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Research Article

ANALYSIS OF EPIDEMIOLOGICAL AND CLINICAL PROFILE IN COVID-19 DEATHS IN A TERTIARY CARE ICU SETUP: A RETROSPECTIVE OBSERVATIONAL STUDY

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Abstract

Background: There are numerous publications describing the epidemiology and clinical outcome of patients infected with COVID-19. However, limited studies solely describing the fatalities, especially in India. In this retrospective, single-centre analysis of patients case records, we aim to describe and discuss the demographics, clinical, laboratory findings in 201 patients who expired as a result of SARS CoV-2 infection. **Methods:** Electronic medical files of all confirmed COVID-19 patients, admitted to the ICU between 1st February 2020 and 15th July 2020, were scanned retrospectively and data was collected from files of the fatalities only, without revealing patient identity at any point. The data, including demographics (age, sex, comorbidities), clinical presentation, baseline laboratory parameters, SOFA score and duration of illness was recorded and analyzed statistically. **Results:** A total of 201 deceased patients were included in the study, out of which 58.2% were males. The median age was 59 years (IQR: 47.5 – 65 years) which appears to be less than a lot of studies conducted outside India. Majority of patients had classical influenza-like symptoms at presentation (74.1%), but a sizable number also had extra-pulmonary manifestations (24.9%). Eight patients had isolated neurological presentation. It was found that number of comorbidities increased and duration of illness decreased with increasing age and this was statistically significant (p 0.03 and 0.01, respectively). SOFA score was found to be an important marker of severity of illness in COVID patients. ARDS remained the primary cause of death in 87.1% patients, although septic shock was observed in 34.8%. Six patients expired due to a high suspicion of pulmonary thromboembolism.

Keywords: COVID-19, Deceased, Demographics, Epidemiology, Fatalities, SARS-CoV-2, SOFA.

INTRODUCTION

December of 2019 witnessed a cluster of patients with pneumonia of unknown cause linked to a seafood wholesale market in Wuhan, China. A previously unknown beta-coronavirus, now labelled as novel Coronavirus 2019 (2019-nCoV) was discovered through the use of unbiased sequencing in samples from these patients.[1] The mean incubation period of this virus is 5.2 days (95% confidence interval [CI], 4.1–7.0), with the 95th percentile of the distribution at 12.5 days.[2] The illness caused by it ranges from asymptomatic or mild upper respiratory disease to non-specific influenza-like illness and pneumonia often leading to florid acute respiratory distress syndrome (ARDS) in some cases. Various extra-pulmonary manifestations like myocarditis, arrhythmias, acute kidney injury (AKI), renal failure and neurological involvement caused by SARS-CoV-2 (Severe Acute Respiratory Syndrome causing Coronavirus 2019) have also been reported.[3] Estimation of the overall mortality rate of affected patients becomes difficult, owing to the lack of a reliable denominator. Severe forms of the disease represent 14% of the reported cases, and the overall mortality is around 2% of the confirmed cases.[4] In the present study, we sought to analyze the demographics and clinical profile in COVID-19 positive patients who succumbed to the disease in our ICU in an attempt to better understand the disease process specific to the population admitted to our hospital.

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METHODS

Study design and sampling

This is a retrospective observational study conducted in the COVID-19 ICU of the tertiary care Safdarjung Hospital in New Delhi, after approval from the institutional ethics committee (S.No. IEC/VMMC/SJH/Project/2020-07/CC-22). Electronic medical records of all consecutive RT-PCR (real time Reverse Transcription-Polymerase Chain Reaction) confirmed COVID positive patients admitted to the ICU between 1st February and 15th July 2020 were scanned and the expired patients were included in the study.

Data collection

The need for a written consent from next of kin of deceased patients was waived by the ethics committee, as all data was compiled from the patient files in a retrospective manner, without disclosing patient identity at any point. Data including demographics like age and sex, comorbidities, symptoms on presentation, condition on presentation (Glasgow Coma Score (GCS), Sequential Organ Failure Assessment (SOFA) score and severity of ARDS) and laboratory parameters (white blood cell count, platelet count, serum bilirubin and creatinine) was collected in data collection forms. Final cause of death, length of hospital stay (LoS) and total duration of illness were also recorded. The total duration of illness was calculated from the day of onset of symptoms till the day of expiry. Severity of ARDS was defined based on PaO_2/FiO_2 ratio (PF ratio), as per the Berlin definition.[5] SOFA scores at admission were also

calculated using the involved variables – GCS, Mean Arterial Pressure (MAP), PF ratio, platelet count, serum creatinine and bilirubin.

Data analysis

Existing literature on mortality due to COVID-19 infection was searched and the demographics, clinical characteristics and laboratory parameters were compared with our study population.

Statistical analysis

Statistical analysis was performed by the SPSS program for Windows, version 17.0 (SPSS, Chicago, Illinois). Continuous variables are presented as mean ± SD, median (IQR), min – max values and categorical variables are presented as absolute numbers and percentage. Data were checked for normality before statistical analysis. The Pearson chi-square test or the chi-square test of association was used to determine if there is a relationship between age groups and other patient characteristics. For comparison of LoS, duration of illness and SOFA score according to Severity of ARDS based on PF ratio and was done using Kruskal Wallis test. Spearman's correlation coefficient was evaluated to measure the strength and direction of association between severity of ARDS, SOFA score, LoS and duration of illness. For all statistical tests, a p value less than 0.05 was taken to indicate a significant difference.

