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Research Article

A Retrospective Case Series on the Clinical Progression and Outcome of Severe COVID-19 Patients in a Tertiary Care Hospital, Chennai, Tamil Nadu

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Abstract

Introduction: COVID-19 began in December, 2019 in Wuhan. The WHO declared the situation as Pandemic on 11 March 2020 due to the threat posed by the infection to the world. The progression and prognosis of Severe COVID-19 is difficult to find out. Thus, this study will assess the factors associated with the severe form of the disease. **Methods:** This Observational-Retrospective case series was done at a tertiary care hospital, in Chennai from June to September, 2020. The study included the medical records of 77 individuals who were confirmed positive for COVID-19 and were classified as severe cases. Chi-square and Paired-t tests were used to analyse the data. **Results:** Out of 77 patients, 45 died. Oxygen saturation, Respiratory rate, and Gender were found to be significantly affecting the outcome. Age, Blood pressure, Co-morbidities, Serum Urea, and Serum creatinine were not significant factors. The mean value of oxygen saturation of patients at the time of admission who died was 83.09±17.55, when compared with the mean value of oxygen saturation of patients at the time of admission who got discharged was 90.31±5.12%. **Conclusion:** Patients with low oxygen saturation, high respiratory rate and are of the female gender are at risk to have a poor prognosis of severe COVID-19 when compared to others. Prompt interventions and targeted focus to these people can improve their survival in the ICU and help in better management of the pandemic.

Keywords: COVID-19; ICU; Severity; Progression; Outcome

Introduction

The COVID-19 pandemic began as a cluster of cases of respiratory illness showing symptoms of Pneumonia (sudden onset with unknown origin) in December 2019 in Wuhan city of central Hubei province of China [1,2]. Soon the cases started spreading all over the world making it a Public Health Emergency [3]. The WHO investigated it to be a viral infection caused by the Novel Coronavirus which is now named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and the disease was termed COVID-19 [4]. The WHO declared the situation as a Pandemic on 11th March 2020 due to the threat posed by the viral infection to the world [5]. Studies done in countries such as Japan, Korea, Italy, USA, and Germany reported the presentation, transmission, progression, and prevention of the disease [6-8]. From various studies conducted so far, it was observed that most people infected with COVID-19, experience mild to moderate respiratory illness and recover without requiring special treatment but older people and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness [9,10].

The clinical progression of COVID-19 was unclear and the CDC had put out a list of 11 symptoms while emphasizing that it was not complete and prone to changes in view of it being updated [11]. It was stated by the CDC that the outcome, mortality, morbidity, and risk factors associated with COVID-19, have also not been determined fully to date [11]. Mild and moderate cases generally have excellent prognoses [12], but it is the severe form of the disease where the progression and prognosis were difficult to be estimated [13,14]. One of the important public health questions during the emergence of a completely novel pathogen that has caused a global pandemic is how severe the disease can be. It determines the therapeutic choices and prognostic expectations [15]. Thus, this study will observe the progression of severe cases and focuses on bridging the gaps mentioned above, and to assess the factors associated with the severe form of the disease.

Methodology

This Observational-Retrospective case series was done at a tertiary care hospital near Chennai which receives most of its cases from Kancheepuram, Chengalpattu, Thiruvallur, and Chennai. The study was done from June to September 2020. Figure 1 represents the method of selection of subjects involved in this study. Thus, based on the selection process the medical records of 77 individuals who were confirmed positive for COVID-19 and were classified as severe cases [16], were included in the study by universal sampling method. The data obtained from these case records comprised their basic details such as their name, age, sex, place of residence, contact history, travel history, and personal history of existing co–morbidities; their symptoms, vitals, and routine investigations at the time of admission, during the stay in the hospital and the progression of these variables until the time of discharge from the hospital.

