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BASELINE LABORATORY AND MOLECULAR PARAMETERS ASSOCIATED WITH SEVERITY AND MORTALITY OF COVID-19: A JEDDAH, SAUDI ARABIA HOSPITAL-BASED RETROSPECTIVE COHORT STUDY

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ABSTRACT
The pandemic of COVID-19 influenced the global health condition heavily, and Saudi Arabia has witnessed many cases of these infections. This paper is research to examine the preliminary clinical and laboratory parameters linked with the morbidity and mortality of COVID-19 patients in Jeddah, Saudi Arabia. At King Abdullah Medical Complex (KAMC-J), a cohort investigation was retrospective with 247 confirmed COVID-19 patients between March 2020 and July 2020. The authors of the study examined the demographic factors, comorbid factors, laboratory results, and management recommendations to determine potential predictors of COVID-19 severity and mortality. The associations between variables and patient outcomes were analyzed by using statistical tests such as logistic regression and chi-square tests. The results showed that age, diabetes mellitus, and D-dimer and ferritin presence were significantly related with bad severity and fatality. Moreover, severe cases had piggy liver enzyme (ALT, AST) and kidney functioning indicators (creatinine, BUN). Poor outcomes were also related to management protocols, e.g., the necessity of invasive ventilation and ICU admission. The research highlights the relevance of early detection of risk patients, especially the elderly and individuals with comorbid conditions, so as to enhance clinical care and mortality rates. The findings also highlight the importance of measuring important laboratory parameters and using patient-specific treatment plans to improve patient outcomes.

KEYWORDS: COVID-19, severity, mortality, Saudi Arabia, laboratory parameters, diabetes, D-dimer, ferritin, retrospective cohort study, King Abdullah Medical Complex

INTRODUCTION

The novel coronavirus (SARS-CoV2) is the leading cause of the pandemic that started in December 2019, causing a rapid spread worldwide (1). At first, SARS-CoV2 emerged as a series of rapid acute atypical respiratory diseases in Wuhan, China (6). Then, throughout its discovery, the novel coronavirus was responsible as it was named after SARS-CoV as SARS-CoV2 due to its high homology (1). The outbreak started in a seafood market with an association of zoonotic transmission, and then China recognized human-to-human transmission as a significant factor of the outbreak (1). The typical clinical symptoms of COVID-19 are fever, cough, and body pain; meanwhile, abnormalities in

laboratory parameters such as elevated liver enzymes, LDH (Lactate Dehydrogenase), lymphopenia, CRP (C-reactive protein), and D-dimer are observable in severe cases ([4, 5]. Liver enzyme abnormality is a common clinical aspect in COVID-19 patients, even though it seems not a prominent feature of COVID-19 patients.

Several studies show that patients between 0-14 are less susceptible to COVID-19 than adults between the ages of 15-64 ([2]. Elderly patients (>65 years old) are at higher susceptibility than the previous age groups as susceptibility increases with the increase of age [(2)]. The disease severity is different throughout different regions, demographic data, and immune response among patients from different regions. For example, the presence of Middle East respiratory syndrome coronavirus (MERS-CoV) antibodies was higher in Saudi Arabia than in other countries [(3)].

Determining the predictive indicators of COVID-19 severity is of great importance as it could help us understand the clinical course of COVID-19 in the peninsula (Saudi Arabia). Therefore, our study aims to investigate clinical laboratory parameters alongside D-dimer level, liver enzymes, and demographic characteristics of admitted COVID-19 patients in Jeddah, Saudi Arabia, to detect predictors for COVID-19 severity and mortality.

METHODOLOGY

Our study is a retrospective cohort study of clinical and laboratory characteristics of 247 confirmed cases of COVID-19. The study setting occurred in King Abdullah Medical Complex-Jeddah (KAMC-J), where it received all residents of the Jeddah region during the data collection period from March 2020-July 2020. We enrolled confirmed COVID-19 patients who tested positive through RT-PCR nasal or pharyngeal first swap who were admitted or transferred to King Abdullah Medical Complex Jeddah (KAMC-J). Our study used a standardized data collection form from the WHO/International Severe Acute Respiratory and Emerging Infection Consortium case record form for Covid-19. Data collection at baseline started from the first day of admission, following the history of first symptoms, exposure, laboratory results, C.T.scan, management protocols, and treatments. The dependent variables are the patients' severity according to NIH Clinical Spectrum of SARS-CoV-2 Infection and mortality.

Statistical analysis

The statistical analyses were performed using Stat software version 13 (Stata Corp, College, Texas, U.S.). Patients' data were coded before data entry as Medical Record Number (MRN) for each patient. Demographic characteristics were categorized into hospital transfer status, a binary variable coded as "1" for patients transferred to KAMC from other hospitals and "2" for admitted non-transferred patients to KAMC. Nationality was coded as "0" for Saudi nationals and "1" for non-Saudis. Also, ethnic groups were divided into five categories "1" for Arabs, "2" for Black, "3" for South Asia, "4" for East Asia, and "5" for White. While, patients' age was divided into four categories "1" for patients less than 30 years old, "2" for patients between 30 and 49 years old, "3" for patients between 50 and 69 years old, and "4" for patients 70 years old and above. Gender was coded as "1" for females and "2" for males. Also, other binary variables such as medical history, symptoms, management protocols, and comorbidities are coded as" 1" yes and "2" according to the variables' categories. Diabetes mellitus was divided into three categories "1" for type II diabetics, "2" for type I diabetics, and 0 for non-diabetics.

Laboratory findings variables were treated as continuous variables, but later on, we collapsed them into categorical variables under each variable's reference cutoff points. The converted categorical variables were coded as "0" for the low range, "1" normal range, and "2" for the high range. Temperature: 36.10C (98.70F) – 37.20C (990F), Heart rate: 60-100 beats/minute, Respiratory rate: 12-20 breath/minute, Systolic Blood Pressure: 90-120, Diastolic Blood pressure: 80**,** Blood urea nitrogen(BUN): 8-21 mg/dL, Ferritin: 12-300 ng/mL (men), 12-150 ng/mL (women), Glucose: 65-110 mg/dL (3.9 mmol/L--5.6 mmol/L), Potassium: 3.5-5 mmol/L, Sodium: 135-145 mmol/L, Total calcium: 2-2.6 mmol/L (8.5-10.2 mg/dL), Urea: 1.2-3 mmol/L, Lactate dehydrogenase (LDH)(serum) 45-90 U/L, Hemoglobin (Hb) Males: 14.0-18.0 g/dL, Females: 12.0-16.0 g/dL, Prothrombin time (P.T.): 9-12 sec, Partial thromboplastin time (aPTT): 25-40sec, Albumin (serum): 3.5-5.0 g/dL.

