The feasibility of ROX index to predict intubation in patients initiated on high-flow oxygenation

To the Editor,

High flow nasal cannula (HFNC) has been successfully used to treat acute hypoxemic respiratory failure (AHRF) inside and outside the intensive care unit (ICU). Use of HFNC became very popular for managing COVID19 pneumonia especially outside the ICU due to limited beds.[1]

In 2016, Roca *et al*.[2] described the Respiratory rate–Oxygenation (ROX) index which is the ratio of oxygen saturation on pulse oximeter/fraction of inspired oxygen (SpO2/FIO2) to respiratory rate (RR). ROX index is calculated at 2 h, 6 h, and 12 h. Roca *et al*.[2] described ROX index in patients with AHRF with pneumonia who were initiated on HFNC. The landmark paper was a prospective study involving 157 patients who were initiated on HFNC out of which 44 patients (28%) failed HFNC and required intubation and mechanical ventilation. At 12 h, the best cutoff point for the ROX index was estimated to be 4.88 (area under the receiver operating characteristic curve (AUC) 0.74 [95% confidence interval (CI), 0.64–0.84]; $P < 0.002$).

During the pandemic when HFNC was used as a popular non-invasive ventilatory modality, ROX index was being increasingly utilized for ward and high-dependency admissions also in patients with COVID19 pneumonia.

In a validity study by Suliman *et al*.,[3] the authors enrolled 69 patients with COVID19 pneumonia and AHRF, and analyzed several variables including ROX index which could be responsible for intubation. They concluded that gender and ROX index were the only significant independent predictors of intubation. In this study, the cutoff point of the ROX index on the first day of admission was ≤25.26 (90.2% of sensitivity and 75% of specificity). This value was much more than suggested by Roca *et al*. and also from various other studies.

In an observational study by Ferrer *et al*.,[4] the authors included 85 patients having AHRF due to COVID19 and were initiated on HFNC. The authors observed that HFNC failed in 47 (55.3%) patients. Out of 47, 45 patients were initially managed with non-invasive ventilation (NIV). ROX index at 24 h was the best predictor of HFNC success (AUC 0.826, 95% CI 0.593–1.00, $P = 0.015$) with a cutoff point of 5.35.

Later, Chandel *et al*.[5] performed a multicenter, retrospective, observational cohort study of 272 patients with AHRF due to COVID19 pneumonia who were initiated on HFNC in the beginning. They used ROX index to predict the success of HFNC therapy. On analysis, the authors concluded that ROX

index was sensitive for the identification of patients for successfully weaning from HFNC. A ROX index of >3.0 at 2 h, 6 h, and 12 h after initiation of HFNC was 85.3% sensitive for identifying HFNC success.

To investigate the accuracy of ROX index in predicting the threshold for intubation after commencing HFNC in COVID19 AHRF outside the ICU and to evaluate the validity of the previously described thresholds, Vega et al.[6] conducted a retrospective observational analysis of prospectively collected data from three centers. On analysis, the authors concluded that a ROX value of <5.99 was associated with an increased risk of HFNC failure in COVID19 patients which was different from the threshold given by Roca et al. in non-covid patients.

Later Prakash et al.[7] performed a systematic review and meta-analysis to evaluate the validity of ROX index in predicting accuracy of HFNC failure in COVID19 patients. A total of eight studies (prospective and retrospective) involving 1301 patients were identified and analyzed. On analysis, the authors concluded that ROX index could predict HFNC failure in COVID-19 patients with AHRF. The authors suggested an optimal cutoff value close to five of ROX index within the 24 h of admission for predicting HNFC failure.

To conclude, although it appears that ROX index reliably predicts HFNC failure in AHRF due to non-covid and covid patients, further adequately powered, well-designed, multicentric studies need to be conducted to establish its reliability.

Conflicts of interest
There are no conflicts of interest.

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