Original Article

Methylprednisolone Effect on the Outcomes of Severe COVID 19 Cases at Ain Shams University Hospitals from *1st* of June 2020 to *31st* of August 2020

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ABSTRACT

Background: The coronavirus disease 2019 (COVID-19) outbreak has posed significant public health issues and its secondary systemic inflammatory response is linked to the viral aggravation so glucocorticoids being with anti-inflammatory properties were utilized to treat severe cases characterized by the cytokine storm. Glucocorticoids, on the other hand, are a double-edged sword, since high doses can cause secondary infection and long-term significant consequences, as well as lengthen virus clearance time. Nonetheless, the risks and benefits of glucocorticoid adjuvant therapy for COVID-19 are inconclusive.

Objective: To assess the effect of methylprednisolone on the outcomes of severe COVID-19 cases at Ain Shams University hospitals from 1st of June 2020 to 31st of August 2020.

Methods: This is a retrospective cohort study involving 110 cases admitted to Ain Shams University hospitals with severe COVID-19 from 1st of June 2020 to 31st of August 2020. Retrospective evaluation of medical records was used to collect data. The study included males and females who were over 45 years old and presented as severe cases that were managed with steroid doses of 0.75-1.5 mg/kg/d. Data extracted included monitoring the patient's vital signs and oxygenation as well as imaging and regular blood tests like C-reactive protein, LDH, and ferritin and patient clinical outcomes whether discharge or death.

Results: Using data collection at Ain Shams University hospitals, a total of 110 severe and critically ill COVID-19 patients were included in this study between 1st of June 2020 to 31st of August 2020. Which showed that methylprednisolone decreased CRP, improved oxygen saturation of cases ($p<0.001$), reduce the need for mechanical ventilation ($p<0.001$) and decreased in-hospital mortality [48/110 (44%)].

Conclusion: Methylprednisolone treatment at a dose of 0.75-1.5 mg/kg/d for severe cases improves prognosis in severe COVID-19 patients.

Key words: Methylprednisolone; COVID 19.

INTRODUCTION

The newly discovered severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was initially reported on December 2019 (2019-nCOV) in the city Wuhan; Hubei province, China. The first COVID-19 case in Egypt was reported on the 14th of February 2020.

Most of COVID-19 patients present with common symptoms including fever, cough, myalgia and fatigue at the onset. The majority of patients recover, however, some patients will progress into severe complications including acute respiratory distress syndrome (ARDS), which may worsen rapidly into respiratory failure, need an intensive care unit (ICU), and even cause multiple organ failure.

The pathological process of severe COVID-19 pneumonia is an inflammatory reaction characterized by the destruction of the deep airways and alveoli. Therefore, it is important to strengthen the treatment aiming to suppress the pro-inflammatory response and control the cytokine storm at this stage. Methylprednisolone is a classical immunosuppressive drug, which is important to stop or delay the progress of pneumonia and has proved to be effective for the

treatment of acute respiratory distress syndrome (ARDS).

However, the results of clinical studies of the effect of corticosteroids remain controversial. In some studies, such as the study of **Diaz et al. (2012),** who performed a prospective observational study of 372 adult severe cases with the diagnosis of primary viral pneumonia and completed outcomes treated in an Spanish ICUs it had found that the use of corticosteroid therapy was not significantly associated with mortality, while in others, such as the study of **Brun-Buisson et al. (2011),** who performed a retrospective analysis of data prospectively collected within the French Re´seau de Recherche en Ventilation Artificielle– Socie´te´ de Re´animation de Langue Francxaise (REVA-SRLF) registry of 567 critically ill adult patients hospitalized for severe A/H1N1v 2009 infection, it had found that early corticosteroid therapy was found to be potentially harmful in patients with influenza pneumonia leading to the benefit is also controversial.

The aim of the current study was to assess the effect of methylprednisolone on the outcomes of severe COVID-19 cases at Ain Shams University hospitals as the primary outcomes were a composite of in-hospital mortality or in-hospital mechanical ventilation and the length of stay in-hospital (ICU and ward), secondary outcomes were measurement of systemic inflammatory response syndrome markers (Ferritin, LDH, CRP) and percentage and characteristics of participants with serious adverse reactions (SARs).

OBJECTIVE

To assess the effect of methylprednisolone on the outcomes of severe COVID-19 cases at Ain Shams University hospitals from 1st of June 2020 to 31st of August 2020.

