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Survival in Critical Care Patients with COVID-19 Pneumonia: A Single Center Based Observational Study

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ABSTRACT

Introduction
The severity of COVID-19 pneumonia ranges from asymptomatic to requiring mechanical support for survival. This observational study describes the demographic, management, vaccination status and outcome in Nepalese patients with COVID-19 who were admitted to critical care settings .

Methods
Single center based cross sectional study was conducted. All the patients admitted to critical care of Tribhuvan University Teaching Hospital (TUTH) were eligible subjects for this study. Demographic, clinical details and vaccination status of respective patients was obtained from interview and chart review. Data was collected in Microsoft Excel 2016 and statistical analysis was performed using statistical software SPSS 21.

Results
A total of 342 patients with mean age 53.95±15.6 years were included in the study. The mean duration of stay in critical care was 6.74±4.43 days. Fever and shortness of breath was the predominant symptom present in the studied patients with all patients having shortness of breath. Out of the 342 patients, 20.2% (n=69) were intubated at least once during their critical care stay, 57.89%(n=198) received only non-invasive ventilation and 21.9% (n=75) received oxygen via other means. The overall survival rate of patients admitted to critical care of TUTH was 60.53% with very low survival rate in intubated patients. Only 8.8% of the included patients had received at least one dose of vaccine.

Conclusion
Our study suggest that the prognosis of critical care COVID-19 patients is poor with highest mortality in patients receiving mechanical ventilation. Delay in intubation may contribute to this worse outcome in intubated COVID-19 patients.

Keywords
Corona virus, COVID-19, critical care, SARS, survival

INTRODUCTION

After its first reported case in Wuhan China in December 2019 and its declaration of global pandemic by WHO, COVID-19 has been a major cause of morbidity and mortality in people from around the world.[1] Caused by a respiratory virus SARS Corona Virus, COVID-19 mainly affects the respiratory system along with reported neurological, hematological and gastrointestinal involvement.[2,3] The severity of disease range from asymptomatic with no symptoms to requiring mechanical support for survival. Reported data suggest that the percentage of COVID-19 patients requiring critical care resources for survival including intensive care units, non-invasive and invasive mechanical ventilation ranges is about 32%.[4]

Several studies have shown that patients admitted to critical care setting have poor outcome with or without mechanical ventilation. Data are limited in context of Nepal about the percentage of patients requiring critical care and the outcome in those patients. In this article we share our experience of critical care patients with COVID-19 admitted to various critical care settings of Tribhuvan University Teaching Hospital (TUTH). This observational study describes the demographic, management, vaccination status and outcome in Nepalese patients with COVID-19 who were admitted to critical care settings.

METHODS

A single center observational study was carried out in one of the major COVID dedicated center (TUTH) of Nepal with high numbers of critical care beds after taking ethical clearance from Institutional Review Committee (IRC) of Institute of Medicine (IOM). All patients (18 years or more) admitted to critical care setting from 3rd May, 2021 to 13th July, 2021 were included in the study. Patients who were discharged on request or left against medical advice were excluded from the study.

First of all, all the laboratory diagnosed cases detected by RT-PCR for N-gene, ONF-gene and E-gene were labelled as COVID positive cases. TUTH followed the WHO protocol of COVID-19 clinical management in classifying the patients with COVID-19 as having mild, moderate, severe and critical disease.[5] Patients with severe COVID-19 diseases were admitted and managed in critical care setting. Standard care protocol developed on the basis of WHO clinical management guidelines was used in the management and treatment of COVID-19 patients. Demographic data, vaccination status, need of invasive (IV) or noninvasive ventilation (NIV) was noted. Noninvasive ventilation was given by Continuous Positive Airway Pressure (CPAP) or Bilevel Positive Airway Pressure (BiPAP) according to the need of patient.

Patient admitted with diagnosis of COVID-19 pneumonia in critical care setting
↓
History, demographic profile, co-morbidities, vaccination status, need for invasive or non-invasive ventilation noted
↓
Length of stay or mortality recorded at the time of discharge
↓
Analysis

Figure 1. Graphical outline of the study design and procedures

All the patients were followed upto their discharge from critical care setting or their mortality inside the critical care setting. A graphical outline of the study design and procedures are shown in Figure 1.

All the data were collected in a self-made data collection Proforma sheet. The data collected was entered in Microsoft Excel (Ver. 2016) and statistical analysis was performed using IBM SPSS 21. The frequencies of patient demographics, co-morbidities, need of invasive ventilation and outcome was calculated. Also the outcome in patient receiving NIV and IV calculated and their vaccination status noted.