RESULTS

The COVID-19 ICU was setup in Safdarjung Hospital on 1st February 2020. Cumulative COVID-19 positive patients admitted to the COVID-19 block from beginning till 15th July 2020 were 1584, out of which, 497 were admitted to the COVID-19 ICU. The first expiry in ICU occurred as late as 10th April and a total of 201 patients expired till 15th July, resulting in an ICU mortality rate of 40.4%. The median age of the deceased patients was found to be 59 years (interquartile range, IQR: 47.5 – 65 years). Age-wise distribution is shown in table 1. Majority of the patients were found to be more than 50 years of age (132, 66.7%). It was noted that the percentage of male patients was more than female patients (58.2% vs 41.8%). Out of 201 patients, 149 (74.1%) presented with classical signs and symptoms of severe acute respiratory illness (SARI) like fever, cough, sore throat and breathlessness only (table 1). On the other hand, 44 (21.9%) presented with combined SARI and non-SARI features (like vomiting, diarrhea, abdominal pain and distension, loss of consciousness, hemiparesis or muscle weakness). Interestingly, 8 patients out of 201 had no respiratory involvement at admission. Five of these patients had exclusive neurological manifestations (2 stroke, 1 Guillain-Barré Syndrome and 2 meningoencephalitis), 2 patients presented with an acute abdomen resembling pancreatitis, and 1 female patient was a postoperative case of hydatidiform mole, who was incidentally found to be COVID-19 positive. Forty-five patients (22.4%) patients had no underlying comorbidity, whereas 74 (36.8%) had a single comorbidity and 82 (40.8%) had 2 or more (table 1). The most common comorbid conditions noted were hypertension (40.8%), diabetes mellitus (39.8%), heart disease (13.9%), chronic kidney disease (CKD, 9.0%), hypothyroidism (7.5%), obstructive lung disease (6.0%) and malignancy (4%). Other underlying conditions noted were pulmonary tuberculosis, seizure disorders and morbid obesity (BMI > 40 kg/m^2). The mean time from onset of symptoms to hospital admission was 5.8 ± 4.2 days and the mean LoS in these patients was found to be 5.1 ± 5.3 days. The total duration of illness was noted to be 10.9 ± 7.0 days (Table 1).

Table 1. Demographic and clinical profile of patients (n=201)

	Mean/Median OR Number (%)
AGE	
Mean	55.4 yrs (SD 14.7)
Median	59 yrs (IQR:47.5-65)
AGE GROUPS	
14-30 years	18 (9.0 %)
30-50 years	45 (22.4 %)
50-65 years	92 (45.8 %)
> 65 years	42 (20.9 %)
SEX DISTRIBUTION	
Males	117 (58.2 %)
(Median age in males – 58 yrs)	
Females	84 (41.8 %)
(Median age in females – 59 yrs)	
PRESENTING FEATURES	
SARI only	149 (74.1 %)
Non-SARI only	8 (4.0 %)
Both SARI and non-SARI	44 (21.9 %)
COMORBIDITIES	
None	45 (22.4 %)
Single comorbidity	74 (36.8 %)
2 comorbidities	43 (21.4 %)
> 2 comorbidities	39 (19.4 %)
Diabetes Mellitus	80 (39.8 %)
Hypertension	82 (40.8 %)
Diabetes and Hypertension both	50 (24.9%)
Heart disease	28 (13.9 %)
COPD/asthma	12 (6.0 %)
CKD	18 (9.0 %)
Hypothyroidism	15 (7.5 %)
Malignancy	8 (4.0 %)
Obesity (BMI > 40)	4 (2.0 %)
Mean MAP at admission (mmHg)	88 mmHg (SD 20)
GCS ON PRESENTATION	
13-15	121 (60.2 %)
9-12	11 (5.5 %)
≤ 8	68 (33.8 %)
Mean duration of symptoms before hospital admission	5.8 days (SD 4.2)
Mean LoS in hospital	5.1 days (SD 5.3)
Mean duration of illness	10.9 days (SD 7.0)
CAUSE OF DEATH	
ARDS	175 (87.1 %)
- ARDS alone	93 (46.2 %)
- ARDS with septic shock	54 (26.8 %)
Septic shock	70 (34.8 %)
Cardiogenic shock	20 (10.0 %)
AKI	22 (10.9 %)
Pulmonary embolism	6 (3.0 %)

Unfortunately, 7 patients out of the total were received in an unstable condition and expired within 2 hours of ICU admission. Consequently, baseline blood gas analysis and laboratory investigations were possible only in 194 patients out of 201. ARDS on presentation was found in 184 (94.8%) patients, with 33 (17.0%) having mild (PF ratio 300-201), 79 (40.7%) having moderate (PF ratio 200-101) and 72 (37.1%) having severe (PF ratio ≤ 100) ARDS. Platelet count was found to be less than 1 lakh/mm^3 in 22.7% of the patients. Total leucocyte count (TLC) on admission was within the normal range (4000-11000/mm^3) in only 31.4% patients, low (< 4000/mm^3) in 19.6% of the patients and leukocytosis in the remaining (49%). The distribution range of platelet count, TLC, serum creatinine and bilirubin are shown in table 2. The mean SOFA score was 7.3 in our patient population.