METHODS

A retrospective cohort study was done using the medical records from ASUHs from 1st of June 2020 to 31st of August 2020. One hundred and ten (110) cases extracted fulfilling criteria that age should be above 45 years old who was diagnosed COVID19 by CT of the lung confirmed to the manifestation of viral pneumonia, also who had criteria for severe conditions: respiratory rate ≥ 30/min; or rest SaO_2 ≤ 93%; or PaO_2/FiO_2≤300mmHg, or more than 50% lung infiltrate for both males and females. Treatment regimen was general symptomatic treatment and organ function support with giving different respiratory support measures according to their conditions, including nasal catheter oxygen inhalation, mask oxygen inhalation, high-flow nasal catheter oxygen inhalation, noninvasive mechanical ventilation, and invasive mechanical ventilation. Treatment involved conventional antiviral treatment in combination with secondary infection and complication prevention and treatment, and other diseases treatment. During treatment, patient oxygenation was closely monitored. In case of deterioration, considering the hyper-inflammatory state of the patients, methylprednisolone was intravenously administered at 0.75-1.5 mg/kg/d.

Data collected regarding these cases were demographic data, co-morbidities, O_2 saturation and inflammatory markers before and after administration of methylprednisolone and the outcomes of patients after treatment with methylprednisolone.

Data obtained by retrospective review of medical records after approval of the study methodology by MASRI ethical committee and Research Review Board of the Geriatrics and gerontology medicine department, Faculty of Medicine, Ain Shams University. Confidentiality and anonymity of participants was be ensured.

Data entry and statistical analysis were on a personal computer using Statistical Package for Social Science (SPSS) (version 26) Quantitative variables were presented in the form of means and standard deviation. Qualitative variables were presented in the form of frequency tables (number and percent). A comparison between quantitative variables was carried out. A comparison between qualitative variables was carried out using Pearson's $\chi 2$ test. Correlation between two quantitative variables was carried out using the Spearman correlation coefficient. The statistical difference were accepted when

P < 0.05 and P< 0.001 is considered highly significant.

RESULTS:

A sample of 109 severe COVID-19 cases were recruited at Ain Shams University hospitals between 1st of June 2020 to 31st of August 2020. Among these patients, the mean age was 65.46 years, 56% of the study population was males and 44% was females, as shown in Table 1. Figure (1) shows that among the common presenting symptoms of severe cases, dyspnea was the commonest (91.7%) and the least presenting symptom was disturbed conscious level (12.8%) while other symptoms such as cough in 79 cases (72%), fever in 42 cases (38%), and GIT symptoms (gastro-intestinal tract symptoms) in 15 cases (13.88%).

Table (2) shows the frequency of comorbidities among cases as HTN (73.4%) and DM (57.8%) were the most associated diseases and chronic liver disease (12.8%) and strokes (12.8%) were the least associated diseases. While table (3) shows the mean duration of administrating of methylprednisolone and it was 11.41 ± 5.47 days.

Figure (2) shows that the number of cases who needed mechanical ventilation was 45 cases (41.2%), with a mean total hospital stay of 11 days. But the number of cases who did not need mechanical ventilation was 64 cases (58.7%) with a mean total hospital stay of 29 days. A statistically significant relationship between mechanical ventilation and total hospital stay has been found.

There was a statistically significant difference in oxygen saturation before and after methylprednisolone treatment with a P value (<0.001) for all cases. Our study found that patients who received corticosteroids presented with statistically significant differences in the systemic anti-inflammatory response as measured by serum level of C reactive protein (CRP) while no significant difference was found between other inflammatory markers before and after treatment with methylprednisolone (TLC, Ferritin, LDH) with a P value (0.001) as shown in tables (4, 5).

Elderly patients exhibited more severe clinical manifestations and higher mortality than cases that were < 60 years old. Older age was considered an independent risk factor for COVID-19 patient death, as the mean age of non survivors was 67.83 years old while the mean age of survivors was 63.59 years old, which was statistically significant.There was no statistically significant between sex and outcome as the mean of died men were 27 cases (SD 44.3%) and discharged men were 34cases (SD 55.7%) while the mean of died women were 21cases (SD 43.8%) and the mean of discharged women were 27 cases (SD 56.3%) with a P value (0.96) as shown in table (6).