RESULTS

A total of 342 patients were included in the study after excluding 10 cases of Leave Against Medical Advice (LAMA) and Discharge On Patient Request (DOPR). The mean age of the patients admitted in the critical care was 53.95±15.6 years and 41.8% of the patients were male. The mean duration of stay in critical care was 6.74±4.43 days ranging from 1 to 21 days. Fever and shortness of breath was the predominant symptom present in the studied patients with all patients having shortness of breath, 52.34% of the patients having fever, 14.79% having myalgia and 21.9% of the patients had other symptoms like loss of taste, gastrointestinal symptoms, and neurological symptoms (Table 1).

Hypertension (34.5%) was the most prevalent co-morbidities present in the patients followed by diabetes (33.9%), coronary artery disease (16.67%) and hypothyroidism (10.53%). Other co-morbidities (29.2%) included chronic liver disease, hematological problems, chronic obstructive lung disease, Systemic Lupus Erythematosus and Chronic kidney disease.

Out of the 342 patients 20.2% (n=69) were intubated at least once during their critical care stay, 57.89%(n=198) received only non-invasive ventilation in the form of either CPAP or BIPAP and 21.9% (n=75) received oxygen via Face mask with

Table 1. Basic demographic profile and outcome of patients in the study

Characteristics	Number (%)
Age	
30 or less	23 (6.7)
31-40	50 (14.6)
41-50	70 (20.46)
51-60	86 (25.14)
61 and above	113 (33)
Address	
Inside Kathmandu valley	310 (90.65)
Out of Kathmandu valley	32 (9.35)
Symptoms	
Fever	179 (52.34)
Shortness of breath	342 (100)
Myalgia	54 (15.79)
Others	75 (21.93)
Comorbidities	
Hypertension	118 (34.5)
Diabetes	116 (33.9)
Coronary artery disease	57 (16.67)
Hypothyroidism	36 (10.53)
Others	100 (29.2)
No comorbidities	124 (36.2)
Mode of ventilation	
Noninvasive ventilation	198 (57.89)
Invasive ventilation	69 (20.2)
Oxygen via NRM or HFNC	75 (21.9)
Vaccination status	
Vaccinated	30 (8.8)
Non Vaccinated	312 (91.2)
Outcome	
Step down to general ward	207 (60.53)
Mortality	135 (39.47)

reservoir (NRM) or High flow nasal cannula (HFNC). The overall survival rate of patients admitted to critical care of TUTH was 60.53% with very low survival rate in intubated patients.

The survival rate in patient in critical care setting with non-invasive ventilation was 70.2% (n=139) and in patients receiving oxygen via NRM and HFNC was 88% (n=60). However, only 8.7% (n-=6) of the patients receiving invasive ventilation were extubated and stepped down from critical care into COVID care ward. Out of the 69 patients receiving invasive ventilation, 21.7% (n=15) died on the day of intubation. Only 8.8% of the patients had received one or more dose of vaccine and only 4% of the patients had completed the then recommended doses of vaccination against COVID-19 (two jabs for Covishield and Verocell and one jab for Jansen). The basic demographic, vaccination status and outcome of patients included in the study is given in Table 1.

DISCUSSION

The study population in our study was mostly of more than 60 years and from inside of the valley (including Kathmandu, Lalitpur and Bhaktapur). Majority of the patients had fever and shortness of breath as their symptoms, and diabetes and hypertension as co-morbidities. Our study showed low survival in patients admitted to critical care setting. The lowest recovery rate was seen in patients receiving invasive ventilation and 21.7% of those patients not surviving the day of intubation.

Our study showed the highest number of patients with shortness of breath as their symptoms when they were admitted to critical care setting followed by fever and myalgia. Other symptoms included gastrointestinal, neurological and nonspecific such as loss of taste and smell. This finding is similar to that summarized findings in other studies.[6] Hypertension was the most common co-morbidities followed by diabetes, coronary artery disease and hypothyroidism. Given the high prevalence of these non-communicable diseases (44.2% prevalence of Hypertension[7], 8.4% of type 2 diabetes[8]), the findings are justifiable. Up to the conduction of the study, vaccines were not readily available and were only given to health care workers, general persons with age 65 or more, personnel involved in government services and public security. The findings of small percentage of patients with full dose of vaccination is justified by this reason. Vaccination status may have contributed to the poor outcome in the study population as a small percentage of the study patient had received full doses of vaccination against COVID-19. This statement is backed up by the findings in different studies comparing outcome of COVID-19 patients with vaccination and without vaccination.[9,10]

Results of our study were comparable, but the outcomes were worse than reported in other studies. A study by Oliveira et al in Florida showed overall ICU mortality of 19.8% and 23.8% in patients receiving MV.[11] Different studies from the United States reported mortality in ICU due to COVID-19 to be 20–62%.[12] A systematic review done by Quah et al have summarized the outcome of ICU COVID-19 patients from different countries. It reported the overall ICU mortality in patients with COVID-19 to be 37.7% in China, 25.6% in Italy, 23.6% in USA, 29.2% in Spain and 8% in UK. The mean pooled prevalence of ICU mortality was 25.7% with highest mortality in patients receiving invasive ventilation (34.8%).[13] In contrast to the outcome of invasive ventilation, the outcomes of non-invasive ventilation were shown to be far better by our study. This finding was similar to a meta-analysis done by taking studies all round the world by Quah et al. in which the mortality rate in noninvasive ventilation and HFNC combined was only 3.7%.[13] HFNC was

rarely used in our center due to low pressure of oxygen supply.

