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INITIAL P/F RATIO FROM ABG ON MORTALITY AT 7 & 30 DAYS IN COVID-19 POSITIVE PATIENTS PRESENTING TO EMERGENCY DEPARTMENT

Emergency Medicine

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ABSTRACT

Introduction: Coronavirus disease 2019 (COVID-19), the highly contagious viral illness caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has had a catastrophic effect on the world's demographics resulting in more than 3.8 million deaths worldwide, emerging as the most consequential global health crisis since the era of the influenza pandemic of 1918. **Aims:** The objective of the study is to analyse whether this formula can early diagnose the severity of the disease, so that rescue measure can be started early which can eventually decrease the mortality. **Materials and Methods**: This was a single center observational, retrospective cohort study from tertiary care hospital in Kolkata, India from July 2020 – January – 2022 with 224 patients were included in this study. **Result**: Data of our study showed that majority number of patients had normal ARDS [107(47.8%)], mild ARDS [99 (44.2%)], Moderate ARDS [12 (5.4%)] and Severe ARDS [6 (2.7%)] but this was not statistically significant. (p=.44726). **Conclusion:** Present study showed that higher number of alive patients in mortality 30 day had Oxygen flow rate 2 liter/min, 1 liter/min and 4 liter/min but this was also statistically significant, COVID-19 is highly infectious and can lead to fatal comorbidities especially ARDS which can ultimately lead to death and we come to a conclusion that P/F ratio from initial ABG can be used as an indicator to rule out ARDS in a hypoxic patient presenting in emergency department. Thus it might help in early identification of ARDS in patients which can benefit in therapeutics and reduce mortality.

KEYWORDS

COVID-19, oximetry, Virology and SARS.

INTRODUCTION

Coronavirus disease 2019 (COVID-19), the highly contagious viral illness caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has had a catastrophic effect on the world's demographics resulting in more than 3.8 million deaths worldwide, emerging as the most consequential global health crisis since the era of the influenza pandemic of 1918. After the first cases of this predominantly respiratory viral illness were first reported in Wuhan, Hubei Province, China, in late December 2019, SARS-CoV-2 rapidly disseminated across the world in a short span of time, compelling the World Health Organization (WHO) to declare it as a global pandemic on March 11, 2020. Since being declared a global pandemic, COVID-19 has ravaged many countries worldwide and has overwhelmed many healthcare systems. The pandemic has also resulted in the loss of livelihoods due to prolonged shutdowns, which have had a rippling effect on the global economy. Even though substantial progress in clinical research has led to a better understanding of SARS-CoV-2 and the management of COVID-19, limiting the continuing spread of this virus and its variants has become an issue of increasing concern, as SARS-CoV-2 continues to wreak havoc across the world, with many countries enduring a second or third wave of outbreaks of this viral illness attributed mainly due to the emergence of mutant variants of the virus. [1,2]

There is a growing concern about the disease for various reasons including the unknown characteristics of the disease, high variety of symptoms, severe infection and rapid and high transmission rate.
Most often viral COVID-19 associated pneumonia presents with hypoxia that can lead to respiratory failure. Unfortunately many patients presents in emergency with COVID-19 associated ARDS. Thus early diagnosis of ARDS and subsequent treatment can reduce mortality of patients.

AIMS AND OBJECTIVES

Aim: To determine value of initial P/F ratio value from ABG as a mortality predictor in COVID-19 patient at day 7 & day 30 from presentation to ED with SpO2 <94 percentage.

Objectives:
The objective of the study is to analyse whether this formula can early diagnose the severity of the disease, so that rescue measure can be started early which can eventually decrease the mortality.

MATERIALS AND METHODS

This was a single center observational, retrospective cohort study from tertiary care hospital in Kolkata, India.

Duration of study: JULY 2020 – JANUARY – 2022
All Patients were presenting with hypoxia with SpO2 <93% in emergency department.

STUDY POPULATION
SAMPLE SIZE – 224
Study group:
224 participants were taken in our study.