Inflammatory markers (CRP, LDH, and Ferritin) were found to be positively correlated with the severity of COVID-19, with higher levels of inflammatory markers found in non-survivors than in survivors. However, TLC had no significant relation with mortality, as shown in table (7).

In the current study, The mean of hospital stay for all cases (109 cases) was 13.24 days (SD= 6.18) with a mean length of ICU stay was 11.41 days (SD=5.47). The whole cases were divided into two major groups: 48 dead cases (44.0%) and 61 discharged cases to the ward (56.0%).Starting with the first group (48 dead cases), the mean length of their ICU stay was 10.9 days (SD=5.6). Moving to the other one (61 discharged cases), their mean length of ICU stay and ward stay were 11.7 days and 3 days accordingly, as shown in table (8).

By logistic regression analysis, the following were independently associated with mortality: oxygen saturation before and after treatment, and length of hospital stay as shown in table (9).

Table (1): Demographic characteristics of the study population

		Min.	Max.	Mean	SD
Age		46.00	88.00	65.46	10.01
		N		**%**	
Gender	**Male**	61		56.0%	
	Female	48		44.0%	

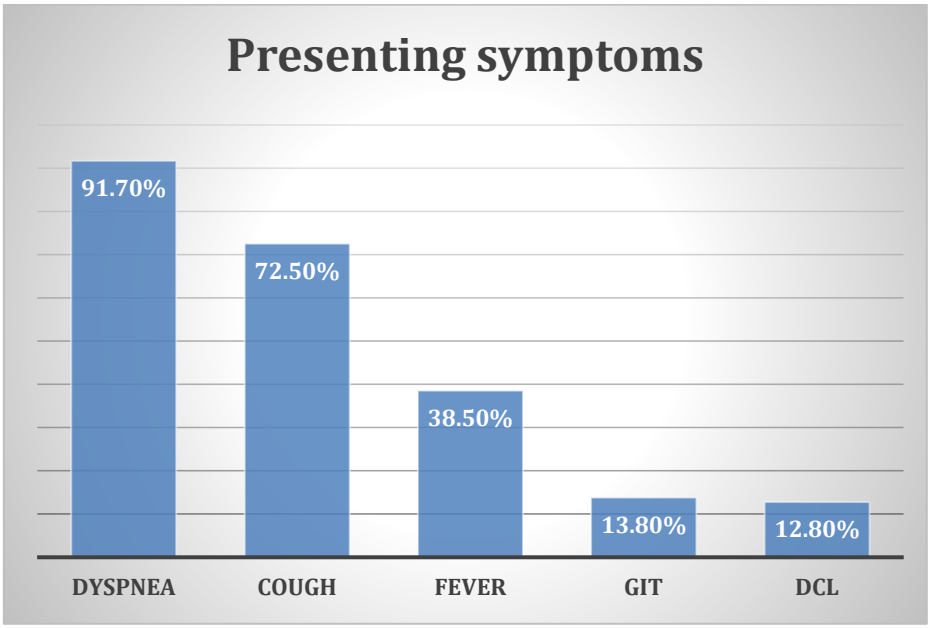

Figure (1): The presenting symptoms of the study population: GIT: gastro-intestinal tract symptoms, DCL: disturbed conscious level

Table 2: The Frequency of comorbidities in study population:

		N	%
DM	**Yes**	63	57.8%
	No	46	42.2%
HTN	**Yes**	80	73.4%
	No	29	26.6%
HF	**Yes**	17	15.6%
	No	92	84.4%
ISHD	**Yes**	21	19.3%
	No	88	80.7%
CKD	**Yes**	21	19.3%
	No	88	80.7%
CLD	**Yes**	14	12.8%
	No	95	87.2%
Stroke	**Yes**	14	12.8%
	No	95	87.2%

DM: Diabetes mellitus, HTN: Hypertension, HF: Heart Failure, ISHD: ischemic heart disease, CKD: Chronic kidney disease, CLD: chronic liver disease