Table 2. Laboratory parameters, severity of ARDS and SOFA score at presentation

	Number (%) (n = 194)
SEVERITY OF ARDS (as per ABG)	
No ARDS (PaO2/FiO2 > 300)	10 (5.2 %)
Mild (PaO2/FiO2 300-200)	33 (17.0 %)
Moderate (PaO2/FiO2 200-100)	79 (40.7 %)
Severe (PaO2/FiO2 < 100)	72 (37.1 %)
Serum creatinine	
< 1.2 mg/dl	79 (40.7 %)
1.2 – 2.0 mg/dl	65 (33.5 %)
> 2.0 mg/dl	50 (25.8 %)
Serum bilirubin	
< 1.2 mg/dl	135 (69.6 %)
1.2 – 2.0 mg/dl	34 (17.5 %)
> 2.0 mg/dl	25 (12.9 %)
Platelet count	
< 1.0 L/mm3	44 (22.7 %)
1.0 – 1.5 L/mm3	53 (27.3 %)
> 1.5 L/mm3	97 (50.0 %)
TLC count	
< 4000 /mm3	38 (19.6 %)
4000 – 11000 /mm3	61 (31.4 %)
> 11000 /mm3	95 (49.0 %)
Mean SOFA score on admission	7.3 (SD 3.3)

The most common cause of death in the patients was ARDS (87.1%), followed by septic shock (34.8%), acute kidney injury (AKI, 10.9%) and cardiogenic shock (10.0%). Isolated ARDS was noted in 93 patients (46.2%), whereas ARDS with septic shock was found in 54 patients (26.8%). Of note, 6 patients showed a high likelihood of pulmonary thromboembolism just before death, based on ECG and echocardiography changes.

A statistically significant negative correlation was observed between increasing patient age and duration of illness (p 0.01) as seen in table 3 and figure 1. When comparing comorbidities in various age groups of patients, it was noted that there was a significant correlation (p value 0.03) between increasing age and number of comorbidities (table 3). In patients with 2 comorbidities, 31.5% patients were less than 50 years as compared to 47.9% who were more than 50 years of age. Similarly, in patients with 3 or more comorbidities, 56.1% of patients were more than 50 years of age, whereas 8.2% were less than 50. We found no statistically significant correlation between age of patients and severity of ARDS (p 0.918). There was also no correlation between increasing age and SOFA scores or presence or absence of comorbid conditions with SOFA scores in our patients (Table 3).

No statistical correlation was observed between presence or absence of any comorbidity and severity of ARDS (table 4). However, all patients with CKD, underlying malignancy or morbid obesity presented to the ICU with moderate to severe ARDS (PF ratio < 200), although this showed no statistical significance. Severity of ARDS also did not show any direct correlation with duration of illness (figure 2). There was no statistically significant difference in LoS and duration of illness between patients having diabetes and hypertension and those without. Notably, patients with CKD, morbid obesity and underlying malignancy had a shorter LoS and duration of illness as compared to those without these conditions (table 4), but without any statistical significance. We found no correlation between increasing SOFA score and LoS or duration of illness (Table 5).

Table 3. Correlation between age groups and other patient characteristics

	Age Groups				
	14-30 Years	**30-50 Years**	**50-65 Years**	**> 65 Years**	**p Value**
COMORBIDTIES (n=201)	(n = 18)	(n = 49)	(n = 92)	(n = 42)	
No comorbidity	9 (50.0 %))	15 (30.6 %)	17 (18.5 %)	4 (9.5 %)	0.030*
Single comorbidity	7 (38.9 %)	20 (40.8 %)	34 (37.0 %)	13 (31.0 %)	
2 comorbidities	2 (11.1 %)	10 (20.4 %)	20 (21.7 %)	11 (26.2 %)	
> 2 comorbidities	0 (0 %)	4 (8.2 %)	21 (22.8 %)	14 (33.3 %)	
SEVERITY OF ARDS (PF RATIO) n=194 (%)	(n = 17)	(n = 47)	(n = 89)	(n = 41)	
> 300					
300-200	1 (5.9 %)	2 (4.3 %)	4 (4.5 %)	3 (7.3 %)	0.918
200-100	3 (17.6 %)	11 (23.4 %)	13 (14.6 %)	6 (14.6 %)	
< 100	8 (47.1 %)	18 (38.3 %)	39 (43.8 %)	14 (34.1 %)	
	5 (29.4 %)	16 (34.0 %)	33 (37.1 %)	18 (43.9 %)	
MEAN SOFA SCORE n=194 (SD)	7.24 (2.7)	7.62 (3.5)	7.28 (3.5)	7.10 (2.9)	0.898
LoS IN HOSPITAL mean (SD),	8.22 (7.95)	6.08 (7.02)	4.26 (3.47)	4.38 (4.31)	
median (IQR)	6.5 (1.75 – 10.0)	4.0 (1.0 – 8.50)	4.0 (2.0 – 6.0)	3.0 (1.0 – 6.0)	0.213
DURATION OF ILLNESS mean (SD),	17.39 (10.40)	11.80 (7.75)	9.60 (5.67) 9.0	10.0 (5.61)	0.010*
median (IQR)	14.5 (8.75 – 23.25)	10.0 (6 – 16.5)	(5.0 – 13.0)	9.0 (5 – 12.25)	

