Admission To Critical Care And Death Rate For Coronavirus Patients In Imam Hussein Medical City (Karbala, Iraq) After Taking The Vaccine

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Abstract: Background: SARS-CoV-2 (COVID-19) vaccination is now essential for preventing the spread of the illness and lowering its severity, hospitalizations, and fatality; so the purpose of the current research is to investigate COVID-19-related mortality and admission to ICU , as well as to assess the effectiveness of vaccination. Patients and Methods: The total number of our study patients were 304 patients who admitted in COVID -ICU during the period between the beginning of June until end of November of 2021 who was need intensive care unit at COVID ICU in Imam Al-Hussein Medical-City at Holy Karbala government. Results: From consecutive patients were included in the study ,240 (79%) were diagnosis to have COVID infection by PCR test and others by chest CT and 58(19%) were fully vaccinated , the total mortality rate was 25.7%. Conclusion: vaccination against the SARS-CoV-2 virus showed a protective impact in terms of mortality and COVID-19's clinical severity.

Keywords: COVID-19, ICU, Vaccine.

INTRODUCTION

The SARS-CoV-2 virus that causes coronavirus disease 2019 (COVID-19) was initially identified in Wuhan, China, in November. On December 31st, 2019, the World Health Organization (WHO) received notification of the first case (Adil, M. T. *et al.,* 2021).

SARS-CoV-2, a respiratory virus that causes severe acute respiratory syndrome, has killed more than 737,000 people worldwide and infected at least 20.1 million more (Adil, M. T. *et al.,* 2021).

Despite the high level of species specificity that the beta corona virus has with the majority of other viruses, even small genetic variations can have a large influence on the virus's tissue tropism, host range, and toxicity. An impressive illustration of how adaptable these viruses are is the rise of SARS-CoV-related lethal zoonotic illnesses in human history (Peiris, J. S. *et al.,* 2004).

The intermediate hosts for SARS-CoV and MERS-CoV, respectively, were the palm civet and dromedary camel. Bats were the natural reservoirs for both viruses, while humans were their terminal hosts (Alagaili, A. N. *et al.,* 2014).

According to the Iraqi Ministry of Health's most recent data, there have been 394,566 confirmed cases and 9,683 fatalities in Iraq. Over two-thirds of the people who died in Iraq had diabetes, cardiovascular disease, cancer, or were previous smokers, and the average age of the victims was 71 (Al-Kuraishy, H. M. *et al.,* 2021).

When COVID-19 patients do experience symptoms, the majority experience only mild (40%) or moderate (40%) disease, 5% experience critical disease with complications like respiratory failure, ARDS, sepsis and septic shock, thromboembolism, and/or multi-organ failure, including acute kidney injury and cardiac injury, and 15% experience severe disease that necessitates oxygen support (Covid, W. H. O. 2020).

Knowledge of baseline patient characteristics and risk factors associated with ICU and hospital mortality is still limited. Male sex, hypertension, cardiovascular disorders, and type 2 diabetes are the most prevalent comorbidities, and they are associated with a high case fatality rate (Myers, L. C. *et al.,* 2020).

Fortunately, the SARS-CoV-2 virus is homologous to SARS-CoV and the Middle East Respiratory Syndrome Coronavirus (MERSCoV), which have been studied for years. Based on the carrier of the antigen, the new-generation vaccines for COVID-19 can be classified into recombinant protein-based vaccines and vector based vaccines, e.g., Messenger RNA (mRNA) vaccines, plasmid DNA vaccines, viral vector-based vaccines, and non-pathogenic bacterial vector-based vaccines.

SARSCoV-2 has four main structural proteins including spike protein (S), envelope protein (E), membrane protein (M), and nucleocapsid (N) protein. The S proteins are located at the outer surface of the virus particles and can bind to ACE2 on the cell surface, allowing receptor-mediated endocytosis of the virus.

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Based on crystallography, ACE2 binding patterns between SARS-CoV-2 and SARS-CoV are highly homologous (Chapin-Bardales, J. *et al.,* 2021).

PATIENTS AND METHODS

A retrospective cohort study sometimes called a historical cohort study, is a type of longitudinal study in which researchers look back to a certain point in time to analyze a particular group of subjects who have already experienced an outcome of interest (20). The research conduct at COVID intensive care unit in Imam Al-Hussein Medical City at Holy Karbala government. Approval was obtained from the Scientific Council of Anesthesia and Intensive care / Iraqi Board for Medical Specialization. The total number of the study were 304 patients whom admitted in COVID ICU during period from beginning of October 2021 until end of April 2022 who was need intensive care unit because of sever COVID symptom (Spo2 less than 90, Respiratory rate above 20 or below 8, Need ventilator support) Whom even were received COVID vaccine or not.

