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Outcomes of COVID-19 in sickle cell disease patients

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ABSTRACT

Coronavirus disease 2019 (COVID-19), is an acute respiratory disease that spread widely around the world, causing increased morbidity and mortality. This was a retrospective observational analytical study from April 2020 to August 2021 in admitted COVID19 patients with Sickle Cell Anaemia, in King Saud Medical City. The study aims to evaluate the outcomes of COVID-19 in Sickle Cell Anaemia patients. Analyse the different prognostic factors to identify prognostic factors associated with mortality. The present study is composed of 13 SCD patients (53.8% male's vs 46.2% females) with a mean age of 29 years old. 6 patients (46.2%) had blood transfusions and 2 patients had bilateral infiltration after a chest x-ray. Patients who required intubation were 15.4% (n=2). 69.2% of the patients were being admitted and the median days of the hospital were 6 days. Finally, the primary limitation of this observational study is the few numbers of SCD who had COVID-19, which raises the possibility of type II statistical error due to the lack of power.

Keywords: Sickle cell, COVID19, Outcomes

1. INTRODUCTION

COVID-19 caused by "Severe Acute Respiratory Syndrome CoronaVirus 2 (SARS-CoV-2)" has wide range of clinical versatility with regards to inflicted subjects. The symptoms seen by infected individuals have a wide spectrum, from little discomfort to serious sickness. Two days to two weeks after viral contact, symptoms may begin to manifest. People who exhibit these signs cold or fever, Cough, and fatigue may have COVID-19 (Gorbalenya et al., 2020). COVID-19 was firstly reported in the Chinese city of Wuhan, in December 2019 (Guan et al., 2020). The disease spreads all over the globe becoming a threat and a critical challenge for the public health, research and medical communities (Fauci et al., 2020; Balanchivadze et al., 2020). According to a report from World Health Organization (WHO), more than 68 million

confirmed cases of COVID-19 have been reported (as of mid-December 2020) resulting in over 1.5 million deaths worldwide (WHO, 2022).

Patients with COVID-19 experience a broad spectrum of symptoms, with up to 81% of cases classified as mild which includes mild fever, malaise, dry cough and nasal congestion, andforty percent of cases as severe which have features of dyspnoea, respiratory rate ≥ 30 per minute, and blood O_2 saturation ≤ 93%. Finally, 5% classified were classified as critical which has more serious features such as septic shock and respiratory failure (Wu & McGoogan, 2020; Cascella et al., 2022). Sickle cell disease (SCD) is a group of hereditary illnesses identified by the presence of dysmorphic HB-S haemoglobin under reduced oxygen circumstances (Inusa et al., 2010). This will cause red blood cells to become sickle and deformed, leading to ischemia, capillary and small vessels reperfusion injury with the following organ damage. Aside from specific COVID-19- related morbidities; acute chest syndrome and vaso-occlusive crisis can be evoked by infections in patients with SCD (Abdul Rahman et al., 2020).

In Saudi Arabia, a recent epidemiologic study found that the prevalence of patients with SCD was about 2.6% which was highest in the eastern region while the least in the western region but with severe symptoms (Jastaniah, 2011). One study concluded that patients with SCD or its trait and seropositive COVID-19 had a mostly minimal, course of the disease, with lesser chances of ICU admission, intubation and death, but with longer hospital stay (Vilela et al., 2021). Moreover, another study found no difference between patients with/without SCD in the incidence of infection, course of disease and clearance seen for COVID-19 infected patients (Strouse et al., 2010).

A study conducted in France included 83 in patients with SCD infected with COVID-19 from 24 centres (Arlet et al., 2020). Among the participants, 44 (54%) of 81 inpatients were complicated with Vaso occlusive crisis. of 82inpatients twenty-three (28%) were associated with acute chest syndrome while seventeen (20%) were ICU admitted among whom only nine needed mechanical ventilation and two of them died in the ICU. nine (13%) of sixty-eight patients having 28 years median age were compared to eight (53%) of fifteen patients having 54 years median age. The analysis results were that patients with ages younger than 45 had a significantly different frequency of ICU admission from those 45 or older.

This study aims to evaluate in-hospital mortality and prognostic factors of COVID-19 patients who have sickle cell disease and to answer the question; Is COVID-19 related to increased mortality in hospital among SCD patients?