Table 4. Correlation between comorbidities with other patient details

		SEVERITY OF ARDS (PF RATIO) (n = 194)					MEAN SOFA		LoS IN HOSPITAL		DURATION OF ILLNESS	
		> 300	300-200	200-100	<100	p		p		p		p
DIABETES	Y (n=79)	6 (7.6%)	13 (16.5%)	31 (39.2%)	29 (36.7%)	0.6	7.1 (3.3)	0.36	4.9 (4.7)	0.88	10.8 (6.2)	0.67
	N (n=115)	4 (3.5%)	20 (17.4%)	48 (41.7%)	43 (37.4%)	5	7.4 (3.2)		5.2 (5.6)		11.0 (7.6)	
HYPERTENSION	Y (n=79)	6 (7.6%)	13 (16.5%)	29 (36.7%)	31 (39.2%)	0.5	7.4 (3.4)	0.88	5.5(5.6)	0.25	10.6 (6.9)	0.75
	N (n=115)	4 (3.5%)	20 (17.4%)	50 (43.5%)	41 (35.7%)	22	7.3 (3.2)		4.8 (5.1)		10.8 (7.2)	
HEART DISEASE	Y (n=27)	2 (7.4%)	5 (18.5%)	11 (40.7%)	9 (33.3%)	0.9	7.07(2.88)	0.676	4.39(3.71)	0.733	11.2(5.9)	0.450
	N (n=167)	8 (4.8%)	28 (16.8%)	68 (40.7%)	63 (37.7%)	25	7.36(3.34)		5.2(5.51)		10.8(7.2)	
CKD	Y (n=18)	0 (0%)	2 (11.1%)	11 (61.1%)	5 (27.8%)	0.2	8.1 (2.9)	0.20	4.9 (5.1)	0.17	10.7 (6.9)	0.24
	N (n=184)	10(5.7%)	31 (17.6%)	68 (38.6%)	67 (38.1%)	7	7.2 (3.3)		6.8 (6.7)		12.7 (7.5)	
MALIGNANCY	Y (n=8)	1 (2.5%)	1 (12.5%)	4 (50.0%)	2 (25.0%)	0.6	7.5 (3.1)	0.85	4.1 (4.1)	0.56	9.6 (5.3)	0.81
	N (n=186)	9 (4.8%)	32 (17.2%)	75 (40.3%)	70 (37.6%)	9	7.3 (3.2)		5.1 (5.3)		10.9 (7.1)	
OBESITY	Y (n=4)	0 (0%)	0 (0%)	2 (50.0%)	2 (50.0%)	0.7	7.0 (2.2)	0.96	3.78 (6.2)	0.259	8.7 (9.53)	0.296
	N (n=190)	10 (5.3%)	33 (17.4%)	77 (40.5%)	70 (36.8%)	6	7.3 (3.3)		5.11 (5.29)		10.95 (7)	

Table 5. Correlation (Spearman's rho) between PF ratio, SOFA score, LoS and Duration of illness

		PF RATIO	SOFA SCORE	LENGTH OF STAY	DURATION OF ILLNESS
PF RATIO	Correlation coefficient	1.000	0.339	0.030	0.034
	Sig. (2-tailed)		<0.001**	0.679	0.643
	N	194	194	194	194
SOFA SCORE	Correlation coefficient	0.339	1.000	-0.013	-0.013
	Sig. (2-tailed)	<0.001**		0.856	0.861
	N	194	194	194	194
LENGTH OF STAY	Correlation coefficient	0.030	-0.013	1.000	0.757
	Sig. (2-tailed)	0.679	0.856		<0.001**
	N	194	194	201	201
DURATION OF ILLNESS	Correlation coefficient	0.034	-0.013	0.757	1.000
	Sig. (2-tailed)	0.643	0.861	<0.001**	
	N	194	194	201	201

