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Research Article

Assessment of Crises Severity in Sickle-Cell Anemia Patients using Hydroxyurea Drug-West of Sudan

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ABSTRACT

Objective: This study was designed to assess crises in Sickle-anemia patients who using hydroxurea as treatment in West of Sudan *via* an estimation of blood parameters and Hemoglobin F (HbF) levels.

Methods: A descriptive, cross-sectional study was done in Heglih hospital, West Sudan. A total of 115 SCA patients were included in this study; 73 of them used hydroxurea and don't use. We compared results of both group with 50 healthy individual.

Results: The results showed that the level of Hb F in SCA patients residing inside the petroleum area was significantly higher than patients who live outside the petroleum area ($p<0.001$), it was also elevated in controls residing outside the petroleum area. Also this study proved that 25% of patients had no symptoms, but the rest of the patients had symptoms ranging between haemolytic crises (43%), vasoocclusion crises (26%), and both hemoylytic and vasooclussive crises (7%).

Conclusion: Hydroxyurea therapy should, in our opinion, be regarded standard-of-care for SCA and an important part of patient management. Early hydroxyurea treatment and widespread use will change the natural course of SCA, allowing affected children to enjoy longer and better lives.

Keywords: Sickle cell anemia; Sickle cell crises; Haemoglobin F; Oilfields

INTRODUCTION

Sickle cell anemia, also known as Sickle Cell Disorder (SCD), is the most common hereditary condition in the world. It is a life-threatening disease defined by molecular abnormalities in haemoglobin. Sickle cell anemia is a serious illness that affects a wide range of medical and surgical disciplines. Sickle-cell disease is a type of sickle-cell disease occurs when a person inherits two faulty copies of the haemoglobin gene, one from each parent. Multiple haemoglobin subtypes exist depending on the exact mutation in each haemoglobin gene. There are no.to as carriers for a person with a single aberrant copy. Although it is widely assumed that this illness is linked to extremely high child mortality, accurate current data is unavailable. We had reviewed published and unpublished African data on mortality linked with SS illness, with a focus on two types of studies: Cross-sectional population surveys and cohort studies. We have concluded that, although current data are inadequate to support definitive statements, they are consistent with an early-life mortality of 50% to 90% among children born in Africa with SS disease. More precise estimates of the number of deaths among children with SCD should improve the inclusion of SCD interventions in child survival policies and initiatives in Africa. Sickle Cell Disease (SCD) is linked to a high rate of childhood mortality in Africa, ranging from 50% to 90%, although there is a shortage of trustworthy, up-to-date information [1].

In sickle cell anemia, Hydroxyurea (HU) is utilized as a treatment (SCA). HU has been shown in numerous trials to improve patient quality of life by lowering symptoms. The effect of HU on erythrocytes, on the other hand, is little understood. In individuals with SCA, we looked at numerous markers linked to oxidative stress and total lipid content of erythrocytes [2].

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Over the last several decades, hydroxyurea has become a well-tolerated and effective disease-modifying drug for children and adults with Sickle Cell Anemia (SCA). Hydroxyurea is presently the standard of care treatment for SCA, according to the National Institutes of Health, the American Society of Hematology, and the British Society of Haematology [3]. Hydroxyurea possesses many of the features of an ideal medication for Sickle Cell Anemia (SCA), and it provides therapeutic efficacy through numerous routes. Over the previous 25 years, there has been a lot of experience with SCA patients in terms of safety and efficacy. Early proof of principle investigations were followed by prospective phase 1/2 trials revealing effectiveness in affected individuals [4].

Sickle-Cell Disease (SCD) causes cells to take on an uneven, stiff, and sickle-like shape under certain circumstances. Sickle cell illness is linked to a variety of acute and chronic health issues, including severe infections, excruciating pain attacks ('sickle cell crisis,') and stroke. There is a higher chance of death. Fortunately, new medicines are in late-stage clinical trials, with more on the way, providing hope for this tragic disease with an ever-increasing worldwide burden [5].

Fetal hemoglobin differs from adult hemoglobin in that it may bind oxygen with greater affinity than adult hemoglobin, allowing the developing fetus to get more oxygen from the mother's bloodstream [6].

