Original Research Article

Clinical profile, risk factors and comorbidities associated with mortality among COVID-19 inpatients at a tertiary care centre in Visakhapatnam: a retrospective study

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Received: 20 June 2021
Accepted: 05 July 2021

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ABSTRACT

Background: The rapid emergence of novel COVID-19 infections has resulted in infection to millions of people and hundreds of deaths around the world. Without effective drugs for COVID-19, early identification and control of risk factors are important measures to combat COVID-19. This study aims to determine the risk factors and comorbidities associated with poor prognosis and mortality in COVID-19 patients in a tertiary hospital.

Methods: This is a retrospective study of all laboratory confirmed cases of COVID-19 patients with poor outcome in a tertiary hospital in Visakhapatnam from April to June months of 2021. Demographic, clinical history comorbidities and outcomes data were collected from government hospital for chest and communicable diseases and were entered in Microsoft excel. The data was analyzed using univariate binomial logistic regression, generalized linear models with poison distribution.

Results: We included 306 COVID-19 positive patients with a median age of 46 years. Of these, 64.05% were males and 36.94% were females. Risk associated with worse outcome included males, old age, comorbidities like hypertension (47.38%), diabetes (37.58%), cardiac disease (4.9%), hypothyroidism (3.26%), chronic kidney disease (CKD) (3.26%), and malignancies (1.63%).

Conclusions: Risk factors for poor outcomes among COVID-19 cases include old age, males, diabetic patients, hypertensive patients, cardiac patients, and CKD patients.

Keywords: COVID-19, SARS CoV-2, Risk factors, Mortality

INTRODUCTION

The rapid emergence of novel corona virus has led to infection to millions of patients and death of hundreds of thousands of patients worldwide. In India total numbers of confirmed cases as of 30 June 2021 are 3.03 crore out of which 2.94 crore cases recovered and 3.98 lakh cases died.¹ It is difficult to control the spread of the COVID-19 infection. Efforts should focus on effective measures to minimize the disease impact on those who are prone to develop adverse outcomes. Healthcare services become compromised due to the rapid increase in infected patients.² Overwhelming of the healthcare system leads to an unexpected rise in mortality and morbidity.³ Therefore it is important to risk stratify COVID-19 patients on the basis of predicted outcomes and guide treatment accordingly.⁴

Several countries have seen a two-wave pattern of reported cases. In India first wave of COVID-19 began in June 20, 2020 and lasted till August 2020, although some isolated cases had been reported in September 2020 to February 2021. As a consequence of the first outbreak, the Indian government introduced a series of strict prevention
measures, which was followed by a period of progressively increasing social interaction, work and commercial activity. As of March 2021 life in country had returned to relative normality, except for a facemask and safe social distancing. Unfortunately, the number of COVID-19 cases began to increase towards the end of April and it once again presented the numbers similar to 2020. This forced the government to introduce serious restrictive measures, including lockdowns, curfew after 12 noon till 6 am.

The clinical manifestation of COVID-19 is broad and ranges from asymptomatic and mild upper respiratory tract symptoms to severe illness and death.\(^5\) It is also very difficult to predict beforehand the clinical course and risk of deterioration in COVID-19 patients.\(^6\) Previous studies have identified that older age and male gender are at risk for severity and higher mortality.\(^3\) Some distinct symptoms and laboratory findings were correlated with poor outcomes.\(^8\) Other comorbidities that were found to be associated with poor prognosis were cardiovascular disease, diabetes mellitus, chronic respiratory disease, and hypertension.\(^9\) However, it is difficult to generalize these studies in countries like India with lot of diversity, where presentation of COVID is different among different states. Literature regarding the risk factors for COVID-19 mortality is limited in India.

With this background this study was conducted to investigate the severity and characteristics of the hospitalized patients in government hospital for chest and communicable diseases (GHCCD), Visakhapatnam. We have assessed the risk factors for death among COVID-19 patients. We have evaluated age, gender, comorbidities, mortality and outcomes in COVID-19 patients.

**METHODS**

The study type that we have conducted is a retrospective cohort study. It is conducted in GHCCD, which is a tertiary care government hospital in Visakhapatnam. We have collected data from all laboratory confirmed cases located in GHCCD in period between April 2021 and June 2021. GHCCD is a tertiary care institute equipped with around 300 beds. It was designated as dedicated COVID health care centre (DCHC). Standard care is being provided free of cost to COVID patients seeing care at the hospital as per the ministry of health and family welfare, government of Andhra Pradesh.