2. MATERIAL AND METHODS

A retrospective observational study ran from April 2020 to August 2021 to determine the outcomes and prognostic factors of COVID-19 in SCD patients in KSMC, Riyadh, Kingdom of Saudi Arabia. The study's Inclusion criteria were Sickle cell disease (SCD) diagnosed with COVID-19 aged 18 years and older, who are admitted to KSMC in Riyadh, Kingdom of Saudi Arabia. Thirteen patients were eligible for inclusion. All of them had SCD and COVID-19 infections tested and were positive and admitted to the emergency department of King Saud Medical City, Riyadh, Saudi Arabia.

Data were collected from hospital records. Patients who were admitted with sickle cell anemia during the period of the study with covid19 were included in the study; this was done by access to medical records of patients after their consent and IRB approval.

Data related to Variables age, gender, Comorbidities, laboratory tests and duration of hospital stay will be collected from the KSMC Record and entered into a purpose-built (STATA/Excel) spreadsheet and statistical analysis will be done by SPSS Analyses. All data will be collected and analysed by using the Statistical Package for Social Sciences (SPSS) to generate statistics and generalise the results to a wider population. Categorical variables were summarized as frequency and proportion (%). Continuous variables were presented as mean and standard deviation. Between comparisons, Fischer exact test (categorical variables) and independent sample t-test (continuous variables) were applied. Normality tests were performed using the Shapiro-Wilk test. A p-value cut-off point of 0.05 at 95% CI was used to indicate statistical significance. The data were analysed using Statistical Packages for Social Sciences (SPSS) version 26.

Ethical approval and waivers of consent were attained from the KSMC review board with the reference number (H1RI-20-Dec21-02). All the forms were kept confidential and managed according to research centre requirements. No patient's names or private information was mentioned in this study. All the data was stored, only the investigators, statisticians and data collectors will have access to it. No fund was provided, and the researchers have no conflict of interest or partiality in this research.

3. RESULTS

Thirteen patients were eligible for inclusion. All of them had SCD with COVID19 infection tested positive and were admitted to the emergency department of King Saud Medical City, Riyadh, Saudi Arabia. The characters of the patients are described below. This

study analysed 13 patients with SCD. As described in Table 1, mean age of the patients was 29 (SD 7.33) years old with more than half (53.8%) being males. The prevalence of patients who had blood transfusion was 46.2% (n=6) with a mean frequency of unit was 1.43 (SD 0.98). Normal chest x-ray findings were found in the majority of the patients (75%) while bilateral infiltration was detected among 2 patients. Positive COVID-19 patient was detected among 2 patients. 2 (15.4%) required intubation. Regarding disposition, 69.2% of patients were admitted and the rest were discharged (30.8%). The median day of hospital stay was 6 days (range 2 – 10 days).

Table 1 Demographic and clinical attributes of the patients [(n=13)]

Study data	N (%)
Age group in years (mean ± SD)	29.0 ± 7.33
Gender	
Male	07 (53.8%)
Female	06 (46.2%)
Blood transfusion	
Yes	06 (46.2%)
No	07 (53.8%)
Number of units (mean ± SD)	1.43 ± 0.98
Chest x-ray findings	
Normal	09 (75.0%)
Unilateral infiltration	01 (08.3%)
Bilateral infiltration	02 (16.7%)
COVID-19 swab	
Positive	02 (15.4%)
Unknown	11 (84.6%)
Intubation	
Yes	02 (15.4%)
No	11 (84.6%)
Disposition	
Admission	09 (69.2%)
Discharged	04 (30.8%)
Admission	
Ward	08 (61.5%)
ICU	03 (23.1%)
Duration of the hospital (days)	
Mean ± SD	5.22 ± 3.23
Median (min-max)	6.00 (2.00 – 10.0)

Table 2 Clinical and laboratory readings of the patients between admission and discharged patients [(n=13)]

Variables	Overall Mean ± SD	Disposition		P-value [§]
		Admission Mean ± SD	Discharged Mean ± SD	
SBP	115.5 ± 20.6	117.2 ± 25.0	111.5 ± 1.29	0.664
DBP	77.3 ± 16.5	72.6 ± 17.7	88.0 ± 5.42	0.123
Pulse rate	92.2 ± 8.29	93.1 ± 8.28	90.0 ± 9.13	0.556
Respiratory rate	21.8 ± 2.92	22.4 ± 3.09	20.2 ± 2.06	0.226
Thermometer	36.9 ± 0.45	36.8 ± 0.53	36.9 ± 0.19	0.566
SPO2	93.2 ± 8.06	91.9 ± 9.52	96.2 ± 0.96	0.391
Ph	7.37 ± 0.04	7.38 ± 0.05	7.34 ± 0.01	0.238

PCO2	38.6 ± 4.81	38.0 ± 5.70	40.0 ± 1.41	0.513
HCO3	19.7 ± 2.59	20.1 ± 3.02	18.7 ± 0.96	0.406
PO2	39.8 ± 8.28	40.3 ± 9.91	38.7 ± 3.20	0.765
LAC	1.58 ± 0.79	1.68 ± 0.95	1.37 ± 0.22	0.551
Hgb	7.45 ± 2.03	7.45 ± 2.04	--	--

§ P-value has been calculated using an independent sample t-test.