The data of the study samples were collected from October 2021 to April 2022 and it is dependent on the information of the patients thought review of medical reports as (vaccine and its type or not vaccinated , duration of stay in ICU, CT percentage, another comorbidity, ABG).

Inclusion criteria.
1. Patients in ICU with COVID who receive vaccine with PCR positive.
2. Patients in ICU with COVID who receive vaccine with PCR negative but CT chest positive.
3. Patients in ICU with COVID & PCR positive who not receive vaccine.
4. Patients in ICU with COVID & PCR negative but CT chest positive who not receive vaccine.

5. Patient between the first of October 2021 till end of April 2022.
6. Exclusion criteria.
7. Patient who receive one dose of any type of COVID vaccine.
8. Patient who was admission because of surgical or medical cause but the PCR for COVID positive.
9. Those age below 16 years .

he researcher was used the program of statistical package for social sciences (SPSS) V. 26 software to manage and analyze the study data. Both descriptive and inferential analysis for the date of samples.

Descriptive data analysis:
1. Frequency and Percentage.
2. Mean of score and standard deviation.
3. These were used to decide whether to accept or reject the following statistical
4. hypotheses
5. Two-sample independent t-test and analysis of variance are used to examine the differences and correlation between variables.
6. One-way ANOVA test, respectively was used for estimating the between variables.

For the comparative significant (C.S.) abbreviations that were utilized:
- Non-significant at Probability value more than 0.05.
- Significant at Probability value equal or less than 0.05.
- Highly significant at Probability value equal or less than 0.01.

RESULTS

304 patients were included in this study with different age group, the youngest patient was 17 years old, the oldest was 100 years, the mean ± standard deviation for the age was: 58.79±18.468.

Table 1: Distribution of the Participants According to their socio demographic data Characteristics.

Demographic Characteristics	Subgroup	Frequency	Percent %	Cumulative
Age group	< 25 years	14	4.6	4.6
	25-45 years	62	20.4	25.0
	46-65 years	105	34.5	59.5
	66-85 years	110	36.2	95.7
	>85 years	13	4.3	100
	Total	304	100	
Gender	Male	154	50.4	
	Female	150	49.3	
	Total	304	100	

In table 1 the results showed that the high percentage (36.2%) of patients in the study sample were old age group from 66- 85 years and less than these percentage from 46- 65 years with mean 58.79 years and regarding the gender the most patients (50.7 %) were men.

Table 2: Distribution of the participants according to their medical characteristics.

Characteristics	Categories	No.	Percent %	Cumulative
Vaccination status	Take vaccine	58	19.1	19.1
	No vaccine	246	80.9	100
	Total	304	100	
Type of vaccination	Pfizer	36	11.8	11.8
	AstraZeneca	5	1.6	13.4
	Sinopharm	17	5.6	19.1
	Total	58	19.1	
Duration of last dose	Not vaccinated	246	80.9	80.9
	1-2 weeks	1	0.3	82.3
	2-4 weeks	10	3.3	84.5
	1-2 months	14	4.6	89.1
	2-4 months	16	5.3	94.4
	4-8 months	17	5.6	100
	Total	304	100	
Duration of ICU admission	1-7 days	253	83.2	83.2
	8-14 days	36	11.8	95.1
	15-21 days	14	4.6	99.7
	22-28 days	1	0.3	100
	Total	304	100	
CT percentage	<30%	119	39.1	39.1
	30-60%	169	55.6	94.7
	>60%	16	5.4	100
	Total	304	100	
Chronic diseases	No diseases	77	25.3	25.3
	Hypertension	65	21.4	46.7
	Diabetes	45	14.8	61.5
	RDS	22	7.2	68.8
	Sepsis	4	1.3	70.1
	MOD	7	2.3	72.4
	HTN+DM	48	15.8	88.2
	HTN+RDS	15	4.9	93.1
	HTN+ Sepsis	3	1.0	94.1
	HTN+MOD	12	3.9	98
	DM+ Sepsis	6	2.0	100
	Total	304	100	
Special Cases	Not have	291	95.7	95.7
	CKD	2	0.7	96.4
	Thalassemia	1	0.3	96.7
	CKD+SLE	1	0.3	97.0
	SLE+GI Bleeding	1	0.3	97.3
	DKA	1	0.3	97.6
	IHD	1	0.3	98
	Pregnant	3	1.0	99
	IHD+HF	1	0.3	99.3
	PE	1	0.3	99.6
	Pregnant+ IO	1	0.3	100
	Total	304	100	

Mortality	Alive	226	74.3	74.3
	Dead	78	25.7	100
	Total	304	100	

The duration of last vaccination was minimally 10 days and the maximum was 220 days with mean of 40.916 and standard deviation 16.71, and for the ICU stay the minimum admission was 1 day and the maximum stay was 25 days with mean 4.81 and standard deviation 4.016 days, and for the involvement of the lung according to CT presentation was minimally 5%, maximumly 80%, mean 32.59 and standard deviation 16.52%.

