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Original Research Article.

Comorbidities, Organ Dysfunction and Mortality in Critically ill COVID Patients in South Rajasthan: A Retrospective Study

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ABSTRACT

Introduction: The advent of severe acute respiratory syndrome corona virus 2 (SARS- COV-2) has placed unprecedented burden on health care systems throughout the world. Estimation of contributing factors to mortality in critically ill patients is important to plan ICU management.

Methods: Medical records of patients admitted to the ICU of a dedicated COVID hospital were retrospectively analysed for presence of comorbidities and organ dysfunction.

Results: The paper analyses the impact of comorbidities and organ failure on mortality and recovery in critically ill COVID patients.

Key words: COVID, Comorbidities, Organ Failure, Sofa Score.

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INTRODUCTION

Severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) causes corona virusdisease-19 is an enveloped, positive sense, single stranded RNA with a size varying between 26 kb and 32 kb.[1] This disease, which originated in china in December 2019 has rapidly become a scourge that mankind has never witnessed before. WHO declared COVID-19 as pandemic on 11th march 2020[2] and in India the first case was reported on 30 January 2020 from Kerala as on 8th may 2020 the disease has affected approximately 7 million individuals across since the inception of world health organization. 216 countries in the world and has resulted in over 400000 deaths.[3] Current evidence suggests spread to humans occurred via transmission from wild animals illegally sold in the Huanan Seafood Wholesale Market.[4] Transmission of the Corona virus is usually via airborne droplets to the nasal mucosa in closed environments and through close contact between people and touching contaminated surfaces with incubation period of 2-14 days and basic reproduction ratio of 2.2.[5] The sheer number of cases along with the daily exponential growth has placed unprecedented stress on health care systems throughout the world. In particular, delivery of quality intensive care unit (ICU) care has been a challenge due to the paucity of equipment as well as personnel.[6,7]

The above scenario becomes graver when viewed in context of developing nations with huge populations. The low health care expenditure, absence of qualified health care workers and almost non-existent infrastructure make it nearly impossible for quality ICU care to be made available to all.[8] Therefore, it is prudent to identify individuals / groups who would require critical care most; as this is the only approach that can ensure justified ICU care to the needy.

The present study aims to identify the outcomes in COVID-19 positive ICU patients in relation to certain factors present in these patients at the time of admission to the ICU. The data thus obtained may help administrators plan rationale and appropriate admission strategy to the limited number of critical care units available.

MATERIAL AND METHODS

The present study is a retrospective cohort analysis of COVID-19 patients admitted to the Intensive Care Unit (ICU) of a dedicated COVID hospital in south Rajasthan. The patient population consisted of Reverse transcriptase-polymerase chain reaction (RT-PCR) confirmed COVID -19 positive individuals admitted to the said ICU from 22 March 2020 to 25 May 2020. For the purpose of analysis, these patients were sub grouped into the following three exposure groups.

A. Patients with or without comorbidities (hypertension, diabetes mellitus, chronic obstructive pulmonary disease [COPD],

cardiovascular disease, chronic kidney disease, thyroid disorder and malignancy)

B. Patient with single or multiple organ dysfunction

C. Patient classified according to admission sequential organ failure assessment (SOFA) score of 0-8, 9-16 and 17-24

The outcomes analyzed in each of these groups were survival and discharge from the ICU at 14 days. Individual organ dysfunction will also be quantified among all patients.

Following were the criteria taken to diagnose complication of COVID-19 patients.