Inclusion Criteria
1. Age ≥ 18 years
2. Initial $SPO_2 \leq 93\%$.
3. COVID-19 positive by RTPCR or GeneXpert within 2 weeks from presentation.

Exclusion Criteria
1) Previous treatment received from other Hospital or OPD basis.
2) Age <18 years
3) Initial SPO2 > 93%.

RESULT AND DISCUSSION

This was a single centre observational, retrospective cohort study from tertiary care hospital in Kolkata, India from JULY 2020 – JANUARY – 2022. All Patients were presenting with hypoxia with SpO2 <93% in emergency department were included Age ≥ 18 years, Initial $SPO_2 \leq$ 93% and COVID-19 positive by RTPCR or GeneXpert within 2 weeks from presentation in this study.

Coronavirus disease 2019 (COVID-19), the highly contagious viral illness caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has had a catastrophic effect on the world's demographics resulting in more than 3.8 million deaths worldwide, emerging as the most consequential global health crisis since the era of the influenza pandemic of 1918.

Mortality at 7 Day
Santus P et al [3](2020) showed that COVID-19 causes lung parenchymal and endothelial damage that lead to hypoxic acute

respiratory failure (hARF). The influence of hARF severity on patients' outcomes is still poorly understood .Observational, prospective, multicentre study. Median (IQR) age was 66 (55–76) years with a PaO2/FiO2 at admission of 262 (140–343) mm Hg. 50.2% had a cardiovascular disease. The only independent risk factors for mortality were age ≥65 years (HR 3.41; 95% CI 2.00 to 5.78, p<0.0001),

Mondal S et al [4] (2021) showed that the dominant respiratory feature of Coronavirus Disease 2019 (COVID-19) is arterial hypoxaemia, greatly exceeding abnormalities in pulmonary mechanics. Arterial Blood Gas (ABG) analysis helps to find out respiratory, metabolic acidosis and alkalosis. All critically ill COVID-19 patients those who were admitted in ICU with more than 15 years of age were included in this study. Most affected age group was 51-60 years among males and above 60 years among females.

In our study, out of 224 patients, most of the patients were 51-60 years old [87(38.8%)]. 77 (37.4%) alive patients were 51-60 years of age and 10 (55.6%) expired patients were 51-60 years of age but this was not statistically significant. (p=0.5086). Data of our study showed that Age were reduced number of expired patients [55.2778± 8.4492] compared to alive patients [56.5777± 9.0694] but this was not statistically significant (p=0.5584).

Salvarani C et al [5] (2021) found that the coronavirus disease 2019 (COVID-19) pandemic is threatening billions of people worldwide. Tocilizumab has shown promising results in retrospective studies in patients with COVID-19 pneumonia with a good safety profile. the majority of patients were male (77 of 126, 61.1%).

It was found that, population of male patients [149 (66.5%)] were higher than Female patients in mortality at 7 day [75 (33.5%)]. but this was not statistically significant (p=0.9888).

In our study most of patients had alive in mortality at 7 day [206 (92.0%)] and expired in Mortality at 7 Day [18 (8.0%)].

Roozeman JP et al [6] (2022) showed that The SpO2/FiO2 is a useful oxygenation parameter with prognostic capacity in patients with ARDS. They investigated the prognostic capacity of SpO2/FiO2 for mortality in patients with ARDS due to COVID–19. In this cohort of patients with ARDS due to COVID–19, the SpO2/FiO2 on day 2 and day 3 are independently associated with and have prognostic capacity for 28–day mortality.

Søvik S et al [7] (2021) found that Mortality rates in COVID-19 patients in need of mechanical ventilation are high, with wide variations between countries. Most studies were retrospective, and results may not be generalizable due to differences in demographics, healthcare organization and surge capacity. In ventilated patients (75% males, age 61 (53-70) years), severe, moderate, and mild ARDS was present in 25%, 70%, and 5%.

