Predictors of ICU Admission in Covid 19 Patients

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Background and study aim: The global spread of the SARS-CoV-2 virus imposes an enormous burden on medical health systems.The aim of this study was to detect the predictors of ICU admission in COVID 19 patients.

Patients and Methods: This was a retrospective study on patients files involving 258 patients with COVID 19. Patients were classified to Group I: Included 186 patients who need ICU care. Then classified into two subgroups Group Ia 134 patient needed mechanical ventilation, Group Ib: Includes 52 patients did not need mechanical ventilation Group II: include72 patient who did not need ICU. All patients subjected to full history taking, clinical examination, O2 saturation, complete blood count, liver and renal function tests, lipid profile inflammatory markers electrolytes, and imaging study.

Results: ICU admission showed significant positive correlation with smoking, age, body weight ,respiratory rate(RR), heart rate(HR), blood pressure, random blood sugar(RBS), Hb,total leucocytic count (TLC),procalcitonin(PCT), Na, kidney function, IL6, total bilirubin and ferritin. And significant negative correlation with albumin and O2 saturation on room temperature. MV showed significant positive correlation with smoking, age, RR, HR, SBP, DBP, RBS, Hb, TLC, PCT, Na, IL6 and ferritin. And significant negative correlation with albumin, K, total bilirubin and saturation on room temperature.

Conclusion: Obesity, increase age, hypertension, diabetes, chest disease, cardiac disease, liver disease and renal disease, High LDH, RR, HR, Bps, DBP, RBS, TLC, CRP, PCT, Na, kidney function, IL6, total bilirubin, ferritin, D dimer and Psychological status are considered predictors of admission to ICU in COVID 19 patients.

Introduction

The severe acute respiratory syndrome corona virus 2 (SARS COV- 2) that causes corona virus disease 2019 (COVID 19) poses multiple challenges to our health care. This virus originally identified in Wuhan, China and has forced several countries to take unprecedented public health measures as health professionals and policy makers try to shield those at highest risk **[1]**.

The requirement of intensive care among COVID 19 hospitalized patients varies between countries from 5% to 32%. Many factors including age, sex, and comorbidities are associated with the severity of disease and ICU admission. According to these studies, severe disease is accompanied by acute kidney injury, acute respiratory distress syndrome (ARDS), myocarditis , cardiac and septic shock. Hence, ICU admission plays a crucial role in the care of COVID 19 patients and also is effective in decreasing the mortality rate **[2].**

The aim of the present study was to detect the predictors of ICU admission in COVID 19 patients.

PATIENTS AND METHODS

This was a retrospective study from patients' files involved 258 patients admitted to Shebin Elkom fever hospital who are diagnosed positive of covid 19 according to WHO criteria in the period between February and May2021. The studied patients were classified into the following groups according to the need of ICU admission Group I: include186 patient who need ICU care on admission or at some point during hospital stay, Group II: Included 72 patients who did not need ICU care. GI patients were reclassified into two subgroups according to the need of mechanical ventilation: GIa: Included 134 patient which undergo mechanical ventilation either invasive (123) IMV patients or not NIMV Group (11 patients), 52 patients admitted to ICU did not undergo mechanical ventilation.GI b

Prognostic effects of variables on admission among patients who received intensive care unit (ICU) support and those who didn't require ICU care were studied. Adults more than18 years who are Covid 19 confirmed with any one item of serological or radiological evidence , real time PCR test positive for SARS-COV2 or radiological findings in the form of ground glass opacity or vascular were included in our study. Patients less than18 years old, Pregnant women and asymptomatic and normal x-ray finding subjects were excluded from our study.

All patients were subjected to full history taking: With special emphasis on constitutional and chest symptom. Full clinical examination (General examination, Local chest examination), Routine laboratory investigations, Complete blood count, Liver Function Tests including serum albumin, serum alkaline phosphatase (ALP), prothrombin concentration, prothrombin time and INR, blood urea and serum creatinine lipid profile inflammatory markers, electrolytes, and Imaging study.

