Relation of Days on Ventilatory Support to Total Days of Illness in COVID-19 Patients

Khalid Ameer, Ahmed Mujadid Khan Burki, Rao Ali Shan Khan, Usman Ghani*, Khan Muhammad Yaqub, Nabeel Tahir Butt*

Combined Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi, Pakistan, *Pak Emirates Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi, Pakistan

ABSTRACT

Objective: To determine the relation between days on ventilatory support and overall mortality to total days of pre- ventilator illness in COVID-19 patients.

Study Design: Cross-sectional study.

Place and Duration of Study: Pak Emirates Military Hospital Rawalpindi Pakistan, from Mar to Aug 2020.

Methodology: A total of 140 admitted patients within the prescribed time frame were observed in the established COVID-Intensive Care Units of Pak Emirates Military Hospital, Rawalpindi. The criteria for inclusion in the study were patients of any age and gender on ventilatory support with a confirmatory diagnosis of SARS-CoV-2 both by RT-PCR, and radiological evidence on HRCT Chest.

Results: The mean age of patients was 59.39 ± 13.517 years. Patients who presented with a confirmed diagnosis of COVID-19 and more than ten days of illness with respiratory compromise had a higher occurrence to be placed on mechanical ventilation. There was a strong linear and positive correlation between the total days of illness on presentation and the total days on ventilatory support (*p*-value <0.01). This linear relationship consequently translated into overall mortality of 78.6% with a 21.4% survival rate.

Conclusion: To conclude, the total days of illness in critical COVID-19 patients had a linear relationship to days on ventilatory support and overall mortality.

Keywords: COVID-19, SARS-CoV-2, Ventilatory support.

INTRODUCTION

The first case of COVID-19 was identified in late Feb 2020, the numbers of cases are still on the rise.[1] Relatively young and healthy people are being admitted to the intensive care unit (ICU), but older adults are at the most significant risk of critical disease and long-term impairment.[2] COVID-19 extensively assaults the body.[3,4] Its victims are not just the lungs, but hypoxia and dysregulated immune response have the potential of damaging the kidneys, liver, heart, brain, and other organs.[5,6] Although it is premature to comment about the lasting disabilities in COVID-19 survivors, one of the most dreadful effects of the disease is its progression to acute respiratory distress syndrome (ARDS).[7,8] Consistent with the preliminary international literature available about the disease, the number of patients requiring ventilatory support in our resource-limited country is increasing dramatically, causing a profound burden on the health care system. With critical symptoms, as mentioned, ventilatory support becomes mandatory for these patients.[9]

With clinical symptoms of ARDS requiring prompt ventilatory support for patients, sometimes within hours of presentation, ventilatory support now remains the mainstay of treatment for these cases, along with supportive therapies.[8]

The varying survival rates across the globe, Intensive Care National Audit and Research Centre, London found that 67% of reported COVID-19 patients from England, Wales, and Northern Ireland receiving "advanced respiratory support" died.[4,9] A study in China found that only "14% survived after going on a ventilator".[10] These statistics made us search further into the facts regarding the ventilatory support. This study was aimed to find the impact of the days of illness on the days spent on a ventilator by critical COVID-19 patients. The critically important decision making for intubation and start of ventilatory support considering the myth that many COVID-19 patients never recover.

METHODOLOGY

The study was carried out at the established COVID Intensive Care Units (ICU) of Pak Emirates

Correspondence: Dr Khalid Ameer, Classified Anesthetist, Combined Military Hospital Rawalpindi Pakistan
Received: 17 Sep 2020; revision received: 15 Jan 2021; accepted: 28 Jan 2021

Military Hospital in Rawalpindi, Pakistan. After permission from the Ethical Committee (vide A/28/EC/208/2020), data was collected.

Inclusion Criteria: All the patients on ventilatory support with a confirmatory diagnosis of SARS-CoV-2 both by RT-PCR and radiological evidence on HRCT Chest were included.

Exclusion Criteria: Patients with more than three co-morbidities were excluded from the study.

Informed consent was taken from the next of kin and patients were allotted serial numbers to maintain confidentiality. Data of 140 ventilated patients was collected by double-blind method on a structured proforma available to every resident doctor on duty. However, no exclusion was done based on age or gender. The total days of illness before initiation of mechanical ventilation and days of ventilatory support were studied, and correlation was calculated.

Statistical Package for Social Sciences (SPSS) version 26.0 was used for the data analysis. Quantitative variables were summarized as mean ± SD and qualitative variables were summarized as frequency and percentages. Chi-square test was applied to find out the association. The p-value ≤0.05 was considered statistically significant.

RESULTS

The mean age of patients was 59.39 ± 13.517 years. Our patient population had a male preponderance (Table-I).

Table-I: Overall mortality among the group on ventilatory support (n=140)

Parameters	n (%)
Total Patients	140 (100%)
Mortality on Ventilatory Support	110 (78.6%)
Survival on Ventilatory Support	30 (21.4%)

Table-II: Pearson correlation coefficient for days of illness and days on mechanical ventilator support among study population (n=140).