The primary outcome was patients' severity, and it was stratified under three categories included mild that was coded as "0", moderate coded as "1," and severe, coded as "2", then when we started the regression analysis, we collapsed this variable into two categories "0 for mild and moderate cases and 1 for severe cases". The death variable was treated as a binary variable coded as "1" for dead patients and "0" for live patients upon discharge.

Descriptive analysis for demographic data was represented by categorical bivariate analysis, including age, gender, nationality, ethnic group, obesity, medical history, symptoms prior to admission, medications during admission, management protocols, and chronic diseases in comparison to dependent variables (severity & death) using chi-square test to identify the significance of each variable according to severity and death. In addition, the association between continuous variables and outcome variable were tested using a one-way analysis of variance, mean, and standard deviations.

Binary-logistic regression was built to find the possible predictors of the dependent variable "COVID-19 severity as a binary variable" we used 0.1 as the significance level for the entrance of variables into the model and 0.101 as the level for exit from the model. First, we used the stepwise regression technique and entered all the significant variables which showed significant association with the COVID-19 severity on the bivariate analysis level, and we ended up with a model containing age, diabetes mellitus, nationality, and cough. The other variables were repelled from the model as D-Dimer as it has missing values. The discrimination of this model was high as the area under the curve was .80.

RESULTS

Our finding shows that age has been a predictor for COVID-19 severity; each year increase,the odds of severity increase (OR=1.03). Shows that d-dimer is a predictor for mortality insevere cases with high ranges, and P.T. and APTT are associated with mortality when severe patients have relatively higher ranges. Elevation in Liver and kidney functions ALT, AST has been associated with COVID severity and indicated impairments in their function among severe COVID-19 patients.

Table 1: Distribution of Socio-demographic Characteristics according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia (n=247)

Variable	All Patients		Mild (n=77)		Moderate (n=22)		Severe(n=148)		P-value
Age	total	%	No	%	No	%	No	%	
<30	31	12.55	17	54.84	2	6.45	12	38.71	<0.001
30-49y	94	38.06	37	39.36	6	6.38	51	54.26	
50-69	96	38.87	16	16.67	14	14.58	66	68.75	
≥70	26	10.53	7	26.92	0	0	19	73.08	
Gender*									
Male	188	76.42	57	30.32	19	10.11	112	59.57	0.483
Female	58	23.58	20	34.48	3	5.17	35	60.34	
Nationality*									
Saudi	153	62.20	46	30.07	7	4.58	100	65.36	0.004
Non-Saudi	93	37.80	31	33.33	15	16.13	47	50.54	
Ethnic group*									
Arab	141	57.32	45	31.91	18	12.77	78	55.32	0.207
Black	15	6.10	5	33.33	1	6.67	9	60.00	
South Asian	73	29.67	24	32.88	2	2.74	47	64.38	
East Asian	13	5.28	1	7.69	1	7.69	11	84.62	
European	4	1.63	2	50.00	0	0	2	50.00	
Hospital Transfers									
Admitted Transfers	121	48.99	27	22.31	11	9.09	83	68.60	0.011
Non-transfers	126	51.01	50	39.68	11	8.73	65	51.59	

Table 1, showed a total of 247 patients with SARS-Cov-2 admitted to KAMC-Jeddah with a male predominance (76.42%). Age group stratifications were into four age groups (<30y, 30-49y, 50-69y, ≥70y). The majority of patients were Saudis representing (62.20%). Age was significantly associated with the severity of COVID, and there was a trend as increasing age is significantly associated with COVID severity. Regarding admission through transfer, the study showed that admitted patients who were transferred (68.60%) experienced significantly severe COVID comparedto their counterparts (51.59%). Saudi patients (65.36%) experienced significantly more severe COVID-19 than non-Saudi patients (50.54).

Table 2: distribution of medical history according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia (n=247)

variable	All Patients		Mild (n=77)		Moderate (n=22)		Severe (n=148)		p-value
	total	%	No	%	No	%	No	%	
History of fever*									
Yes	167	67.89	42	25.15	15	8.98	110	65.87	0.008
No	79	32.11	35	44.30	7	8.86	37	46.84	
Cough*									
Yes	166	67.76	37	22.29	11	6.63	118	71.08	<0.001
No	79	32.24	39	49.37	11	13.92	29	36.71	
Sore throat									
Yes	30	12.15	11	36.67	5	16.67	14	46.67	0.162
No	217	87.85	66	30.41	17	7.83	134	61.75	
Runny nose									
Yes	13	5.26	7	53.85	0	0	6	46.15	
No	234	94.74	70	29.91	22	9.40	142	60.68	0.141
Wheezing									
Yes	2	0.81	0	0	0	0	2	100	
No	245	99.19	77	31.43	22	8.98	146	59.59	0.509
Shortness of breath									
Yes	134	54.25	0	0	48	35.56	87	64.44	<0.001
No	113	45.75	87	77.22	22	19.64	3	2.68	
Chest Pain									
Yes	16	6.48	2	12.50	1	6.25	13	81.25	0.187
No	231	93.52	75	32.47	21	9.09	135	58.44	

The history of medical symptoms was reported on the day of admission among COVID-19 patients. It was revealed that patients admitted with fever significantly experienced severe COVID, 65.87% compared to their counterparts. Cough was found a significant association with COVID severity as patients who were admitted with cough (71.08 %) significantly experienced severe COVID compared to patients without cough symptoms (36.71%). Most patients who did not have shortness of breath at admission showed significantly mild severity of COVID (77.20%) compared to no reported mild case among patients who had shortness of breath.

Table 3: Distribution of Baseline vital signs according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah (N=247)

variable	Total (247)	Mild (n=77)	Moderate (n=22)	Severe (n=148)	Range	P

	Mean±SD(min-max)	Mean±SD (95% CI)	Mean±SD (95& CI)	Mean±SD (95% CI)		value
Temperature	37.3±0.75 (36-39.4)	37.15±0.68 (36.9-37.3)	37.5±0.85 (37.1-37.8)	37.38± 0.76 (37.2-37.5)	36.1-37.2 0_C	0.057
Respiratory Rate	20.63±4.31 (9-45)	19.78±3.5 (18.9-20.5)	19.36±2.3 (18.3-20.4)	21.28± 4.79 (20.5-22.1)	12-20 Beats/min	0.017
Heart rate	92.7±16.5 (39.4-153)	88.7±14.7 (85.3-92)	92.2±15.2 (85.4-92)	94.8±17.3 (92-97.7)	60-100 Breaths/ min	0.029
SystolicB/P	129.3±17.3 (90-191)	128.84±16.7 (125-132.6)	128.6±18.5 (120.8-136)	129.7±17.51 (26.7-132.6)	90-120 mmHg	0.92
DiastolicB/P	74.04±10.8 (41-115)	74.3±9.6 (72.1-76.5)	69.8±10.5 (65.4-74.2)	74.5±11.3 (72.6-76.3)	<80 mmHg	0.16
Oxygen Saturation	95±6.9 (20-100)	98.2± 0.86 (98.08-98.4)	95.1±0.63 (94.8-95.4)	93.2±8.4 (91.8-94.6)	95-100 %	<0.01
Height	166.1±8.2 (140-184)	165.9±7.3 (163.6-168.2)	166.7±9.3 (161.4-172.1)	166.1±8.5 (164.4-167.9)	_	0.95
Weight	80.5±17.6 (43.5-138)	74.7±17.1 (69.09-80.3)	84.6±20.4 (72.9-96.2)	82.2±17.2 (78.7-85.6)	_	0.06

Table 3 demonstrates the distribution of baseline vital signs according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah. On admission, patients with the highest mean respiratory rate and heart rate (21.28±4.79) & (94.80±17.30) significantly experienced severe COVID compared to other patients. On the other hand, patients with the least mean oxygen saturation significantlyexperienced severe COVID compared to patients with higher oxygen saturation.