In table 2 the results showed the majority (80.9%) of patients with COVID19 in ICU not take the vaccination and the other percentage (19.15) take vaccination, Regarding the duration of admission in ICU the majority 83.2% in the first week.

According to the CT percentage the most (55.6%) of the participants with 30% - 60% ,The results also shown 74.7% with chronic disease and from this percentage 21.4% just with hypertension and 14.8% just wit diabetic mellitus and 15.8% with hypertension and diabetic mellitus together. According to the mortality 25.7% from the participant patients with COVID19 in ICU were death.

Table 3: Distribution of the participants according parameter and ABG.

Parameter	Subgroup	Frequency	Percent%	Cumulative
SpO_2	>90%	19	6.3	6.3
	70-89%	248	81.6	87.8
	59-69%	37	12.2	100
	Total	304	100	
Respiratory rate (BPM)	1-9	5	1.6	1.6
	10-20	31	10.2	11.8
	21-30	147	48.4	60.2
	31-40	89	29.3	89.5
	41-60	32	10.5	100
	Total	304	100	
Level of consciousness	Conscious	205	67.4	67.4
	Drowsy	62	20.4	87.8
	Unconscious	37	12.2	100
	Total	304	100	
Ventilation	Invasive ventilation	47	15.5	15.5
	Non-invasive	257	84.5	100
	Total	304	100	
PCR	Positive	240	78.9	78.9
	Negative	64	21.1	100
	Total	304	100	
pH in ABG	Not done	33	10.9	10.9
	7.35-7.45	110	36.2	47.0
	<7.35	127	41.8	88.8
	>7.45	34	11.2	100
	Total	304	100	
PaO_2 in ABG (mmHg)	Not done	33	10.9	10.9
	75-100	58	19.1	29.9
	<75	159	52.3	82.2
	>100	54	17.8	100
	Total	304	100	
$PaCO_2$ in ABG (mmHg)	Not done	33	10.9	10.9
	35-45	79	26	36.8
	<35	100	32.9	69.7
	>45	92	30.3	100

		Total	304	100	

In table 3 the results showed the most of participants (81.6%) with 70-89% level of SPO2 and at most (48.4%) with 21-30 BPM rate of respiratory and the most (67.4%) were conscious. The results also showed the majority (84.5%) of patients with COVID19 in ICU with noninvasive ventilation and regarding the PCR the just 21.1% were positive. According to the ABG 10.9% not done ABG and the other percentage at most 41.8% with acidosis PH, 52.3% less than 75 mmHg of PaO2, 32.9% less than 35 mmHg of PaCO2.

Table 4: Effectiveness of vaccination on the patients with COVID-19 in ICU.

Group	Subgroup	Vaccinated %	Not vac. %	t-test analysis		
				t-test	Df	p-Value
Admission		19.1	80.9	1.372	57	
Duration of ICU admission	1-7 days	91.4	81.3	1.228	57	0.224
	8-14 days	6.9	13.0			
	15-21 days	1.7	5.3			
	22-28 days	0	0.4			
	Total	100	100			
CT percent	<30%	70.3	31.7	3.107	57	0.003
	30-60%	27.6	62.2			
	>60%	1.7	6.1			
	Total	100	100			
SpO$_2$	>90%	19	3.3	2.462	57	0.017
	70-89%	77.6	82.5			
	59-69%	3.4	14.2			
	Total	100	100			
Respiratory rate (BPM)	1-9	0	2	0.034	57	0.973
	10-20	3.4	11.8			
	21-30	58.6	45.9			
	31-40	31	28.9			
	41-60	6.9	11.4			
	Total	100	100			
Level of consciousness	Conscious	89.7	62.2	1.308	57	0.196
	Drowsy	6.9	23.6			
	Unconscious	3.4	14.2			
	Total	100	100			
Ventilation	Invasive ventilation	5.2	17.9	0.0	57	1.000
	Non-invasive	94.8	82.1			
	Total	100	100			
PCR	Positive	29.3	19.1	0.597	57	0.553
	Negative	70.7	80.9			
	Total	100	100			
pH in ABG	Not done	13.8	10.2	1.317	57	0.193
	7.35-7.45	43.1	34.6			
	<7.35	25.9	45.5			
	>7.45	17.2	9.8			
	Total	100	100			
PaO$_2$ in ABG (mmHg)	Not done	13.8	10.2	1.262	57	0.212
	75-100	20.7	18.7			
	<75	34.5	56.5			
	>100	31.0	14.6			
	Total	100	100			
PaCO$_2$ in ABG (mmHg)	Not done	13.8	10.2	0.436	57	0.664
	35-45	29.3	25.2			