Clinical and epidemiological investigations have revealed important information about the function of HbF in reducing the clinical consequences of SCD, which is a serious public health problem that affects both people and society [7].

MATERIALS AND METHODS

A total of 150 children aged 2 years to 7 years old were enrolled in this cohort research. One hundred of the youngsters were diagnosed with sickle cell anemia and were admitted to Heglig Hospital in West Sudan, and remaining were normal. Sickle cell disease patients and written agreement to participate in the trial were required for enrollment. If a patient had a chronic condition (s) that could affect the outcomes, they were excluded. All patients and their parents were given an explanation of the study method, and written informed consent was obtained. For all children, specific questionnaires were created, and demographic data such as age, sex, and sickness duration were recorded. Moreover, we recorded clinical manifestations of patients such as pain crisis, severity of pain, chest pain syndrome, number of hospitalizations, number of specialist visits due to pain, and rate of transfusion, and we collected 2.5 mL of EDTA venous blood from them. Blood tests such as CBC, Hb electrophoresis, and HbF measurement were also performed for all patients and repeated periodically. After then, hydroxyurea 10 mg/kg/day was given for a year. The dosage of hydroxyurea was decided based on the pediatric section's assessment of the patient's endurance and weight. Patients were referred to Heglig Hospital for their medicine on a monthly basis during this time. The pediatric section kept a careful eye on them in case any tests or measurements needed to be repeated. At the conclusion of the trial, all tests were repeated, and any possible HU-related side effects were assessed and recorded. SPSS version 21 was used to analyze the data. Continuous data was given as mean SD, whereas categorical data was provided as numbers (percent). To compare categorical variables, we utilized the Chi square test. The significance threshold was set at 0.05.

RESULTS

All samples from the test groups passed the sickling test, and electrophoresis indicated that they were homozygous HbSS. HbF values were 4.7 (2.0), 0.8 (0.1), and 0.4 (0.3) in patients on hydroxyurea (we compared hydroxyurea at a fixed dose (about 20 mg per kilogram of body weight per day), patients not taking hydroxyurea, and controls, respectively (Table 1). The results showed that patients who treated with hydroxurea had crises less severe than those who not used it (Table 2). The hospital statistical records and test group data show three types of SCA crises: Haemolytic, vasoocclusive, or these two presented concurrently. A haemolytic crisis was seen in 24% of patients living inside petroleum area, and 24% in patients living outside the petroleum area, all patoents living inside oil area. Vasoocclusion was seen in 25% of the group living inside the petroleum area and 29% of those living outside. Mixed haemolytic and vasoocclusive crises were seen in 7% in patients who living inside oilfields, but 36% of in patients who living outside oilfields. 25% of patients living inside oilfields showed no crises, but 12% had similar features in two groups (Tables 3-5).

Group	Age(Mean ±)
SCA patients treated with hydroxyura	6.31 ± 3.06
SCA patients not treated with hydroxyura	5.66 ± 2.80
Haelthy control	5.51 ± 0.85

Table 1: Mean ± for participants ages of study groups.

Group	(Mean ± SD)	P value
Patients used hydroxyurea	04.72 ± 02.05%	<0.001

Control patients not used hydroxura area	00.58 ± 00.12%	0.108
Controls healthy people	00.45 ± 00.27%	<0.001

Table 2: HbF and P-values within study groups. (Mean ± SD).

Group	Crises onset	Hospitalization	Transfusion
Patients used hydroxyurea	01.89 ± 01.72	02.19 ± 01.82	01.06 ± 01.47
Control patients not used hydroxura area	05.11 ± 02.59	06.57 ± 02.25	01.92 ± 02.17
Comparisons	**P value**	**P value**	**P value**
	<0.001	<0.001	0.026

Table 3: Statistical differences between patients using hydroxura and patients not used and healthy control.