Statistical analyses:

Data was statistically analyzed using SPSS (statistical package for social science) program version 13 for windows and for all the analysis a p value < 0.05 was considered statistically significant: Data are shown as mean, range, or value and 95% confidence interval (95% CI) and frequency and percent. Chi square test was done for qualitative variable analysis and p-value < 0.05 was considered p significant. Student t- test was done for normally distributed quantitative variables to measure mean and standard deviation and p-value < 0.05 was considered significant. Pearson correlation test was done to study correlation between one qualitative variable and one quantitative variable or two quantitative variables of not normally distributed data and p- value less than 0.05 was considered significant. All these tests were used as tests of significance at P<0.05: >0.05 non-significant, <0.01 Highly significant.

RESULTS

They were 145 males (56.2 %) and 113 females (43.8%) and their ages ranged between 30 and 82 years with mean value (61.57 ± 14.58 years). Sex had no effect on ICU admission (p>0.05). However, Obesity, age, hypertension, diabetes, chest disease, cardiac disease, liver disease and renal disease showed significant association with ICU admission (P 0.001, 0.006). However, autoimmune diseases had no association with admission to ICU (p >0.05) (table 1).

RR(respiratory rate), HR(heart rate, SBP(systolic blood pressure) and DBP(diastolic pressure), showed significant increase in patients admitted to ICU when compared to patients not admitted to ICU (P= 0.001 each). However, saturation on room air showed significant decrease in patients admitted to ICU when compared to patients not admitted to ICU (P= 0.001) (table 2). Advanced CT and abnormal ABG were significantly associated with admission to ICU (P= 0.001). (table 3).

This table shows that TLC(total leucocytic count), CRP(c-reactive protein), PCT (procalcitonin), Na, kidney function, IL6, total bilirubin, ferritin, D dimer High LDH were significantly associated with ICU admission (p= 0.001). when compared to patients not admitted to ICU (P= 0.001) K level showed no significant difference between the two groups (p>0.05) (table 4).

There was significant difference between the studied groups (IMN, NIMV and no MV groups) regarding sex, age, smoking and weight (0.001, 0.001, 0.002, 0.001). significant difference between the studied groups (IMN, NIV MV and no MV groups) regarding Bp, diabetes, Chest Diseases, Cardiac history, Kidney diseases and kidney function (p =0.001, 0.001, 0.001, 0.001, 0.004, 0.022). However, no significant difference

was found regarding liver diseases and auto immune diseases (table 5).There is significant difference between studied groups (IMN , NIV MV and no MV groups) regarding CT, ABG, LDH (p=0.001 each). There is significant difference between studied groups (IMN , NIV MV and no MV groups) regarding RR, HR, SPB, DBP and RBS (0.001, 0.001, 0.001, 0.002 and 0.001) (table 5).

Significant difference between studied groups (IMN, NIMV and no MV groups) regarding Hb, TLC, PCT, K, Il6, albumin, ferritin, D dimmer and saturation on room air. However, no significant difference was found regarding CRP, kidney function and total bilirubin (table 7).

MV has significant difference between studied groups (IMN, NIMV and no MV groups) regarding ICU admission (p=0.001) (table 6).

There is a significant difference between studied groups (IMN, NIMV and no MV groups) regarding mortality among studied patients (p=0.001) (table 7).

Table (1): Relation between demographic data, medical history and ICU admission among studied group.

