Mortality Predicting Factors In Covid-19

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Abstract

Introduction

In late 2019, a novel coronavirus, now designated SARS CoV-2 was identified as the course of an outbreak of acute respiratory illness in Wuhan, China. In February 2020, the WHO designated the disease COVID-19. In this study, we summarized the clinical characteristics of 80 death cases with COVID-19; the purpose is to identify critically ill patients of COVID-19 early and reduce their mortality in future.

Materials and methods

A hospital-based retrospective study based on medical records of patients who are COVID-19 positive and died of the same admitted at Dept. of pulmonary medicine, GHCCD/AMC Visakhapatnam between June 2020 to September 2020. The clinical records, laboratory findings and radiological assessments (chest X-rays or CTs) were extracted from medical records and identified risk factors contributing to mortality. Statistical analysis was done using SPSS version 21. Cross-validation of the model was done using R software.

Results

A total of 80 death patients with COVID-19 pneumonia (56 male and 24 female) were included in the study, of which 47 were aged ≥60years. Presenting complaints were fever (77.5%), cough (72.5%), shortness of breath [SOB] (96.25%), myalgia, Sore throat, anosmia & ageusia. Common comorbidities were hypertension [HTN] (40%), diabetes[DM] (33.75%), chronic kidney disease [CKD], coronary artery disease[CAD] etc. Leukocytosis and lymphocytopenia in blood pictures, high neutrophil-to-lymphocyte ratio of >5 (94.5%), elevated serum inflammatory markers levels (C-reactive protein[CRP], lactate dehydrogenase[LDH], D-dimer and Ferritin) with the radiological picture of viral pneumonia were observed in most of the patients.

Conclusion

Delayed presentation, multiple comorbidities, malnutrition, COVID-19 complications namely ARDS, low oxygen saturation and organ failure, raised blood counts and inflammatory markers were associated with an increase in the risk of mortality of COVID-19 pneumonia**.**

Keywords: COVID 19, risk factors, mortality

INTRODUCTION

In late 2019, a novel coronavirus, now designated SARS-CoV-2 was identified as the course of an outbreak of acute respiratory illness in Wuhan, a city in China. In February 2020, the WHO designated the disease COVID-19.[1]

The patient's common clinical manifestations included fever, nonproductive cough, dyspnea, myalgia, fatigue, normal or decreased leukocyte counts, raised inflammatory markers level and radiographic evidence of pneumonia. COVID-19 is a new disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) which targets the angiotensin-converting enzyme 2 (ACE-2), with symptoms ranging from mild to critical [2]. The patients with a more severe illness are often more difficult to treat and have poor prognosis, including death [3]. While researchers have made unprecedentedly rapid progress in understanding the occurrence, progression, and treatment of the disease [4-6], it is still urgent to identify the risk factors for severe illness from COVID-19 and to protect the most vulnerable people. Previous studies have reported that older age, male gender, smoking and other conditions such as hypertension, diabetes, obesity, and chronic lung disease are the risk factors for severe illness or death [7-8]. Increasing evidence is investigating the clinical features and laboratory abnormalities in patients with COVID-19 infection. Considering the widespread of COVID-19, early and accurate prognosis prediction is urgently warranted.

In this study, we summarized the clinical characteristics of 80 death cases with COVID-19; the purpose is to identify critically ill patients of COVID-19 early and reduce their mortality.

OBJECTIVES OF THE STUDY

1. This study aims to summarize the clinical characteristics of death cases with COVID-19

2. To identify critically ill patients of COVID-19 early and reduce their mortality.

MATERIALS AND METHODS

This is a hospital based retrospective study 80 laboratory confirmed COVID 19 patients who died from June 2020 to September 2020 in Dept. of pulmonary medicine, Gov. Hospital for Chest and Communicable Diseases / Andhra Medical College, Visakhapatnam.

Inclusion criteria:

1. All patients who tested positive for severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) by use of RT-PCR /True NAAT on samples from

there respiratory tract and died of COVID 19 related health issues

Exclusion criteria:

1. All COVID-19 patients who were successfully treated and recovered.

2. All patients who tested negative for severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) by use of RT-PCR /True NAAT on samples from there respiratory tract.

3. Patients who had cause of death unrelated to Covid 19.

The epidemiological and clinical features, laboratory findings and radiological assessments included chest X-ray or CT of laboratory confirmed COVID 19 patients were extracted from medical records of Dept. of pulmonary medicine, GHCCD, Visakhapatnam from June 2020 to September 2020. Statistical analysis was done using SPSS version 21. Cross validation of the model was done using R software.

