< 200$ . The proportion of children with SF ratio  $< 300$  was significantly higher in those admitted to PICU compared to those admitted in the ward (36, 97.3% vs 228, 82%,  $P = 0.01$ ). Likewise, the proportion of children with PF ratio  $< 200$  was also significantly higher in those admitted to PICU compared to those admitted in the ward (23, 62.2% vs 15, 5.4%,  $P < 0.001$ ). SF ratio  $< 300$  had a sensitivity of 97.3%, but specificity of 16.19% for predicting PICU admission, while PF ratio  $< 200$  had a sensitivity of 62.2% and specificity of 94.6% for predicting PICU admission. Additionally, SF ratio  $< 300$  and PF ratio  $< 200$  was able to predict in-hospital mortality with a sensitivity of 100%, but much lower specificity (**Table III**).

A cut-off value of  $< 178.79$  for SF ratio predicted PICU admission with a sensitivity (%) of 72.97 (55.88 - 86.21) and specificity (%) of 89.57 (85.36 - 92.9) [AUC (95% CI) of 0.841 (0.767 - 0.914)] See **Fig. 1a**. PF ratio at cut-off value  $< 201.81$  had a sensitivity (%) of 64.86 (47.46 - 79.79) and specificity (%) of 93.53 (89.96 - 96.12) for predicting PICU admission [AUC of 0.848 (0.775 - 0.924)]. See **Fig. 1b**. Further, SF ratio  $< 208.21$  was able to predict in-hospital mortality with sensitivity (%) of 100 (59.05-100) and specificity (%) of 30.0% (14.73-49.40) [AUC (95CI) 0.500 (0.317-0.683)]. PF ratio  $< 183.3$  could predict in-hospital mortality with a sensitivity (%) of 100 (59.05-100) and specificity (%) of 53.33 (34.33-71.66) [AUC (95%CI) 0.726 (0.556-0.897)]. A linear relationship was observed between SF ratio and PF ratio as depicted by scatter

plot in **Web Fig. 1**. The line represents the best fit linear relationship; SF ratio = 83.59+0.64 PF ratio, with r value of 0.44 and  $P < 0.001$ .

## DISCUSSION

We found that SF ratio at admission can be explored as a useful non-invasive screening parameter for predicting the need for intensive care treatment and in-hospital mortality in wheezy children, with proposed cut-off values of  $< 178.79$  and  $< 208.21$ , respectively.

Several oxygenation parameters have been studied as markers for disease severity and outcomes by researchers in various disease conditions. SF ratio apart from being simple, non-invasive and readily available, also reduces the need for frequent arterial blood gas sampling. However, how well it correlates with PF ratio in different subsets of patient population remains a point of concern. Colunga et al in their study [3] observed that SF ratio at 1 hour was a reliable predictor of early non-invasive ventilator failure in children having acute respiratory failure (ARF). Though, the study population had heterogenous causes, 36% of the patients had bronchiolitis/bronchospasm. Lobete et al in their large data set attempted to validate utility of SF ratio in critically ill children needing mechanical ventilation, non-invasive ventilation and oxygen support. The authors found a linear correlation between SF and PF ratio, rendering it a good replacement of PF ratio [8]. Khemani et al raised concerns for using PF ratio in determining acute lung injury in mechanically ventilated patients in PICU [9]. Further-on, they demonstrated that using SPO<sub>2</sub> dependent parameters of hypoxemia, namely SF ratio and oxygen saturation index (OSI) could identify double the number of patients having ARDS [10]. SF ratio was also found to predict high flow nasal cannulation (HFNC) failure at initiation as well as 2 hours at cut-offs of  $< 230$  and  $< 200$ , respectively [11]. The ratio was also used recently in Covid-19 patients in emergency and ICU settings and was found to be good predictor of intermittent mandatory ventilation (IMV) [12], severity of hypoxemia [13] and mortality risk [14].