Table 4: Distribution of history of chronic diseases according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah (N=247)

variable	All Patients		Mild (n=77)		Moderate (n=22)		Severe (n=148)		P-value
	total	%	No	%	No	%	No	%	
Chronic cardiac disease									
Yes	24	9.72	3	12.50	2	8.33	19	79.17	
No	223	90.28	74	33.18	20	8.97	129	57.85	0.09
Hypertension*									
Yes	74	30.08	18	24.32	5	6.76	51	68.92	
No	172	69.92	58	33.72	17	9.88	97	56.40	0.1
Diabetes									
No	157	63.56	59	37.58	17	10.83	81	51.59	
Type I	21	8.50	5	23.81	1	4.76	15	71.43	
Type II	69	27.94	13	18.84	4	5.80	52	75.36	0.01
Asthma									
Yes	6	2.43	1	16.67	0	0	5	83.33	

No	241	97.57	76	31.54	22	9.13	143	59.34	0.4
Kidney disease*									
Yes	9	3.66	1	11.11	1	11.11	7	77.78	0.4
No	237	96.34	75	31.65	21	8.86	141	59.49	
Neurological disorder*									
Yes	5	2.03	0	0	1	20.00	4	80.0	0.2
No	241	97.97	76	31.54	21	8.71	144	59.75	

Table 4 illustrates the distribution of the history of chronic diseases according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah. It shows a significant association between a history of diabetes and the severity of COVID, as patients with type II diabetes (75.36%) significantly experienced a severe form of COVID compared to non-diabetic or type I diabetes, respectively (51.59% & 71.43%).

Table 5: Chronic Diseases History among hospital admitted COVID-19 patients in Jeddah (N=247)

variable	All Patients		Mild (n=77)		Moderate (n=22)		Severe (n=148)		p-value
	total	%	No	%	No	%	No	%	
Non-invasive ventilation*									
Yes	72	29.27	7	9.72	7	9.72	58	80.56	<0.01
No	174	70.73	70	40.23	14	8.05	90	51.72	
Invasive ventilation									
yes	36	14.57	0	0	0	0	36	100	<0.01
no	211	85.43	71	33.65	20	9.48	120	56.87	
Inserted tracheostomy									
Yes	15	6.07	0	0	0	0	15	100	<0.01
No	232	93.93	73	31.47	21	9.05	138	59.48	
Renal replacement therapy (dialysis)*									
Yes	7	2.86	1	14.29	1	14.29	5	71.43	<0.01
No	238	97.14	74	31.09	21	8.82	143	60.08	
ICU admission									
Yes	89	36.03	15	16.85	4	4.49	70	78.65	<0.01
No	158	63.97	62	39.24	18	11.39	78	49.37	

Table 5 displays the distribution of management protocol guidelines according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah. It shows that patients subjected to non-invasive / invasive ventilation, inserted tracheostomy, renal replacement therapy, and ICU admission significantly experienced severe COVID-19 compared to their counterparts.

Table 6: Distribution of baseline laboratory investigation "Using Cutoff Points" according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah (N=247)

variable	Total	Mild (n=77)	Ioderate (n=22)	Severe (n=148)	P-value
		N (%)	N (%)	N (%)	
Hemoglobin* Females, g/dL					
Anemia(low)<12.0	26(45.61)	8(30.77)	2(7.69)	16(61.54)	
Normal 12.0-16	29(50.88)	11(37.93)	1 (3.45)	17 (58.62)	

High >16.0	2(5.26)	1(50)	0	1(50)	0.9
Hemoglobin* males, **g/dL**					
Anemia(low)<14.0	104(55.32)	30(28.85)	7(6.73)	67(64.42)	0.3
Normal 14.0-18.0	81(43.09)	26(32.10)	12(14.81)	43(53.09)	
High >18	3(1.60)	1(33.33)	0	2(66.67)	
WBC (Leukocyte)*, × 10^9/L					
Low <4.5	41(16.80)	13(31.71)	4(9.76)	24(58.54)	0.08
Normal 4.5-11.0	163(66.80)	57(34.97)	15(9.20)	91(55.83)	
High >11.0	40(16.39)	5(12.50)	3(7.50)	32(80.00)	
Lymphocyte*, 10^3/ul					
Low <1.5	160(65.04)	36(22.50)	11(6.88)	113(70.63)	<0.001
Normal 1.5-3.0	76(30.89)	36(47.37)	11(14.47)	29(38.16	
High >3.0	10(4.07)	5(50)	0	5(50)	
Neutrophils*, 10^3/L					
Low <1.8	18(7.32)	10(55.56)	2(11.11)	6(33.33)	0.001
Normal 1.8-7.7	169(68.70)	60(35.50)	16(9.47)	93(55.03)	
High >7.7	59(23.98)	7(31.30)	22(8.94)	48(81.36)	
Hematocrit* males, %					
Low <38.3	51(27.57)	18(35.29)	2(3.92)	31(60.78)	0.4
Normal 38.3-48.6	126(68.11)	36(28.57)	16(12.70)	74(58.73)	
High >48.6	8(4.32)	2(25.00)	1(12.50)	5(62.50)	
Hematocrit* female, %					
Low <35.5	22(39.29)	8(36.36)	2(9.09)	12(54.55)	0.6
Normal 35.5-44.9	32(57.14)	12(37.50)	1(3.13)	19(59.38)	
High >44.9	2(3.57)	0	0	2(100)	
Ferritin males, ng/mL					
Low <12	1(100)	1(100)	0	0	0.17
Normal 12-300	24(12.77)	11(45.83)	3(12.50)	10(41.67)	
High >300	163(86.70)	45(27.61)	16(9.82)	102(62.58)	
Ferritin females, ng/mL					

Low <12	2(3.45)	2(100.00)	0	0	0.33
Normal 12-150	8(13.79)	3(37.50)	0	5(62.50)	
High >150	48(82.76)	15(31.48)	3(5.17)	30(62.50)	

Table 6 illustrates the distribution of management protocol guidelines according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah. The result shows that virtually three-quarters of patients with low lymphocytic count (70.63%) significantly experienced a severe form of COVID compared to patients with normal and high counts (38.16% & 50%, respectively). On the other hand, the majority of patients with high neutrophil count (81.36%) significantly experienced severe COVID compared to normal and low counts (55.03% & 33.33%, respectively). Also, male patients with higher Ferritin insignificantly experienced severe COVID compared to those with lower and average counts.