In our experience, there were more asymptomatic patients followed by patients who experienced mild to moderate symptoms. Patients who required critical care were minimum. With the origin of second wave, there was change in pattern of severity in patients with COVID-19 as the percentage of critical care patients were high and our center had to upgrade the critical care settings. The seven bedded ICU dedicated to COVID patients was not enough. Eventually, 56 beds were either added or critical care setting not dedicated to COVID patients were made available for COVID patients. This made a total of 63 critical care beds dedicated to management of COVID-19 patients. The then seven bedded ICU was upgraded to 20 bedded ICU by adding ICU beds with or without ventilators. Although the facilities were upgraded and number of ICU beds increased, there were never enough (especially in the beginning of the second wave) to accommodate all patients requiring intensive care because of large number of COVID-19 cases. Also patients requiring invasive ventilation were intubated only once the ventilators were available which contributed to poor outcome in patients with invasive ventilation. This delay in intubation and invasive mechanical ventilation may contribute to hypoxic brain injury and poorer outcome in intubated patients of our study. Some reports also suggest that delayed intubation highly impacts the outcome in patients with COVID-19.[14] However, a systematic review and meta-analysis by Papoutsi et al concluded that timing of intubation may have no effect on mortality and morbidity of critically ill patients with COVID-19.[15] This poor outcome may also be explained by the fact that Acute respiratory distress syndrome (ARDS) caused by COVID-19 was different than typical ARDS. Because of this fact, mechanical ventilation may not have been effective in reducing the lung injury.[16]

We followed a strict protocol for investigation and management of COVID-19 patients. All patients requiring oxygen therapy and diagnosed as moderate to severe and critical pneumonia were admitted. Patients diagnosed with severe COVID-19 pneumonia or with ARDS as critical COVID-19 pneumonia and requiring NIV or IV were admitted in the critical care setting. Baseline investigations including complete and differential leukocyte count, renal and liver function test, prothrombin time, international normalized ratio, chest X-ray and ABG was done on first day of admission. Other investigations included inflammatory markers such as ferritin, C- reactive protein (CRP), procalcitonin and coagulation profile (assessed by measuring D-dimers). If both procalcitonin and CRP were positive, bacterial infection source were searched and blood culture was sent. If CRP was positive and Procalcitonin negative, the patient was considered for therapy with Tocilizumab (this statement is true for later stages of this study as Tocilizumab was considered after some studies showed its potential efficacy in managing COVID-19 patients[17]). However, most patients qualifying the criteria to start tocilizumab did not receive it because of the cost factor. Mode of ventilation was decided clinically on the basis of oxygen saturation, respiratory effort. Awake proning method was implemented in all patients. We did not use Remdesivir or convalescent plasma therapy routinely. Patients with stay in COVID critical care setting of more than 21 days were shifted to non COVID ICU and managed accordingly.

This report reports the demographic profile, co-morbidities, vaccination status and outcome of patients with severe and critical COVID-19 pneumonia. This helped us understand shortness of breath as the most common symptoms, hypertension as the most common co-morbidity poor outcome in intubated patient and potential role of vaccination in improving outcome in critical care patients with COVID-19. However, this study has some several limitations. This was a cross-sectional study conducted at a single center so the findings of the study may not be generalized. Also this being study conducted in a center with one of the most sophisticated ICU setup, these findings may not be generalized to other centers of Nepal with less infrastructure and lack of skilled manpower. No follow-up after discharge was performed and if a patient was re-admitted to ICU after step down, the authors would not know. Laboratory investigation values, different factors that may influence the outcome in critical care patients is not taken into consideration and just mere outcome data sought.

CONCLUSION

Our study reports the outcome of critical care patients with COVID-19 in Nepal. Our study suggest that the prognosis of critical care COVID-19 patients is poor with highest mortality in patients receiving mechanical ventilation. Patient receiving invasive ventilation had highest mortality which may be due to delay in intubation. The poor outcome reported in the study can be due to low number of patients receiving recommended complete dosing of vaccination. The delay in ventilation may be contributing to high ventilation in those patients and this can be prevented by further increasing the facilities with ventilators and early intubation in patients with ARDS.

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CONFLICT OF INTEREST

The author(s) declare that they do not have any conflicts of interest with respect to the research, authorship, and/or publication of this article.

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