A. Cardiac involvement (myocarditis)

1. History of acute onset pain chest suggestive of cardiac origin
2. Acute onset ECG changes in form tachycardia / bradycardia, interventicular conduction defects (IVCD), and secondary ST – T wave changes
3. Elevated cardiac biomarkers (CPK-MB/ TROP-I)

B. Acute respiratory distress syndrome (ARDS) – Berlin 2017 criteria were taken

1. Onset of illness less than week
2. Bilateral opacity in chest X-ray which are not due to cardiac failure or fluid overload
3. $PaO_2/FiO_2 < 300$

C. Multiple organ dysfunction syndrome (MODS) - 2 or more than 2 organ involvement

D. Renal involvement (AKI/CKD): Raised urea and serum creatinine above the normal value (serum urea >40 mg/dl and serum creatinine>1.3 mg/dl)

All frequencies have been expressed as absolute numbers (n) and percentages. The incidence, cumulative incidence and relative risk of both outcomes were calculated in the cohort by using MS excel version.

Table 1: Outcomes in relation to comorbidities

Number of patients (n=48)		Incidence of death (n=10)		Incidence of discharge (n=38)	
With comorbidities	**Without comorbidities**	**With comorbidities**	**Without comorbidities**	**With comorbidities**	**Without Comorbidities**
38(79.16%)	10(20.83%)	8(21.05%)	2(20.0%)	30(78.94%)	8(80.0%)

Table 2: Outcomes in relation to organ failure

Number of patients (n=48)		Incidence of death (n=10)		Incidence of discharge (n=38)	
Single organ dysfunction	**Multiple organ dysfunction**	**Single organ dysfunction**	**Multiple organ dysfunction**	**Single organ dysfunction**	**Multiple organ Dysfunction**
22 (45.83%)	26(54.16%)	2 (09.09%)	8 (30.76%)	20 (90.90%)	18 (69.23%)

Table 3: Outcomes in relation to SOFA score

Number of patients (n=48)			Incidence of death (n=10)			Incidence of discharge (n=38)		
SOFA Score 0-8	**SOFA Score 9-16**	**SOFA Score 17-24**	**SOFA Score 0-8**	**SOFA Score 9-16**	**SOFA Score 17-24**	**SOFA Score 0-8**	**SOFA Score 9-16**	**SOFA Score 17-24**
34 (70.83%)	8 (16.7%)	6 (12.5%)	0	4 (50%)	6 (100%)	34 (100%)	4 (50%)	0