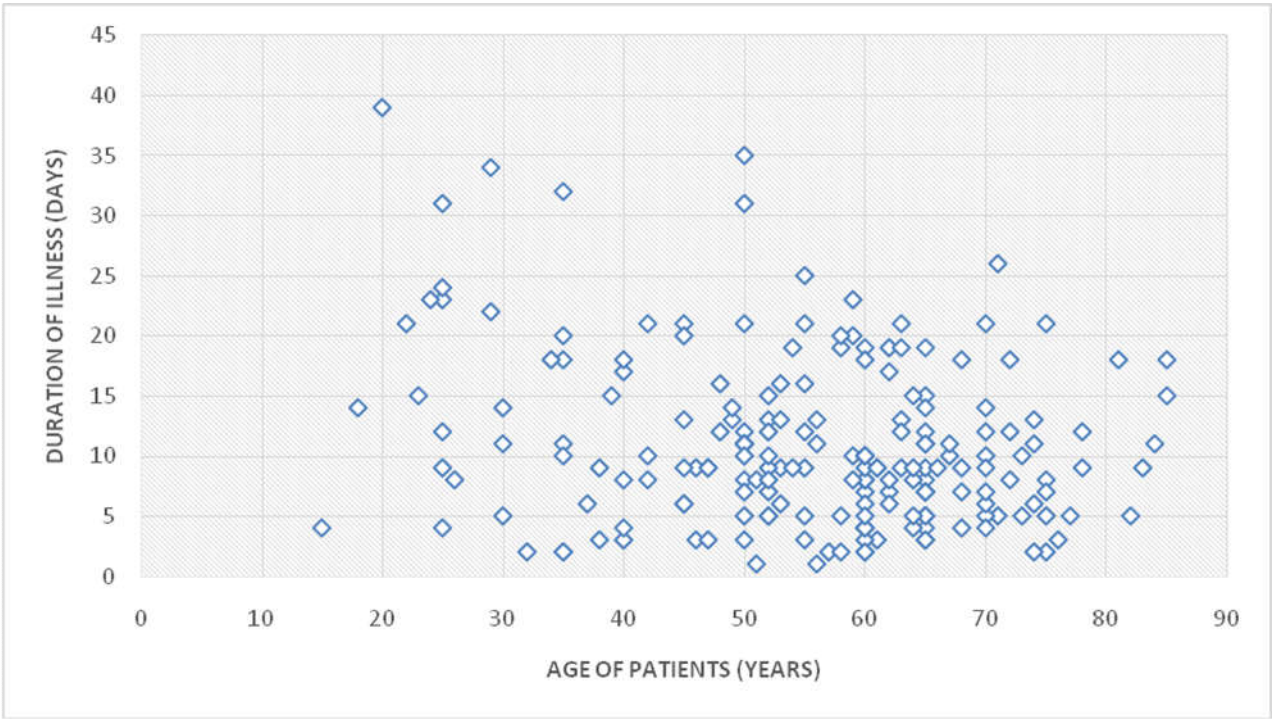

Figure 1: Linear correlation observed between increasing patient age and duration of illness (p value 0.01)

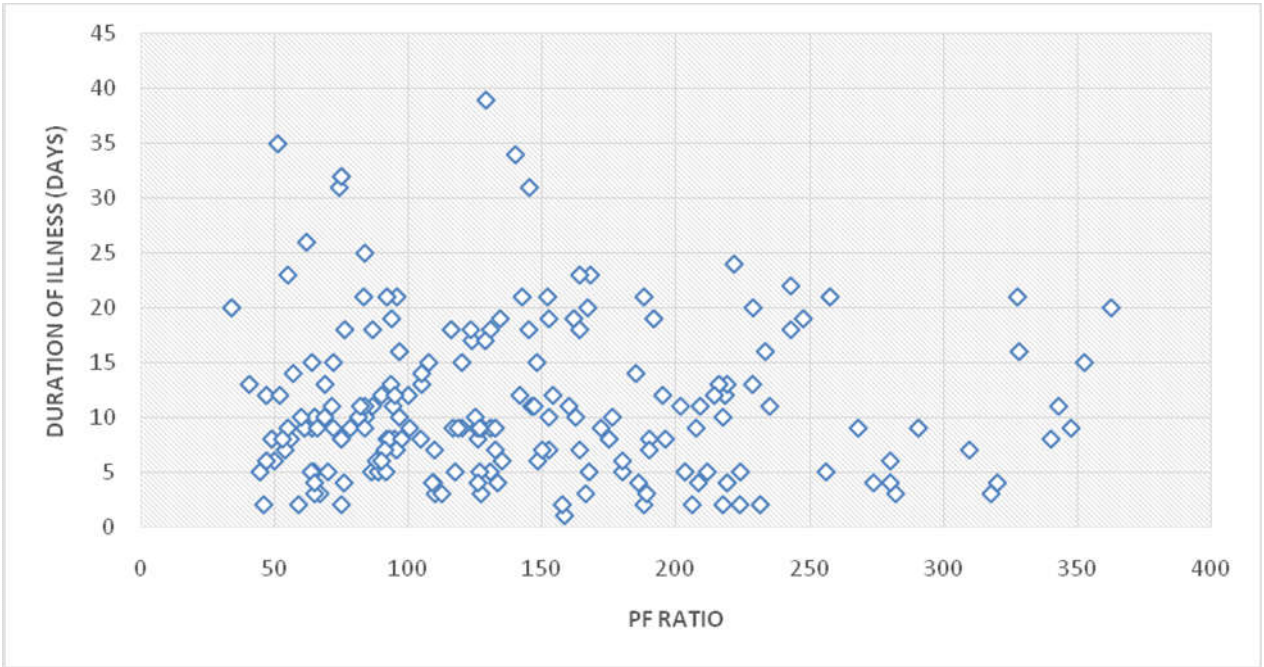

Figure 2: Non-significant correlation between decreasing severity of ARDS (PF ratio) and duration of illness (Spearman's rho coefficient 0.643)