CBC Parameters	SCD patients treated with hydroxyurea	SCD patients Nottreated with Hydroxyurea	P value
Hemoglobin level	9.10 ± 0.79	6.88 ± 1.74	0
Red blood cells count	3.22 ± 0.37	2.83 ± 0.59	0.01
Total leucocyte count	7.52 ± 3.24	15.49 ± 4.87	0
Packed cell volume	30.66 ± 3.72	22.51 ± 4.77	0
Mean cell volume	94.01 ± 61.62	81.46 ± 8.57	0
Mean corpuscular hemoglobin	28.77 ± 2.62	25.08 ± 2.92	0
Mean corposcular hemoglobin concentration	29.90 ± 1.81	30.92 ± 4.08	0.163
Reticulocyte count	3.33 ± 4.30	30.92 ± 4.08	0
Platelet count	165.30 ± 1.81	443.92 ± 77.8	0

Table 4: CBC (Mean ±) for SCA patients treated and not treated with hydroxyurea.

CBC Parameters	SCD patients treated with Hydroxyurea	Healthy Control	P value
Hemoglobin Level	9.10 ± 0.79	12.72 ± 1.43	0
Red Blood Cells Count	03.22 ± 0.37	4.46 ± 0.58	0.01
Total leucocyte count	07.52 ± 3.24	6.49 ± 1.98	0
Packed Cell Volume (PCV)	30.66 ± 3.72	38.36 ± 3.88	0

Mean Cell Volume (MCV)	94.01 ± 61.62	86.37 ± 7.19	0
Mean Corpuscular Hemoglobin (MCH)	28.77 ± 2.62	28.66 ± 0.79	0
Mean Corpuscular Hemoglobin concentration (MCHC)	29.90 ± 1.81	32.42 ± 4.68	0.163
Reticulocyte count	03.30 ± 4.30	00.55 ± 00.80	0
Platelet count	165.30 ± 53.94	245.06 ± 53.68	0

Table 5: CBC (Mean ±) for SCA patients treated with hydroxyurea and healthy control.

DISCUSSION

SCD is a well-known type of haemoglobinopathy. No significant difference was seen between male and female patients. This study showed that the mean HbF ratio in patients used hydroxurea treatment was higher than patients not used also higher than control with a significant P value<0.001 (Table 1). In a randomized, placebo-controlled clinical trial, treatment with Hydroxyurea (HU) reduced crisis rates in adult patients with severe sickle cell anemia. No serious acute toxicity was seen, but the safety of long-term therapy could not be evaluated. The rationale for the use of HU was based on its ability to increase fetal Hemoglobin (HbF) synthesis and the inhibitory effect of HbF on polymerization of sickle cell hemoglobin [8]. The placebo-controlled trial of HU in adult SS hemoglobinopathy patients (the Multicenter Study of Hydroxyurea in Sickle Cell Anemia) reported in May 1995 that HU therapy reduced significantly the frequencies of severe pain episodes, acute chest syndrome, and transfusion [9]. There was a statistically significant reduction (83%) in the number of blood unit's transfused per annum 12 after post-HU therapy [10]. Hydroxyurea is effective and safe in SCA children in Jos, Nigeria. The findings could strengthen educational programme aimed at improving the utilization of hydroxyurea among SCA children [11]. In our opinion, hydroxyurea therapy should be considered standard-of-care for SCA, representing an essential component of patient management. Early initiation and broader use of hydroxyurea will alter the natural history of SCA, so affected children can live longer and healthier lives. In addition, hydroxyurea use should be extended to low-resource settings such as sub-Saharan Africa, where the burden of SCA and the need for hydroxyurea is arguably the greatest [12]. Hydroxyurea decreases the severity of anemia in some patients, and it may decrease the frequency of vaso-occlusive crises. Its short-term hematologic toxicity is minimal [13]. The Multicenter Study of Hydroxyurea (HU) in Sickle Cell Anemia (MSH) previously showed that daily oral HU reduces painful sickle cell (SS) crises by 50% in patients with moderate to severe disease. The morbidity associated with this disease is known to have serious negative impact on the Overall Quality of Life (QOL) of affected individuals. Treatment of SCD with HU improves some aspects of quality of life QOL in adult patients who already suffer from moderate-to-severe SS [14]. The recent observation that mortality rates for older children with SCA have not changed in 20 years indicates the need for new approaches to disease management, especially regarding therapeutic intervention. At the current time, curative therapy with stem cell transplantation remains an unavailable option to most patients with SCA, although newer successful approaches may increase interest in this modality. Until something better becomes available that has a similar wide spectrum of efficacy and safety, hydroxyurea appears to be the best available treatment option for children and adolescents with SCA [15].

