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**COVID-19 Vaccination Status and Disease Burden in Patients with Sickle Cell Disease**

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**Abstract Background:** Patients with sickle cell disease (SCD) are immunocompromised due to impaired splenic function, dysfunctional antibody production and opsonization, and defects in complement activation leading to increased susceptibility to infections (PMID: 19497774). Therefore, severe acute respiratory syndrome coronavirus 2, also known as COVID-19, may potentially cause severe complications in patients with SCD. The clinical course of COVID-19 infection in SCD has been described in larger cohorts with disease severity varying widely among patients (PMID: 34882837, 33570644). The COVID-19 vaccines have been used since becoming available in late 2020 but data regarding COVID-19 vaccination status, efficacy, and safety in patients with SCD is lacking. The purpose of this study is to investigate COVID-19 vaccination acceptance rates and its efficacy and safety in SCD.

**Methods:** A total of 535 adults (age ≥ 18 years old) with the diagnosis of SCD who had encounters at the University of Illinois Hospital and Health Sciences System (UIHealth) between January 1st, 2021 and December 31st, 2021 were included in this retrospective study. Demographic information, COVID-19 vaccination status, COVID-19 infection and other relevant clinical information were collected. The COVID-19 vaccination status for residents in Chicago was collected from the official website of the city of Chicago. Univariate analyses of patient characteristics were conducted using the Kruskal-Wallis test for continuous variables and the Chi-square test for categorical variables. Stepwise logistic regression analysis was used to identify clinical correlates of COVID-19 vaccination status and infection.

**Results:** In this retrospective cohort, 52.3% received at least one dose and 48.6% completed the primary series of COVID-19 vaccination by December 31, 2021 (Figure 1). This vaccination rate is lower than that of the general African American population (64.7% and 59.1%, respectively). Older age, being employed or a student, and previous influenza immunization history were significant predictors of COVID-19 vaccination completion (Table 1). Approximately 23% of the patients contracted COVID-19 infection with the highest incidence in patients with a higher number of acute healthcare encounters. COVID-19 vaccination decreased the infection risk by 70% (OR 0.311, 95%CI: 0.127-0.766, p = 0.01), but no significant difference in COVID-19 infection severity was found in patients with versus without COVID-19 vaccination. The incidence of side effects associated with COVID-19 vaccination was evaluated by comparing the number of ACC/ED/hospitalization after receiving the vaccine to the same time period in the previous year. No significant difference was found for each dose received (for the 1st door dose: p = 0.105; for the 2nd dose: p = 0.143; and for the 3rd dose: p = 0.397).
Summary: We conclude that COVID-19 vaccination did not cause significant side effects and was effective in patients with SCD, but the completion rate is not ideal considering the greater need for vaccination in this patient population. Our findings further emphasize the importance of developing strategies to address vaccination hesitance in patients with SCD.

Figure 1. COVID-19 Vaccination rates in Sickle Cell Disease

Table 1. Independent Clinical Correlates of Receiving COVID-19 Vaccines

|                          | Odds Ratio | 95% CI        | P value |
|--------------------------|------------|---------------|---------|
| Age (10 years)           | 1.533      | 1.253 – 1.876 | <0.001  |
| Employment/student       | 3.574      | 2.077 – 6.149 | <0.001  |
| Received flu shot in     | 7.334      | 4.437 – 12.122| <0.001  |
| either 2020 or 2021      |            |               |         |

A stepwise ordinal logistic regression analysis was performed of categories of receiving COVID-19 vaccine or not. The covariates originally placed into the analysis were age, gender, national ADI score, distance to the closest pharmacy, being employed or a student, and receiving flu shot. Age, being employed or a student, and receiving flu shot remained in the regression model after covariates with P > 0.20 were eliminated from the model in a stepwise manner. N=535.

Figure 1.

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