Since, SF ratio was found to be a good surrogate for PF ratio, attempts were also made to find a correlation between the two. Rice et al demonstrated a linear relationship between PF ratio and SF ratio in adults with acute lung injury or acute respiratory distress syndrome and they found SF ratio of 235 and 315 correlated well with PF ratio of 200 and 300, with r value of 0.89 [4]. Lobete et al also concluded that SF ratio had a strong correlation with PF ratio. SF ratio of 296, 236 and 146 corresponded to PF ratio of 300, 200 and 100, with  $r^2$  of 0.843, in critically ill children [8]. A moderate correlation between SF ratio and PF ratio was also observed by Bilan et al with regression equation: SF=57+0.61 PF ( $P < 0.0001$ ) in ARDS patients [15]. PF ratio derived from SF ratio was found to be a better predictor of mortality than original PF ratio, when the values were incorporated into Pediatric Index Mortality-3 (PIM-3) prediction model in PICU patients [16]. We observed only a fair positive correlation between SF ratio and PF ratio in wheezy children. Given that changes in SpO<sub>2</sub> and PaO<sub>2</sub> can take place quickly and we performed ABGs within half an hour of admission and not simultaneously, this could have affected our results. We were not able to control some of the confounders like body temperature and hemoglobin, while performing ABG. Further studies in more controlled environment are therefore suggested.

SF ratio is increasingly been proven to be a reliable marker of hypoxemia in children with acute lung injury due to various etiologies. To the best of our knowledge, this is the first study on wheezy children, which constitute a significant population of patients in emergency setting. As this is a study based in tertiary care

hospital, where more critically ill patients are admitted, the study population did not reflect normal distribution of patients. More studies are needed before such parameters are translated into clinical practice.

*Ethical clearance:* IECHR/2020/PG/46/70, dated Dec 21, 2020.

*Contributors:* PB: Conceptualization, study design, manuscript writing and critical review; RB: Study design, data collection and analysis, writing the initial draft of the manuscript; VB, DH: Supervision of data collection, critical inputs. All authors agreed to the final version and are accountable for all aspects of the manuscript.

*Funding:* None. *Competing interest:* None stated.

#### WHAT THIS STUDY ADDS?

- SpO<sub>2</sub>/FiO<sub>2</sub> can be explored as a useful non-invasive screening parameter for predicting PICU admission and in-hospital mortality in wheezy children, irrespective of the etiology.
- SpO<sub>2</sub>/FiO<sub>2</sub> had a fair correlation with PaO<sub>2</sub>/FiO<sub>2</sub> in the study population.

#### REFERENCES

1. Weiss LN. The diagnosis of wheezing in children. *Am Fam Physician*. 2008;77:1109-14.
2. Asher MI, Twiss J, Ellwood E. The epidemiology of asthma. *In: Wilmott RW, Boat TF, Bush A, Editors. Kendig and Chernick' Disorders of the Respiratory Tract in Children*. 8<sup>th</sup> ed. Philadelphia: Elsevier Saunders; 2012. pp.647-76.
3. Mayordomo-Colunga J, Pon, López Y, et al. Predicting non-invasive ventilation failure in children from the SpO<sub>2</sub>/FiO<sub>2</sub> (SF) ratio. *Intensive Care Med*. 2013;39:1095-103.
4. Rice TW, Wheeler AP, Bernard GR, Hayden DL, Schoenfeld DA, Ware LB; National Institutes of Health, National Heart, Lung, and Blood Institute ARDS Network. Comparison of the SpO<sub>2</sub>/FIO<sub>2</sub> ratio and the PaO<sub>2</sub>/FIO<sub>2</sub> ratio in patients with acute lung injury or ARDS. *Chest*. 2007;132:410-7.
5. Leteurtre S, Dupré M, Dorkenoo A, Lampin ME, Leclerc F. Assessment of the Pediatric Index of Mortality 2 with the PaO<sub>2</sub>/FiO<sub>2</sub> ratio derived from the SpO<sub>2</sub>/FiO<sub>2</sub> ratio: A prospective pilot study in a French pediatric intensive care unit. *Pediatr Crit Care Med*. 2011;12:e184-6.
6. Bisgaard H, Jensen SM, Bonnelykke K. Interaction between asthma and lung function growth in early life. *Am J Respir Crit Care Med*. 2012;185:1183-9.
7. Kwack WG, Lee DS, Min H, et al. Evaluation of the SpO<sub>2</sub>/FiO<sub>2</sub> ratio as a predictor of intensive care unit transfers in respiratory ward patients for whom the rapid response system has been activated. *PLoS One*. 2018;13:e0201632.
8. Lobete C, Medina A, Rey C, Mayordomo-Colunga J, Concha A, Menéndez S. Correlation of oxygen saturation as measured by pulse oximetry/fraction of inspired oxygen ratio with PaO<sub>2</sub>/fraction of inspired oxygen ratio in a heterogeneous sample of critically ill children. *J Crit Care*. 2013;28:538.e1-7.