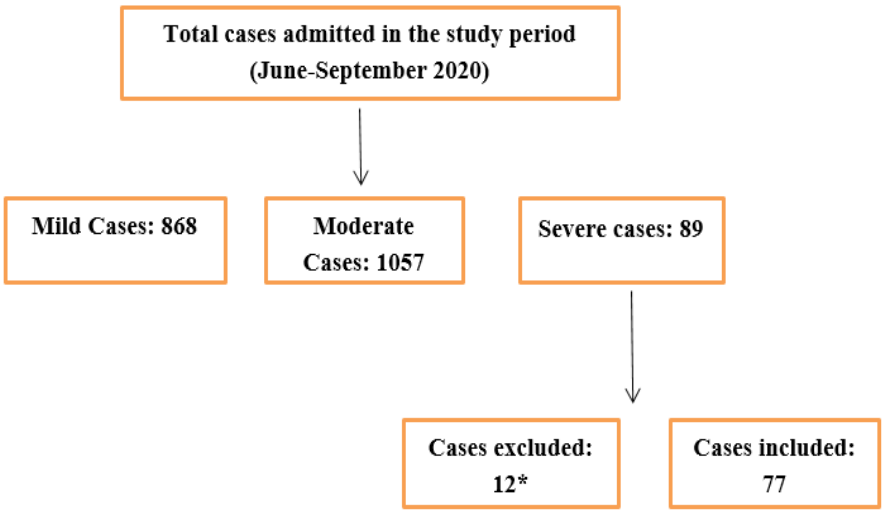

Figure 1: Flow diagram showing the selection of study participants. **Inclusion Criteria:** All severe cases admitted and treated during the study period were included in the study. ***Exclusion Criteria:** All cases that left Against Medical Advice (AMA) and cases, which were transferred in or shifted to other hospitals, were excluded from the study.

This study includes all the lab-confirmed (through RT-PCR) severe cases of COVID-19 belonging to diverse age and gender determinants within the study period and excludes the information on subjects that have left the premises of the hospital, either against medical advice or have decided to transfer to another facility. The required data was collected by obtaining permission from the respective authorities of the hospital to gain access to the case files of these COVID-19 patients from the Medical Records Department. The records were meticulously checked, so as to take into consideration the inclusion and exclusion criteria required for this study. Only the records which were fulfilling these criteria were taken up for the study and their data has been documented in an acceptable format. The authorities were informed regularly on the attainment and submission of the case records to the medical records department at subsequent intervals. The data collected was regularly monitored and cross-verified by the senior peer from the Internal Medicine department to rule out any discrepancies in the data if present.

Statistical Analysis: The data was entered in MS-Excel and analysed in SPSS version 22. Descriptive statistical methods such as frequency, percentage, mean and standard deviation were used. Chi square and Paired T test have been used to analyse the data based on a single variable. The p value of <0.05 is considered significant.

Results

It was observed that a total of 2014 patients were admitted during June-September 2020, of which the majority 74.9% of the cases were women, 48.2% of them belonged to the 20-40 years age group and 52.4% of them were moderate cases. This study discusses only the 77 severe cases in detail below. It is to be noted that all these cases were admitted to the ICU during the study period. 47 Patients got directly admitted to the ICU and the remaining got transferred from other wards.

Among 77 cases, 57.1% belonged to more than 60 years of age, 76.6% of them were males, 44.1% had a hospital stay of 8-14 days and 44.1% of these patients had an ICU stay of 4-7 days. Association between study variables such as age, gender, contact history, travel history, hospital stay and day of health care services sought since onset of symptoms and outcome of the disease showed that the gender, contact history and hospital stay were found to be statistically significant and affecting the outcome of the patient (Table 1).

Study Variables	Deceased n (%) N=45	Discharged n (%) N=32	Total no of individuals N=77	P value
Age (Years)				
20-40	4 (50%)	4 (50%)	8	0.56
41-60	13 (52%)	12 (48%)	25	
>60	28 (63.6%)	16 (36.4%)	44	
Gender				
Male	30 (50.8%)	29 (49.2%)	59	0.01*
Female	15 (83.3%)	3 (16.7%)	18	
Contact History				
Yes	0	3 (100%)	3	0.03*
No	45 (60.8%)	29 (39.1%)	74	
Travel History				
<3 Days	9 (100%)	0	9	0.00*
4-7 Days	14 (73.7%)	5 (26.3%)	19	
8-14 Days	19 (55.9%)	15 (44.1%)	34	
>15 Days	3 (20%)	12 (80%)	15	
Healthcare services sought				

<3 Days	17 (63%)	10 (37%)	27	0.69
4-7 Days	21 (56.8%)	16 (43.2%)	37	
8-14 Days	4 (44.4%)	5 (55.6%)	9	
>15 Days	3 (75%)	1 (25%)	4	
*Chi-square test was used, (P<0.05 is significant)				

Table 1: Association between Baseline details and outcomes of COVID-19.