DISCUSSION

Our study provides in-depth analysis of demographics, clinical characteristics, symptomatology and relevant laboratory parameters of COVID-19 positive mortality in our ICU over the specified period of five and a half months. To the best of our knowledge, this is the first analysis of such a large COVID-19 mortality population in India. However, such analyses of clinical and epidemiological characteristics in COVID-19 fatalities have been carried out in other countries before. A retrospective study of deceased COVID-19 patients was carried out by Chen *et al* [6] in Wuhan, China. They evaluated a cohort of 799 COVID-19 patients, out of which, the 113 who expired were included in their study. The median age of the deceased patients was 68 years, as compared to 51 years in recovered patients. In a similar retrospective review of 320 COVID-19 death case files by Biagi *et al* [7], the median age of the expired patients was reported to be 78.0 years, ranging from 40-98 years. These findings are different from our study, in which the deceased patients were found to be younger (median age 59.0 years). Our finding is similar to the study done by Bhadade *et al* [8] who found the median age of 62.0 years in 69 deceased patients in a tertiary care center in Mumbai, Maharashtra. Similarly, Aggarwal *et al* [9] in a tertiary care hospital in New Delhi found a median age of 56.5 years in patients who died due to COVID-19. These results suggest that in the Indian population, patients with age greater than 55 years may be at a greater risk of mortality. This is in contrast to the literature on risk factors for COVID-19 mortality, which has reported a higher risk in the age group more than 65 years.[10,11] With respect to sex distribution of cases, the findings of our study (58.2% males vs 41.8% females) are similar to many more.[6-11] The male preponderance in COVID-19 infection and mortality may partly be explained by the article by Gemmati *et al* [12] and Scully *et al* [13]. They reported that the *ACE2* gene is located on X chromosome, making females potentially heterozygous in the expression of this gene, whereas males are always hemizygous. Also, X chromosome also has various genes related to innate and adaptive immunity which may make females less susceptible to this infection and less likely to die from it as well. A similar article by Klein *et al* [12] also explained the sex difference in immune response, as well environmental factors like healthier lifestyles and behaviours in women as compared to men.

Majority of our patients had classical features of SARI on presentation, but a sizeable number also had presence of atypical symptoms like abdominal pain, vomiting and diarrhea. The presence of such atypical features is not uncommon and has been reported on numerous occasions.[3,15,16] Presentation with isolated features of neurological involvement however, needs a high index of suspicion for COVID-19 infection, as it may cause inadvertent co-admission of such patients with non-COVID ones. Isolated neurological involvement was observed in 5 of our patients. It has been repeatedly observed that underlying comorbidities like diabetes mellitus and hypertension (especially when uncontrolled) are independent predictors of severe infection. In our study, 39.8% and 40.2% patients had diabetes and hypertension, respectively. Numerous patients had both conditions co-existing. In recently published meta-analyses by Abdi *et al* [17] and Nandy *et al* [18], diabetes mellitus was identified as a risk factor contributing to disease severity and mortality in these patients. Similar findings were reported by Wu *et al* [19] in their review, where they found an association between diabetes and COVID-19 mortality with the pooled odds ratio of 1.75 (p value 0.0002). Zhang *et al* [20] reported in their meta-analysis that hypertension significantly increases the risk of severity and fatality in SARS-CoV-2 infection (3.48 fold higher risk of mortality). Association has also been reported between presence of obstructive lung disease and severity of COVID-19 infection. Nandy *et al* [18] found that the risk of developing serious events in COVID-19 patients was 6.6 times higher in patients with obstructive lung disease than in those without. Other comorbidities like CKD (5.3 fold risk of serious events [18]), obesity and underlying malignancy were also independently associated with disease severity and fatality, as reported by many authors.[21-24] In our study, we found that patients with underlying CKD, malignancy and morbid obesity presented with severe disease on admission and had a shorter duration of illness, indicating early mortality. This difference in disease severity between patients having CKD, malignancy or obesity and those without these conditions was not reflected statistically, probably as a result of a small number of patients with these comorbidities.

While analyzing laboratory investigations, we found leucopenia in 19.6% of our patients and leucocytosis in 49.0%. Many authors have reported primary leucopenia in COVID-19 infection.[25-27] However, leukocytosis has been observed in literature in severe cases [28], which may be a result of co-infection or super-imposed infection. Often this rise in leucocyte count is associated with poor patient outcome, as is observed in our study. Low platelet count may be seen in severe cases of COVID-19 infection, and thrombocytopenia on admission has been found to be an independent risk factor for in-hospital mortality.[27,29] Half of our patients have platelet counts less than 1.5 lakhs/mm^3, with 22.7% showing platelets less than 1 lakh/mm^3. Mean SOFA score on admission was found to be 7.3 ± 3.3 in our study. While reviewing literature on utility of SOFA in predicting COVID-19 mortality, we found that Liu *et al* [30] calculated an optimal cutoff of ≥ 3 SOFA score for mortality prediction (with sensitivity, specificity, positive predictive value, and negative predictive value of 90.00%, 83.18%, 50.00%, and 97.80%, respectively). Higher SOFA scores have been recognized as predictors of mortality by Aggarwal *et al* [9] and Zhou *et al* [31] also. In the latter study, the median SOFA score in COVID-19 non-survivors was 4.5 (IQR: 4.0-6.0), whereas in survivors it was 1.0 (1.0-2.0). High mean SOFA score on admission in our patients signifies that patients admitted in our ICU were received sick, as ours is a tertiary care hospital and a designated referral centre for peripheral hospitals and COVID care centres in our catchment area. Scoring systems other than SOFA have also been used, like CURB-65 [32] and more recently, the 4C (Coronavirus Clinical Characterisation Consortium) mortality score [33] as predictors of poor outcome in COVID-19 patients. An observational study by Du *et al* [32] on 85 fatal cases of COVID-19 infection revealed a mean duration of symptom onset to hospital admission of 10.1 ± 6.2 days and a mean LoS in hospital was 6.35 ± 4.51 days. Although the LoS is similar to our study (5.1 ± 5.3 days), our duration of symptom onset to hospital admission is less (5.8 ± 4.2 days). This could be explained by the fact that the above-mentioned study was carried out in early days of the pandemic and public awareness regarding disease dynamics were much less. By the time the infection was widespread in our population, the general public was more educated regarding the disease and hence may have presented to the hospital early. The retrospective analysis of 320 COVID deaths by Biagi *et al*