RESULTS

General clinical characteristics

A total of 80 dead patients with COVID-19 pneumonia (56 male and 24 female) [figure 1: sex distribution] were included in the study, of which 47 were aged ≥60years 14 were aged between 50-59years, 11 were aged between 40-49 years and were <40years. [age distribution of patients - table no.1]

Out of 80 patients, 77 (96.25%) had SOB, 62 (77.5%) had fever, 58 (72.5%) had cough, 19 (23.75%) had myalgia, 5 (6.25%) had sore throat, 3 (3.75%) had anosmia & ageusia and 8 (10%) had other symptoms like vomiting, loose stools, headache, running nose and chest pain [figure 2]. The average duration of illness at presentation was 4.925 days, of which most of the patient's presentation with less than 1 week of illness and only 7 (8.75%) patients presented with > 7days of illness.[figure 3]

Common comorbidities observed in these patients were hypertension [HTN](40%), diabetes [DM](33.75%), chronic kidney diseases [CKD] (7.5%), coronary artery diseases [CAD](7.5%) COPD (5%), tuberculosis [TB](3.75%), chronic liver diseases [CLD](2.5%) and other comorbidities like malignancies, bronchial asthma, hypothyroidism, gall stones etc.(Common comorbidities observed in

patients table 2). 8% of the total patients found to had 3 or more comorbidities, 18.57% had 2 comorbidities, 28.75% had single comorbidity and 40% had no comorbidities on admission[figure 4].

Most of the patients presented with febrile episodes with abnormal vitals such as tachycardia, tachypnea and low oxygen saturation. 14 out of 80 (17.5%) patients presented with only <60% of oxygen saturation on admission, 16 (20%) patients with Spo2 of 61-70%, 12 (15%) patients with Spo2 of 71-80%, 25 (31.25%) patients with Spo2 of 81-90% and 13 (16.25%) patients with an Spo2 of >90%. (Oxygen saturation at the time of admission is depicted in table .3). Most of the cases were severe (85%) and moderate (15%) covid 19 according to clinical severity assessment guidelines by MOHFW. (Table 4: clinical severity and assessment parameters- Gov. of India MOHFW guidelines) [figure 5]

Analysis of laboratory test results of dead patients

In addition to the lung, the most common organ damage outside the lungs was the heart, followed by the kidney (serum blood urea nitrogen (BUN) or/and creatinine (Cr) levels were increased [16 patients (20%)] and liver serum alanine transaminase (ALT) and aspartate aminotransferase (AST) levels were increased [10 patients (8%)]. Besides, all the patient's albumin and lactate levels were decreased and increased respectively. The routine blood tests, procalcitonin (PCT), C-reactive protein (CRP) D-dimer and ferritin were used to reflect changes in an inflammatory response in COVID-19. In the patient's last test before death, white blood cell and neutrophil counts were elevated in 52 patients (65%) and 58 patients (72.5%), lymphocyte counts were decreased in 68 patients (85%) with a high neutrophil to lymphocytes ratio of >5 (in 94.5% patients). Most patients had mild anemia, red blood cells and hemoglobin levels were decreased in 64 (80%) and 54(67.5%) patients respectively. Most patients' PCT, CRP and LDH levels were elevated, the percentages were 89%, 95% and 86% respectively.

Specific biomarkers that indicating poor prognosis

To screen for biomarkers indicating poor prognosis, we observed the changes of biochemical indicators in all patients (if repeated measurements were present). The results showed that the levels of the last test of

neutrophils (72.5%), procalcitonin [PCT] (89%), CRP (95%), D-dimer (75%), lactate dehydrogenase (LDH) (86%) and ferritin (65%) were increased as compared to the first test, while the levels of lymphocytes were decreased (87.5%).

Chest radiographs of the studied subjects were studied and 20% did not have any abnormalities at any point during the illness. Common abnormal radiographs findings were consolidation and ground-glass opacities, with bilateral, peripheral, and lower lung zone distributions; lung involvement increased throughout illness with a peak severity at 10-12 days after symptom onset. 12 patients showed mild to moderate pleural effusions and 6 of the patients developed spontaneous pneumothorax during illness. Chest radiographs showed that the patient's pulmonary lesions were worse in the late stage than in the early stage. The available Chest CTs showed ground glass opacifications (87%), ground glass opacifications with consolidation (56%), adjacent pleural thickening (46%), interlobular septal thickening (44%), and air bronchograms (33%). [CT chest findings available with dead patients in Table 5]. Other less common findings were crazy paving patterns, bronchiectasis, pleural effusion, and lymphadenopathy. Chest CT abnormalities were observed as bilateral, with peripheral distribution, and in lower lobes.

