EDITORIAL

Custodian of Oxygen Monitoring: Is There a Winner?

Praveen Kumar G[1], Vivek Kakar[2]

Indian Journal of Critical Care Medicine (2021): 10.5005/jp-journals-10071-23970

Hypoxemia is extremely common in critically ill patients. In a multicenter study, over 50% of the patients evaluated had some degree of hypoxemia and close to 27% of the patients with hypoxemia died in the hospital.[1] This makes a point for close and continuous monitoring of patients with hypoxemia. Measuring peripheral oxygen saturation (SpO_2) by pulse oximetry and dissolved oxygen in the arterial blood (SaO_2) remains the most validated and common method for evaluating the degree of hypoxemia. Both the modalities have been used interchangeably for monitoring oxygen saturation, but PaO_2 measurements have been more widely accepted as a method to quantify the degree of hypoxemia and to titrate inspired oxygen levels.

In a retrospective analysis, involving 300 patients, Sheetal Babu et al. showed that SF ratio can be used as an alternative to PF ratio in critically ill patients with hypoxic respiratory failure. Notably, a significant number of patients were on vasopressor and inotropic support when the measurements were made, highlighting the functionality of SpO_2 in patients with good peripheral perfusion. Rice and his colleagues described the relationship between the P/F and S/F ratios with a simple equation and showed that SF and PF ratios can be interchanged across varying degrees of hypoxemia with near accuracy.[2] Likewise, multiple researchers have tried to answer the same question, if SpO_2 can replace PaO_2 in critical care settings, and the answer is an overwhelming YES.[3–5]

Another part of the study was to establish cutoffs of SF ratio for various PF ratios. Even if the cutoffs were established, they had a lower sensitivity and specificity. SF ratio of 285 correlated with PF of 200, and SF ratio of 323 correlated with PF ratio of 300. The cutoffs though different when compared to other studies, they were definitely not disparate. The reason for varying values in different studies could be explained by the fact that SpO_2 remains the same for a wide range of PaO_2.

In the study published in this edition of IJCCM, Sheetal Babu and his colleagues also tried to answer another pertinent question. If PF ratio can be replaced by SF ratio or SpO_2 unambiguously with different methods of oxygen supplementation. The answer again is an overwhelming YES. The answer remained YES for both invasive and noninvasive methods of oxygen supplementation.

In the middle of the raging pandemic with thousands of patients on some form of oxygen supplementation, this study asks critical care physicians a cardinal question, and it questions the utility of arterial blood gases in measuring oxygenation and quantifying hypoxemia. The study and already existing literature are a testament to the fact that SpO_2 is a reliable indicator for tissue oxygenation. Restoring the utility and benefits of SpO_2 has limitless advantages. First, PaO_2 is a finer indicator of oxygen content in the blood, but SpO_2 also reflects upon tissue perfusion and oxygen delivery. Second, SpO_2 gives a continuous measure of tissue oxygen levels and thereby precludes the delays in decision-making based on PaO_2. Thirdly, in comparison to SpO_2, the use of arterial blood gases is invasive, expensive, and of limited utility in measuring oxygenation. Also, PaO_2-based interventions preludes to additional blood gas testing, thereby squandering resources. Fourth, albeit not yet validated, to quantify the degrees of hypoxemia and acute respiratory distress syndrome, SF ratio can be reliably used for therapeutic targets and clinical decision-making in intensive care settings. A worsening SF ratio can be reliably interchanged with the PF ratio for escalation of care in the pyramid for the treatment of hypoxic patients. Fifth, SpO_2 and SF ratio can be more appropriate in the middle of the pandemic when scores of patients need repeated assessments of oxygenation and the resources are scarce and limited.

Since SpO_2 remains more than 90 for a very wide range of PaO_2, accepting a lower PaO_2 or late diagnosis of worsening hypoxemia is a concern while using SF ratios, and the concern is not without a merit. Thus, though SF ratio can be used as a surrogate for PF ratio in wide settings, when in doubt PaO_2 measurements using arterial blood gases should be considered. Also, multiple other drawbacks of pulse oximetry should be worth remembering.

So, to answer the question in the title: Is there a custodian of oxygen monitoring? The answer can definitely not be a plain sailing. We would rather reframe the question and ask which modality among the two is more beneficial? And the answer is clearer and it is definitely SpO_2. Through the quotidian traffic of monitoring equipment available for intensive care physicians, SpO_2 remains the simplest way of measuring hypoxemia and still remains the only continuous monitoring device ubiquitously present. We would conclude by saying that taking the road not taken might be challenging and rewarding, but one should not forget that the road not taken is not taken for a reason, and knowing the reason before can prevent adversities. Measuring SF ratio is the road not taken, and the critical care physicians should know the reasons before driving down the road.

[1,2]Critical Care Institute, Cleveland Clinic Abu Dhabi, Abu Dhabi, United Arab Emirates

Corresponding Author: Praveen Kumar G, Critical Care Institute, Cleveland Clinic Abu Dhabi, Abu Dhabi, United Arab Emirates, Phone: +589885598, e-mail: drpk1987@gmail.com

How to cite this article: Praveen Kumar G, Kakar V. Custodian of Oxygen Monitoring: Is There a Winner? Indian J Crit Care Med 2021;25(9):967–968.

Source of support: Nil

Conflict of interest: None

Orcid

Praveen Kumar G https://orcid.org/0000-0002-2875-5726
Vivek Kakar https://orcid.org/0000-0001-6353-3283

References

1. Grimaldi D, Hraiech S, Boutin E, Lacherade JC, Boissier F, Pham T, et al. Hypoxemia in the ICU: prevalence, treatment, and outcome. Ann Intensive Care 2018;8(1):82. DOI: 10.1186/s13613-018-0424-4.
2. Rice TW, Wheeler AP, Bernard GR, Hayden DL, Schoenfeld DA, Ware LB. Comparison of the SpO_2/FIO_2 ratio and the PaO_2/FIO_2 ratio in patients with acute lung injury or ARDS. Chest 2007;132(2):410–417. DOI: 10.1378/chest.07-0617.
3. Lu X, Jiang L, Chen T, Wang Y, Zhang B, Hong Y, et al. Continuously available ratio of SpO_2/FiO_2 serves as a noninvasive prognostic marker for intensive care patients with COVID-19. Respir Res 2020;21(1):1–4. DOI: 10.1186/s12931-020-01455-4.
4. Fukuda Y, Tanaka A, Homma T, Kaneko K, Uno T, Fujiwara A, et al. Utility of SpO_2/FiO_2 ratio for acute hypoxemic respiratory failure with bilateral opacities in the ICU. PLoS One 2021;16:1–11. DOI: 10.1371/journal.pone.0245927.
5. Babu S, Abhilash KPP, Kandasamy S, Gowri M. Association between SpO_2/FiO_2 Ratio and PaO_2/FiO_2 Ratio in Different Modes of Oxygen Supplementation. Indian J Crit Care Med 2021;25(9):1001–1005.