Table (3): Duration of administrating of methylprednisolone

	Min.	Max.	Mean	SD
Duration in days	4	25	11.41	5.47

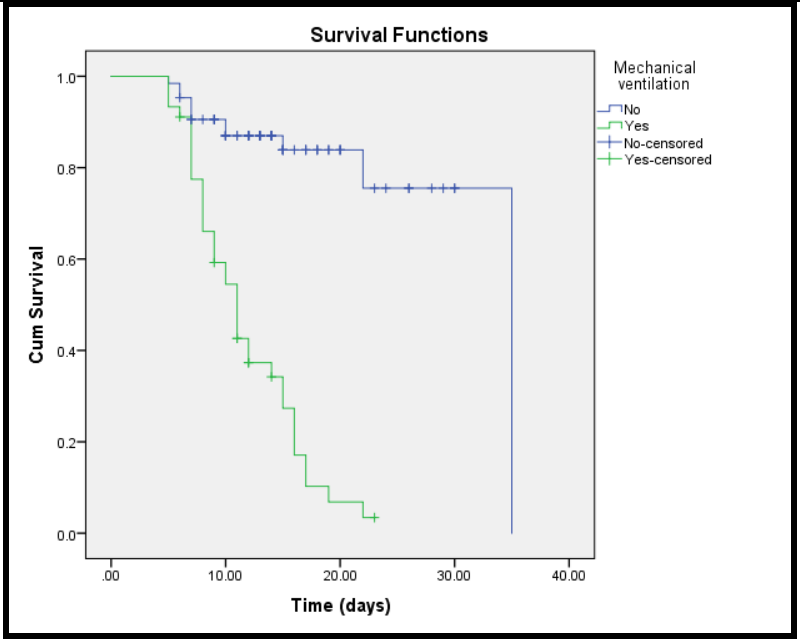

Figure (2): Relation between mechanical ventilation and overall total hospital stay

Table (4): Comparison between oxygen saturation before and after treatment with methylprednisolone for all the study population

	Mean	SD	t*	P value
O_2 **saturation before**	81%	.08	10.01	<0.001
O_2 **saturation after**	93%	.05		

Table (5): Comparison between systemic inflammatory markers before and after treatment with methylprednisolone for all the study population

	Mean	SD	t*	P value
TLC before	10.43	7.18	0.51	0.61
TLC after	10.86	6.56		
CRP before	99.51	83.14	5.66**	<0.001
CRP after	52.79	67.52		
Ferritin before	1174.66	1079.19	1.09	0.28
Ferritin after	1079.45	986.02		
LDH before	501.56	468.51	0.80	0.42
LDH after	470.06	258.81		

*Paired samples t test *Wilcoxon signed rank test
TLC: total leukocyte count, CRP: C - reactive protein, LDH: lactic acid dehydrogenase

Table (6): Relation between outcomes and demographic data of the study population

		Outcome				t*	P value
		Death		Discharge			
		Mean	SD	Mean	SD		
Age		67.83	10.42	63.59	9.33	2.24	0.03
		N	%	N	%	X^{2**}	P value
Gender	Male	27	44.3%	34	55.7%	0.003	0.96
	Female	21	43.8%	27	56.3%		

*Student t test **Chi square test

Table (7): Relation between outcomes and inflammatory markers after methylprednisolone treatment

	Outcome				t*	P value
	Death		Discharge			
	Mean	SD	Mean	SD		
TLC	11.88	8.41	10.09	4.62	1.24	0.22
CRP	43.00	22-86	20.00	8-40	3.36**	0.001
Ferritin	1454.83	1116.88	787.48	761.03	3.32	0.001
LDH	569.86	317.19	392.04	167.14	3.33	0.001

*Student t test **Mann Whitney U test (median and IQR)
TLC: total leukocyte count, CRP: C - reactive protein, LDH: lactic acid dehydrogenase

Table (8): Short term outcomes (including mechanical ventilation and ICU stay) after treatment with methylprednisolone

	N	Min.	Max.	Mean	SD
Length in ICU (days) for all cases	109	4.00	35.00	11.41	5.47
Length in ward (days) for all cases	55	2.00	7.00	3.62	1.18
Hospital Stay (days) for all cases	109	5.00	35.00	13.24	6.18
Length in ICU (days) for discharged cases	61	4	26	11.77	5.33
Length in word (days) for discharged cases	61	2	7	3.2	1.55
Length in ICU (days) for died cases	48	5	35	10.95	5.67
		N		%	
Mechanical ventilation	Yes	45		41.3%	
	No	64		58.7%	
Outcome	Die	48		44.0%	
	Discharge	61		56.0%	

ICU: intensive care unit

Table (9): Logistic regression analysis for factors affecting outcomes

	B	Sig.	Odds ratio	95% C.I. for odds ratio	
				Lower	Upper
O_2 saturation before treatment	-6.700	.007	.001	.000	.167
Presence of Comorbidity	.328	.628	1.388	.368	5.233
Length of Hospital Stay	-.141	.001	.868	.797	.946
Constant	6.601	.002	735.947		

DISCUSSION

The study included 110 cases admitted to Ain Sham university hospitals in Cairo, Egypt. It was conducted from 1st of June 2020 to 31st of August 2020 where the data collection and follow up of the cases was done. Data collection was obtained by retrospective review of medical records.