Table 7: Distribution of blood sugar level according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah (N=247)

variable	Total	Mild (n=77)	Moderate (n=22)	Severe (n=148)	P-value
		n (%)	n (%)	n (%)	
Glucose*, mg/dL					
Normal 65-110	28(15.91)	10(35.71)	1(3.57)	17(60.71)	0.54
High >110	148(84.09)	41(27.70)	12(8.11)	95(64.19)	
HBA1C*, %					
Normal 4.0-5.6	4(7.69)	2(50)	1(25)	1(25)	0.09
High >5.6	48(92.31)	9(18.75)	3(6.25)	36(75)	

Table 7 demonstrates the distribution of blood sugar levels according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah. Findings that a borderline significant assoc to be between glycated hemoglobin and the severity of COVID as three-quarters of patients with high HbA1C experienced severe COVID compared to their counterparts (P=0.09).

Table 8: Distribution of Coagulation profile according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah (N=247)

variable	Total	Mild (n=77)	Ioderate (n=22)	Severe (n=148)	
	n=247	N (%)	N (%)	N (%)	P-value
Platelets*, x 109 /L					
Low <150	45(18.52)	15(33.33)	5(11.11)	25(55.56)	0.8
Normal 150-400	175(72.02)	55(31.43)	14(8.00)	106(60.57)	
High >400	23(9.47)	5(21.74)	2(8.70)	16(69.57)	
APTT*, sec					
Low <25	14(8.38)	3(21.43)	2(14.29)	9(64.29)	

Normal 25-40	132(79.04)	33(25.00)	13(9.85)	86(65.15)	0.8
High >40	21(12.57)	4(19.05)	16(9.58)	111(66.47)	
PT*, sec					
Normal 9-12	68(40.96)	17(25.00)	5(7.35)	46(67.65)	0.6
High >12	98(59.04)	22(22.45)	11(11.22)	65(66.33)	
INR*					
Low	2(1.20)	0	0	2(100)	0.7
Normal	110(65.87)	29(26.36)	10(9.09)	71(64.55)	
High	55(32.93)	11(20)	6(10.91)	38(69.09)	
D-dimer, mg/L					
Normal <0.46	42(17.00)	21(50)	4(9.52)	17(40.48)	0.01
High >0.46	205(83.00)	56(27.32)	18(8.78)	131(63.90)	
Troponin*, ng/mL					
Low <0	2(1.45)	0	0	2(100)	0.7
Normal 0-0.4	127(92.03)	26(20.47)	6(4.72)	95(74.80)	
High >0.4	9(6.52)	3(21.01)	6(4.35)	6(5.83)	

Table 8 shows the distribution of the coagulation profile according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah. There is a significant association between D-dimer and the severity index of COVID-19. D-dimer results show that nearly two-thirds (63.90%) of patients with high levels of D-dimer were significantly diagnosed with severe COVID, compared to only 40.48% of patients with normal D-dimer.

Table 9: Distribution of hepatic function according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah (N=247).

Variable	Total N=247	Mild (n=77)	Moderate (n=22)	Severe (n=148)	P-value
	N (%)	N (%)	N (%)	N (%)	
Total Bilirubin*, µmol/L					
Normal 0-10	97(56.40)	29(29.90)	7(7.22)	61(62.89)	0.3
High >10	75(43.60)	15(20)	6(8.00)	54(54)	
ALT/SGPT*, U/L					
Normal 7-56	144(66.36)	51(35.42)	9(6.25)	84(58.33)	0.003
High>56	73(33.64)	10(13.70)	8(10.96)	55(75.34)	
AST/SGOT* males, U/L					
Normal 10-40	79(46.75)	36(45.57)	6(7.59)	37(46.84)	< 0.01
High >40	90(53.25)	12(13.33)	8(8.89)	70(77.78)	

AST/SGOT* females, U/L					
Normal 9-32	28(58.33)	11(39.29)	2(7.14)	15(53.57)	0.15
High >32	20(41.67)	3(15.00)	1(5.00)	16(80.00)	

Table 9 demonstrates the distribution of hepatic function according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah. Hepatic results show a significant association between ALT/SGPT and AST/SGOT to the severity of COVID. More than three-quarters of male patients with high AST/SGOT significantly experienced severe COVID compared to their counterparts (46.84%). Also, three-quarters of patients with high ALT/SGPT (75.34%) significantly experienced severe COVID compared to their counterparts (58.33%).

Table 10: Distribution of kidney function according to the severity of COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia (n=247)

Variable	Total n=247	Mild (n=77)	Moderate (n=22)	Severe (n=148)	P value
		N (%)	N (%)	N (%)	
Creatinine kinase* (M), U/L					
Normal 20-215	55(65.48)	11(20)	3(5.45)	41(74.55)	0.4
High >215	29(34.52)	3(10.34)	1(3.45)	25(86.21)	
Creatinine kinase*(F), U/L					
Normal 20-160	20(71.43)	4(20)	1(5)	15(75)	0.7
High>160	8(28.57)	2(25)	0	6(75)	
Sodium*, mmol/L					
Low <135	49(20.00)	12(24.49)	5(10.20)	32(65.31)	0.5
Normal 135-145	183(74.69)	61(33.33)	16(8.74)	106(57.92)	
High>145	13(5.31)	2(15.38)	1(7.69)	10(76.92)	
Potassium*, mmol/L					
Low <3.5	47(19.26)	9(19.15)	4(8.51)	34(72.34)	0.3
Normal 3.5-5	182(74.59)	61(33.52)	17(9.34)	104(57.14)	
High >5.0	15(6.15)	4(26.67)	1(6.67)	10(66.67)	
Urea(BUN)* mmol/L					
Low <1.2	52(21.49)	15(28.85)	5(9.62)	32(61.54)	

Normal 1.2-3.0	154(63.64)	52(33.77)	13(8.44)	89(57.79)	0.3
High >3.0	36(14.88)	6(16.67)	2(11.11)	26(72.22)	
Creatinine* µmol/L					
Low <50	29(11.93)	11(37.93)	2(6.90)	16(55.17)	0.19
Normal 50-110	170(69.96)	56(32.94)	16(9.41)	98(57.65)	
High >110	44(18.11)	7(15.91)	4(9.09)	33(75)	

The distribution of kidney function according to the severity of COVID-19 among patients admitted to King Abdullah Medical Complex. Kidney findings show that males & female patients with creatinine kinase, sodium, potassium, Urea (BUN), and creatinine insignificantly experienced severe COVID-19 compared to regular range counterparts.