Treatment parameters

Patients are treated with symptomatic treatment, adequate fluid management, respiratory support in the form of O2 therapy and prone positioning, antibiotics, steroids, anticoagulants, antivirals, antipyretics and other supportive medications along with close monitoring according to the 'Clinical management protocol for COVID 19 in adults by Government of India Ministry of Health and Family Welfare.

Oxygen therapy was in the form of o2 supplementation through nasal cannula or face mask or high flow nasal cannula and in the form of non-invasive or invasive mechanical ventilation according to their clinical severity. Since most of the studied subjects were of severe COVID cases 33 patients were given non-invasive mechanical ventilation and 5 were treated with invasive mechanical ventilation.

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16 were supplemented oxygen through a high flow nasal cannula.[figure 6]

Out of the 80 cases, 77(96.25%) were treated with intravenous or oral steroids, 36(55%) patients received anticoagulants and 33(41.25%) were given antiviral (injection remdesivir or oral favipiravir) according to treatment guidelines and drug availability. [Table 6: treatment received by patients].

Most of the patients also received higher antibiotics because of secondary bacterial infection and sepsis. COVID-19 complications namely acute respiratory distress syndrome[ARDS], systemic inflammatory storm, multi-organ damage and organ failure were anticipated and measures were taken for the management of the same.

Proper measures were taken to prevent complications associated with critical illness such as ventilator-associated pneumonia, venous thromboembolism, catheter-related blood stream infections, pressure ulcers, stress ulcers gastrointestinal bleeding, and opportunistic infections.

The average duration of hospital stay was 6.5 days (range 2-24 days) [figure 7 : total duration of hospital stay before death]. Most of the patients landed up in ARDS and respiratory failure. Multiple organ dysfunction observed among many patients, the most common organ damage outside the lungs was the heart, followed by kidney and liver. The results demonstrated that the death of the patient may be primarily related to impaired cardiopulmonary function.

DISCUSSION

In this study, we reported 80 dead cases of with COVID-19. The clinical characters of these patients indicated that age and underlying diseases were the most important risk factors for death.

As concerning the underlying diseases, the most common one was hypertension, followed by diabetes, kidney disease, Heart disease, COPD, malignancies and other preexisting lung conditions.

The SARS-CoV-2 has been identified as one of a class of single-stranded enveloped 39 RNA viruses, belonging to the beta- coronaviruses genus of the Coronaviridae family (Zhu et al., 2019).

In this study, most of the patients died of respiratory failure, which indicated that the lung is the most common target organ of SARS-CoV-2.

Multiple organ dysfunction could also be observed, the most common organ damage outside the lungs was the heart, followed by kidney and liver. The results demonstrated that the death of the patient may be primarily related to impaired cardiopulmonary function. All the patients' albumin levels, RBC counts and Hb levels were decreased, which indicates that malnutrition is common to severe patients.

COVID-19 is a viral disease characterized by normal or low white blood cell count and decreased lymphocyte count. In this study, increased white blood cell and neutrophils count and decreased lymphocyte counts were observed in most of the patients. In addition, procalcitonin (PCT) levels were elevated in 89% of patients. PCT is a sensitive indicator of bacterial infection. The results indicated that bacterial infections may play an important role in promoting the death of patients.

To screen out biochemical indicators that are meaningful for the diagnosis of disease progression, we consulted the laboratory test results of all the dead patients, among which 34 patients had repeated measurements. The results showed that the levels of the last test of neutrophils (72.5%), PCT (89%), C-reactive protein [CRP] (95%), D-dimer (75%), lactate dehydrogenase (LDH) (86%) and ferritin (65%) were increased as compared to the first test, while the levels of lymphocytes were decreased (87.5%), suggesting that the rising of neutrophils, PCT, CRP, ferritin, D-dimer and LDH levels as well as the decline of lymphocytes counts can be used as indicators of disease progression,.

This was a small sample size retrospective study, which was limited by the small numbers of patients and by using a retrospective method. In particular, some important laboratory results were incomplete.