	<35	39.7	31.3			
	>45	17.2	33.3			
	Total	100	100			
Mortality	Alive	91.4	70.3	2.319	57	0.024
	Dead	8.6	29.7			
	Total	100	100			

The results in table 4 showed there were highly significant statistical differences in admission to ICU for vaccinated and not vaccinated patients with COVID19 at P <0.01 and there were significant statistical differences in CT percentage, SPO2 and mortality for vaccinated and not vaccinated patients with COVID19 in ICU at P <0.05. And the results achieved the null hypothesis thought there were no effectiveness of vaccination on admission in ICU.

Table 5: Demographics and clinical data for vaccinated and not vaccinated patients with COVID19 in ICU.

Group	Subgroup	Vaccinated %	Not vac. %	t-test analysis		
				t-test	Df	p-Value
Age	< 25 years	12.1	2.8	1.618	57	0.111
	25-45 years	29.3	18.3			
	46-65 years	37.9	33.7			
	66-85 years	20.7	39.8			
	>85 years	0	5.3			
	Total	100	100			
Gender	Male	56.9	49.2	1.062	57	0.293
	Female	43.1	50.8			
	Total	100	100			
Chronic disease	No diseases	20.7	26.4	4.847	57	0.055
	Hypertension	20.7	21.5			
	Diabetes	13.8	15.0			
	RDS	8.6	6.9			
	Sepsis	0	1.6			
	MOD	6.9	1.2			
	HTN+DM	22.4	14.2			
	HTN+RDS	3.4	5.3			
	HTN+ Sepsis	1.7	0.8			
	HTN+MOD	1.7	4.5			
	DM+ Sepsis	0	2.4			
	Total	100	100			
Special cases	Not have	91.4	96.7	0.432	57	0.667
	CKD	1.7	0.4			
	Thalassemia	1.7	0			
	CKD+SLE	1.7	0			
	SLE+GI Bleeding	1.7	0			
	DKA	1.7	0			
	IHD	0	0.4			
	Pregnant	0	1.2			
	IHD+HF	0	0.4			
	PE	0	0.4			
	Pregnant+ IO	0	0.4			
	Total	100	100			

The results in table 5 showed there were non-significant statistical differences in demographics and clinical data for vaccinated and not vaccinated patients with COVID19 in ICU at P > 0.05.

Table 6: The relationship between the mortality with demographic characteristics, medical information and parameter for patients with COVID19 in ICU.

Group	Subgroup	Mortality		p-Value
		Alive (No.=226)	Dead (No.=78)	
Age	< 25 years	11	3	0.002
	25-45 years	52	10	
	46-65 years	81	24	
	66-85 years	78	32	
	>85 years	4	9	
Gender	Male	120	34	0.094
	female	106	44	
Vaccination status	Take vaccine	53	5	0.000
	No vaccine	173	73	
Type of vaccination	Not vaccinated	173	73	0.011
	Pfizer	33	3	
	AstraZeneca	5	0	
	Sinopharm	15	2	
Duration of last dose	Not vaccinated	173	73	0.031
	1-2 weeks	1	0	
	2-4 weeks	10	0	
	1-2 months	13	1	
	2-4 months	13	3	
	4-8 months	16	1	
Duration of ICU admission	1-7 days	202	51	0.000
	8-14 days	21	15	
	15-21 days	3	11	
	22-28 days	0	1	
CT percentage	<30%	115	4	0.000
	30-60%	107	62	
	>60%	4	12	
Chronic diseases	No diseases	73	4	0.000
	Hypertension	59	6	
	Diabetes	40	5	
	RDS	15	7	
	Sepsis	0	4	
	MOD	5	2	
	HTN+DM	23	25	
	HTN+RDS	7	8	
	HTN+ Sepsis	0	3	
	HTN+MOD	2	10	
	DM+ Sepsis	2	4	
Special Cases	Not have	219	72	0.088
	CKD	2	0	
	Thalassemia	1	0	
	CKD+SLE	0	1	
	SLE+GI Bleeding	0	1	
	DKA	1	0	
	IHD	1	0	
	Pregnant	2	1	
	IHD+HF	0	1	
	PE	0	1	
	Pregnant+ IO	0	1	
SpO_2	>90%	19	0	0.000