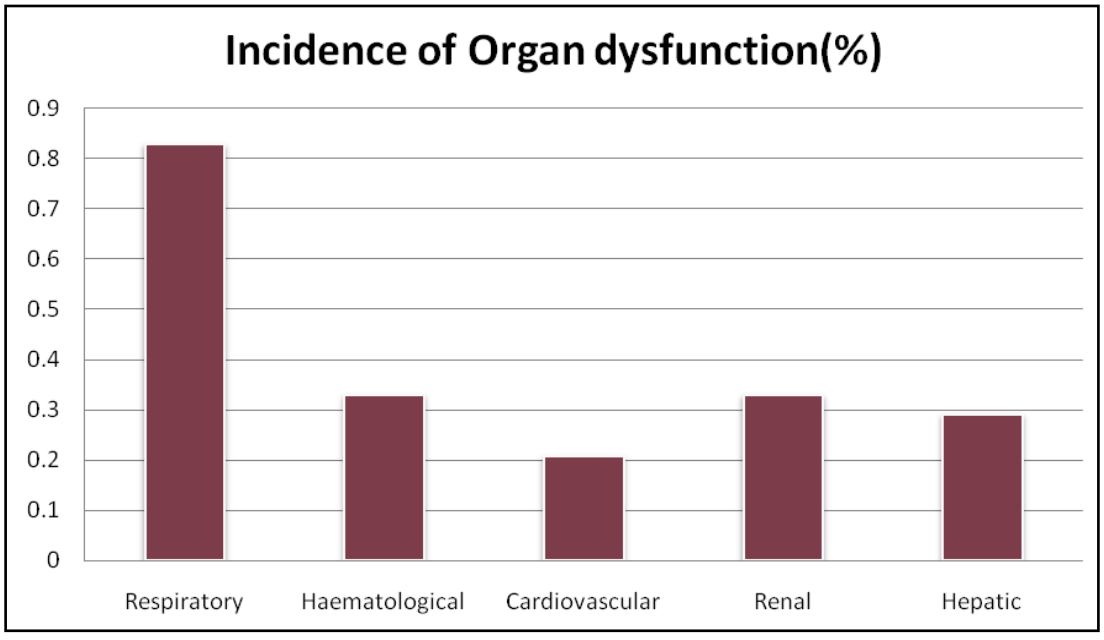

Figure 1: Incidence of organ dysfunction

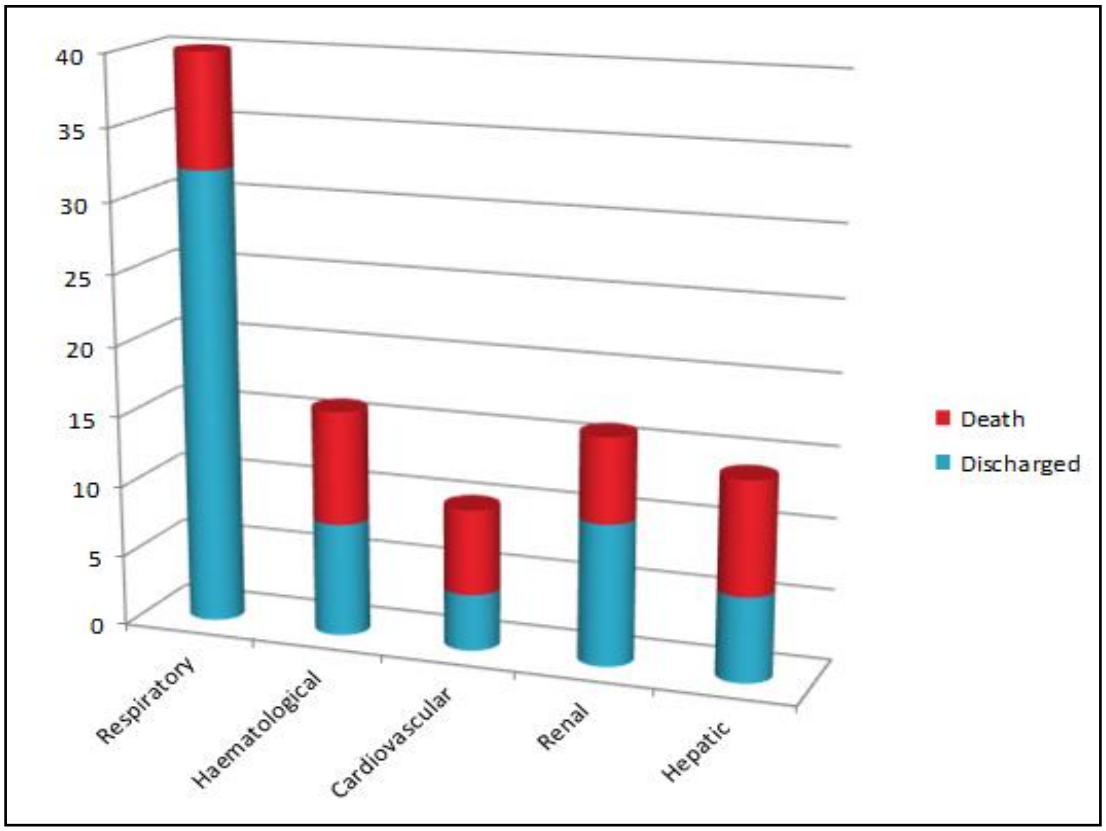

Figure 2: Outcomes in organ dysfunction

OBSERVATIONS AND RESULTS

Data from 48 patients admitted to the ICU were analysed as per the study protocol. The incidence of comorbidities, organ dysfunction and SOFA score and their relation to the outcomes was calculated.

A total of 38 patients (79.16%) had comorbidities while 10 patients were free from comorbidities. The incidence of death in patients with and without comorbid conditions was 21.05% and 20% respectively while 78.94% of patients with comorbidities and 80% of patients without comorbidities were discharged.