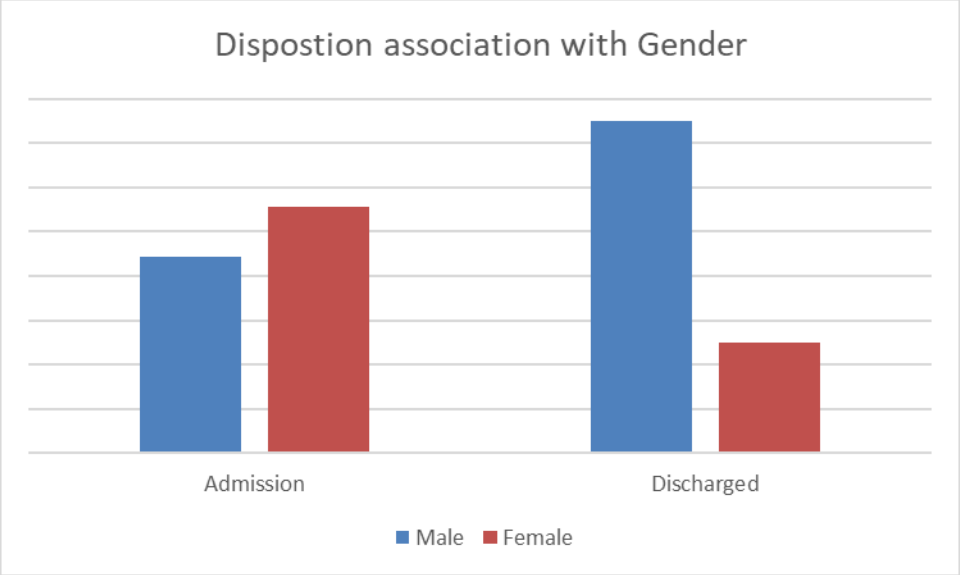
In Graph 1, the association between disposition and gender was highlighted, which showed higher males discharge rate. In Table 2, the mean values of SBP and DBP were 115.5, 77.3 while the mean values of Pulse rate, respiratory rate and thermometer were 92.2, 21.8, and 36.9. In addition, the mean values of SPO2, Ph, PCO2, HCO3, PO2, LAC and Hgb were 93.2, 7.37, 38.6, 19.7, 39.8, 1.58 and 7.45, respectively. When comparing the clinical and laboratory values of admission and discharge, the results revealed that significant differences were not found in all laboratory parameters between admitted and discharged patients (all p>0.05). In Table 3, increasing age was more associated with discharged patients (p=0.025) while blood transfusion was more associated with admission (p=0.026). Gender showed no significant association between admission and discharge (p=0.559).

Table 3 Association between disposition and the basic demographic characteristics (n=13)

Factor	Disposition		P-value §
	Admission N (%) (n=9)	Discharged N (%) (n=13)	
Age group in years (mean ± SD)	26.1 ± 5.88	35.5 ± 6.40	0.025 **
Gender			
Male	04 (44.4%)	03 (75.0%)	0.559
Female	05 (55.6%)	01 (25.0%)	
Blood transfusion			
Yes	06 (66.7%)	0	0.026 **
No	03 (33.3%)	4 (100%)	

§ P-value has been calculated using Fischer Exact test.

** Significant at p<0.05 level.



Graph 1 The disposition association in accordance with gender.

4. DISCUSSION

Our study offers crucial clinical data on variables influencing the clinical picture in SCD and COVID-19-infected patients. We included sequentially identified COVID-19-infected SCD patients who presented to the hospital. We measured factors and vital signs and discovered the determinant of the clinical course of the disease. In the study, there were thirteen SCD patients (53.8% male's vs 46.2% females) with a mean age of 29 years old.