CONCLUSION

Risk factors for increased mortality in patients with COVID-19 identified in this study can be used a reference in the prevention of death in COVID-19 patients in future. Delayed presentation, multiple comorbidities, malnutrition (low BMI, anemia & hypoprotenemia), patients low body resistance, low oxygen saturation, raised blood counts and

inflammatory markers, secondary bacterial infection, COVID-19 complications namely ARDS , sepsis, septic shock, and organ failure, were associated with an increase in the risk of mortality of COVID-19 pneumonia.

Comorbidity or concomitant diseases of diabetes mellitus, hypertension, chronic kidney disease, cardiovascular disease, TB and underlying lung diseases are also important risk factors. The patient's low body resistance is characterized by low white blood cells (WBC), lymphocytopenia, and neutrophilia. Various mortality risk factors that occur in COVID-19 patients identified in this study are expected to be a guide in efforts to prevent death in COVID-19 patients in future quickly and accurately.

Our study have some limitations such as some of patients did not recieve timely supportive interventions such as ICU admission, mechanical ventilation, pulmonary thromboemolysis etc ,because of an increasing no.of severe patients occurred in a short period, non availability of CTPA and other advanced investigative measures and overwhelming of our medical system.

ACKLOWLEDGEMENTS

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TABLES

Age	Number
>60 years	47
50-59 years	14
40-49 years	11
<40 years	8

Table 1: Age distribution of dead patients

Comorbidity	Number of patients
DM	27
HTN	32
DM & HTN	19
CKD	6
CAD	6
COPD	4
TB	3
CLD	2

Table 2: Comorbidities observed in dead patients

SpO2 at presentation	No. of patients	Percentage
>90%	13	16.25%
81-90%	25	31.25%
71-80%	12	15%
61-70%	16	20%
<60%	14	17.5%

Table 3: Oxygen saturation of dead patients at the time of admission.

Clinical Severity	Clinical presentation
Mild	Patients with uncomplicated upper respiratory tract infection, may have mild symptoms such as fever, cough, sore throat, nasal congestion, malaise, headache Without shortness of breath or Hypoxia (normal saturation).
Moderate	Pneumonia with no signs of severe disease Adults with presence of clinical features of dyspnea and or hypoxia, fever, cough, including SpO2 90 to ≤93% on room air, Respiratory Rate more or equal to 24 per minute.
Severe	Severe Pneumonia- Adults with clinical signs of Pneumonia plus one of the following; respiratory rate >30 breaths/min, severe respiratory distress, SpO2 <90% on room air. ARDS, Sepsis, Septic shock

Table 4: Clinical severity and assessment parameters- Govt of India MOHFW guidelines.

CT Chest findings	Percentage of patients with characteristic findings
GGOs	87%
GGOs with consolidation	56%
Adjacent pleural thickenings	46%
Interlobular septal thickening	44%
Airbronchograms	33%

Table 5: Available CT chest findings of dead patients

Treatment	Percentage of patients received treatment
Antivirals	41.25%
Corticosteroids	96.25%
Anticoagulants	55%

Table 6: Treatment received by dead patients.

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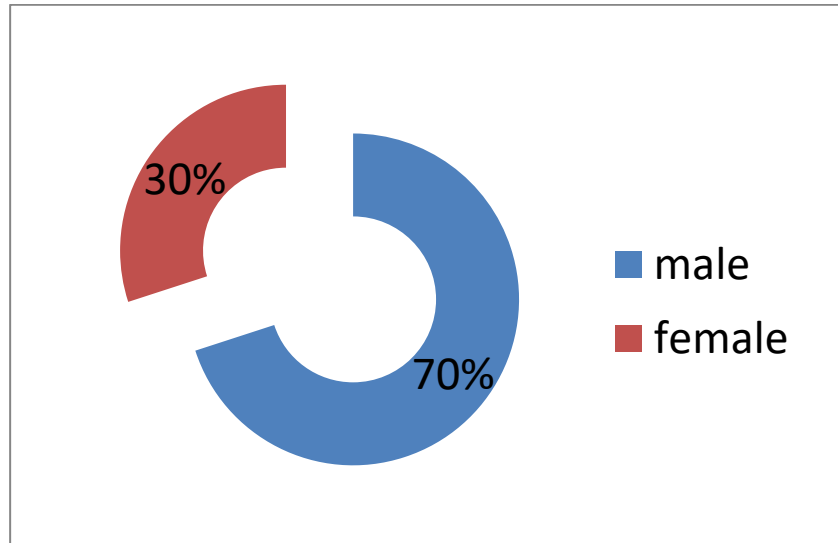
FIGURES