Table 11: Distribution of demographic characteristics according to mortalities related to COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah (N=247)

variable	All Patients		Alive		deceased		P-value
Age	total	%	No	%	No	%	<0.001
<30	31	12.55	30	100	0	0	
30-49y	94	38.06	81	86.17	13	13.83	
50-69	96	38.87	72	76.60	22	23.40	
≥70	26	10.53	14	58.33	10	41.67	
Obesity*							0.01
Yes	27	13.43	11	40.74	16	59.26	
No	174	86.57	32	18.71	139	81.29	
Gender*							0.873
Male	188	76.42	150	81.97	33	18.03	
Female	58	23.58	47	81.03	11	18.97	
Nationality*							0.155
Saudi	153	62.20	117	78.52	32	21.48	

Non-Saudi	93	37.80	79	85.87	13	14.13	

Table 11 shows the distribution of demographic characteristics according to the mortality of patients with COVID-19 admitted to King Abdullah Medical Complex. Demographic characteristics show there is a significant association between age and COVID-19 mortality. Patients between 50-60 years (n=96) hold almost one-quarter of reported mortality 22(23.40%). However, 70 years or above patients (n=26) have roughly two-quarters of mortality 10(41.67%). Lastly, obesity is significantly associated with covid-19 mortality, even though frequency 27(13.43%) is relatively lower than their counterparts 174 (86.57%).

Table 12: Distribution of chronic disease history according to mortalities related to COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia (N=247)

Variable	All Patients		Alive		Deceased		P-value
	total	%	No	%	No	%	
Hypertension*							0.019
Yes	74	30.08	54	72.97	20	27.03	
No	172	69.92	143	85.63	24	14.37	
Diabetes							<0.001
No	157	63.56	134	87.01	20	12.99	
Type I	21	8.50	11	52.38	10	47.62	
Type II	69	27.94	52	77.61	15	22.39	
Asthma							0.045
Yes	6	2.43	3	50.00	3	50.00	
No	241	97.57	194	82.20	42	17.80	
Kidney disease*							0.004
Yes	9	3.66	4	44.44	5	55.56	
No	237	96.34	192	82.76	40	17.24	
Chronic cardiac disease							
Yes	24	9.72	13	54.17	11	45.83	<0.001
No	223	90.28	184	84.40	34	15.60	

The distribution of chronic disease history according to mortality of COVID-19 patients shows a significant association between types I & II diabetes and COVID-19 mortality. Roughly two-quarters of type I (47%) significantly died compared to type II diabetic patients, who nearly had one quarter (22.39%) of significantly dead patients. Hypertensive patients show a significant association with COVID-19 mortality. Nearly one-third of hypertensive patients (27.02%) significantly died compared to their counterparts. Patients with chronic cardiac diseases have shown a significant association with COVID-19 morality. Nearly two-quarters of chronic cardiac patients (45.83%) have

significantly died compared to their counterparts. A significant association between kidney disease patients and COVID-19 mortality has resulted in our findings. More than half of kidney disease patients have significantly died (55.56%) compared to their counterparts. Finally, asthma patients have shown a significant association with COVID-19 mortality. Two-quarters of asthma patients (50%) died due to COVID-19 complications.

Table 13: Distribution of blood laboratory picture according to mortalities related to COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia (n=247)

Variable	All Patients		Alive n=197		Deceasedn=45		P-value
	total	%	No	%	No	%	
Hemoglobin* Females, g/dL							0.003
Anemia(low)<12.0	104	55.32	74	73.27	27	26.73	
Normal 12.0-16	81	43.09	73	92.41	6	7.59	
High >16.0	3	1.60	3	100	0	0	
Hemoglobin* males, **g/dL**							0.027
Anemia(low)<14.0	26	45.61	17	65.38	9	34.62	
Normal 14.0-18.0	29	50.88	27	93.10	2	6.90	
High >18	2	3.51	2	0	0	0	
WBC (Leukocyte)*, × 10^9/L							< 0.001
Low <4.5	41	16.80	38	92.68	3	7.32	
Normal 4.5-11.0	163	66.80	142	89.31	17	10.69	
High >11.0	40	16.39	15	37.50	25	62.50	
Lymphocyte*, 10^3/ul							0.04
Low <1.5	160	65.04	120	76.92	36	23.08	
Normal 1.5-3.0	76	30.89	68	90.67	7	9.33	
High >3.0	10	4.07	8	80	2	20	
Neutrophils*, 10^3/L							<0.001
Low <1.8	18	7.32	17	94.44	1	5.56	

Table 13

Normal 1.8-7.7	169	68.70	149	90.30	16	9.70	
High >7.7	59	23.98	30	51.72	28	48.28	
Hematocrit* males, %							
Low <38.3	51	27.57	34	66.67	17	33.33	0.005
Normal 38.3-48.6	126	68.11	106	87.60	15	12.40	
High >48.6	8	4.32	7	87.50	1	12.50	
Hematocrit* female, %							
Low <35.5	22	39.29	15	68.18	7	31.82	0.06
Normal 35.5-44.9	32	57.14	29	90.63	3	9.38	
High >44.9	2	3.57	1	50	1	50	
Ferritin males, ng/mL							
Low <12	1	0.53	1	100	0	0	0.041
Normal 12-300	24	12.77	24	100	0	0	
High >300	163	86.70	125	79.11	33	20.89	
Ferritin females, ng/mL							
Low <12	2	3.45	2	100	0	0	0.24
Normal 12-150	8	13.79	8	100	0	0	
High >150	48	82.76	37	77.08	11	22.92	

demonstrate the distribution of laboratory blood investigation according to COVID-19 mortality status among cases admitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia. The findings show that nearly a quarter of patients with a low lymphocytic account (23.08%) significantly have died compared to their alive counterparts. There is a significant association between male patients with high ferritin levels and COVID-19 mortality status. High ferritin levels among males (20.89%) significantly died compared to alive male patients. On the other hand, females with high ferritin levels insignificantly died (22.92%) compared to their encounters with alive female patients. It is a possibility of fewer female sample size has contributed to test statistic insignificance. Nearly one-half of patients with high neutrophils significantly died compared to their average (9.70%) and low (5.56%) counterparts. Low hemoglobin among males has shown a significant association with mortality status as more than a quarter of patients died (26.73%) compared to normal and high counts (7.59% & 0%).

On the other hand, females with low hemoglobin have a significantly associated mortality status as more than one-

third died (34.62%) compared to normal and high counts (6.90% & 0%). The majority of patients with high WBC significantly died (62.50%) compared to normal and low counts (10.69% & 7.32). Low hematocrit counts among males have shown a significant association with mortalities related to COVID-19, as one-third of patients died (33.33%) compared to normal and high counts (12.40% & 12.50%).