		G I		GII		X^2	P.value
Sex	Male	104	55.9%	41	56.9%	0.02	0.881
	Female	82	44.1%	31	43.1%		
Age	mean±SD	66.8±10.2		48.06±15.6		11.33	0.001
Smoking	No	145	78.0%	31	43.1%	29.16	0.001
	yes	41	22.0%	41	56.9%		
Weight	Morbid obesity	41	22.0%	0	0.0%	Fisher's Exact Test 21.39	0.001
	obese	51	27.4%	20	27.8%		
	over weight	31	16.7%	21	29.2%		
	normal weight	62	33.3%	30	41.7%		
	Thin	1	0.5%	1	1.4%		
BP	Normal	31	16.7%	50	69.4%	67.13	0.001
	HTN	155	83.3%	22	30.6%		
Diabetes	Normal	94	50.5%	61	84.7%	25.29	0.001
	DM	92	49.5%	11	15.3%		
Chest Diseases	No history	141	75.8%	59	81.9%	37.33	0.001
	bronchial asthma	21	11.3%	1	1.4%		
	COPD	24	12.9	2	2.8		
	TB	0	0	10	13.9		
Cardiac history	No history	116	62.4%	61	84.7%	Fisher's Exact Test 59.29	0.001
	AF	21	11.3%	0	0.0%		
	cardiomyopathy	38	20.4%	0	0.0%		
	IHD and AF	11	5.9%	0	0.0%		
	IHD	0	0.0%	11	15.3%		
Kidney diseases	No History	42	22.6%	40	55.6%	26.03	0.001
	CKD	144	77.4%	32	44.4%		
Liver diseases	No history	163	87.6%	71	98.6%	7.41	0.006
	CLD	23	12.4%	1	1.4%		
Auto Immune diseases	No history	171	91.9%	65	90.3%	4.38	0.357
	SLE	5	2.7%	5	6.9%		
	rheumatoid arthritis	5	2.7%	2	2.8%		
	auto immune thyroiditis	4	2.2%	0	0.0%		
	sjogrin syndrome	1	0.5%	0	0.0%		

This table shows that sex,auto immune diseases had no effect on ICU admission (p>0.05). However, Obesity and increase age showed significant association with ICU admission (P=0.001 each).

AF; atrial fibrillation CKD chronic kidney diseases; CLD chronic liver diseases; COPD chronic obstructive pulmonary diseases; HTN hypertension; IHD ischemic heart diseases; SLE systemic lupus

Table (2): Relation between vital signs and ICU admission among studied group

Vital signs	GI	GII	X^2	P.value
RR	34.54±5.71	29.13±5.32	6.96	0.001
HR	90.58±15.54	82.78±13.65	3.74	0.001
SBP	144.89±20.38	121.25±8.38	9.53	0.001
DPB	87.58±13.51	78.33±14.04	4.88	0.001
Saturation on room air	82.73±7.59	90.46±1.76	8.54	0.001

RR, HR, Bps, BPD, showed significant increase in patients admitted to ICU when compared to patients not admitted to ICU (P= 0.001 each). However, saturation on room air showed significant decrease in patients admitted to ICU when compared to patients not admitted to ICU (P= 0.001).
RR respiratory rate; HR heart rate; SPB systolic blood pressure; DPB diastolic blood pressure;

Table (3): Relation between (CT,ABG and LDH) and admission among studied groups

investigation		ICU admission				X^2	P.value
		GI N=186		GII N=72			
CT	Corad 1	0	0.0%	20	27.8%	107.66	0.001
	Corad 3	21	11.3%	31	43.1%		
	Corad 4	31	16.7%	10	13.9%		
	Corad 5	134	72.0%	11	15.3%		
ABG	Normal	51	27.4%	42	58.3%	76.7	0.001
	R alkalosis with M acidosis	42	22.6%	0	0.0%		
	M acidosis	42	22.6%	0	0.0%		
	R alkalosis	41	22.0%	20	27.8%		
	M alkalosis	0	0.0%	10	13.9%		
	R acidosis	10	5.4%	0	0.0%		
LDH	Normal	44	23.7%	51	70.8%	49.66	0.001
	High	142	76.3%	21	29.2%		

High LDH was significantly associated with ICU admission (p= 0.001). Advanced CT and abnormal ABG were significantly associated with admission to ICU (P= 0.001)

Table (4): Relation between investigation and ICU admission among studied group.

investigation	Groups		T test	P.value
	GI N=186	GII N=72		
Hb	11.24±1.84	12.84±2.05	6.06	0.001
Tlc	14.24±6.22	7.53±5.27	8.09	0.001
CRP	45.16±27.30	37.33±17.96	2.25	0.001
PCT	2.10±1.51	1.12±1.13	4.99	0.001
Na	139.68±7.43	136.43±4.61	3.46	0.001
K	4.06±0.66	4.14±0.47	0.926	0.355
Kidney function	2.09±1.10	1.77±1.10	2.13	0.034
Il6	57.51±33.33	10.01±8.04	11.94	0.001
Albumin	3.07±0.60	3.40±0.46	4.15	0.001
Total bilirubin	1.18±0.87	0.78±0.21	3.82	0.001
RBS	242.42±114.7	172.50±98.82	4.56	0.001
Ferritin	253.56±165.75	160.76±134.75	4.24	0.001
D dimmer	403.86±213.50	178.40±256.42	7.18	0.001