Figure 1: Sex distribution of dead patients
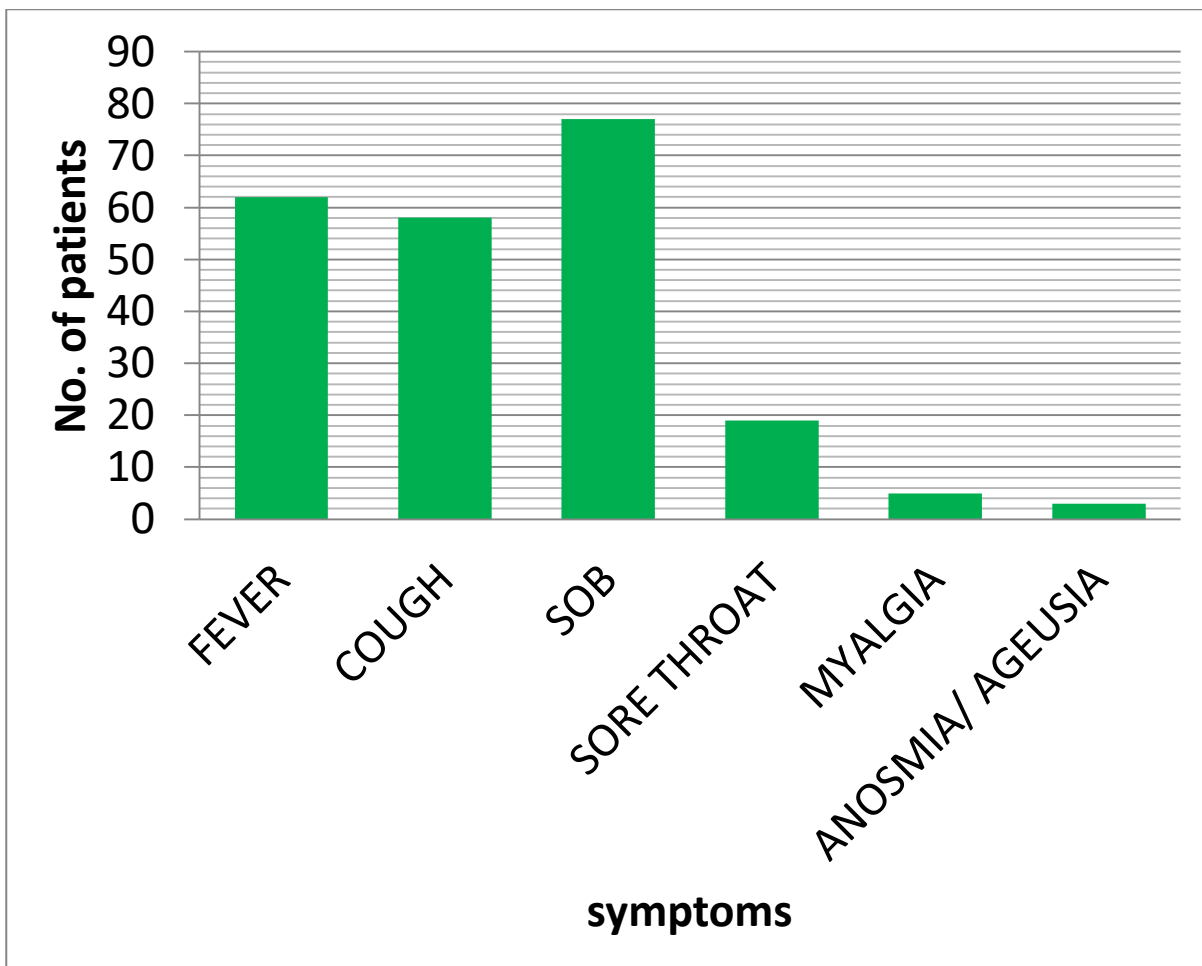
Figure 2: Initial symptoms of patients.