9. Khemani RG, Patel NR, Bart RD 3rd, Newth CJL. Comparison of the pulse oximetric saturation/fraction of inspired oxygen ratio and the PaO<sub>2</sub>/fraction of inspired oxygen ratio in children. *Chest*. 2009;135:662-8.
10. Khemani RG, Thomas NJ, Venkatachalam V, et al; Pediatric Acute Lung Injury and Sepsis Network Investigators (PALISI). Comparison of SpO<sub>2</sub> to PaO<sub>2</sub> based markers of lung disease severity for children with acute lung injury. *Crit Care Med*. 2012;40:1309-16.
11. Kim GE, Choi SH, Park M, et al. SpO<sub>2</sub>/FiO<sub>2</sub> as a predictor of high flow nasal cannula outcomes in children with acute hypoxemic respiratory failure. *Sci Rep*. 2021;11:13439.
12. Alberdi-Iglesias A, Martín-Rodríguez F, Ortega Rabbione G, et al. Role of SpO<sub>2</sub>/FiO<sub>2</sub> ratio and ROX index in predicting early invasive mechanical ventilation in COVID-19. A pragmatic, retrospective, multi-center study. *Biomedicines*. 2021;9:1036.
13. Catoire P, Tellier E, de la Rivière C, et al. Assessment of the SpO<sub>2</sub>/FiO<sub>2</sub> ratio as a tool for hypoxemia screening in the emergency department. *Am J Emerg Med*. 2021;44:116-20.
14. Lu X, Jiang L, Chen T, et al. Continuously available ratio of SpO<sub>2</sub>/FiO<sub>2</sub> serves as a noninvasive prognostic marker for intensive care patients with COVID-19. *Respir Res*. 2020;21:194
15. Bilan N, Dastranji A, Ghalehgholab Behbahani A. Comparison of the SpO<sub>2</sub>/FiO<sub>2</sub> ratio and the Pao<sub>2</sub>/Fio<sub>2</sub> ratio in patients with acute lung injury or acute respiratory distress syndrome. *J Cardiovasc Thorac Res*. 2015;7:28-31.
16. Ray S, Rogers L, Pagel C, et al. PaO<sub>2</sub>/FIO<sub>2</sub> ratio derived from the SpO<sub>2</sub>/FIO<sub>2</sub> ratio to improve mortality prediction using the Pediatric Index of Mortality-3 score in transported intensive care admissions. *Pediatr Crit Care Med*. 2017;18:e131-e136.

**Table I Demographic Profile of Patients Admitted in PICU Versus Ward**

| Variable                            | Total (n=315)  | PICU (n=37)    | Ward (n=278)     |
|-------------------------------------|----------------|----------------|------------------|
| Age group <sup>a</sup>              |                |                |                  |
| 6 mo - 1 y                          | 118 (37.5)     | 16 (43.2)      | 102 (36.7)       |
| 1 - 5 y                             | 157 (49.8)     | 16 (43.2)      | 141 (50.7)       |
| 6 - 12 y                            | 40 (12.7)      | 5 (13.)        | 35 (12.6)        |
| Age <sup>b</sup>                    | 1.5 (0.7, 3.6) | 1.1 (0.6, 3.5) | 1.55 (0.7, 3.60) |
| Male gender <sup>a</sup>            | 184 (58.4)     | 20 (54.1)      | 164 (59.0)       |
| Anthropometric profile <sup>a</sup> |                |                |                  |
| Severe underweight                  | 32 (10.2)      | 3 (8.1)        | 29 (10.4)        |
| Severe wasting                      | 19 (6.9)       | 5 (15.2)       | 14 (5.8)         |
| Severe stunting                     | 11 (3.5)       | 1(2.7)         | 10 (3.6)         |

Values expressed as <sup>a</sup>n (%) or <sup>b</sup>median (IQR)