TLC, CRP, PCT, Na, kidney function, IL6, total bilirubin, ferritin, D dimer showed significant increase in patients admitted to ICU when compared to patients not admitted to ICU (P= 0.001 each K level showed no significant difference between the two groups (p>0.05)

CRP c-reactive protein, DPB diastolic blood pressure ; HR heart rate; PCT procalcitonin RR respiratory rate; SPB systolic blood pressure;; TLC total leucocytic count,

Table (5): Correlation between ICU admission and mechanical ventilation with other parameters

	ICU admission		Mechanical ventilation	
	r	**P.value**	**r**	**P.value**
Smoking	0.336**	<0.001	0.135*	0.03
Weight	0.216**	<0.001	0.304**	<0.001
Age	0.578**	<0.001	0.222**	<0.001
RR	0.399**	<0.001	0.434**	<0.001
HR	0.228**	<0.001	0.318**	<0.001
Bps	0.512**	<0.001	0.404**	<0.001
DBP	0.292**	<0.001	0.188**	0.002
RBS	0.274**	<0.001	0.383**	<0.001
Hb	0.355**	<0.001	0.297**	<0.001
Tlc	0.452**	<0.001	0.443**	<0.001
Pct	0.298**	<0.001	0.413**	<0.001
Na	0.211**	0.001	0.134*	0.031
K	-0.058	0.355	-0.255**	<0.001
Kidney function	0.132*	0.034	-0.025	0.687
Il6	0.598**	<0.001	0.555**	<0.001
Albumin	-0.251**	<0.001	-0.173**	0.005
Total bilirubin	0.233**	<0.001	-0.011	0.866
Ferritin	0.256**	<0.001	0.160*	0.01
Saturation on room air	-0.471**	<0.001	-0.641**	<0.001

*** P<0.05 significant** **** P<0.01 Highly significant**

ICU admission showed significant positive correlation with smoking, age, RR, HR, Bps, Bpd, RBS, Hb, TLC, PCT, Na, kidney function, IL6, total bilirubin

CRP c-reactive protein, DPB diastolic blood pressure ; HR heart rate; PCT procalcitonin RR respiratory rate; SPB systolic blood pressure;; TLC total leucocytic count,

Table (6): Relation between ICU admission and mechanical ventilation in the study group

ICU admission	MV						X^2	P.value
	No		IMV		NIV MV			
Yes	52	41.9%	123	100.0%	11	100.0%	107.92	0.001
No	72	58.1%	0	0.0%	0	0.0%		

MV is significant difference between studied groups (IMN , NIV MV and no MV groups) regarding ICU admission (p=0.001).

MV mechanical ventilation

Table 7: relation between mortality and mechanical ventilation in the study group

Mortality	MV						X^2	P.value
	No		**IMV**		**NIV MV**			
Died	21	16.9%	116	94.3%	11	100.0%	159.6	0.001
Improved	103	83.1%	7	5.7%	0	0.0%		

A significant difference between studied groups (IMN , NIV MV and no MV groups) regarding mortality among studied patients (p=0.001).

MV mechanical ventilation; IMV invasive mechanical ventilation ; NIVMV non invasive mechanical ventilation.

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Discussion

The present study was retrospective study aimed to detect the predictors of ICU admission in COVID 19 patients.

Most studied cases were male (56.2%), The mean age was 61.57± 14.58, Most cases were nonsmoker (68.2%). 35.7% of cases were normal weight, 27.5% were obese, 20.2% were overweight and 15.9%were morbid obesity. These results could be attributed to the fact that sex hormones play an important role in various immunoinflammatory responses **[3]**.