Data of our study showed that majority number of patients had normal ARDS [107(47.8%)], mild ARDS [99 (44.2%)], Moderate ARDS [12 (5.4%)] and Severe ARDS [6 (2.7%)] but this was not statistically significant. (p=.44726).

Secco G et al [8] (2021) found that COVID-19 is an emerging infectious disease, that is heavily challenging health systems worldwide. Endpoints were subsequent oxygen support need and survival. In the subgroup of patients with P/F between 300 and 400, 94.7% (n = 107) had high AaDO2 values, and 51.4% (n = 55) received oxygen support, with 2 ICU admissions and 10 deaths. According to ROC analysis, AaDO2 > 39.4 had 83.6% sensitivity and 90.5% specificity (AUC 0.936; p < 0.001) in predicting subsequent oxygen support, whereas a LUS score > 6 showed 89.7% sensitivity and 75.0% specificity (AUC 0.896; p < 0.001).

We observed that higher number of alive patients had Oxygen flow rate 4 liter/min and 6 liter/min [6 (33.3%)], Oxygen flow rate 2 liter/min [22 (10.7%)], 1 liter/min [11 (5.3%)] and 4 liter/min [6 (2.9%)] but this was statistically significant. (p<0.0001)

Gupta B et al [9] (2021) found the alveolar–arterial oxygen (A–a) gradient measures the difference between the oxygen concentration in alveoli and the arterial system, which has considerable clinical utility. The primary objective was to investigate the utility of the A–a gradient (pre-NIV) as a predictor of 28-day mortality in COVID pneumonia. The optimal criterion for A–a gradient to predict 28-day mortality was calculated as ≤430.43 at a Youden index of 0.5029, with the highest area under the curve (AUC) of 0.755 (p <0.0001). This study demonstrated that the A–a gradient is a significant predictor of mortality in patients initiated on NIV for worsening respiratory distress in COVID pneumonia.

Our study showed that most of patients were alive in Mortality at 30 Day [195 (94.7%)] but this was not statistically significant. (p=0.3147) In our study Pulse oximetry initial (spo2) was significantly less in expired patients [76.0000± 14.7209] compared to alive patients [87.2282± 5.4765]. (p<0.0001)

Vu CA et al [10] (2020) found that due to the lack of proven therapies, they evaluated the effects of early administration of tocilizumab for COVID-19. Tocilizumab was administered at a median of 8 days (range 1–21) after initial symptoms and 2 days (range 0–12) after hospital admission. On the day of administration, the median PaO2 /FiO2 was 166 (range 33–523) and 50 patients (83.3%) had ARDS.

Secco G et al [11](2021) showed that COVID-19 is an emerging infectious disease, that is heavily challenging health systems worldwide. The aim of the study was to demonstrate the capability of alveolar-to-arterial oxygen difference (AaDO2) in predicting the need for subsequent oxygen support and survival in patients with COVID-19 infection, especially in the presence of baseline normal PaO2 / FiO2 ratio (P/F) values.

We found that PAO2 Initial was significantly high in alive patients [66.2573± 5.5627] compared to expired patients [47.4444± 15.3325]. (p <0.0001).

Our study showed that Fio2 initial was significantly more in expired patients [33.6667± 9.8100] compared to alive patients [21.9951± 2.2382]. (p<0.0001).

Patel S et al [12] (2021) found that PaO2 to FiO2 ratio (P/F) is used to assess the degree of hypoxemia adjusted for oxygen requirements. The Berlin definition of Acute Respiratory Distress Syndrome (ARDS) includes P/F as a diagnostic criterion. P/F is invasive and cost-prohibitive for resource-limited settings Their study shows that the S/F ratio is a better predictor of mortality than the more widely used P/F ratio to monitor and manage hypoxemia.

We observed that P/F ratio was significantly higher in alive patients [303.1525± 30.7400] compared to expired patients [146.7973± 40.8920]. (p<0.0001).