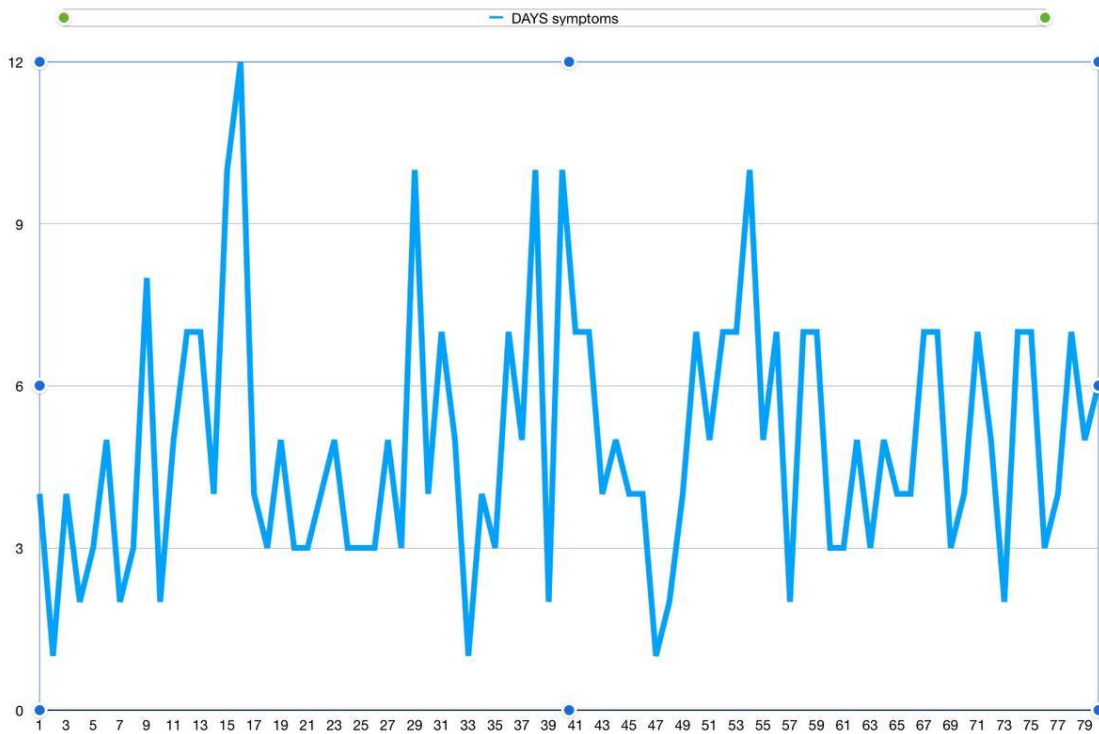
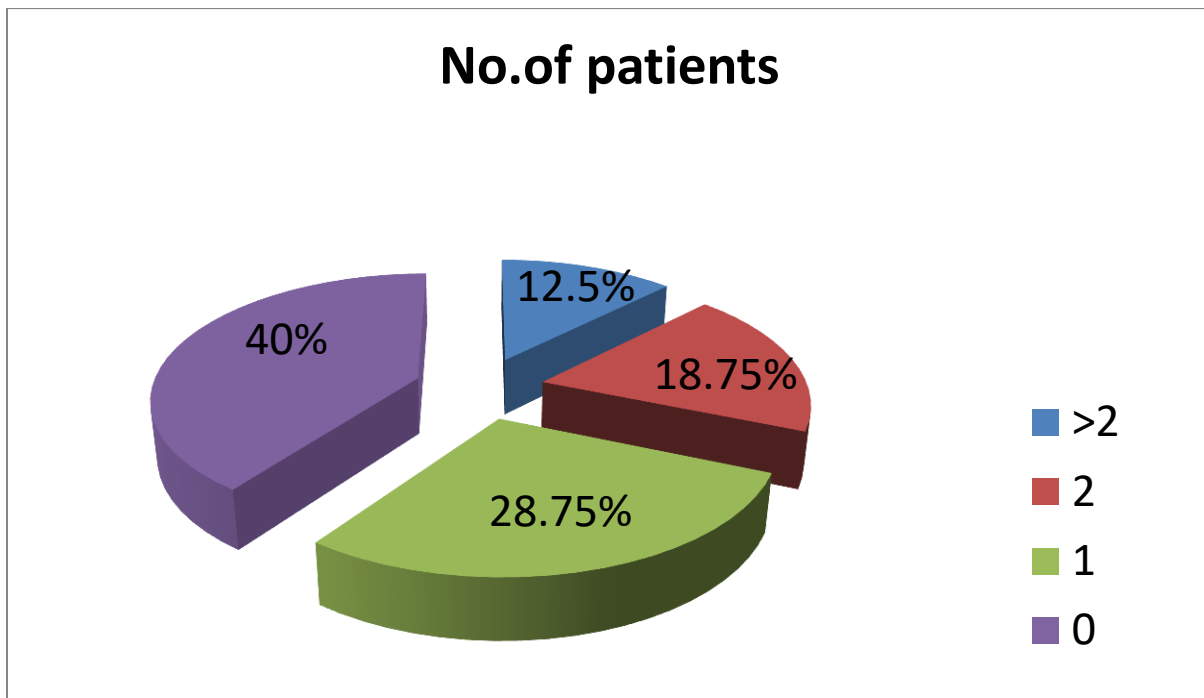**Figure 3: Duration of symptoms before admission reported in dead patients**