In line with our finding, The study of **Akbari et al.,(2020)** conducted in Shiraz city (southern Iran) showed that 56.6% of patients were male and 38.4% were in the age range of 40-60 years **[4]. In 2020, Guan et al**. examined the demographic characteristics and clinical signs of patients with coronavirus infection in China; 58% of the patients were male and the mean age of the patients was 47 years **[5].**

The present study revealed that sex and smoking had no effect on ICU admission. However, obesity and increase age showed significant association with ICU admission. In agreement with our finding, **Hatami et al** suggested that patients aged 60-80 years (and over 80 years are at higher risk of disease deterioration and ICU admission independently from other cofounders, such as underlying comorbidities **[6].**

Petrilli et al., (2020) showed that smoking was not associated with an increased risk of hospitalization or critical illness**.** Medical history of diabetes mellitus (DM), HTN, CVD, cerebrovascular accident (CVA), and COPD have been cited as predictive factors for severe outcomes in COVID-19 patients**[7].**

The present study revealed that Hypertension, diabetes, chest disease, cardiac disease, liver disease and renal disease showed significant association with ICU admission. Similarly**, Hatami et al.,**(2020) found significantly higher rates of HTN, CVD, and, CVA in ICU rather than non-ICU patients **[6]. Alsaad et al.,** (2020) showed that the comorbidities that demonstrated a statistically significant association with ICU admission were heart failure, chronic obstructive pulmonary disease, and chronic kidney disease **[10].**

Diabetes mellitus and hypertension have been reported to increase the risk of ICU admission in previous studies but were not reported in the present study In previous study, 66% of the patients were known type 2 diabetics and 48% suffered from hypertension. Diabetes is associated with a worse outcome in COVID-19 with a higher proportion of ICU admission, ARDS and mechanical ventilation being observed **[11,12,13].**

Current evidence suggests that patients with COPD have a higher risk of ICU admission and severe COVID-19 because they are prone to viral infections, including SARS-CoV-2. This outcome is primarily due to the increased expression of ACE2 receptors in the small airways and could also be related to a poor lung reserve **[14].**

Moreover, we showed that autoimmune diseases had no association with admission to ICU. Similarly, in certain cases patients with autoimmune diseases may have better sepsis-related clinical outcomes **[15].** Contrarily, **Godeau et al** included 69 patients with SLE, necrotizing vasculitis, AR, and other rheumatic diseases. The main reasons for admission were infections and acute exacerbation of the disease **[16].**

The present study revealed that High LDH was significantly associated with ICU admission. In line with our finding, high LDH was significantly associated with ICU admission. Elevated LDH indicates cell death and injury and is associated with a poor host immune response, resulting in a higher susceptibility to severe viral infections **[17].** Also, **Hatami et al** showed that Lactate dehydrogenase (LDH) level was also significantly higher among the ICU group**[7].**

The present study showed that worse CT and abnormal ABG were significantly associated with admission to ICU. Similarly, previous studies showed that increased rate of consolidations, along with increasing percentages of lung involvement in patients is associated with disease progression and could partially explain the observed association **[18, 19].**

Also, **Kanne et al** showed that a higher proportion of cases who mandated ICU admission had worse CT signs of infection **[19]** Numerous studies have illustrated the practical value of CT chest not just as a detector of disease severity but also as a diagnostic instrument in areas with limited resources **[18].**

Regarding vital signs we found that RR, HR, DPB, SBP, RBS showed significant increase in patients admitted to ICU when compared to patients not admitted to ICU. However, saturation on room air showed significant decrease in patients admitted to ICU when compared to patients not admitted to ICU.