According to our findings, SCD patients were not at high risk for developing a serious infection from COVID-19 as all of the patient's vitals were mild on admission and discharge. These results were not consistent with the current data shocking because it is well known that SCD patients are more likely to have a severe illness from viral infections, particularly influenza, which can worsen as a result of pathophysiological alterations unique to sickle cell disease (Strouse et al., 2010). The mild course found in our study is, however, similar to other studies, In SCD paediatrics, COVID-19 had a mild clinical course, and many studies showed that COVID-19 had a mild to moderate clinical presentation in SCD adults (Bundy et al., 2010). According to a literature review, children with SCD and COVID-19 had a death rate of 2.1%; however, the international SCD registry, reported that the mortality rate for paediatric COVID-19 patients was 0.3% (Vilela et al., 2021).

In our study, the mortality rate was zero as all of the patients were discharged with no complications. This could be due to the fewer number of patients as this rate is similar to in other published datasets up to this point (Beerkens et al., 2020; Chakravorty et al., 2020; De Luna et al., 2020; Hussain et al., 2020; McCloskey et al., 2020; Nur et al., 2020). This could be because SCD patients are more inclined to seek medical attention than their non-sickle cell counterparts since they have a higher knowledge of the recognized risk of the condition during times of infection. The mortality rate of sickle cell disease/COVID-19 patients in our analysis lends more evidence to this. Future studies are required to ascertain if access to care or the length of time spent with COVID-19 therapy affects results for the entire population.

Significant differences in the laboratory parameters between admitted and discharged patients ($p>0.05$) were observed. On the other hand, we found increasing age was more associated with discharged patients while blood transfusion was more associated with admission ($p=0.026$). This is consistent with the literature (Stettler et al., 2015). This is attributed to the increased potential of serious illness in patients who had previous blood transfusions. Additionally, two patients (15.4%) required intubation. In one thousand hospitalized confirmed COVID-19 patients from New York City, the percentage of ICU admission rate was 23.6%, while 21.1%the mortality rate was 21.1% (Argenziano et al., 2020). This is a comparable picture with the sickle cell patients, although, no difference was not statistically significant in our study.

Although it is limited to one institution and so reflects the community of patients getting care at the hospital institutions, the current study employed data from Saudi health care Covid19 databases and is therefore broadly generalizable. Additionally, stale patterns in the pandemic and treatments received, which may affect outcomes, were not taken into consideration in our study. Moreover, the fewer SCD patients included in the study who developed COVID-19 which is the potential for a type II statistical error as a result of poor power is the primary drawback of this observational research. Future national and international studies with more participants are needed.

5. CONCLUSION

In conclusion, our study offers crucial clinical data on variables influencing the clinical picture in SCD and COVID-19-infected patients. We included sequentially identified COVID-19-infected SCD patients who presented to the hospitals. In the study, there were thirteen SCD patients (53.8% male's vs 46.2% females) with a mean age of 29 years old. According to our findings, SCD patients were not at high risk for developing a serious infection from COVID-19 as all of the patient's vitals were mild on admission and discharge. Significant differences in the laboratory parameters between admitted and discharged patients ($p>0.05$) were observed. On the other hand, we found increasing age was more associated with discharged patients while blood transfusion was more associated with admission ($p=0.026$). This is consistent with the literature. Finally, the fewer number of SCD patients in the study who developed COVID-19 which is potential for a type II statistical error as a result of poor power is the primary drawback of this observational research. Future national and international studies with more participants are needed.

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Author's contributions

Principal investigator: Mahmoud sulubalsomali: orchestrated and supervised the whole project and participated in all steps of the research from proposal writing to the conclusion; Co-author: Osama M Binbakheet: Participated in all the steps of the research from proposal writing to the conclusion; Mohammad Salem Alshammari: was in charge of Proposal writing and data collection and contributed to most of the steps of the research from proposal writing to the conclusion; Raffan Abdullah Alghamdi: was in charge of final introduction writing and data collection and contributed to most of the steps of the research from proposal writing to the conclusion; Sara Adel Aljumaan: was in charge of questionnaire formulation, data collection and analysis and data collection and contributed to most of the steps of the research from proposal writing to the conclusion; AbdulAziz Abdullah Al Tamimi: was in charge of discussion and conclusion writing and contributed to most of the steps of the research from proposal writing to the conclusion; lyana nabeelabdrabalnabi: Participated in questionnaire formulation, data collection and analysis and contributed to most of the steps of the research from proposal writing to the conclusion; Almaha Bassam Albalwi: Participated in questionnaire formulation, data collection and analysis and contributed to most of the steps of the research from proposal writing to the conclusion; Eliya Hussain Almubarak: participated in discussion and conclusion writing and contributed to most of the steps of the research from proposal writing to the conclusion; Mannar Mohammad Saud Al Masaud: Participated in questionnaire formulation, data collection and analysis and contributed to most of the steps of the research from proposal writing to the conclusion.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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