It was observed in our study that 87% of the patients had co-morbidities. Diabetes (64.9%) was the most common co-morbidity present followed by systemic hypertension (45.4%). Association between co-morbidities and the outcome of the disease showed that having co-morbidities such as coronary artery disease, cerebrovascular disease, and thyroid disorders were found to be significant (Table 2). It should also be noted that 90% of patients had fever as a symptom, followed by 77.9% of patients having breathlessness. Association between different symptoms and outcomes of COVID-19 showed that no symptom was found to be statistically significant and affecting the final outcome of the patient.

Study Variables	Deceased n (%) N=45	Discharged n (%) N=32	Total no of individuals N=77	P value
Co-morbidities				
Yes	39 (60.9%)	25(39.1%)	67	0.95
No	6 (60%)	4(40%)	10	
Diabetes Mellitus				
Yes	31(62%)	19(38%)	50	0.49
No	14(53.8%)	13(46.2%)	27	
Diabetic Ketoacidosis				
Yes	3(60%)	2(40%)	5	0.94
No	42(58.3%)	30(41.7%)	72	
Acute Kidney Disease				
Yes	10(83.3%)	2(16.7%)	12	0.05
No	35(53.8%)	30(46.2%)	65	
Chronic Kidney Disease				
Yes	3(60%)	2(40%)	5	0.94
No	42(58.3%)	30(41.7%)	72	
Systemic Hypertension				
Yes	20(57.1%)	15(59.5%)	35	0.83
No	25 (42.1%)	17(40.5%)	42	
Coronary artery Disease				
Yes	8(88.9%)	1(11.1%)	9	0.04*
No	37(54.4%)	31(45.6%)	68	
Cerebrovascular accident				
Yes	3(75%)	1(25%)	4	0.04*
No	42(57.5)	31(42.5%)	73	
Thyroid Disorders				
Yes	5(100)	0	5	0.05*
No	40(55.6%)	32(44.4)	72	

Bronchial Asthma				
Yes	4(100%)	0	4	0.08
No	41(56.2%)	32(43.8%)	73	
Epilepsy				
Yes	1(100)	0	1	0.39
No	44(57.9%)	32(42.1%)	76	
Cancers				
Yes	0	1(100%)	1	0.41
No	45(59.2%)	31(40.8%)	76	
Auto-Immune Disorders				
Yes	1(100)	0	1	0.39
No	44(57.9%)	32(42.1%)	76	
*Chi-square test was used, (P<0.05 is significant)				

Table 2: Association between Co-morbidities and outcomes of COVID-19.

It was seen in our study that 64.9% of the patients were afebrile at the time of admission, 32.4% of the patients had an oxygen saturation level of 90-94% and 48% people had a respiratory rate of 21-30 cycles per minute. The association between baseline vitals at the time of admission and outcomes of COVID-19 showed that the respiratory rate at the time of admission was found to be significantly affecting the outcome of the patient (Table 3). It was observed that 27.2% of patients had an elevated random blood glucose level of 201-300mg/dl at the time of admission. Among the patients, 36.3% had serum D-dimer levels of more than 4200ng/ml at the time of admission. Association between bio-chemical markers at the time of admission and outcomes of COVID-19 showed that none of the biochemical markers were significantly affecting the outcome of COVID-19 (Table 4).

Study Variables	Deceased n (%) N=45	Discharged n (%) N=32	Total no of individuals N=77	P value
Systemic Blood Pressure				
<100mmhg	5(83.3%)	1(16.7%)	6	0.2
110-119mmhg	6(35.3%)	11(64.7%)	17	
120-139mmhg	13(61.9%)	8(38.1%)	21	
140-159mmhg	14(60.9%)	9(39.1%)	23	
>160mmhg	7(70%)	3(30%)	10	
Diastolic Blood Pressure				
<70mmhg	7(50%)	7(50%)	14	0.7
70-79mmhg	6(54.5%)	5(45.5%)	11	
80-89mmhg	13(61.9%)	8(38.1%)	21	
90-99mmhg	15(68.2%)	7(31.8%)	22	
>100mmhg	4(44.4%)	5(55.6%)	9	
Temperature				

