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Research Article

Prompt blood transfusion is the only treatment option for correction of moderate to severe anemia in diabetic foot/leg ulcers: experience from a tertiary health facility in southeastern Nigeria

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Abstract

Background/introduction: Anaemia is a common complication in patients with diabetic foot/leg ulcers (DFU) and the severity of the anaemia is a predictor of non-healing ulcers, amputation and mortality. Identification and prompt treatment of cormorbid conditions such as anaemia play a critical role in the healing of DFUs. The objective of this study was to show that the identification and prompt correction of anaemia improved outcome in patients with DFU

Methods and methodology: This was a prospective study of a case series of 10 patients admitted and managed for various degrees of DFU with or without gangrene in the medical wards of Abia State University Teaching Hospital (ABSUTH), Aba, southeast Nigeria from June 1, 2024 to September 30, 2024.

Results: Ten patients (5 males and 5 females) were enrolled in this case series with a mean age of 56 ± 9.88 years and an age range of 35 to 68 years. Five of the patients who were not anaemic at admission and during hospitalization needed no blood transfusion for their wounds to heal completely while all the four patients who had moderate to severe anaemia at presentation and had foot ulcers with gangrene of their one or more digits (Keith Wagner grade 4) and required limited amputations received several units of blood transfusion. The fifth patient who was anaemic at presentation but no gangrene (Keith Wagner grade 2) received only one unit of blood.

Conclusion/Recommendation: This study has shown that moderate to severe anaemia at presentation or while hospitalization of diabetic foot ulcer with gangrene of the digit(s) required prompt blood transfusions before healing of the wound could occur. It is, therefore, recommended that diabetic patients with foot ulcers must continually be assessed for any form of anaemiaand promptly transfused if moderate to severe anaemia is present.

Keywords: Anaemia, blood transfusion, diabetic foot/leg ulcer, Nigeria, treatment option.

INTRODUCTION

Prevalence of DM is rising[1], more so, in sub–Saharan Africans[2]as a result of ageing of the population, improving survival of people living with diabetes, physical inactivity, resultant obesity, increased urbanization and westernization of their diets. Diabetes mellitus is projected by the WHO to rise to 625 million people world-wide[3]by the year 2045from 425 million in 2017.

Complications of DM include the acute metabolic and chronic complications, the latter include the microvascular (involving the eyes, kidneys and the nerves) and the macrovascular complications which constitute the main causes of death in DM. Diabetic foot ulceration (DFU) is a serious and very common complication of DM and it is estimated that 25% of people living with diabetes are at risk of developing DFU during their lifetime. Prevalence of DFU ranges from 4.6% in Jordan[5], 10% in Nigeria, with a quarter of the newly diagnosed patients presenting with the complication[6]to as high as 15% in the United States[7]. In a hospital-based study in Southeastern Nigeria[8], Nkpozi et al noted that 18.03% were admitted on account of diabetic foot ulcers and the mortality among the diabetic admissions with foot ulcers was 20%. Diabetic foot ulcers are caused by one or a combination of the following pathophysiological factors – vascular complications (micro- and macrovascular complications), chronic hyperglycemia, foot deformity, sensory polyneuropathy, active infection, altered foot

biomechanics, chronic inflammation and impaired immunity[9].

In their retrospective, cross sectional study involving 1673 participants, anaemia[10] was found in 14% of the study group and the prevalence of DFU was 8%. It is also reported that about 15% of people with DM will eventually develop a DFU and 14-24% of these patients will require amputation due to ulcer related complication[11]. In their multicenter study[12], anaemia was present in 180 (53.6%) of the subjects that had DFU with 88 (48.9%) of them requiring blood transfusion. In the same report, anaemia was significantly associated with poor wound healing ($p<0.009$), amputation ($p<0.036$) and risk of death ($p<0.034$). Meanwhile, earlier study[13] have reported that the prevalence of anaemia in patients with DFU is over 50%. In another study, it was reported that the prevalence of anaemia in patients with DFU[14] was as high as 51.8 – 85.3% and the rate of adverse outcome was even higher[15]

The same study by Gezawa et al[12]in Nigeria concluded and suggested that future studies should explore whether prompt correction of anaemia in subjects hospitalized for DFU would improve outcome. This case series is an effort to fill up that gap in knowledge whether prompt blood transfusions in diabetic patients with foot/leg ulcers with moderate to severe anaemia is the only treatment option that is beneficial and affects the outcome in that situation.