Relative risk (RR) of death in patients with comorbidity when compare to without comorbidities equals 1.05.

A total of 22 patients (45.83%) had single organ dysfunction while 26 patients had multi organ dysfunction. The incidence of death in patients with single organ dysfunction and multi organ dysfunction was 9.09% and 30.76% respectively while 90.90% of patients with single organ dysfunction and 69.23% patients with multi organ dysfunction were discharged.

Relative risk of death in patients with multi organ failure is 3.38 when compare to single organ failure.

A total of 34 patients (70.87%) had SOFA score of 0-8,8 patients (16.7%) had SOFA score of 9-16, while 6 patients (12.5%) had a SOFA score of 17-24. The incidence of death in patients with SOFA scores of 0-8, 9-16 and 17-24 was 0%, 50% and 100% respectively.

Relative risk of death in patients with SOFA score 17-24 was 2 when compared to that in patients with SOFA score 9-16.

The cumulative incidence of deaths in the study group was 20.83%.

Figures 1 and 2 depict the incidence of Individual organ dysfunction and their relation to the outcome.

DISCUSSION

The expeditious emergence and varied presentation of COVID 19 disease has led to a lot of questions on the pathophysiology, clinical features and course of the illness that continue to be unanswered. A particular intriguing feature is the mortality rate of COVID 19, which varies considerably in different countries of the world, from >15% to certain European countries to less than 3% in India, Russia and Pakistan.[9] To the best of our knowledge; ours is the first study to explore the mortality in terms of certain at admission statistics of patients in South Rajasthan. In doing so, we have tried to identify a few red flags that might predict mortality so that appropriate, timely interventions can be planned and executed

A prior study Guan et al[10] demonstrated that patients with comorbidities were 1.79-2.59 times more likely at risk of death or invasive ventilation when compared to patient without comorbidities. Similarly, Yang et al[11] in their metaanalysis have stated that Odds ratio of developing severe disease or death in patients of hypertension, respiratory disease and cardiovascular disease was 2.36 to 3.42 respectively. In contrast to the above; the relative risk of death in our series was 1.05 in patients with comorbidities. This may be due to the fact that both the above authors have used invasive ventilation, severe disease and death as their end points while we have calculated the risk for mortality alone. Furthermore, our patient population consisted of patient admitted to ICU alone which may have led to more uniformly severe disease status at admission. In addition, the genetic and immune differences between the study populations may have contributed to the same.

Vincet et al.[12] in their commentary on understanding pathway of death in patients with COVID-19 have stressed upon the need for

data to determine the role of multi organ dysfunction in mortality. we have evaluated the correlation of multi organ dysfunction and its objective measurement i.e. SOFA score in mortality among COVID -19 patients admitted to our ICU.

We found that the relative risk of death in patients with multi organ dysfunction was 3.35 when compared to patients with single organ dysfunction. this is further reinforced by our findings that the relative risk of dying is twice as much in COVID-19 patient in SOFA score of 17 or above when compared with SOFA score of 9-16.Our findings are in agreement to those of Ruan et al.[13] who have reported increased mortality in patients with myocardial dysfunction and respiratory failure when compare to isolated respiratory failure. Similar results have also been reported by Wang et al[14] who have reported the presence of cardiovascular disease in 97.2% and AKI in 8.3% of patients admitted in the ICU compare to noncritical patients.

A major limitation of our study is the relatively small sample size. further determining phenotypes of cardiac injury and renal injury may add further insights into our findings.

CONCLUSION

The presence of multi organ dysfunction and elevated SOFA scores led to a significant increase in the probability of death in COVID-19 patients admitted to our ICU. The presence of comorbidities however did not lead to increased mortality risk. Measures and interventions for prevention and early diagnosis of multi organ dysfunction may contribute greatly to the reduction of mortality in these patients.

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