97.8-98.9ºF	28(56%)	22(44%)	50	0.56
99-100.9ºF	13(68.4%)	6(31.6%)	19	
101-104ºF	4(50%)	4 (50%)	8	
Oxygen Saturation				
>95%	8(53.3%)	7(46.7%)	15	0.22
90-94%	12(48%)	13(52%)	25	
85-89%	9(56.3%)	7(43.8%)	16	
80-84%	5(50%)	5(50%)	10	
70-79%	4(100%)	0	4	
60-69%	2(100%)	0	2	
50-59%	2(100%)	0	2	
<50%	3(100%)	0	3	
Respiratory Rate(Cycles/Min)				
<20/min	2(22.2%)	7(77.8%)	9	**0.03***
21-30/min	20(54.1%)	17(45.9%)	37	
31-40/min	17(77.3%)	5(22.7%)	22	
>40/min	6(66.7%)	3(33.3%)	9	
Pulse Rate (Beats per minute)				
<60bpm	1(25%)	3(75 %)	4	0.28
60-90bpm	17(68%)	8(32%)	25	
91-110bpm	19(61.3%)	12(38.7%)	31	
>110bpm	8(47.1%)	9(52.9%)	17	
*Chi-square test was used, (P<0.05 is significant)				

Table 3: Association between Baseline vitals at the time of admission and Outcomes of COVID-19.

Study Variables	Deceased n (%) N=45	Discharged n (%) N=32	Total no of individuals N=77	P value
Capillary Blood Glucose				
<100mg/dl	1(33.3%)	2(66.7%)	3	0.74
100-120mg/dl	3(50%)	3(50%)	6	
121-159mg/dl	9(64.3%)	5(35.7%)	14	
160-200mg/dl	6(46.2%)	7(53.8%)	13	
201-300mg/dl	13(61.9%)	8(38.1%)	21	
300-400mg/dl	6(54.5%)	5(45.5%)	11	
>400mg/dl	7(77.8%)	2(22.2%)	9	
Serum Urea				
12-30mg/dl	22(66.7%)	11(33.3%)	33	0.51
31-50mg/dl	12(46.2%)	14(53.8%)	26	
51-100mg/dl	7(58.3%)	5(41.7%)	12	
101-150mg/dl	3(60%)	2(40%)	5	
>150mg/dl	1(100%)	0	1	
Serum Creatinine				
0.5-0.7mg/dl	19(65.5%)	10(34.5%)	29	0.09
0.8-1.2mg/dl	15(45.5%)	18(54.5%)	33	
1.3-2mg/dl	7(87.5%)	1(12.5%)	8	
2-3mg/dl	2(100%)	0	2	
>3mg/dl	2(40%)	3(60%)	5	
Serum D-dimer				
<250ng/ml	1(33.3%)	2(66.7%)	3	0.56
250-500 ng/ml	3(42.9%)	4(57.1%)	7	
501-1000 ng/ml	5(71.4%)	2(28.6%)	7	
1001-2000 ng/ml	9(60%)	6(40%)	15	
2000-4200ng/ml	8(47.1%)	9(52.9%)	17	
>4200 ng/ml	19(67.9%)	9(32.1%)	28	
*Chi-square test was used, (P<0.05 is significant)				

Table 4: Association between Bio-chemical markers at the time of admission and Outcomes of COVID-19.

The mean values of biochemical markers and baseline vitals at the time of admission between those who were deceased and those who were discharged showed a difference between mean values of oxygen saturation levels and serum d-dimer which was found to be statistically significant and impacting the outcome of COVID-19 (Table 5).

Study Variable	Severe Patients who were Deceased	Severe Patients Who were discharged	P-value
Capillary Blood Glucose	231.09±138.16mg/dl	229.19±118.10mg/dl	0.45
Serum Urea	35.35±36.68mg/dl	39.34±29.51mg/dl	0.31
Serum Creatinine	1.04±1.52mg/dl	1.24±1.46mg/dl	0.86
Serum D-dimer	2240.89±1906.84ng/ml	2408.34±1642.64ng/ml	**0.01***
Oxygen saturation	83.09±17.55%	90.31±5.12%	**0.04***
Pulse rate	96.02±25.25bpm	100.84±27.77bpm	0.44
Respiratory rate	30.53±9.20cycles/min	28.13±9.64cycles/min	0.60
Temperature	96.72±14.77ºF	99.08±1.60ºF	0.22
Systolic Blood Pressure	133.60±28.91mmhg	131.25±25.36mmhg	0.33
Diastolic Blood Pressure	80.84±15.28mmhg	82.41±14.77mmhg	0.57
*Paired-t-test was used, (P<0.05 is significant)			

Table 5: Mean Values of Biochemical Markers and Baseline vitals at the time of admission with respect to outcome of severe patients.