Figure 4: Number of comorbidities observed in dead patients
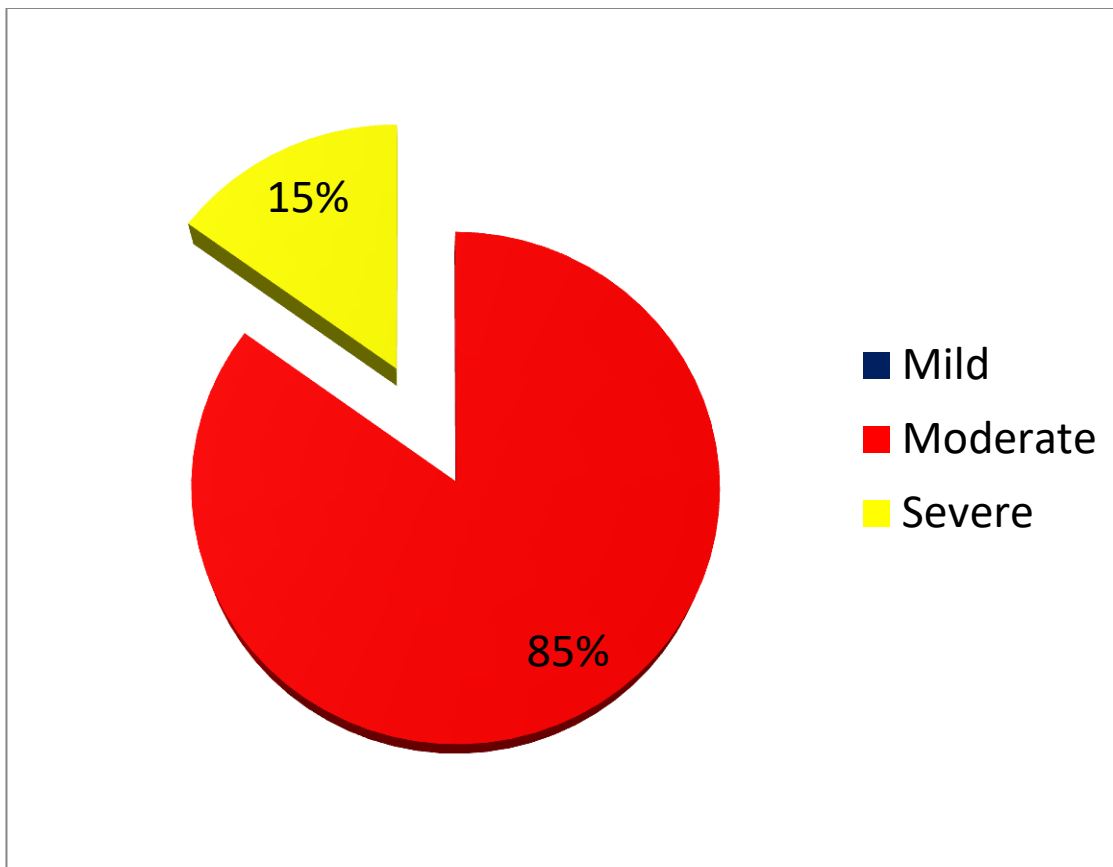
Figure 5: Clinical severity of COVID 19 observed in dead patients
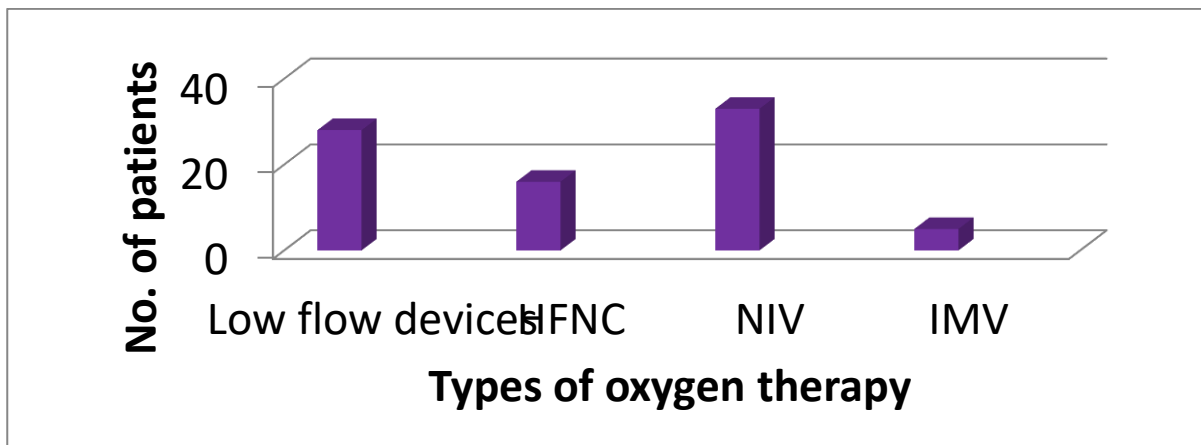