In the current study, the mean age of the participants was 65.46 ±10.01 years. Our study found that death was high among the older age group. In ***Yang et al. (2020)*** study which included 52 critically ill with COVID-19, they observed that non-survivors were older than survivors, which is supported by our data**,** So older adult patients should be prioritized in the implementation of preventive measures.

These results were similar to those reported by ***the Afriyie-Mensah et al. (2021)*** study, who performed a retrospective study at the medical intensive care unit (MICU) of the department of Medicine, Korle-Bu Teaching Hospital in Ghana from 13th of April to 28th of June 2020 for the admission of COVID-19 patients presenting to the hospital with severe cases (as having oxygen saturation (SpO2) less than or equal to 93% on room air with increasing oxygen demands, respiratory rate (RR) >30/min, >50% lung involvement on chest imaging) to critical disease (characterized by organ/multi-organ dysfunction (lung plus any other) and evidence of sepsis/septic shock)**,** the median age of the 34 MICU patients was 62 years, with 63.6% was at least 60 years with elevated inflammatory markers such as serum ferritin, CRP, LDH and ESR. They were started on high dose IV methylprednisolone (100mg) with infusion of 400mg over 24 hours for day 1, totally given 250mg infusion daily for 5 days. There is agreement between this study and the current study regarding the factor of age and severity of disease, but differ regarding the factor of the dose of Methylprednisolone. This difference was what distinguished the current study, as it led to the required prognosis while avoiding the complications that appeared in the study of ***Afriyie-Mensah et al. (2021)*** due to higher doses of Methylprednisolone.

In a study by ***Gold et al. (2020)***, who performed a retrospective study in the United States for 305 severe cases hospitalized with COVID-19 aged ≥18 years at seven hospitals in metropolitan Atlanta from March 1–March 30, 2020 which observed characteristics and clinical outcomes of adult patients hospitalized with severe COVID-19, it found that Intensive care unit (ICU) admission occurred in 119 (39.0 percent) of the patients and increased significantly with age group: 53.8 percent of patients aged 65 years were admitted to an ICU (p0.001) and had poor prognosis.

Similarly ***Guan et al. (2020), Cummings et al. (2020) and Wu et al. (2020)*** agree with findings of our study regarding advanced age was being a significant risk factor for developing severe to critical COVID-19 and for ICU admission.

The greater probability of having more comorbidities among the elderly compared to the younger population has been connected to the observed poor disease prognosis. It's also possible that the medications used to treat existing comorbidities weaken the immune system, resulting in a severe illness pattern. Slower immune cell responses to viral signals (immune senescence) are also thought to be relevant, allowing for high viral replication orders. Also, the thymus, which is responsible for pumping out T-cells, diminishes with age, reducing the quantity of T-cells released and so impacting many elements of the overall immune response.

In the current study, 56% of the study population were males and 44% were females. The mean number of men who died was 27 (44.3%) and the mean number of men who were discharged was 34 (55.7%) while the mean number of females who died was 21 (43.8%) and the mean number of females who were discharged was 27 (56.3%), gender difference was found to be not statistically-significant regarding prognosis in the study with a P value **(**0.96).

On the contrary, this finding disagreed with ***the Afriyie-Mensah et al. (2021)*** study who performed a retrospective study at the medical intensive care unit (MICU) of the department of Medicine, Korle-Bu Teaching Hospital in Ghana from 13th of April to 28th of June 2020 for the admission of COVID-19 patients presenting to the hospital with severe cases which showed that men were more liable to infection. When the gender difference in infection rates first emerged, it was thought to be too early. However, ***Bwire et al., (2020)*** research has pointed to relevant variables, such as males having higher expression of COVID-19 virus angiotensin-converting enzyme-2 receptors than females, as well as sex-based immunological differences. A substantial part of the gender gap has been linked to lifestyle factors, such as men smoking and drinking alcohol more than women. There is also the opinion that, generally, women showed a more responsible attitude toward coronavirus during the epic period than men´s reluctance to take preventive measures.

