

## ORIGINAL ARTICLE

# Hematological Parameters and Comorbidities in COVID-19: Insights into Clinical Profiles and Outcome Predictors

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### SUMMARY

**Background:** The global pandemic, known as the coronavirus disease 2019 (COVID-19) and caused by the severe acute respiratory syndrome, coronavirus 2 (SARS-CoV-2), poses a significant threat, particularly to individuals with comorbidities such as hypertension, chronic obstructive pulmonary disease (COPD), diabetes, HIV, cardiovascular disease (CVD), and cancer.

**Methods:** This descriptive retrospective study investigates the impact of comorbidities on COVID-19-positive patients. The study includes individuals that were tested positive for SARS-CoV-2 via polymerase chain reaction at the Security Forces Hospital, Makkah, KSA, between February, 2022, and June, 2022. A total of 208 patients (107 males, 101 females) were examined, and the laboratory results revealed normal parameters.

**Results:** An analysis indicates that 86.5% of the patients were discharged, 2.9% remained hospitalized, and 10.6% succumbed to the disease, indicating a 10.6% mortality rate among comorbid COVID-19-positive patients. Notably, the study identifies specific comorbidities (chronic kidney disease, diabetes mellitus, hypertension) and changes in laboratory parameters (red blood cells, hemoglobin, C-reactive protein, white blood cells, ferritin, D-dimer, ALT, troponin, LDH, neutrophils) associated with ICU admission during hospitalization.

**Conclusions:** This study underscores the critical impact of comorbidities, such as chronic kidney disease, diabetes, and hypertension, on the clinical outcomes of COVID-19-positive patients. The identification of specific laboratory parameters linked with ICU admission provides valuable insights for risk stratification and tailored management strategies.

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Supplementary Data

Table S1. Multiple correlations between all parameters: Using, Spearman's rho in ICU admission group.

	APTT	D-dimer	CRP	Procalcitonin	CK	Troponin	LDH	Erritin	ALT	AST	HBA1C
Age (years)	R	0.101	0.392 **	0.161	0.067	0.462 **	0.195 **	0.329 **	0.089	0.251 **	-0.090
	s										
	P	0.194	0.000	0.120	0.378	0.000	0.009	0.000	0.211	0.000	0.408
RBCs	R	-	-	-0.445 **	0.056	-0.265 **	-	0.065	0.055	0.051	0.113
	s	0.305 **	0.452 **				0.154 *				
	P	0.000	0.000	0.000	0.456	0.000	0.042	0.386	0.446	0.477	0.300
Hemoglobin	R	-	-	-0.482 **	0.121	-0.317 **	-	0.106	0.024	-	0.149
	s	0.279 **	0.407 **				0.126				
	P	0.000	0.000	0.000	0.109	0.000	0.096	0.153	0.732	0.521	0.168
WBCs	R	0.033	0.250 **	0.323 **	-	0.136	0.102	-0.020	-	-	0.123
	s				0.006				0.162 *	0.124	
	P	0.672	0.001	0.002	0.938	0.073	0.178	0.788	0.022	0.082	0.255
Neutrophils	R	0.032	0.320 **	0.413 **	0.049	0.164 *	0.167 *	0.096	-	-	0.118
	s								0.091	0.033	
	P	0.684	0.000	0.000	0.516	0.030	0.026	0.198	0.202	0.644	0.277
Platelets	R	0.094	0.057	0.013	-	-0.013	-	-0.142	-	-	0.201
	s				0.263 **		0.028		0.145 *	0.176 *	
	P	0.228	0.457	0.899	0.000	0.870	0.708	0.057	0.041	0.013	0.062
PT	R	0.294 **	0.292 **	0.414 **	0.091	0.276 **	0.119	0.217 **	-	0.066	-0.217 *
	s								0.092		
	P	0.000	0.000	0.000	0.235	0.000	0.118	0.004	0.203	0.365	0.045
APTT	R	1.000	0.145	0.290 **	0.035	0.209 *	0.052	0.203 *	-	0.030	-0.060
	s								0.006		
	P	-	0.087	0.701	0.007	0.676	0.013	0.015	0.937	0.704	0.610
D-dimer	R	0.145	1.000	0.381 **	0.006	0.365 **	0.298 **	0.226 **	0.034	0.202 **	-0.112
	s										
	P	0.087	-	0.000	0.939	0.939	0.000	0.003	0.658	0.008	0.316
CRP	R	-	0.532 **	0.432 **	0.052	0.332 **	0.331 **	0.306 **	0.115	0.252 **	-0.087
	s	0.032	1.000								
	P	0.701	0.000	0.000	0.501	0.000	0.000	0.000	0.122	0.001	0.432
Procalcitonin	R	0.290 **	0.381 **	1.000	-	0.336 *	0.061	0.324 **	0.076	0.206 *	0.157
	s				0.021						
	P	0.007	0.000	0.000	0.847	0.001	0.566	0.002	0.468	0.048	0.277
CK	R	0.035	0.006	-0.021	1.000	0.285 **	0.316 **	0.210 **	0.336 **	0.363 **	-0.068
	s										
	P	0.676	0.939	0.501	0.847	0.000	0.000	0.007	0.000	0.000	0.551