CONCLUSION

Patients with SCC in Western areas of Sudan who used hydroxyurea showed a substantial decrease in the frequency of crises. The level of hospitalization (total of admission days during crises) was substantially reduced in SCD patients. Hydroxyurea therapy should, in our opinion, be regarded standard-of-care for SCA and an important part of patient management. Early hydroxyurea treatment and widespread use will change the natural course of SCA, allowing affected children to enjoy longer and better lives.

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ETHICAL APPROVAL

The Directorate of Health Affairs of the Sudanese state of South Kurdufan gave ethical approval to this study. Prior to participating, each participant received an information leaflet and a consent form. All participants were told that participation was completely voluntary and that they could refuse to answer any questions if they didn't want to. They were free to interrupt the interview and leave whenever they wished, with no consequences. According to this study, all participants' consent forms included the distribution of anonymised responses.

CONFLICT OF INTEREST

The author declares that there are no conflicts of interest.

AUTHORS CONTRIBUTIONS

Tariq E. Elmissbah carried out the experiments and wrote the manuscript

REFERENCES

1. Grosse SD, Odame I, Atrash HK, Amendah DD, Piel FB, Williams TN. Sickle cell disease in Africa: A neglected cause of early childhood mortality. Am J Prev Med. 2011;41(6):S398-405.
2. Reno CO, Barbosa AR, de Carvalho SS, Pinheiro MB, Rios DR, Cortes VF, et al. Oxidative stress assessment in sickle cell anemia patients treated with hydroxyurea. Ann Hematol. 2020;99:937-945.
3. Nader E, Grau M, Fort R, Collins B, Cannas G, Gauthier A, et al. Hydroxyurea therapy modulates sickle cell anemia red blood cell physiology: Impact on RBC deformability, oxidative stress, nitrite levels and nitric oxide synthase signalling pathway. Nitric Oxide. 2018;81:28-35.
4. Agrawal RK, Patel RK, Shah V, Nainiwal L, Trivedi B. Hydroxyurea in sickle cell disease: Drug review. Indian J Hematol Blood Transfus. 2014;30:91-96.
5. Adekile A. The genetic and clinical significance of fetal hemoglobin expression in sickle cell disease. Med Princ Pract. 2021;30(3): 201-211.
6. Akinsheye I, Alsultan A, Solovieff N, Ngo D, Baldwin CT, Sebastiani P, et al. Fetal hemoglobin in sickle cell anemia. Blood. 2011;118(1):19-27.
7. Steinberg MH. Fetal hemoglobin in sickle hemoglobinopathies: High HbF genotypes and phenotypes. J Clin Med. 2020;9(11):3782.
8. Paikari A, Sheehan VA. Fetal haemoglobin induction in sickle cell disease. Br J Haematol. 2018;180(2):189-200.
9. Papassotiriou I, Kister J, Griffon N, Stamoulakatou A, Abraham DJ, Marden MC, et al. Modulating the oxygen affinity of human fetal haemoglobin with synthetic allosteric modulators. Br J Haematol. 1998;102(5):1165-1171.
10. Barbara j. Bain, Imelda bates, S. Mitchell lewis. Practical hematology, 2017;288(14).
11. US Environmental Protection Agency 2002. Air Trends. 2000.
12. World Health Organization. Turning the tide of malnutrition: Responding to the challenge of the 21st century. 2000.
13. MGH physician, former colleague to receive Inventor of the Year award. 2023
14. Power-Hays A, Ware RE. Effective use of hydroxyurea for SCA in low-resource countries. Curr Opin Hematol. 2020;27(3):172.
15. Adewoyin AS. Management of sickle cell disease: A review for physician education in Nigeria. Anemia. 2015.