P > 0.05 for all comparisons

**Table II Oxygenation and Arterial Blood Gas Parameters of Wheezy Children Admitted in PICU and Ward**

| Parameters   | Total (n=315)       | PICU (n=37)          | Ward (n=278)        | P value |
|--|---------------------|----------------------|---------------------|---------|
| SpO <sub>2</sub> (%) <sup>a</sup>                  | 98.24 (0.55)        | 98.11(0.56)          | 98.26 (0.55)        | 0.13    |
| FiO <sub>2</sub> (%) <sup>b</sup>                  | 40 (36, 45)         | 60 (50, 60)          | 40 (35, 45)         | < 0.001 |
| PaO <sub>2</sub> (mmHg) <sup>b</sup>               | 112.8 (104,134)     | 102 (89, 117.5)      | 115(104.85,134.05)  | < 0.001 |
| SpO <sub>2</sub> /FiO <sub>2</sub> <sup>b</sup>    | 245 (217.7, 277.77) | 165 (163.33, 208.21) | 247.5 (217.77, 280) | < 0.001 |
| PaO <sub>2</sub> /FiO <sub>2</sub> <sup>b</sup>    | 288.88(245, 333.33) | 180 (153.3, 257.55)  | 297.14(255,338.93)  | < 0.001 |
| pH <sup>a</sup>                                    | 7.37 (0.05)         | 7.34(0.07)           | 7.38(0.05)          | < 0.001 |
| PaCO <sub>2</sub> (mmHg) <sup>a</sup>              | 33.38(6.26)         | 32.34(8.75)          | 33.52(5.85)         | 0.63    |
| HCO <sub>3</sub> <sup>-</sup> (mEq/L) <sup>a</sup> | 18.97(2.96)         | 16.45(3.74)          | 19.31(2.68)         | < 0.001 |

Data expressed as <sup>a</sup>mean (SD), <sup>b</sup>median (IQR)

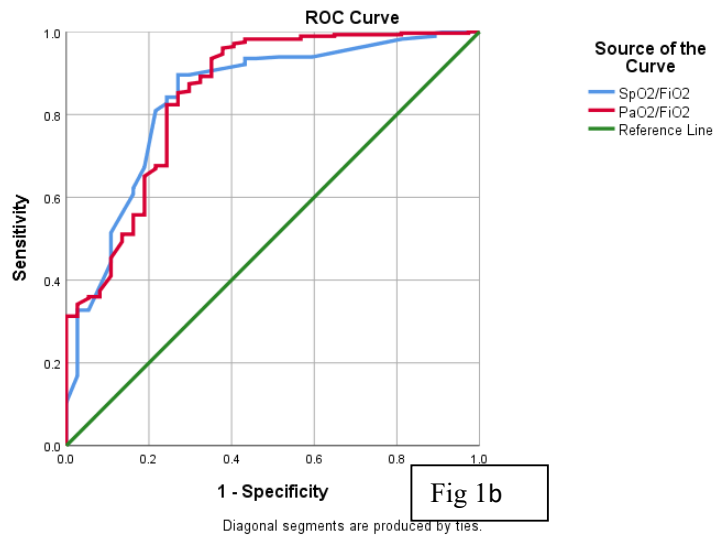
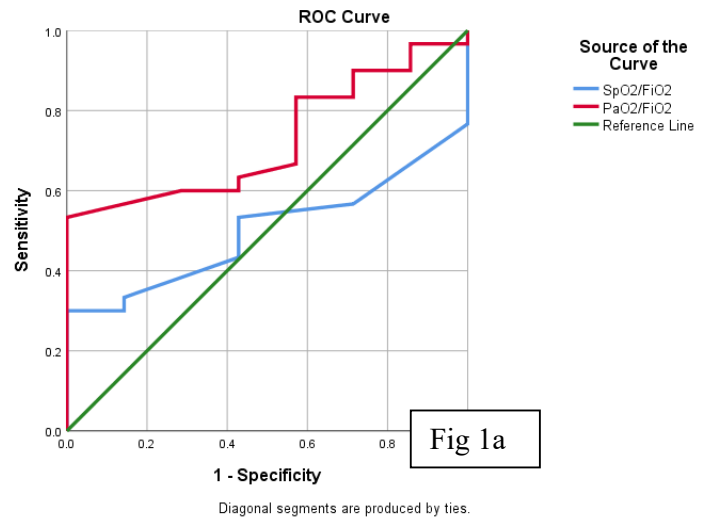
FiO<sub>2</sub> Fraction of oxygen in inspired air, HCO<sub>3</sub> Bicarbonate, PaCO<sub>2</sub> Partial pressure of carbon dioxide in arterial blood, PaO<sub>2</sub> Partial pressure of oxygen in arterial blood, SpO<sub>2</sub> Percentage oxygen saturation