Discussion

Among 45 Patients who died, 63.6% were in the age group of more than 60 years. The numbers of deaths in the patients were seen to be increasing with age as seen in European studies conducted by Hoffman, et al. and Ahrenfeldt et al. [17,18]. There were equal numbers of discharges as there were deaths in the 20-40 years age group, despite being the group with maximum number of discharges. Gender wise, there were more deaths among females than males, showing 83.3% of female's death in our study. This is contrary to the studies done in Rajasthan by Gupta, et al. [19] and in Karnataka by Venkatraja, et al. [20] where deaths are more among males. This difference in pattern of deaths may be attributed to the fact that number of females in our study is very low when compared to the males. The number of deaths was observed to be gradually decreasing as the number of hospital days increased. About 75% of people who had sought health care services after 15 days of onset of symptoms, had passed away. Therefore, people's chances at survival were better if they had sought health care services earlier.

Co-morbidities did not affect the progression of disease and did not impact the outcome in severe cases. Out of 77 cases, 60% of patients with and without comorbidities passed away. This is contrary to the Spanish study done by Gude-Sampedro, et al. [21] where co-morbidities affected severe outcomes. However, 88.9% of people with coronary artery disease and 75% of patients with cerebrovascular accident died and also all the patients with conditions like Bronchial asthma, Thyroid disorders, Epilepsy passed away. The symptoms also did not have an impact on the outcome in severe cases.

All the patients with oxygen saturation level of 70% and below at the time of admission died. Numbers of deaths increased as the oxygen saturation levels at the time of admission decreased. All the 29 Patients who were shifted to the ICU from the normal ward with less than 70% of oxygen saturation levels at the time of shifting, had died. This is similar to a Mexican study conducted by Olivas-Martínez, et al. [22] where in majority of people with less than 80% Spo2 progressed to death. It was seen that 66.6% of people with respiratory rate more than 40 cycles per minute at the time of admission died showing increased respiratory rate to be associated with increased probability of death which was similar to a study done in England by Stow et al, wherein majority of people with elevated respiratory rates had progressed to die. The mean value of oxygen saturation of patients at the time of admission who had died was 83.09±17.55% when compared with the mean value of oxygen saturation of patients who got discharged, 90.31±5.12%. Hence, patients who came to the hospital with better oxygen saturation levels had more chances of survival. Mean Value of serum d-dimer at the time of admission for those who passed away was 2240.89±1906.84 ng/ml whereas 2408.34±1642.64 ng/ml was the mean value of serum D-Dimer at the time of admission in patients who got discharged.

Recommendations

For the Community

- The elderly should prefer staying indoors, double mask and be vigilant about their safety. The young population also needs to be cautious and not complacent as there are deaths happening

among them too.

- Pulse oximeters need to become a must-have in every household, as they can determine the need for hospitalization of an individual. The public must be taught the technical know-how to operate a pulse oximeter as we can see from the study that Spo2 levels impact the outcome of the disease.
- Patients should also learn to calculate and estimate their respiratory rate as from our study it is evident that respiratory rate impacts the progress of the disease and this facilitates early admission.
- It is of paramount importance that awareness and health education must be given to the public to reach out to triaging or screening centres at the earliest as it may help decrease the severity of the disease [23].

For the Physicians

- Deaths tend to increase with increase in age, especially with people who are aged more than 60 years of age. Hence, precautionary measures, vaccination drives and government initiatives are to be focussed towards the adult and the elderly. This stresses the importance of development of geriatric care in COVID management and training physicians to handle and treat geriatric patients better.
- Mild and moderate cases can be managed through Home-quarantine and Tele-consultation [24] as they are stable and recover quickly so that hospital care and beds can be allotted to more severe cases. As severe cases require prolonged hospital stay.
- Every patient must be subjected to a serum d-dimer test as they can indicate the prognosis of the patient which helps the doctors to take necessary steps at the earliest.
- Health care needs to be given at the earliest possible point of time, since the onset of symptoms as it improves the prognosis and outcome.

Conclusion

Oxygen saturation, Respiratory rate, old age are all factors that affect the progression of COVID-19 and impact its outcome. They potentially could determine whether a patient in ICU would survive or not. Hence these factors need to be monitored by both the patients and physicians very carefully.

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