In the current study, we found that patients who received corticosteroids presented statistically significant differences in the systemic anti-inflammatory response as measured by serum level of CRP with a P value (<0.001), while no significant difference was found between other inflammatory markers before and after treatment with methylprednisolone (TLC, Ferritin, LDH).

These results were similar to those reported by ***Edalatifard et al. (2020)*** who performed a single-blind, controlled, randomized, clinical trial involving adult severe cases aged ⩾18 years with confirmed COVID-19 at the early pulmonary phase of the illness in Iran from April 20, till Jun 20, 2020. The patients were randomly allocated in a 1:1 ratio randomly to receive standard care with methylprednisolone pulse (intravenous injection, 250 mg·day−1 for 3 days) or standard care alone. Sixty eight (68) eligible patients were randomly assigned to one of two groups (each with 34 individuals), during therapy, six patients in the usual care group were given corticosteroids by the attending physician. It was found that the mean serum level of CRP before treatment by methylprednisolone was 99 mg/L and after treatment was 40.8 mg/L which was statistically significantly less with a P value (0.001). Although the current study had the same results with this study but with using less dose of methylprednisolone and avoiding the complications resulting from high dose of methylprednisolone.

With the exception of TLC, in the current study, we found a highly positive, statistically significant relationship between outcomes and inflammatory markers after treatment (CRP, LDH, Ferritin), with the mean CRP, LDH, and Ferritin in died cases being higher than discharged cases with a p value of 0.001.

These results were similar to those reported by ***Cui et al. (2021)*** who retrospective cohort study, the charts of patients who were admitted to Montefiore Medical Center between March 10, 2020, and May 2, 2020 for the management of COVID-19 were examined. Out of two thousand seven hundred and seven (2,707) adult patients aged above 50 years admitted during the study period with different degree of severity, 324 received corticosteroid treatment with a total daily dose of 0.5 mg/kg prednisone equivalent or greater. Among patients who received corticosteroid treatment, CRP responders had reduced risk of death compared with risk among CRP non-responders (25.2% vs 47.8%; unadjusted odds ratio [OR], 0.37; 95% CI, 0.21-0.65; P <.001). Reduction in CRP by 50% or more within 72 hours of initiating corticosteroid therapy potentially predicted inpatient mortality. This study and the current study agree as regard the factors of age and steroid dose, but they disagree regarding the severity of cases that confirm the effect of steroid on decreasing inflammatory indicators.

These results were similar to those reported by ***Myall et al. (2021),*** who performed a prospective observational study of 1,272 adult case aged above 18 years with different degree of severity with a diagnosis of SARS-CoV-2 pneumonitis 6 weeks after discharge from the hospital after treatment with steroids. 837 patients were assessed by

telephone 4 weeks after discharge. On follow-up, biochemical indicators showed a reduction in systemic inflammation, with C-reactive protein dropping from 230.2± 162.6 mg/L at peak illness during admission to 30.9±37.5 mg/L at discharge and 6.1± 9.797 mg/L in clinic after 6 weeks of discharge. Similarly, ferritin levels peaked at 1,592.4 ± 1,274.6 µg/L on admission then dropped to 807.6 ± 450.0 µg/L at discharge and 179.0 ±141.8 µg/L on structured assessment. Patients had a high d-dimer during their admission 17.2 ±6 8.1 mg/L, and although this had fallen by 6 weeks, it was elevated at 2.35 ±6 3.7 mg/L.

Also ***Salton et al. (2021)*** had found similar results to the current study who conducted a multicenter observational study in patients with severe COVID-19 pneumonia admitted to 14 Italian RHDUs (respiratory high-dependency units) between February 27 and April 24, 2020 to see if there was a link between low-dose methylprednisolone treatment and the need for ICU referral, intubation, or death within 28 days. Inclusion criteria were the following: (1) SARS-CoV-2 positive (on swab or bronchial wash); (2) age >18 years and <80 years; (3) PaO_2:FiO_2 <250 mmHg; (4) bilateral infiltrates; (5) CRP >100 mg/L; and/or 6) diagnosis of acute respiratory distress syndrome (ARDS). The following protocol was followed for methylprednisolone administration: a loading dose of 80 mg intravenously at study entry (baseline), followed by an infusion of 80 mg/d in 240 mL of normal saline at 10 mL/h for at least 8 days. Findings were reported as 83 cases were received methylprednisolone and control group who did not received methylprednisolone were 90 patients and there were a reduction of 59% in the risk of ICU referral, invasive mechanical ventilation (MV), or death within 28 days respectively. Study treatment was associated with rapid improvement in PaO2:FiO2 and CRP levels. This study and the current study agree regarding the element of degree of severity, but they differ regarding the factors of age and Methylprednisolone doses utilised, which confirm the steroid's effect on reducing the inflammatory storm.