		Days on Mechanical Ventilation
Days of Illness	Pearson Correlation Coefficient (r)	0.791
	p-value	<0.001

A total of 140 patients who presented with more than ten days of illness having constitutional symptoms developing shortness of breath had a higher occurrence to be placed on ventilatory support, and there was a strong positive correlation between total days of illness on presentation to the occurrence and total days on ventilatory support (p-value <0.01) as shown in the Table-II. The overall mortality was 78.6%, with a 21.4% survival rate in the group.

DISCUSSION

COVID-19 patients are mostly asymptomatic; around 15-20% need hospitalized care.[7,8] Out of the hospitalized patients, approximately 20-25% require admission to the Intensive Care Units.[13] Amongst the critical patients, oxygenation failure secondary to acute respiratory distress syndrome (ARDS) is the dominant pathology. The most common disease complications observed in our patients were acute kidney injury (AKI), deranged liver functions, coronary thrombosis and myocardial injury leading to arrhythmias and sudden cardiac death. The less common happenings contrary to most commonly encountered critical illnesses were sepsis, shock and multi-organ failure.[9]

The study revealed very important insights and helped us compare our work and statistics with the international literature available for these critical cases. The earliest recognition of the disease-induced plethora of pulmonary injuries and management interventions reduced overall mortality. Oxygenation manoeuvres as awake proning, high flow oxygen via nasal cannulae (HFNC), non-invasive ventilation (NIV) and invasive mechanical ventilation remained the mainstay of management and general care.[10]

Our management protocol for critically ill patients with COVID-19 remained administration of the lowest possible fraction of inspired oxygen (FiO2) to meet oxygenation goals of oxygen saturation (SpO2) >93% on pulse oximetry. The critical decision of appropriate time and modality to initiate non-invasive or invasive ventilation was based on clinical requirements. Meanwhile, making the best use of existing resources and balancing the risks and benefits to the patient and the risk of exposure to healthcare workers.[11]

In patients with COVID-19 who have an acute respiratory failure with severe hypoxemia and increasing oxygen requirements than the capacity of conventional low flow delivery systems. We prefer non-invasive measures whenever possible rather than directly proceeding to intubation as a routine, but intubations must never be delayed once required. Patients who spend more extended time fighting the initial phase of illness suffer exceptionally severe lung injury, including PSILI (Patient Self Inflicted Lung Injury). This prolonged duration of illness makes them prone to a set of physical, cognitive, and mental health

problems.[12] ARDS once sets in caused by COVID-19 requires more than 2 weeks of ventilatory support may be due to different phenotypes as opposed to ARDS by all other illnesses, which may require 7 to 10 days of reliance on ventilator.[13]

The overall mean age of these total cases (n=140) was 59.39 years, with a predominantly male population. All the cases included in the study were diagnosed based on RT-PCR for SARS-CoV-2 and HRCT Chest. There was a strong and linear positive correlation between the days spent with illness after diagnosing critical COVID-19 disease and prolongation of ventilatory support in these patients (p<0.01). The variability of findings and questionable outcomes has always confused the critical care teams in making a clearcut decision of mechanical ventilation for critically ill patients and unfortunately amplified the same in COVID-19 patients.[14]

The prolonged duration of ventilatory support in these patients was found to be multi-factorial, not seeking the medical advice well in time because of hype and panic created by the media industry, publishing the scientific data by non-scientific people, and exaggerated mortality figures have created a demoralizing impact on the treating teams.[15] Few important factors responsible for the prolongation of the ventilatory support in COVID-19 patients are late presentations due to the phenomenon of "happy hypoxia", extremes of lung parenchymal damage as evident by CT severity index on presentation, prolonged stay on ventilator leading to atrophic muscles, ICU delirium caused by the disease itself, Benzodiazepines as sedatives to facilitate ventilation and superadded infectious complications. The disease has the propensity towards the elderly population already suffering from chronic ailments, henceforth, limited reserves to fight a relatively new menace with a higher magnitude of damage leading to increased morbidity and mortality.[16,17]

Auld *et al*, raised concerns that survival among those receiving mechanical ventilation is exceedingly poor. However, our data showed a mortality of 79% with a survival rate of 21% post- extubation. As per their report of 217 critically ill patients, mortality for those who required mechanical ventilation was 35.7% (59/165). They concluded higher mortality rate in patients of older age, lower body mass index, chronic renal disease, higher d-dimer, higher C-reactive protein, and greater days on mechanical ventilation. New research and studies that are being carried out around the globe also confirm that early detection and careful selection of patients using the severity index results in improved survival on ventilator support.[18]

Rahim *et al*, carried out ventilator-associated mortality analysis on 204 patients in Peshawar, Pakistan. Non-invasive ventilation (NIV) was adminis-tered to 61.8% of patients. Mortality was higher for invasive mechanical ventilation (IMV) (93.6% vs 66.7%, p<0.001) with an overall mortality of 77% and for over 60 years (87.3% vs 72.3%, p=0.019), thus supporting our study results.[19]

These reports, along with our study and analysis, debunk the initial approach of delaying mechanical ventilation and relying on alternative methods of oxygen therapy until necessary. This approach aggravates the already debilitating co-morbidities and increases overall mortality in setups where appropriate oxygen therapy and mechanical ventilatory support can provide an early benefit in reducing mortality rates.