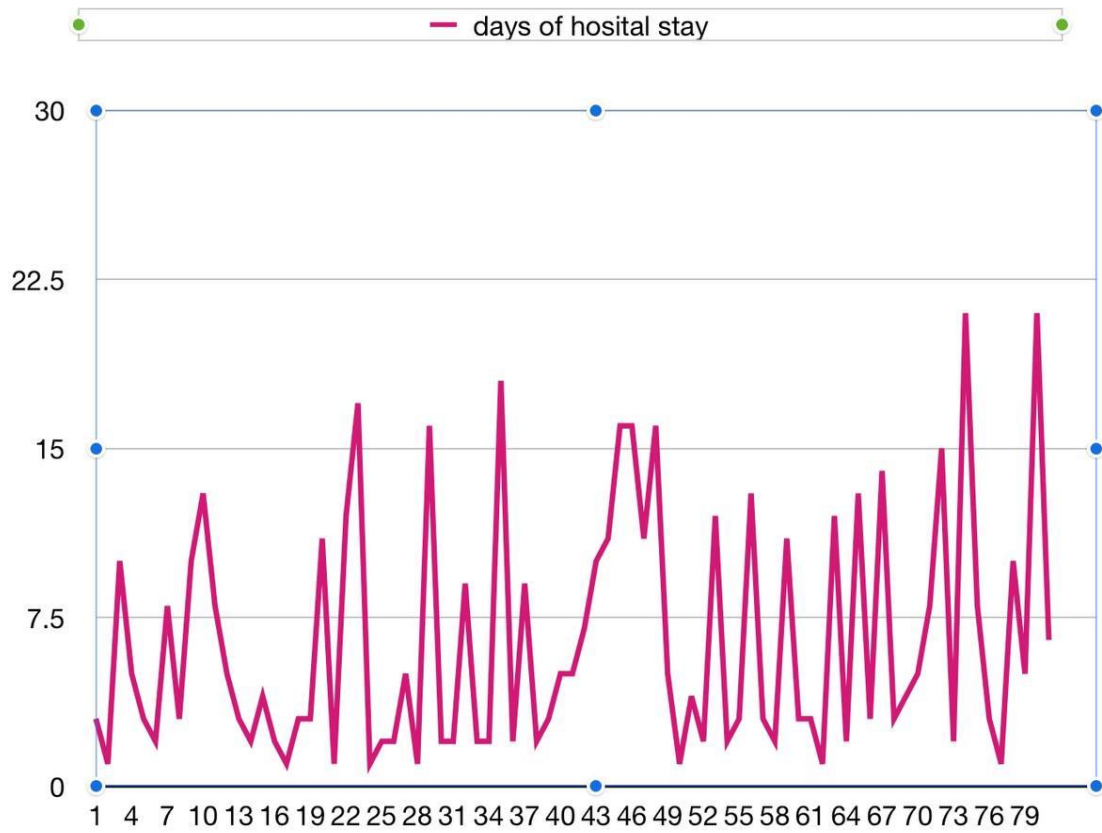**Figure 6: Modes of oxygen therapy given to dead patients**

Figure 7: Total duration of hospital stay of dead patients