Table S1. Multiple correlations between all parameters: Using, Spearman's rho in ICU admission group (continued).

	Age (years)			RBCs	Hemoglobin	WBCs	Neutrophils	Platelets	PT
	R	s	P						
Age (years)		1.000	-	-	-0.042	0.048	0.021	-0.133	0.319 **
		-	0.113	0.543	0.492	0.767	0.056	0.000	
		-	1.000	0.806 **	-	-0.176 *	0.057	0.057	0.277 **
RBCs		0.111	-	0.000	0.057	0.011	0.415	0.000	
		-	0.806 **	1.000	-	-0.160 *	-0.069	-	-
		0.042	0.000	-	0.158 *	0.021	0.325	0.005	
Hemoglobin		0.543	0.000	-	-	0.882 **	0.000	0.000	0.089
		-	0.132	-0.158 *	0.000	0.000	0.000	0.000	0.209
		0.048	0.132	0.023	-0.160 *	0.882 **	1.000	0.306 **	0.116
WBCs		0.492	0.057	0.023	0.021	-	0.000	0.000	0.099
		0.021	0.176 *	0.021	0.021	0.000	-	0.000	0.099
		0.767	0.011	0.021	0.021	0.000	0.000	0.000	0.099
Neutrophils		-	0.057	-0.069	0.403 **	0.306 **	1.000	1.000	0.011
		0.133	0.057	0.415	0.325	0.000	0.000	-	0.874
		0.056	0.415	0.325	0.325	0.000	0.000	0.000	0.874
Platelets		0.319 **	-	-0.195 **	-0.195 **	0.089	0.116	0.011	1.000
		-	0.277 **	0.005	0.005	0.209	0.099	0.874	-
		0.000	0.000	0.005	0.005	0.209	0.099	0.874	-
APTT		0.101	-	-0.279 **	-0.279 **	0.033	0.032	0.094	0.294 **
		-	0.305 **	0.000	0.000	0.672	0.684	0.228	0.000
		0.194	0.000	0.000	0.000	0.672	0.684	0.228	0.000
D-dimer		0.392 **	-	-0.407 **	-0.407 **	0.250 **	0.320 **	0.057	0.292 **
		-	0.452 **	0.000	0.000	0.001	0.000	0.457	0.000
		0.000	0.000	0.000	0.000	0.001	0.000	0.457	0.000
CRP		0.288 **	-	-0.168 *	-0.168 *	0.216 **	0.277 **	-0.044	0.217 **
		-	0.193 **	0.023	0.023	0.003	0.000	0.557	0.003
		0.000	0.009	0.023	0.023	0.003	0.000	0.557	0.003
Procalcitonin		0.161	0.445 **	-0.482 **	-0.482 **	0.323 **	0.413 **	0.013	0.414 **
		-	0.000	0.000	0.000	0.002	0.000	0.899	0.000
		0.120	0.000	0.000	0.000	0.002	0.000	0.899	0.000
CK		0.067	0.056	0.121	0.121	-	0.049	-0.263 **	0.091
		-	0.006	0.109	0.109	0.938	0.516	0.000	0.235
		0.378	0.456	0.109	0.109	0.938	0.516	0.000	0.235

Table S1. Multiple correlations between all parameters: Using, Spearman's rho in ICU admission group (part II continued).