METHODS AND METHODOLOGY

Study design and Location

We carried out a prospective study on 10 adult patients with DFU of various severity admitted into the medical wards of ABSUTH, Aba. Aba is an epicenter of commercial activities in the Southeastern region of Nigeria and ABSUTH is the only state tertiary health facility in the city. She gets referrals from all the primary and secondary health facilities in Aba. There are 60 beds and 2 isolation wards in the medical wards. Medical in-patients are admitted from the accident and emergency unit, medical out-patient clinic, transfers from the wards of the other specialties of the hospital such as Surgery and Obstetrics/Gynecology. The Department of Internal Medicine, ABSUTH, Aba has Consultants in the subspecialty units in the department with resident doctors and house officers. All the diabetic patients admitted with foot/leg ulcers were managed by the Diabetes and Endocrinology unit of the Department of Internal Medicine. There are other support units in the medical wards such as the nursing unit, medical records, pharmacy section and the cleaners.

Inclusion criteria

Diabetic patients admitted in the medical wards between 1st June and 30th September 2024 on account of diagnoses of DFU/leg ulcers and aged 15 years and above were included in the study. All diabetic patients admitted in the medical wards for hyperglycemic emergencies precipitated by foot/leg ulcers within the study period were included in the study.

Exclusion criteria

Diabetic patients who had moderate to severe anaemia from other illnesses such as diabetic nephropathy, sickle cell diseases, leukemia, bone marrow failures or were Jehova witness members or who signed against being part of the study were excluded from the study. We did this to avoid confusions as these patients already have a known cause of anaemia in them or refuse blood transfusions on religious grounds.

Recruitment/Data Collection

Between June 1, 2024 and September 30, 20t24, eighteen patients that met the inclusion criteria were enrolled to participate in the study. The following data were obtained from the patients: age, gender, grade of DFU (keith Wagner grading), haemoglobin at presentation or while being hospitalized, total number of pints of blood given and outcome of treatment. The outcome measures for the study were improved and healed, died, discharged against medical advice (DAMA) or transferred to another specialty outside the medical wards or to another health facility. It is important to note that eight patients who enrolled in the study withdrew voluntarily on account of demands for blood donation at some stages in the study.

Statistical Analysis

Data collected for the study were entered into and analyzed with Statistical Package for Social Sciences (SPSS Inc. Chicago IL. USA) version 23.0 statistical software. Mean values and standard deviations (SD) were calculated for continuous variables such as the ages of the study participants and the means were compared using independent two samples t-test. Frequency of the sex and outcome of medical ward treatment were categorical variables in the study which were summarized using proportions expressed in percentages. The level of statistical significance was set at $p < 0.05$.

RESULT:

Ten diabetic patients (5 males and 5 females) who had various severity of anaemia were recruited in this case series with a mean age of 56 ± 9.88 years and an age range of 35 to 68 years. Five patients (50%) were not anaemic at presentation and throughout the period of hospitalization and needed no blood transfusion for their wounds/ulcers to heal while all the other five patients who had ulcer with gangrene in one or several of their digits (4) and needed limited amputations received several units of blood transfusion (Table 1).

Patients	Required blood?	Severity of ulcer (keith wagner grading)	No of units of blood	Outcome of hospital treatment
No anaemia in 5 of the patients with DFU	No	2	None	improved
Anaemia: Patient A	Yes	2	1	improved
Patient B	Yes	4	3	improved
Patient C	Yes	4	8	improved
Patient D	Yes	4	10	improved
Patient E	Yes	4	3	improved

Key: DFU = diabetic foot ulcer

Presence of anaemia was proportional to the severity of the ulcer (keith wagner grading system). Eight enrolled participants withdrew voluntarily from the study for various reasons such as Discharge Against Medical Advice, blood requirements etc

DISCUSSION:

The main findings of this study were that varying degrees of anaemia was present in patients with diabetic foot ulcers which was proportional to the severity of the ulcer. Again, diabetic patients with moderate to severe anaemia at presentation or who developed anaemia during hospitalization required blood transfusion of one or several pints of blood before complete healing of the ulcer/wound could take place.