The study revealed valuable insight into the relationship between the days of illness on presentation to the total days on ventilatory support. COVID-19 patients presented late in hospital with more than ten-days duration of illness had more chances of the requirement for ventilatory support. There was a strong linear and positive correlation between the total days of illness on presentation and the total days on ventilatory support. The longer a critical patient remained on ventilatory support, the higher the like-lihood of mortality on ventilatory support.

CONCLUSION

To conclude, the total days of illness in critical COVID-19 patients had a linear relationship to days on ventilatory support and overall mortality

Conflict Of Interst: None

Authors' Contribution

KA: Manuscript draft, concept, AM: Supervisor, RASK: concept, UG: Manuscript draft, concept, KMY: Proof reading, NTB: Data compilation analysis.

REFERENCES

1. Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). Int J Surg 2020; 76(1): 71-76.
2. Lu H, Stratton CW, Tang YW. Outbreak of pneumonia of unknown etiology in Wuhan, China: The mystery and the miracle. J Med Virol 2020; 92(4): 401-402.
3. Andersen KG, Rambaut A, Lipkin WI, Holmes EC. The proximal origin of SARS-CoV-2. Nat Med 2020; 26(4): 450-452.
4. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020; 395(10223): 497-506.

5. Yang X, Yu Y, Xu J, Shu H, Liu H, Wu Y, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. Lancet 2020; 8(5): 475-481

6. Boni MF, Lemey P, Jiang X, Lam TT, Perry BW, Castoe TA, et al. Evolutionary origins of the SARS-CoV-2 sarbecovirus lineage responsible for the COVID-19 pandemic. Nat Microbiol 2020; 5(11): 1408-1417

7. Li L, Li R, Wu Z, Yang X, Zhao M, Liu J, et al. Therapeutic strategies for critically ill patients with COVID-19. Ann Inten Care 2020;10(1):1-9.

8. Gibson PG, Qin L, Puah SH. COVID-19 acute respiratory distress syndrome (ARDS): clinical features and differences from typical pre-COVID-19 ARDS. Med J Aust 2020; 213(2): 54-56.

9. Ji D, Zhang D, Xu J, Chen Z, Yang T, Zhao P, et al. Prediction for Progression Risk in Patients with COVID-19 Pneumonia: The CALL Score. Clin Infect Dis 2020; 71(6): 1393-1399.

10. Schleicher GK, Lowman W. Case study: a patient with asthma, COVID-19 pneumonia and cytokine release synd-rome treated with corticosteroids and tocilizumab. J Clin Med 2020; 2(SI): 47.

11. Du RH, Liu LM, Yin W, Wang W, Guan LL. Hospitalization and critical care of 109 decedents with COVID-19 pneumonia in Wuhan, China. Ann Am Thorac Soc 2020; 17(7): 839-846.

12. Henry BM, Lippi G. Poor survival with extracorporeal membrane oxygenation in acute respiratory distress syndrome (ARDS) due to coronavirus disease 2019 (COVID-19): Pooled analysis of early reports. J Crit Care 2020; 58(1): 27-28.

13. Grieco DL, Menga LS, Eleuteri D, Antonelli M. Patient self-inflicted lung injury: implications for acute hypoxemic respiratory failure and ARDS patients on non-invasive support. Minerva Anestesiol 2019; 85(9): 1014-1023.

14. Gattinoni L, Chiumello D, Caironi P, Busana M, Romitti F, Brazzi L. COVID-19 pneumonia: different respiratory treatments for different phenotypes? Intens Care Med 2020; 46(6): 1099-1102.

15. Depoux A, Martin S, Karafillakis E, Preet R, Wilder-Smith A, Larson H. The pandemic of social media panic travels faster than the COVID-19 outbreak. J Travel Med 2020; 7(3): 31.

16. Zhang W, Wang K, Yin L, Zhao W, Xue Q, Peng M, et al. Mental health and psychosocial problems of medical health workers during the COVID-19 epidemic in China. Psychother Psychosomat 2020; 89(4): 242-250.

17. Richardson S, Hirsch JS, Narasimhan M, Crawford JM, McGinn T, Davidson KW, et al. Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized with COVID-19 in the New York City Area. J Am Med Asssoc 2020; 323(20): 2052-2059.

18. Auld SC, Caridi-Scheible M, Blum JM, Robichaux C, Kraft C, Jacob JT, et al. ICU and ventilator mortality among critically ill adults with coronavirus disease 2019. Crit Care Med 2020; 48(9): e799-e804.

19. Rahim F, Amin S, Noor M. Mortality of patients with severe COVID-19 in the intensive care unit: an observational study from a major COVID-19 receiving hospital. Cureus 2020; 12(10): e10906.

....