The selection criteria for the study included all critically ill patients who tested real time-polymerase chain reaction (RT-PCR) positive for COVID-19 with nasopharyngeal swab/oropharyngeal swab, and got admitted in the hospital and died during treatment. In parallel with the World Health Organization (WHO) protocols, COVID-19 was diagnosed based on the results of qualitative real time-polymerase chain reaction (RT-PCR) testing from nasopharyngeal samples/oropharyngeal swabs taken from suspected patients who were admitted in the hospital. Case sheets of all the COVID-19 positive patients who died during the treatment in the hospital were collected. The Demographic, clinical, laboratory, and comorbidity data of COVID-19 positive patients who died were collected and entered in Microsoft excel. The variables that were collected from the case sheets included age, gender, personal history of smoking and alcohol intake, comorbidities like diabetes, hypertension, cardiac diseases, chronic kidney disease (CKD), hypothyroidism, malignancies. A total of 1041 patient’s case sheets of COVID-19 confirmed cases were collected. Out of which the case sheets of COVID-19 patients who died were separated and analyzed. Age and gender distribution of mortality of COVID-19 positive patients were calculated. The risk of mortality due to comorbidities was compared between the patients who died and patients who got discharged.

**Statistical analysis**

Data were entered using Microsoft excel and analysis was done using STATA statistical software version 14. The continuous variables age and duration of stay are summarized as mean with standard deviation (SD) or median with an interquartile range based on the distribution of the data. The categorical variables are summarized as frequencies and proportions. Categorical variables underwent a test of association using the Chi-square test or Fisher exact test. The data was analyzed using univariate binomial logistic regression, to analyze the risk factors associated with COVID-19 mortality. The strength of association is expressed as relative risk with 95% confidence intervals. Survival curves were made using the Kaplan-Meier method. Long-rank test was used to test the equality of survivor functions between the groups.

**Ethical consideration**

Ethical approval was taken from the Andhra medical college ethics committee to which the hospital is affiliated before the study was conducted.

**RESULTS**

Between 01 April 2021 and 29 June 2021 a total of 1041 COVID-19-positive cases were screened, 306 patients died and 735 patients were discharged. The patients included in the study had a mean age of 46.9 years. The distribution of the gender in COVID mortality cases was males constituted 64.05% (n=196) and females constituted 35.95% (n=110) as shown in Figure 1. The median survival time of male COVID19 patients (9 days) was lesser than the female COVID19 patients (15 days) and the difference was statistically significant (p value <0.023). The results (Table 1) show that as the age increased, the risk of death due to COVID-19 also increased, when compared to 31-40 years age group, patients with 41-50 years age had 1.6 (95% CI: 0.9-2.8) times increased risk of mortality. 51-60 year old had 2.7 (95% CI: 0.9-2.8) times...
increased risk of mortality. 61-70 year old patients had 2.8 (95% CI: 1.1-6.9) times increases risk of dying and 71-80 years age group had 3.8 (95% CI: 1.2-7.8) times increased risk of mortality.

Table 1: Age distribution among COVID19 patients admitted to the tertiary care centre.

| Characteristics (age) | Discharged N=1041 | Died N=306 | RR (95% CI) | aRR (95% CI) | P value |
|-----------------------|-------------------|------------|-------------|--------------|---------|
| 20-30                 | 4                 | 0          | 0.6 (0.3-1.7) | 0.4 (0.2-1.4) | 0.04    |
| 31-40                 | 84                | 21         | 1.3 (0.5-2.8) | 1.0 (0.6-1.9) | 0.03    |
| 41-50                 | 195               | 59         | 1.6 (0.9-2.8) | 1.8 (0.9-2.1) | 0.04    |
| 51-60                 | 165               | 78         | 2.7 (0.9-5.1) | 2.1 (1.1-3.3) | 0.002   |
| 61-70                 | 125               | 91         | 2.8 (1.1-6.9) | 2.4 (1.3-4.5) | 0.003   |
| 71-80                 | 162               | 56         | 3.8 (1.2-7.8) | 3.3 (1.7-5.9) | 0.001   |

Table 2: Gender distribution.

| Gender | Discharged | Died | RR (95%CI) | Arr (95%CI) | P value |
|--------|------------|------|------------|-------------|---------|
| Male   | 490        | 196  | 1.9 (0.8-5.9) | 1.0 (0.6-1.9) | 0.016   |
| Female | 245        | 110  | 1.1 (0.7-4.5) | 0.7 (0.4-1.3) | 0.012   |