Mortality 30 Day

Vu CA et al [13] (2020) found that due to the lack of proven therapies, they evaluated the effects of early administration of tocilizumab for COVID-19. By inhibition of the IL-6 receptor, it has been proposed that tocilizumab may help to mitigate the hyperinflammatory response associated with progressive respiratory failure. Most patients were male (66.7%), Hispanic (63.3%) or Black (23.3%), with a median age of 54 years.

Salvarani C et al [14] (2021) found that the coronavirus disease 2019 (COVID-19) pandemic is threatening billions of people worldwide. Tocilizumab has shown promising results in retrospective studies in patients with COVID-19 pneumonia with a good safety profile. The median (interquartile range) age was 60.0 (53.0-72.0) years.

It was found that out of 224 patients, most of the patients were 51-60 years old [87(38.8%)]. 71 (36.4%) alive patients were 51-60 years of age and 16 (55.2%) expired patients were 51-60 years of age but this was not statistically significant. (p=0.3711).

We examined that, population of male patients [130 (66.7%)] were higher than Female patients [65(33.3%)]. but this was not statistically significant (p=0.3711).

Present study showed that higher number of alive patients had Oxygen flow rate 2 liter/min [22 (11.3%)], 1 liter/min [11 (5.6%)] and 4 liter/min [6 (3.1%)] but this was also statistically significant. (p<0.0001)

CONCLUSION

In my study we come to a conclusion that P/F ratio from initial ABG can be used as an indicator to rule out ARDS in a hypoxic patient presenting in emergency department. Thus it might help in early identification of ARDS in patients which can benefit in therapeutics and reduce mortality.

Table: Association between Oxygen flow rate L/min initial: MORTALITY AT 7 & 30 DAY

			Alive	Expired	Total	Chi-square value	p-value
MORTALITY AT 7 DAY	Oxygen flow rate L/min initial	1 liter/min	11	0	11	105.0295	<0.001
		Row %	100.0	0.0	100.0		
		Col %	5.3	0.0	4.9		
		2 liter/min	22	0	22		
		Row %	100.0	0.0	100.0		
		Col %	10.7	0.0	9.8		
		4 liter/min	6	6	12		
		Row %	50.0	50.0	100.0		
		Col %	2.9	33.3	5.4		
		6 liter/min	0	6	6		
		Row %	0.0	100.0	100.0		
		Col %	0.0	33.3	2.7		
		nil	167	6	173		
		Row %	96.5	3.5	100.0		
		Col %	81.1	33.3	77.2		
		TOTAL	206	18	224		
		Row %	92.0	8.0	100.0		
		Col %	100.0	100.0	100.0		
MORTALITY 30 DAY	Oxygen flow rate L/min initial	1 litre/min	11	0	11	61.3652	<0.001
		Row %	100.0	0.0	100.0		
		Col %	5.6	0.0	4.9		
		2 litre/min	22	0	22		
		Row %	100.0	0.0	100.0		
		Col %	11.3	0.0	9.8		
		4 litre/min	6	6	12		
		Row %	50.0	50.0	100.0		
		Col %	3.1	20.7	5.4		
		6 litre/min	0	6	6		
		Row %	0.0	100.0	100.0		
		Col %	0.0	20.7	2.7		
		nil	156	17	173		
		Row %	90.2	9.8	100.0		
		Col %	80.0	58.6	77.2		
		TOTAL	195	29	224		
		Row %	87.1	12.9	100.0		
		Col %	100.0	100.0	100.0		