Table 14: Distribution of coagulation profile according to mortalities related to COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia (n=247)

variable	Alive	Deceased	P-value
	N (%)	N (%)	
D-dimer, mg/L			
Normal <0.46	41(100)	0	0.001
High >0.46	156(77.61)	45(22.39)	
APTT*, sec			
Low <25	13(92.86)	1(7.14)	<0.001
Normal 25-40	101(77.10)	30(22.90)	
High >40	7(33.33)	14(66.67)	
PT*, sec			
Normal 9-12	55(80.88)	13(19.12)	0.05
High >12	66(67.35)	32(32.65)	
Platelets*, x 109 /L			
Low <150	36(80.00)	9(20.00)	0.42
Normal 150-400	137(80.12)	34(19.88)	
High >400	21(91.30)	2(8.70)	
INR			
Low	0(0.00)	2(100.0)	<0.001
Normal	90(81.82)	20(18.18)	
High	31(57.41)	23(42.59)	
Troponin*, ng/mL			
Low <0	0(0.00)	2(100.00)	0.006
Normal 0-0.4	90(71.43)	36(28.57)	
High >0.4	2(22.22)	7(77.78)	

Table 14 demonstrates the distribution of the coagulation profile according to mortality status among patients admitted

to King Abdullah Medical Complex in Jeddah, Saudi Arabia. High D-dimer shows a significant association with COVID-19 mortality cases, as (22.39%) of patients with high D-dimer havesignificantly died compared to patients with an average count (0%). High P.T. was significantly associated with COVID-19 death status, as (32.65%) of patients died in comparison to average counts of (19.12%). As well as a significant association between INR counts and COVID-19 death status hence (42.59%) of patients with high counts and low counts (100%) have died in comparison to normal ranges (19.88%). The majority of patients with high APTT counts were significantly associated with deceased patients (66.67%) compared to normal and low counts (22.90% & 7.14%). Troponin counts are significantly associated with mortality status, as patients with low and high counts (77.78% & 100%) have died compared to average counts (28.57%).

Table 15: Distribution of liver functions according to mortalities related to COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia (n=247)

variable	Alive	Deceased	P-value
	N (%)	N (%)	
Total Bilirubin*, µmol/L			
Normal 0-10	76(80.85)	18(19.15)	0.035
High >10	50(66.67)	25(33.33)	
ALT/SGPT*, U/L			
Normal 7-56	114(80.28)	28(19.72)	0.809
High>56	56(78.87)	15(21.13)	
AST/SGOT* males, U/L			
Normal 10-40	69(89.61)	8(10.39)	0.006
High >40	64(72.73)	24(27.27)	
AST/SGOT* females, U/L			
Normal 9-32	25(89.29)	3(10.71)	0.041
High >32	13(65.00)	7(35.00)	

Table 15 illustrates the distribution of liver functions according to COVID-19 mortality among patientsadmitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia. The table findings show that there is a significant association between AST/SGOT among males and females to COVID-19 mortality status,as more than a quarter of males died (27.27%) and more than one-third of females died (35%) in comparison to average counts(10.39% & 10.71% respectively). Also, high total bilirubin has significantly associated with COVID-19 mortality (33.33%).

Table16: distribution of kidney function according to mortalities related to COVID-19 among cases admitted to King Abdullah Medical Complex in Saudi Arabia (n=247)

variable	Alive N=197	Deceased N=45	P-value
	N (%)	N (%)	
Creatinine kinase* (M), U/L			
Normal 20-215	40(72.73)	15(27.27)	0.054
High >215	15(51.72)	14(48.28)	
Creatinine kinase*(F), U/L			
Normal 20-160	16(80.00)	4(20.00)	0.006
High>160	2(25.00)	6(75.00)	
Sodium*, mmol/L			
Low <135	44(89.80)	5(10.20)	<0.001
Normal 135-145	150(84.27)	28(15.73)	
High>145	2(15.38)	11(84.62)	
Potassium*, mmol/L			
Low <3.5	33(71.74)	13(28.26)	0.007
Normal 3.5-5	153(85.96)	25(14.04)	
High >5.0	9(60.00)	6(40.00)	
Urea(BUN)* mmol/L			
Low <1.2	48(96.00)	2(4.00)	<0.001
Normal 1.2-3.0	130(86.09)	21(13.91)	
High >3.0	14(38.89)	22(61.11)	
Creatinine* µmol/L			
Low <50	25(86.21)	4(13.79)	

Normal 50-110	151(90.42)	16(9.58)	<0.001
High >110	18(42.86)	24(57.14)	

Table 16 demonstrates the distribution of kidney function investigations among cases admitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia. Table 16 shows that patients who died from COVID-19 complications had a significant association with high creatinine kinase (48.28%), high sodium (48.28%), potassium (40%), high BUN (61.11%), and creatinine (57.14%) in comparison to alive counterparts.

Table 17: Distribution of guideline management protocol according to mortalities relatedto COVID-19 among cases admitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia (N=247)

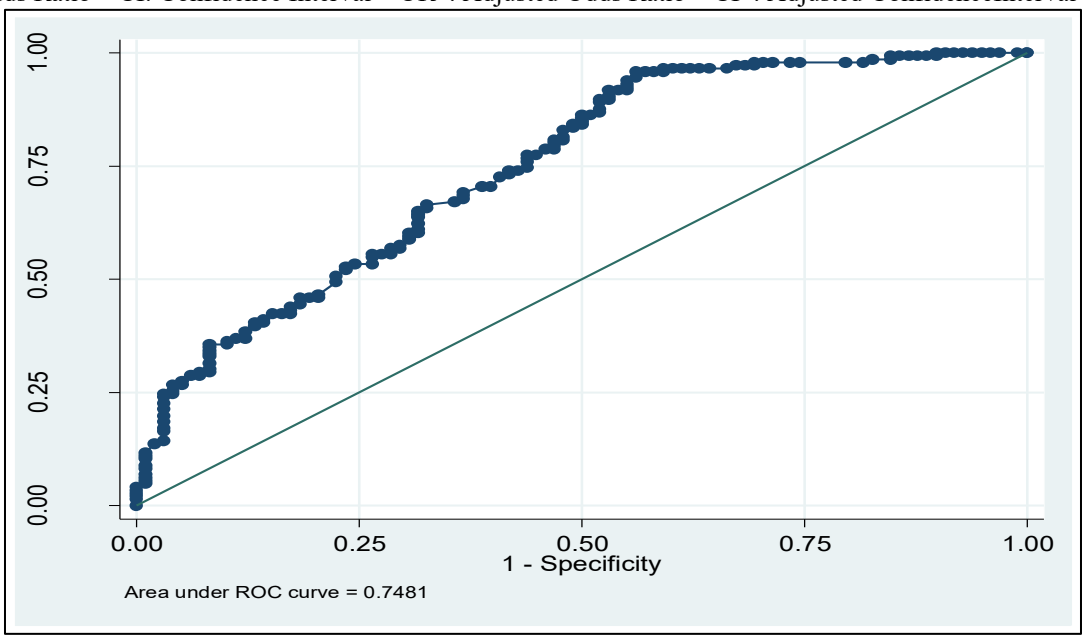
Variable	All Patients		Alive		Deceased		P-value
	total	%	No	%	No	%	
Non-invasive ventilation*							
Yes	72	29.27	56	80.00	14	20.00	0.654
No	174	70.73	141	82.46	30	17.54	
Inserted tracheostomy							
Yes	15	6.07	13	86.67	2	13.33	<0.001
No	232	93.93	195	85.90	32	14.10	
Invasive ventilation							0.000
Yes	36	14.57	2	5.56	34	94.44	
No	211	85.43	195	94.66	11	5.34	
Renal replacement therapy (dialysis)*							0.007
Yes	7	2.86	3	42.86	5	57.14	
No	238	97.14	40	17.17	193	82.83	
ICU Admission							
Yes	88	36.36	44	50.00	44	50.00	<0.001
No	154	63.64	15	153	1	0.65	