Table 3: Comorbidities.

| Comorbidities | Discharged | Died | RR (95%CI) | Arr (95%CI) | P value |
|---------------|------------|------|------------|-------------|---------|
| Diabetes      | 456        | 115  | 3.3 (0.9-7.8) | 1.8 (1.1-2.9) | 0.015   |
| Hypertension  | 367        | 145  | 4.5 (0.8-6.7) | 1.7 (0.7-3.2) | 0.018   |
| Cardiac       | 35         | 15   | 2.9 (0.6-4.8) | 1.8 (0.9-4.9) | 0.019   |
| CKD           | 24         | 10   | 3.2 (0.7-4.9) | 2.3 (0.8-5.2) | 0.099   |
| NEURO         | 9          | 4    | 3.3 (0.9-5.7) | 4.5 (0.7-5.4) | 0.008   |
| Hypothyroid   | 14         | 2    | 2.1 (0.8-3.7) | 3.5 (0.9-5.6) | 0.015   |
| Malignancy    | 4          | 1    | 1.0 (0.4-2.7) | 1.2 (0.6-3.2) | 0.016   |

The comorbidities with which COVID-19 patients most commonly presented were hypertension (47.38%), diabetes (37.58%). Other comorbidities were cardiac disease (4.9%), hypothyroidism (3.26%) CKD (3.26%) and malignancies (1.63%). COVID-19 patients with comorbidities had 3.4 (95% CI: 2.3-5.4) increased risk of death than patients with no comorbidities. Hypertension was the most common comorbidity followed by diabetes mellitus with which the COVID-19 patients presented to the hospital. Hypertensive patients had increased risk of mortality by 4.5 (95% CI: 0.8-6.7). Diabetic patients had increased risk of mortality by 3.3 (95% CI: 0.9-7.8). Risk of mortality in COVID-19 patients with CKD was 3.2 (95% CI: 0.7-4.9) and cardiac illness 2.9 (95% CI: 0.6-4.8) Figure 3.

Figure 1: Gender distribution among the COVID-19 patients who died.

Figure 2: Gender distribution among the COVID-19 patients who got discharged.

Figure 3: Median survival time among males and females.
DISCUSSION

The results of our study shows that increasing age, male gender, comorbidities such as diabetes mellitus, hypertension, CKD, cardiac disease and malignancy were significantly associated with higher mortality in COVID-19 patients. In our study male COVID-19 patients, showed higher mortality and higher risk ratio. Meta-analysis done by Peckham also showed higher mortality in male COVID-19 patients.10 Our study shows that increasing age has the higher risk of COVID-19 mortality in Indian population. Meta-analysis done by Bonanad also shows that COVID-19 patients have increasing mortality with increasing age.11 Immunosenescence (ageing causing decline in immune function), presence of comorbidities, mucosal barrier changes could be the reasons for the increased COVID-19 mortality risk among older patients. The presence of any comorbidity increased the risk of mortality by 4 times in our analysis which is similar to other studies. Diabetes and hypertension are the most common comorbidities which were associated with increased COVID-19 mortality. Meta-analysis done by corona showed higher mortality in COVID-19 patients having diabetes mellitus.12 This may be due to altered immune response caused by diabetes and hypertension. Study done by Cook showed higher mortality in COVID-19 patients with associated hypertension as comorbidity.13 Our study also showed that CKD patients are 5 times more at risk of COVID-19 mortality. Other comorbidities that were associated with higher mortality were cardiac diseases, neurologic diseases, hypothyroidism, and malignancies.

Limitation of this study is that, it is a record based study done in a dedicated respiratory centre. So patients with other comorbidities might be less, especially cardiac, renal, and pregnant women.

CONCLUSION

To conclude increasing age, male gender, presence of comorbidities is associated with significant risk factors for mortality due to COVID-19. Early identification of patients with these risk factors and appropriate treatment is important to prevent death among COVID-19 patients. COVID-19 patients with these risk factors should be given appropriate inpatient care than domiciliary management to prevent fatal outcomes among high risk patients.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Praveen JV, Kumar KVVV. Clinical profile, risk factors and comorbidities associated with mortality among COVID-19 inpatients at a tertiary care centre in Visakhapatnam: a retrospective study. Int J Res Med Sci 2021;9:xxx-xx.