In agreement with our study, **Elsharawy et al.,(2021)** demonstrated that ICU patients had significantly higher respiratory rates, body temperatures, and pulse rates. Furthermore, only two ICU admitted patients had bradycardia, while the majority had either normal or increased pulse rates. So pulse rate can be used as a rapid, simple, and bedside indicator of disease severity. Therefore, this finding highlights the importance of conducting ECG as a routine for COVID-19 infected patients **[20].** This increase in pulse rate can be attributed to many influences, including increased body temperature (as pulse increases 9.46 beats/min/°C in female patients and 7.24 beats/min/°C in male patients for every 1°C increase in body temperature)**,** cardiac affection caused by COVID-19 infection, and associated inflammation**.**

The present study showed that CRP showed significant increase in patients admitted to ICU when compared to patients not admitted to ICU. CRP, in our study, was considerably higher in the ICU group and revealed an evident correlation with both oxygen saturation and severities, it could not be considered an independent forecaster of ICU admission since it was one of the crucial variables in univariate but not multivariate analysis, in contrast to previous studies **[21, 22].**

The present study showed that TLC, PCT, Na, kidney function, IL6, total bilirubin, ferritin, D dimer showed significant increase in patients admitted to ICU when compared to patients not admitted to ICU. However, K level showed no significant difference between the two groups.

Previous studies showed that patients at high risk for ARDS development are those older than 65 years old, presenting high fever ($T > 39^{o}C$), neutrophilia, lymphocytopenia, elevated markers of hepatic and renal failure (aspartate aminotransferase, alanine aminotransferase, creatinine, and urea), elevated acute-phase proteins as markers of inflammation (high-sensitivity C-reactive protein, procalcitonin, and serum ferritin), and elevated coagulation function-related indicators (prothrombin time, fibrinogen, and D-dimer) **[23, 24]. Huang et** al in meta-analysis showed that an elevated serum CRP, PCT, D-dimer, and ferritin were associated with a poor outcome in COVID-19 **[23].**

The present study revealed that ICU admission not associated with presence of cancers. Contrarily, other study showed that suffering from cancer could increase the prevalence of ICU admission among COVID-19 infected patients **[26]**

The present study showed that psychological status showed significant association with admission to ICU. Similarly, other study estimated that the risk for psychiatric sequelae is higher in COVID-19 patients and in those admitted to ICU using electronic health records data **[28].**

Our study revealed that ICU admission showed significant positive correlation with, Hb, TLC, PCT, Na, kidney function, IL6, total bilirubin and ferritin. And significant negative correlation with albumin and saturation on room temperature.

In line with our finding, previous studies showed that the level of serum ferritin had been posited as one of the predictors of poor outcome in COVID 19 sufferers. Higher levels of serum ferritin were associated with higher odds of ICU admission through both univariate and multivariate analyses in this work, which was comparable to earlier studies that found an association between raised ferritin count and fatality, but with a lower cut off value (300 ng/ml) vs (368 ng/ml) in our study **[29].**

Sadeghi et al., (2020) showed that the admission O2 saturation, HCT, CRP levels at first admission and myalgia presentation could be considered as the valuable predictors of ICU admission **[27].**

D-dimer elevation was associated with a hypercoagulable state, however, its specificity on the main cause of elevation may not be known as D-dimer elevations were associated with several unfavorable events including occlusion, sepsis, micro-thrombosis, and intravascular coagulation **[28] Zhao et al. (2020)** shows that COVID 19 survivors and non-survivors had normal WBCs, non-survivors had higher WBC counts and slightly reduced lymphocyte counts **[29].**

The present study revealed that there was significant difference between the IMN, NIV MV and no MV groups regarding sex, age,

smoking and weight. men might be more susceptible to receive IMV and NIMV than women. Jackson et al reported that advanced age is one of the strongest predictors of the mortality-related to mechanical ventilation in COIVD19 patients **[30].**

Cummings et al(2020) showed that among demographical variables, increasing age was significantly associated with a higher duration of MV and ICU mortality **[31].**

Moreover, we demonstrated significant difference between the IMN, NIV MV and no MV groups regarding Bp, diabetes, chest diseases, cardiac history, kidney diseases and kidney function. However, no significant difference was found regarding liver diseases and auto Immune diseases.