In the current study, we found that the mean oxygen saturation before receiving methylprednisolone was 80% on room air while after receiving methylprednisolone was 93% on room air. The difference in oxygen saturation before and after methylprednisolone treatment was positive statistically significant with a p value (<0.001).

These results were similar to those reported by ***Wang et al. (2020),*** who performed a retrospective cohort study of forty-six hospitalized patients with severe COVID-19 pneumonia hospitalized who had age above 60 years old at Wuhan Union Hospital from January 20 to February 25, 2020. A total of 26 patients received intravenous administration of methylprednisolone with a dosage of 1-2mg/kg/d for 5-7 days, while the remaining patients not. The patients with administration of methylprednisolone had a faster improvement of saturation of oxygen, while patients without administration of methylprednisolone had a significantly longer interval of using supplemental oxygen therapy (8.2days [IQR 7.0-10.3] vs. 13.5 days (IQR 10.3-16); P<0.001). This study and the current study agree regarding the dose of steroid, the degree of severity, and the age group, but the days of steroid administration differ, however the prognosis is largely the same.

In the current study, whole cases were divided into two major groups: 48 dead cases (44.0%) and 61 discharged cases to the ward (56.0%). There was a highly positive significant relation between the need for mechanical ventilation and outcomes as dead cases needed mechanical ventilation more than discharged cases (p<0.001). Although some discharged cases were intubated in the ICU, there was also a statistically significant link between mechanical ventilation and total hospital stay. The number of cases that needed mechanical ventilation was 45 cases of all participants with a total hospital stay of 11 days, but the number of cases that did not need mechanical ventilation was 64 cases of all participants with a mean total hospital stay of 29 days with a P value (<0.001). Cases

who needed mechanical ventilation were 45 case (41.3%).

These results were similar to those reported by ***Papamanoli et al. (2021),*** who have investigated 447 adult patients aged ⩾18 years with severe COVID-19 pneumonia (patients on high - flow oxygen; FiO_2 ≥50%) admitted to an academic center in New York, from 1 March to 15 April 2020. Patients who received an average of 160 mg per day methylprednisolone for 14 days and those who did not receive corticosteroids were compared. As a result, risk for death or mechanical ventilation was 37% lower with methylprednisolone (hazard ratio 0.63; 95% CI 0.47-0.86; *P* =.003). There is agreement between this study and the current studyregarding the dose of steroid and degree of severity but differ regarding the factor of age and variable of days of administration of steroid while the prognosis was mostly the same.

By logistic regression analysis in the current study, the following were independently associated with mortality and highly significant factors affecting outcomes**:** O_2 saturation before and after treatment besides the length of hospital stay.

These results were similar to those reported by ***Alizadehsani et al. (2021),*** who performed a prospective observational study of 319 adult severe patients with a diagnosis of COVID-19 from March 3rd, 2020 to April 8th, 2020 at the imaging department of OMID hospital, Tehran, Iran, the results indicated that age, heart disease, anosmia, and dry cough are the most crucial factors in the mortality of patients with severe COVID-19.

In the current study, we found that mortality rate increased in the older group (above 67.83 years old) so we need more studies to determine the risk factors that affect elderly mortality in this group. Moreover we need more studies on the neurological, renal, GIT and nutritional status of severe cases of COVID 19 considering different environmental factors as well. For a more precise results, multicenters should have been included in this study as we only collected cases from Ain Shams University hospitals. Evidence on effective COVID-19 therapies was lacking when the pandemic hit our area in early June 2020.

CONCLUSION

Methylprednisolone treatment at a dose of 0.75-1.5 mg/kg/d for elderly patients with severe COVID 19 improves the prognosis of disease.

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