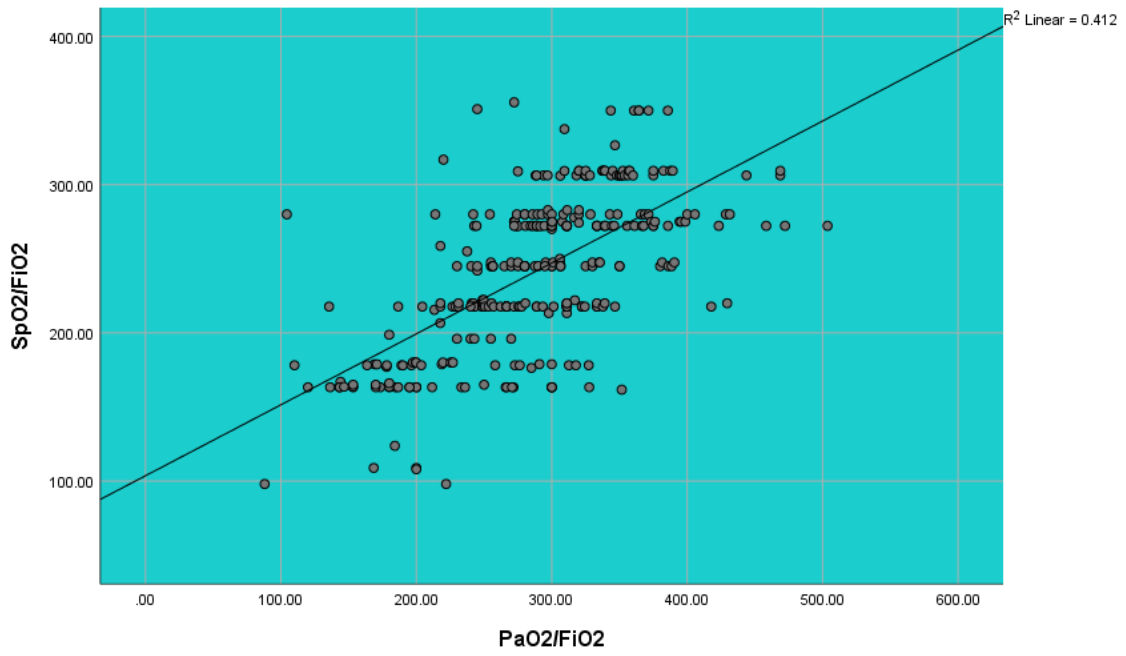
**Table III SpO<sub>2</sub>/FiO<sub>2</sub> <300 and PaO<sub>2</sub>/FIO<sub>2</sub> <200 for Predicting the Need for Intensive Care Admission and In-hospital Mortality**

|   | <i>Sensitivity (%)</i> | <i>Specificity (%)</i> | <i>PPV (%)</i> | <i>NPV (%)</i> | <i>LR + (%)</i> | <i>LR - (%)</i> | <i>AUC (95%CI)</i>      | <i>P value</i> |
|---|------------------------|------------------------|----------------|----------------|-----------------|-----------------|-------------------------|----------------|
| <i>Intensive Care Admission</i>         |                        |                        |                |                |                 |                 |                         |                |
| SpO <sub>2</sub> /FiO <sub>2</sub> <300 | 97.30                  | 16.19                  | 12.0           | 98.08          | 1.16            | 0.17            | 0.841<br>(0.767, 0.914) | < 0.001        |
| PaO <sub>2</sub> /FiO <sub>2</sub> <200 | 62.16                  | 94.6                   | 60.53          | 94.95          | 11.52           | 0.40            | 0.848<br>(0.775, 0.924) | < 0.001        |
| <i>Mortality</i>                        |                        |                        |                |                |                 |                 |                         |                |
| SpO <sub>2</sub> /FiO <sub>2</sub> <300 | 100                    | 3.33                   | 19.44          | 100            | 1.03            | -               | 0.500<br>(0.317, 0.683) | < 0.001        |
| PaO <sub>2</sub> /FiO <sub>2</sub> <200 | 100                    | 46.67                  | 30.43          | 100            | 1.88            | -               | 0.726<br>(0.556, 0.897) | <0.001         |

*FiO<sub>2</sub> Fraction of oxygen in inspired air, LR Likelihood ratio, NPV Negative predictive value, PaO<sub>2</sub> Partial pressure of oxygen in arterial blood, PPV Positive predictive value, SpO<sub>2</sub> Percentage saturation of oxygen*



**Fig. 1** Receiver Operating Characteristic (ROC) curve for SF ratio < 300 and PF ratio < 200 for predicting PICU admission (**1a**) and mortality (**1b**) in wheezy children



**Web Fig 1.** Scatter plot between SpO<sub>2</sub>/F<sub>i</sub>O<sub>2</sub> and PaO<sub>2</sub>/F<sub>i</sub>O<sub>2</sub>