Table 17 shows the distribution of guideline management protocol according to COVID-19 mortality status among patients admitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia. There is asignificant association between patients on invasive ventilation and COVID-19 morality status. Exceedingly, most patients on invasive ventilation died (94.44%) compared to their alive counterparts (6.07%). Also, patients treated with inserted tracheostomy have shown a significant association with COVID-19 mortality status. Nearly a quarter of two-thirds of patients on inserted tracheostomy (13.33%) significantly died compared to their alive counterparts (86.67%). Finally, renal replacement therapy findings show a significant association between patients on dialysis and COVID-19 mortality status. Marjory of patients on dialysis have died (57.14%) compared to alive patients on dialysis upon discharge (2.85%). Also, half of the patients admitted to the ICU (50%) have died comparedto their alive counterparts.

Table 18: Multiple Logistic Regression Model for Possible Predictors of COVID-19 Severityamong Patients admitted to King Abdullah Medical Complex (N=244)

Variable	OR	CI	P	OR*	CI*	P*
Nationality	1.85	1.09-3.12	0.022	2.11	1.08-4.14	0.03
Age	1.03	1.01-1.05	0.000	1.04	1.01-1.06	0.004
Cough	4.17	2.38 -7.69	0.000	4.35	2.13-8.33	0.000
Diabetes Mellitus	2.73	1.55-4.82	0.001	2.17	1.09-4.81	0.05

OR: Odds Ratio – CI: Confidence Interval – OR*: Adjusted Odds Ratio – CI*: Adjusted ConfidenceInterval



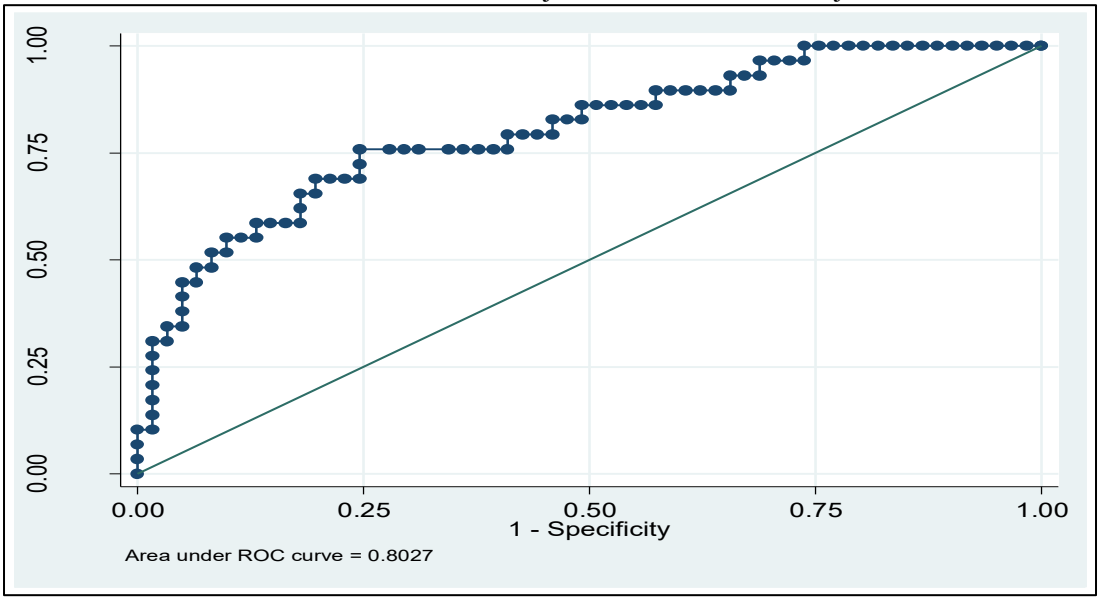
Building a multiple logistic regression model shows possible predictors for COVID-19 severity among patients admitted to King Abdullah Medical Complex: cough, diabetes mellitus, nationality, and age. Those diagnosed with a cough had a 4.35 higher odds of severe COVID-19 than their counterparts after adjusting for age, nationality, and diabetes mellitus. Being diabetic, severe COVID-19 is 2.17 times compared to non-diabetic after adjustment for age, nationality, and cough. Being non-Saudi, the odds of severe COVID-19 are nearly twice as high as Saudi after controlling for all other variables in the model. For each year's increase in age, the odds of Severe Covid-19 will be increased by 1.04 after fixing diabetes, nationality,and cough.

Table 19: Multiple Logistic Regression Model for Possible Predictors of COVID-19 Mortality among Patients admitted to King Abdullah Medical Complex (N=90)

Variable	OR	CI	P	OR*	CI*	P*
Diabetes Mellitus "Ref: Non-Diabetics"	2.66	1.37-5.14	0.004	2.89	1.03-8.14	0.04

D-dimer	1.21	1.07-1.36	0.002	1.10	1.01- 1.19	0.02
Ferritin	1.00	1.00- 1.01	0.000	1.01	1.00-1.01	0.01

OR: Odds Ratio – CI: Confidence Interval–OR*: Adjusted Odds Ratio–CI*: Adjusted Confidence Interval



Building a multiple logistic regression model showed that the possible predictors for COVID-19 mortality among patients admitted to King Abdullah Medical Complex are diabetes mellitus, D-dimer, and Ferritin levels. Being diabetic, the odds of death are 2.89 times compared to non-diabetics after adjustment for D-dimer and Ferritin. Also, our findings show that in one unit increase of D-dimer death rises by 1.10 times after controlling for diabetes and Ferrit. With a one-unit increase in Ferritin, the odds of death increased by 1.01 times after fixing both diabetes and D-dimer. Therefore, the discrimination power of this model is high as the area under the curve equals 0.80.