[7] mentions a median duration of hospital stay of 7.6 days (IQR: 5.0-11.5) and median duration of symptom onset to hospital admission of 6.0 days (IQR: 5.0-11.0). To date our study is the largest collection of COVID-19 fatalities yet described in Indian population. Nevertheless, it has its limitations. Firstly, since we did not include any data of survivor patients, this does not allow a comparison and a better analysis of the results obtained. Secondly, despite the high number of patients, these refer to the population of a single Indian metropolitan city, albeit one of the most affected by the pandemic. Lastly, because of the retrospective nature of the study and missing data from patient files, we were unable to include inflammatory markers and D-dimer in our analysis. To conclude, in our analysis, most of the COVID-19 fatalities were elderly male patients, although the median age seems to be lower in the Indian population. Patients with diabetes and hypertension continue to be at risk, but those with CKD, malignancy and obesity also need vigilant monitoring. The number of comorbid conditions increase and duration of illness decreases with increasing patient age. Although ARDS remains the primary cause of mortality in majority of the patients, COVID-19 may present with isolated neurological manifestations, which may pose a dilemma to clinicians. Higher SOFA score on admission may be considered as a predictor of mortality in COVID-19 illness.

Conflicts of interest: We declare no conflicts of interest.

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REFERENCES

1. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, *et al*. A Novel Coronavirus from Patients with Pneumonia in China, 2019. *N Engl J Med*. 2020; 382(8): 727-33.
2. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, *et al*. Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia. *N Engl J Med*. 2020; 382(13): 1199-1207.
3. Zheng KI, Feng G, Liu WY, Targher G, Byrne CD, Zheng MH. Extrapulmonary complications of COVID-19: A multisystem disease? *J Med Virol*. 2020: 10.1002/jmv.26294.
4. Bouadma L, Lescure FX, Lucet JC, Yazdanpanah Y, Timsit JF. Severe SARS-CoV-2 infections: practical considerations and management strategy for intensivists. *Intensive Care Med*. 2020; 46(4): 579-82.
5. ARDS Definition Task Force, Ranieri VM, Rubenfeld GD, Thompson BT, Ferguson ND, Caldwell E, *et al*. Acute respiratory distress syndrome: the Berlin Definition. *JAMA*. 2012; 307(23): 2526-33.
6. Chen T, Wu D, Chen H, Yan W, Yang D, Chen G, *et al*. Clinical characteristics of 113 deceased patients with coronavirus disease 2019: retrospective study. *BMJ*. 2020 Mar 26; 368: m1091.
7. Biagi A, Rossi L, Malagoli A, Zanni A, Sticozzi C, Comastri G, *et al*. Clinical and epidemiological characteristics of 320 deceased patients with COVID-19 in an Italian Province: A retrospective observational study. *J Med Virol.* 2020: 10.1002/jmv.26147. (Epub ahead of print).
8. Bhadade R, Harde M, deSouza R, Kasbe A, Deshpande C, Dave S, *et al*. Appraisal of Critically Ill COVID-19 Patients at a Dedicated COVID Hospital. *J Assoc Physicians India*. 2020; 68(9): 14-19.
9. Aggarwal A, Shrivastava A, Kumar A, Ali A. Clinical and Epidemiological Features of SARS-CoV-2 Patients in SARI Ward of a Tertiary Care Centre in New Delhi. *J Assoc Physicians India*. 2020; 68(7): 19-26.
10. Xie Y, Wang Z, Liao H, Marley G, Wu D, Tang W. Epidemiologic, clinical, and laboratory findings of the COVID-19 in the current pandemic: systematic review and meta-analysis. *BMC Infect Dis*. 2020; 20(1): 640-651.
11. Du RH, Liang LR, Yang CQ, Wang W, Cao TZ, Li M, *et al*. Predictors of mortality for patients with COVID-19 pneumonia caused by SARS-CoV-2: a prospective cohort study. *Eur Respir J*. 2020; 55(5): 2000524.
12. Gemmati D, Bramanti B, Serino ML, Secchiero P, Zauli G, Tisato V. COVID-19 and Individual Genetic Susceptibility/Receptivity: Role of ACE1/ACE2 Genes, Immunity, Inflammation and Coagulation. Might the Double X-chromosome in Females Be Protective against SARS-CoV-2 Compared to the Single X-Chromosome in Males? *Int J Mol Sci*. 2020; 21(10): 3474.
13. Scully EP, Haverfield J, Ursin RL, Tannenbaum C, Klein SL. Considering how biological sex impacts immune responses and COVID-19 outcomes. *Nat Rev Immunol*. 2020; 20(7): 442-7.
14. Klein SL, Flanagan KL. Sex differences in immune responses. *Nat Rev Immunol*. 2016; 16(10): 626-38.
15. Baj J, Karakuła-Juchnowicz H, Teresiński G, Buszewicz G, Ciesielka M, Sitarz E, *et al*. COVID-19: Specific and Non-Specific Clinical Manifestations and Symptoms: The Current State of Knowledge. *J Clin Med*. 2020; 9(6): 1753.
16. Gulati A, Pomeranz C, Qamar Z, Thomas S, Frisch D, George G, *et al*. A Comprehensive Review of Manifestations of Novel Coronaviruses in the Context of Deadly COVID-19 Global Pandemic. *Am J Med Sci*. 2020; 360(1): 5-34.
17. Abdi A, Jalilian M, Sarbarzeh PA, Vlaisavljevic Z. Diabetes and COVID-19: A systematic review on the current evidences. *Diabetes Res Clin Pract*. 2020; 166: 108347. (Epub ahead of print).
18. Nandy K, Salunke A, Pathak SK, Pandey A, Doctor C, Puj K, *et al*. Coronavirus disease (COVID-19): A systematic review and meta-analysis to evaluate the impact of various comorbidities on serious events. *Diabetes Metab Syndr*. 2020; 14(5): 1017-25. (Epub ahead of print).
19. Wu ZH, Tang Y, Cheng Q. Diabetes increases the mortality of patients with COVID-19: a meta-analysis. *Acta Diabetol*. 2020; 1-6. (Epub ahead of print).
20. Zhang J, Wu J, Sun X, Xue H, Shao J, Cai W, *et al*. Association of hypertension with the severity and fatality of SARS-CoV-2 infection: A meta-analysis. *Epidemiol Infect*. 2020; 148: e106.
21. Oyelade T, Alqahtani J, Canciani G. Prognosis of COVID-19 in Patients with Liver and Kidney Diseases: An Early Systematic Review and Meta-Analysis. *Trop Med Infect Dis*. 2020; 5(2): 80.
22. Palaiodimos L, Kokkinidis DG, Li W, Karamanis D, Ognibene J, Arora S, *et al*. Severe obesity, increasing age and male sex are independently associated with worse in-hospital outcomes, and higher in-hospital mortality, in a cohort of patients with COVID-19 in the Bronx, New York. *Metabolism*. 2020; 108: 154262.