	70-89%	201	47	
	59-69%	6	31	
Respiratory rate (BPM)	1-9	0	5	0.000
	10-20	24	7	
	21-30	132	15	
	31-40	60	29	
	41-60	10	22	
Level of consciousness	Conscious	194	11	0.000
	Drowsy	28	34	
	Unconscious	4	33	
Ventilation	Invasive ventilation	5	41	0.000
	Non-invasive	220	37	
PCR	Positive	47	17	0.484
	Negative	179	61	
pH in ABG	Not done	33	0	0.000
	7.35-7.45	91	19	
	<7.35	79	48	
	>7.45	23	11	
PaO_2 in ABG (mmHg)	Not done	33	0	0.000
	75-100	58	0	
	<75	86	73	
	>100	49	5	
$PaCO_2$ in ABG (mmHg)	Not done	33	0	0.000
	35-45	65	14	
	<35	66	34	
	>45	62	30	

In table 6 the results showed there were significant statistical correlation between the mortality with demographic characteristics, medical information and parameter for patients with COVID19 in ICU.

DISCUSSION

The result of this study show 36% from samples were old age (66- 85) years , and 35% were (46 66) years and this result support by study conducted by Kipourou[8] to exam the Probabilities of ICU admission and hospital discharge at Jaber Al-Ahmad Al-Sabah Hospital in AL Kuwait, the result of this study show was patients entering the ICU were mostly between 40 and 69 years. Also the data analyze show 19% of the study sample were vaccinated because most of people still afraid from the new vaccine and some of its side effect and there is no enough health awareness ,and this finding similar to the study did by Sotiriou in Central Greece (University Hospital of Larisa) which appear about 38% of the samples were vaccinated . Regarding type of vaccine most related to the study sample was Pfizer and this findings agree with study conducted by Brechje[10] in Netherlands to assess the effect of vaccine on hospital and ICU admission .

Regarding duration of staying in ICU , the result show the maximum duration in ICU for vaccinated and non-vaccinated study patients were one week this mean was no significant effect of vaccine on staying in ICU and this results supported by study in Greece was did to assess severity and mortality of vaccination against COVID 19 (Samara, A. A. *et al.*, 2022).

About parameters of severity and indication for admission to ICU, start with oxygen saturation (SpO_2) ,the result showing significance difference between vaccinated and non-vaccinated O_2 saturation of patients as maximum of vaccinated samples SpO_2(77%) and maximum of non-vaccinated samples SpO_2 (82%) were between (70 %– 90 %) and this was supported by study occurs in St. Petersburg, Russia by Anton to assess effect of vaccine against sever lung injury (Barchuk, A. *et al.*, 2021).

Also about the CT scan to chest to calculate lung injury ,the result show highly significance difference between vaccinated and non-vaccinated as 70% of vaccinated less than 30% while 32% of non-vaccinated less than 30% and this also supported by Petersburg (Barchuk, A. *et al.*, 2021).

Regarding respiratory rate ,conscious level and type of ventilation , the result of study showing there was no significance difference between vaccinated and non-vaccinated patients and this may be due to the data collect from severely COVID infected ICU samples this similar to study of Sevinc[12] which done in Cambridge University in April 2021.

About mortality , there was highly difference in result as the percentage of death from vaccinated sample was (8.6%) while from non-vaccinated more than (30%) and this finding support by study of central Greece as show the fatality rate for patients take vaccine (10.1%) and (24.9%) for non-vaccinated, but not similar to Cambridge University study[12] which found the effectiveness of the CoronaVac vaccine in relation to hospital and ICU mortality with no differences between vaccinated and unvaccinated groups.

Finally the result regarding ABG , the patients with acidosis (pH less than 7.35) was in non-vaccinated (45.5%) more than in those take vaccine (26%) ,As the $PaCO_2$ of (33.3%) from non-vaccinated were more than 45 mmHg and (17%) from vaccinated were more than 45 mmHg and this different from study done in Cambridge University to assess effectiveness of inactivated SARS-CoV-2 vaccine (CoronaVac) on intensive care unit survival (Sevinc, S. A. *et al.,* 2022) which show no difference between ABG for vaccinated and non-vaccinated.

CONCLUSION

It can be concluded, based on the study's findings :
There are decrease in infection ,symptoms , admission rate to ICU and mortality for people take corona vaccine -specially (Pfizer)- from those not taken vaccine The all type of vaccine included in this study have effectiveness on decrease fatality rate and admission to ICU.

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