Table 20: Multiple Logistic Regression Model of COVID-19 Mortality for examining the interaction term of sex and troponin among patients admitted to King Abdullah Medical Complex (N=162)

Variable	OR	CI	P
Sex	2.9	0.89-9.73	0.07
Troponin	$5.6*10^{22}$	26.39- $1.2*10^{44}$	0.03
Interaction term "Sex*Troponin"	$4.2*10^{-12}$	$9.07*10^{-23}$-0.19	0.04

OR: Odds Ratio – CI: Confidence Interval

By building a model to test the effect of modification of sex in the association between death and troponin levels among COVID-19 patients admitted to King Abdullah Medical Complex. Results show that sex modified the effect of troponin on the mortality from COVID-19. Males have a different effect on mortality from COVID-19 compared to females. For each unit increase in troponin, the odds of mortality will be 2.9 among males. On the other hand, for each unit increase in D-dimer, the odds of mortality will be 4.2*10-12 among females.

Table 21: Multiple Logistic Regression Model of COVID-19 Severity for examining the interaction term of

sex and D-dimer among patients admitted to King Abdullah Medical Complex (N=166)

Variable	OR	CI	P
Sex	1.04	0.33-3.26	0.07
D-dimer	1.94	1.28-8.01	0.03
Interaction term "Sex*D-dimer"	0.73	0.36-0.99	0.04

OR: Odds Ratio – CI: Confidence Interval

By building a model to test the effect modification of sex in the association between disease severity and D-dimer levels among COVID-19 patients admitted to King Abdullah Medical Complex. Findings show that sex modified the effect of D-dimer on the COVID-19 severity. Males have a different effect on COVID-19 severity compared to females. For each unit increase in D-dimer, the odds of disease severity will be increased by 1.94 among males. Conversely, for each unit increase in D-dimer, the odds of disease severity will be 0.73 among females.

DISCUSSION

Our study, which reported a retrospective cohort of 247 patients with laboratory-confirmed COVID-19, aims to identify risk factors associated with COVID-19 severity and mortality among patients admitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia. The study period was from 1st March 2020 to 30th June 2020. Of the 247 patients included in the study, 99 (40.08%) had mild or moderate cases of COVID-19, and 148 (59.92%) had severe cases during hospitalization, with a mean duration of 10.31 days (Table 1).

Elderly patients were found to be at increased risk for severe COVID-19 and mortality [7,11,13,14,15,17,18]. Age was identified as a risk factor, with older patients more susceptible to severe or fatal outcomes due to weakened immune function and the presence of comorbidities that often accompany advanced age [7,11,13,14,15,17,18]. The association between COVID-19 severity and age varied between age groups, with higher percentages of severe cases and mortality observed among older patients aged 50-69 years and ≥70 years (Table 17) [1,5,7,8,9,11,12]. Multiple logistic regression analysis indicated that age was a predictor of COVID-19 severity, with odds of severity increasing with each year of age after adjusting for nationality, cough, and diabetes mellitus (Table 25) [7,11,13,14,15,17,18].

Results of laboratory parameters among severe COVID-19 patients showed high ranges in white blood cell count (WBC) and neutrophil, which were identified as risk factors for mortality and disease severity [3,10,11]. Elevated WBC indicates an inflammatory response to bacterial or viral infection and may indicate disease progression [3,10,11]. Excessive inflammation can occur due to dysregulation of the immune response during disease progression, leading to apoptosis of lymphocytes [3,10,11]. Previous studies have shown that coronavirus can cause the consumption of lymphocytes and inhibit cellular immune function, leading to low lymphocyte levels [3,10,11]. Consistent with these findings, our study observed a reduction in lymphocyte levels among severe COVID-19 patients (Table 10, Table 20) [3,10,11].

There were some limitations to our study, including missing laboratory data ordered "upon need" and missing data for transferred patients from previous hospitals. Significant laboratory findings within 24 hours of admission, such as complete blood count (CBC), were available, but some laboratory parameters were reported several days after hospitalization [7,11,13,14,15,17,18]. Additionally, King Abdullah Medical Complex was the main hospital receiving all patients from Jeddah during the study period, so some data may be missing for transferred patients [7, 11, 13, 14, 15,17,18].

Overall, our study found that age, comorbidities, specific laboratory parameters, management protocols, and certain clinical symptoms were significantly associated with increased severity and risk of mortality in COVID-19 [1,5,7,8,9,11,12]. Comorbidities such as diabetes and hypertension were found to be significantly associated with increased severity and risk of mortality [1,5,7,8,9,11,12]. Laboratory parameters, including WBC, neutrophil, and D-dimer levels, were also significantly associated with increased severity and risk of mortality (Table 10, Table 20) [9,16,17]. Management protocols, including invasive ventilation and ICU admission, as well as certain medications, were found to be significantly associated with increased severity (Table 6) [6,14]. Clinical symptoms, including hospital transfer, fever, cough, shortness of breath, respiratory rate, heart rate, and oxygen saturation, were also found to be significantly

associated with increased severity (Table 6) [6]. It is important to note that elderly patients, those with comorbidities, and those with specific laboratory abnormalities or management protocols may be at increased risk for severe COVID-19 and mortality [1,5,7,8,9,11,12].

Conclusion and recommendation

In conclusion, our study found that particular demographic and clinical characteristics, comorbidities, laboratory parameters, and management protocols were significantly associated with increased severity and risk of mortality in COVID-19. Age, comorbidities such as diabetes and hypertension, laboratory parameters including WBC, neutrophil, and D-dimer levels, and management protocols including invasive ventilation and ICU admission were all identified as significant factors in the severity and risk of mortality of COVID-19 [7,11,13,14,15,17,18]. Clinical symptoms, including hospital transfer, fever, cough, shortness of breath, respiratory rate, heart rate, and oxygen saturation, were also found to be significantly associated with increased severity [6]. Elderly patients and those with comorbidities should be closely monitored and provided with appropriate medical care to reduce the risk of severe COVID-19 and mortality [7,11,13,14,15,17,18]. Further research is necessary to understand better the factors that contribute to the severity and mortality of COVID-19 and to identify potential interventions to improve outcomes for high-risk groups.

It is important to note that the findings of our study are specific to the patient population at King Abdullah Medical Complex in Jeddah, Saudi Arabia, and may not be generalizable to other populations. Further research is needed to confirm and expand upon our findings in different populations and settings.

In summary, our study identified several significant risk factors and laboratory parameters associated with increased severity and risk of mortality in COVID-19 among patients admitted to King Abdullah Medical Complex in Jeddah, Saudi Arabia. These findings highlight the importance of closely monitoring elderly patients and those with comorbidities and providing appropriate medical care to reduce the risk of severe COVID-19 and mortality. Further research is necessary to confirm and expand upon these findings and to identify potential interventions to improve outcomes for high-risk groups.

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