Previous studies showed that acute kidney injury is a known risk factor for prolonged mechanical ventilation in critically ill patients, regardless of the underlying disease **[32, 25].**

Our study showed that there is a significant difference between IMN, NIV MV and no MV groups regarding CT, ABG, LDH. In line with our finding, **Fang et al** showed that patients with COVID-19 who require PMV exhibit fibrosis on computed tomography (CT) **[32].**Factors to be independently predictive for mechanical ventilation requirement (diabetes mellitus, SpO2:FiO2 ratio, C-reactive protein, and lactate dehydrogenase) **[33].**

Previous studies demonstrated that the presence of comorbidities, age, absolute lymphocyte count, LDH, oxygen saturation, respiratory rate, and bilateral opacities on CT scan in order to identify patients at risk of adverse outcomes**. Zhou et al**. showed that CT at the time of reintubation showed progressive lung fibrosis **[29].**

We found that there is a significant difference between studied groups (IMN, NIV, MV and no MV groups) regarding RR, HR, SBP, DBP and RBS. **Seetharam et al** showed that mechanically ventilated patients had a higher incidence of tachycardia (heart rate > 125), elevated respiratory rate > 24 cycles per minute, shortness of breath, and headaches. In addition, mechanically ventilated patients had a lower serum albumin (g/dl) ≤3 units, elevated serum creatinine, elevated serum CRP-HS, serum LDH, SGOT IU/L or AST IU/L, SGPT or ALT, and WBC count **[33].**

The present study showed that there is significant difference between studied groups (IMN , NIV MV and no MV groups) regarding Hb, Tlc, PCT, K, Il6, albumin, ferritin, D dimmer and saturation on room air. However, no significant difference was found regarding CRP, kidney function and total bilirubin.

Our study showed that there is significant difference between studied groups (IMN, NIV MV and no MV groups) regarding associated oncology. **Péron (2021)** showed that the risk of intubation and mechanical ventilation was lower among cancer patients **[35].**

The current study showed that there is significant difference between studied groups (IMN, NIV MV and no MV groups) regarding psychological status. Similarly, **Melamed et al.,(2022)** demonstrated an increased need for critical care interventions and specialized post-discharge care as well as longer ICU and hospital LOS in COVID-19 patients with prolonged mechanical ventilation **[36].**

Moreover, we found that there is a significant difference between studied groups (IMN , NIV MV and no MV groups) regarding mortality among studied patients.

In line with our finding, studies of invasive mechanical ventilation to treat COVID-19 respiratory failure have shown a mortality rate greater than 85% **[37].**

Regarding the notable limitations of the present study, one can refer to limited generalizability of the results since it was a retrospective study based on a single institution. Moreover, relatively limited sample size; this could limit the generalizability of our results.

Conclusion

Obesity, increase age, Hypertension, diabetes, chest disease, cardiac disease, liver disease and renal disease, High LDH, RR, HR, Bps, DBP, RBS, TLC, CRP, PCT, Na, kidney function, IL6, total bilirubin, ferritin, D dimer and Psychological status are considered predictors of admission to ICU in COVID 19 patients. Also study showed that there is significant difference between studied groups (IMN , NIV MV and no MV groups) regarding Hb, TLC, PCT, K, Il6, albumin, ferritin, D dimmer and saturation on room air. However, no significant difference was

found regarding CRP, kidney function and total bilirubin for the need for mechanical ventilation.

Ethical considerations All procedures were carried out in accordance with the ethical standards. Approval from the ethics committee of the Faculty of Medicine, Menoufia University was taken.

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Conflict of interest; None

Abbreviation ABG: arterial blood gas, CRP: c_reactive protein, HR: heart rate, DBP: diastolic pressure, IMN: invasive mechanical ventilation, LDH: lactic dehydrogenase, NIMV: noninvasive mechanical ventilation, MV: mechanical ventilation, PCT: procalcitonin, RBS: random blood suger, RR: respiratory rate, SBP: systolic pressure, TLC: total leucocytic count.

Highlights:

- The global spread of the SARS-CoV-2 virus imposes an enormous burden on medical health systems.
- Predictors of ICU admission in COVID 19 patients are needed.
- Obesity, increase age, hypertension, diabetes, chest disease, cardiac disease, liver disease and renal disease, high LDH, RR, HR, Bps, DBP, RBS, TLC, CRP, PCT, Na, kidney function, IL6, total bilirubin, ferritin, D dimer and psychological status are considered predictors of admission to ICU in COVID 19 patients.

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