	PT	APTT	D-dimer	CRP	Procalcitonin	CK	Troponin	LDH	Ferritin	ALT	AST	HBA1C
Troponin	R	0.276**	0.365**	0.332**	0.336**	0.285**	1.000	0.150	0.184*	-	0.175*	-0.020
	s									0.002		
LDH	P	0.000	0.000	0.000	0.001	0.000	-	0.056	0.019	0.976	0.021	0.857
	R	0.119	0.298**	0.331**	0.061	0.316**	0.150	1.000	0.372**	0.313**	0.448**	0.016
Ferritin	P	0.118	0.000	0.000	0.566	0.000	0.056	-	0.000	0.000	0.000	0.890
	R	0.217**	0.226**	0.306**	0.324**	0.210**	0.184*	0.372*	1.000	0.320**	0.423**	-0.045
ALT	P	0.004	0.003	0.000	0.002	0.007	0.019	0.000	-	0.000	0.000	0.683
	R	-	0.034	0.115	0.076	0.336**	-0.002	0.313**	0.320**	1.000	0.759**	0.010
AST	P	0.203	0.658	0.122	0.468	0.000	0.976	0.000	0.000	-	0.000	0.926
	R	0.066	0.202**	0.252**	0.206*	0.363**	0.175*	0.448*	0.423**	0.759**	1.000	-0.121
HBA1C	P	0.365	0.008	0.001	0.048	0.000	0.021	0.000	0.000	0.000	-	0.269
	R	-	-	-	-	=	-	0.000	0.000	0.000	-	-
	s	0.217*	0.112	0.087	-0.157	0.068	-0.020	0.016	-0.045	0.010	0.121	1.000
	P	0.045	0.316	0.432	0.277	0.551	0.857	0.890	0.683	0.926	0.269	-

Table S1. Multiple correlations between all parameters: Using, Spearman's rho in ICU admission group (part II continued).

	Age (years)	RBCs	Hemoglobin	WBCs	Neutrophils	Platelets
Troponin	R	-	-0.317**	0.136	0.164*	-0.013
	s	0.265**				
	P	0.000	0.000	0.073	0.030	0.870
LDH	R	-	-0.126	0.102	0.167*	-0.028
	s	0.154*				
	P	0.009	0.042	0.178	0.026	0.708
Ferritin	R	-	0.106	-	0.096	-0.142
	s	0.065		0.020		
	P	0.329**	0.153	0.788	0.198	0.057
ALT	R	0.055	0.024	-	-0.091	-0.145*
	s	0.089		0.162*		
	P	0.446	0.732	0.022	0.202	0.041
AST	R	-	-0.046	-	-0.033	-0.176*
	s	0.051		0.124		
	P	0.251**	0.521	0.082	0.644	0.013
HBA1C	R	0.113	0.149	0.123	0.118	0.201
	s	0.090				
	P	0.408	0.168	0.255	0.277	0.062

RBCs - Red blood cells, WBCs - white blood cells, PT - Prothrombin time, APTT - Activated partial thromboplastin time, CRP - C-Reactive protein CK - Creatine kinase, LDH - Lactate dehydrogenase, ALT - Alanine aminotransferase, AST - Aspartate aminotransferase, HBA1c - Hemoglobin A1C.

\*\* Correlation is significant at the 0.001 level (2-tailed).

Multiple comparisons of all parameters.

This table represents the comparison of different parameters in ICU admitted patients using Spearman's rho. This table shows statistically significant positive correlation between age with hemoglobin (r-value 0.806 & p-value < 0.001); PT (r-value 0.319 & p-value < 0.001 \*\*); D-dimer (r-value 0.392 & p-value < 0.001 \*\*); CRP (r-value 0.288 & p-value < 0.001 \*\*); Troponin (r-value 0.462 & p-value < 0.001 \*\*); LDH (r-value 0.195 & p-value 0.009 \*); Ferritin (r-value 0.329 & p-value < 0.001 \*\*) and AST (r-value 0.251 & p-value < 0.001 \*\*). Additionally, there was a statistically significant positive correlation between RBCs with Hemoglobin (r-value 0.806 & p-value < 0.001 \*\*); while statistically significant negative correlation between RBCs with PT (r-value -0.277 & p-value < 0.001 \*\*); Neutrophils (r-value -0.176 & p-value 0.011 \*); APTT (r-value -0.305 & p-value < 0.001 \*\*); D-dimer (r-value -0.452 & p-value < 0.001 \*\*); CRP (r-value -0.193 & p-value 0.009 \*); Procalcitonin (r-value -0.445 & p-value < 0.001 \*\*); Troponin (r-value -0.265 & p-value < 0.001 \*\*) and LDH (r-value -0.154 & p-value 0.042 \*). Furthermore, there was a statistically significant negative correlation between hemoglobin with WBCs (r-value -0.158 & p-value 0.023 \*); Neutrophils (r-value -0.160 & p-value 0.021 \*); PT (r-value -0.195 & p-value 0.005 \*); APTT (r-value -0.279 & p-value < 0.001 \*\*); D-dimer (r-value -0.407 & p-value < 0.001 \*\*); CRP (r-value -0.168 & p-value 0.023 \*); Procalcitonin (r-value -0.482 & p-value < 0.001 \*\*) and Troponin (r-value -0.317 & p-value < 0.001 \*\*).