23. Klang E, Kassim G, Soffer S, Freeman R, Levin MA, Reich DL. Severe Obesity as an Independent Risk Factor for COVID-19 Mortality in Hospitalized Patients Younger than 50. *Obesity*. 2020; 28(9): 1595-9.
24. Meng Y, Lu W, Guo E, Liu J, Yang B, Wu P, *et al*. Cancer history is an independent risk factor for mortality in hospitalized COVID-19 patients: a propensity score-matched analysis. *J Hematol Oncol*. 2020; 13(1): 75.
25. Mardani R, Ahmadi-Vasmehjani A, Zali F, Gholami A, Mousavi Nasab SD, Kaghazian H, *et al*. Laboratory Parameters in Detection of COVID-19 Patients with Positive RT-PCR; a Diagnostic Accuracy Study. *Arch Acad Emerg Med*. 2020; 8(1): e43.
26. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, *et al*. Clinical Characteristics of Coronavirus Disease 2019 in China. *N Engl J Med*. 2020; 382(18): 1708-20.
27. Zhang Y, Zeng X, Jiao Y, Li Z, Liu Q, Ye J, *et al*. Mechanisms involved in the development of thrombocytopenia in patients with COVID-19. *Thromb Res*. 2020; 193: 110-15.
28. Contou D, Claudinon A, Pajot O, Micaëlo M, Longuet Flandre P, Dubert M, *et al*. Bacterial and viral co-infections in patients with severe SARS-CoV-2 pneumonia admitted to a French ICU. Ann Intensive Care. 2020; 10(1): 119.
29. Lippi G, Plebani M, Henry BM. Thrombocytopenia is associated with severe coronavirus disease 2019 (COVID-19) infections: A meta-analysis. *Clin Chim Acta*. 2020; 506: 145-8.
30. Liu S, Yao N, Qiu Y, He C. Predictive performance of SOFA and qSOFA for in-hospital mortality in severe novel coronavirus disease. *Am J Emerg Med*. 2020. PMC7354270. (Epub ahead of print).
31. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, *et al*. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet*. 2020; 395(10229): 1054-62.
32. Du Y, Tu L, Zhu P, Mu M, Wang R, Yang P, *et al*. Clinical Features of 85 Fatal Cases of COVID-19 from Wuhan. A Retrospective Observational Study. *Am J Respir Crit Care Med*. 2020; 201(11): 1372-9.
33. Knight SR, Ho A, Pius R, Buchan I, Carson G, Drake TM, *et al*; ISARIC4C investigators. Risk stratification of patients admitted to hospital with covid-19 using the ISARIC WHO Clinical Characterisation Protocol: development and validation of the 4C Mortality Score. *BMJ*. 2020; 370: m3339.

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