In the index study, about 50% of the participants in the study received blood transfusions before their wound could heal. This is comparable to the Gezawa et al[12]multicentre study where it was reported that anaemia was present in 180 (53.6%) of their subjects with 88 (48.9%) of them requiring blood transfusion. Similarly, this finding is in tandem with the study from a Specialist Foot care centre in Pakistan that reported a prevalence of anaemia of 51.8-85.3% in DFU patients. Again, severity of the foot ulcer in the current study was similar to the reports by Yammine et al[13]who noted in their systematic review and meta-analysis that severity of anaemia affected the severity of DFU, is a predictor of amputation, non-healing ulcer and mortality. The patients in this study who received blood transfusion belonged majorly to Keith Wagner grade 4 and needed limited amputation of the digits. This degree of anaemia in the index study could have arisen from the nutritional deficiencies self-inflicted by the patients as a result of the food restrictions imposed on the patients to curb chronic hyperglycaemia which is characteristic of DM. It is possible that many of the diabetic patients may be anaemic because of the aforementioned reasons before the onset of the ulcers.

Anaemia in the index study could have resulted from nutritional causes, anaemia of chronic inflammation, blood loss from limited amputations and debridement and dilutional anaemia because most of the patients needed fluid replacement arising from dehydration due to hyperglycaemic emergencies. It is, also, important to note that when anaemia was corrected with the required pints of blood, feeding augmented and the anabolic effects of insulin taken advantage of, formation of granulation tissues was massive and wound healing progressed smoothly. The 50% of the patients who were not anaemic at presentation to the hospital were encouraged to feed well, placed on oral haematinics and insulin therapy. No other forms of correction of anaemia including parenteral iron administration and parenteral erythropoietin were prescribed for the recipients of blood except blood transfusions.

In addition, Gezawa et al[12]opined that future studies should explore whether prompt correction of anaemia in subjects hospitalized for DFU would improve outcome. The index study was an answer to that opinion/hypothesis. This study is ongoing as the small number of patients in this case series was a strong factor against it. Meanwhile, in the current study, the rapidity of granulation tissue formation and wound healing once anaemia was promptly corrected suggests strongly that prompt blood transfusion is all that is needed for wound healing to occur in DFU patients complicated by moderate to severe anaemia. This study can be extrapolated to conclude that healing of wounds of patients with DFU occurs when anaemia is corrected, there is improvement in their general body health, improved nutrition, removal of sloughs and infections which hindered wound healing.

In conclusion, presence of anaemia in a patient with DFU deprives the injured tissues of enough oxygen, nutrients, minerals and antioxidants necessary for granulation tissues to form. Correction of moderate to severe anaemia in DFU patients via any other options such as oral elemental iron and folic acid supplementation, parenteral iron and erythropeitin, blood tonics and nutritional supplements was not effective as they all needed time (120 days) for red blood cell production to take place.

CONCLUSION/RECOMMENDATIONS

This study has shown that anaemia is very common in people living with diabetes complicated by DFU, the severity of the foot ulcer was proportional to the extent of anaemia and that prompt blood transfusions are necessary to correct moderate to severe anaemia in them. It is, therefore, recommended that clinicians/physicians should have a high index of

suspicion for anaemia as a complication of DFU and promptly correct it.

Ethical Approval: This was obtained from the Abia State University Teaching Hospital's Health Research Ethics Committee before the study commenced.

Author's Contributions:

- Dr Marcellinus O. Nkpozi - Conception and design of the research, drafting of the manuscript and taking care of the overall responsibility for the study.
- Dr Nzechukwu GI – collection, collation and analysis of the data.
- Dr Ubani BC and Dr Okeke IM - interpretation of the data and statistical analysis.
- Dr Onwuchekwa UN and Dr Bozimo GE - Final approval and critical revision of the manuscript.

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