REFERENCES

1. Zu ZY, Jiang MD, Xu PP, Chen W, Ni QQ, Lu GM, et al. Coronavirus disease 2019 (COVID-19): a perspective from China. Radiology. 2020:200490. pmid:32083985
2. da Costa VG, Moreli ML, Saivish MV. The emergence of SARS, MERS and novel SARS-2 coronaviruses in the 21st century. Archives of Virology. 2020:1–10. pmid:32322993
3. Santus P, Radovanovic D, Saderi L, Marino P, Cogliati C, De Filippis G, Rizzi M, Franceschi E, Pini S, Giuliani F, Del Medico M. Severity of respiratory failure at admission and in-hospital mortality in patients with COVID-19: a prospective observational multicentre study. BMJ open. 2020 Oct 1;10(10):e043651.
4. Mondal S, Das TK, Bhattacharya S, Banerjee S, Hazra D. Blood gas analysis among covid-19 positive patients: A single centre, retrospective, observational study. Journal of Clinical and Diagnostic Research. 2021:LC01-4.
5. Salvarani C, Dolci G, Massari M, Merlo DF, Cavuto S, Savoldi L, Bruzzi P, Boni F, Braglia L, Turrà C, Ballerini PF. Effect of tocilizumab vs standard care on clinical worsening in patients hospitalized with COVID-19 pneumonia: a randomized clinical trial. JAMA internal medicine. 2021 Jan 1;181(1):24-31.
6. Roozeman JP, Mazzinari G, Neto AS, Hollmann MW, Paulus F, Schultz MJ, Pisani L, Committee S, Algera AG, Boers LS, Bos LD. Prognostication using SpO2/FiO2 in invasively ventilated ICU patients with ARDS due to COVID-19–Insights from the PRoVENT-COVID study. Journal of critical care. 2022 Apr 1;68:31-7.
7. Søvik S, Bådstøløkken PM, Sørensen V, Myhre PL, Prebensen C, Omland T, Berdal JE. A single‐centre, prospective cohort study of COVID‐19 patients admitted to ICU for mechanical ventilatory support. Acta Anaesthesiologica Scandinavica. 2021 Mar;65(3):351-9.
8. Secco G, Salinaro F, Bellazzi C, La Salvia M, Delorenzo M, Zattera C, Barcella B, Resta F, Vezzoni G, Bonzano M, Cappa G. Can Alveolar-Arterial Difference and Lung Ultrasound Help the Clinical Decision Making in Patients with COVID-19?. Diagnostics. 2021 May;11(5):761.
9. Gupta B, Jain G, Chandrakar S, Gupta N, Agarwal A. Arterial Blood Gas as a Predictor of Mortality in COVID Pneumonia Patients Initiated on Noninvasive Mechanical Ventilation: A Retrospective Analysis. Indian Journal of Critical Care Medicine: Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine. 2021 Aug;25(8):866.
10. Vu CA, DeRonde KJ, Vega AD, Maxam M, Holt G, Natori Y, Zamora JG, Salazar V, Boatwright R, Morris SR, de Lima Corvino D. Effects of Tocilizumab in COVID-19 patients: a cohort study. BMC infectious diseases. 2020 Dec;20(1):1-0.
11. Secco G, Salinaro F, Bellazzi C, La Salvia M, Delorenzo M, Zattera C, Barcella B, Resta F, Vezzoni G, Bonzano M, Cappa G. Can Alveolar-Arterial Difference and Lung Ultrasound Help the Clinical Decision Making in Patients with COVID-19?. Diagnostics. 2021 May;11(5):761.
12. Patel S, Singh G, Zarbiv S, Ghiassi K, Rachoin JS. Mortality Prediction Using SaO2/FiO2 Ratio Based on eICU Database Analysis. Critical care research and practice. 2021 Nov 8;2021.
13. Vu CA, DeRonde KJ, Vega AD, Maxam M, Holt G, Natori Y, Zamora JG, Salazar V, Boatwright R, Morris SR, de Lima Corvino D. Effects of Tocilizumab in COVID-19 patients: a cohort study. BMC infectious diseases. 2020 Dec;20(1):1-0.
14. Salvarani C, Dolci G, Massari M, Merlo DF, Cavuto S, Savoldi L, Bruzzi P, Boni F, Braglia L, Turrà C, Ballerini PF. Effect of tocilizumab vs standard care on clinical worsening in patients hospitalized with COVID-19 pneumonia: a randomized clinical trial. JAMA internal medicine. 2021 Jan 1;181(1):24-31.