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Morphological classification of anaemia among first-time blood donors in Northwest Nigeria and the implication of empirical haematinics therapy

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ABSTRACT: Anaemic donors in Nigeria are often empirically treated with haematinics without investigations. We studied morphological pattern of anaemia among first-time donors in Kano, Nigeria and reviewed the clinical implications of empirical use of haematinics with respect to morphology. Haematological parameters of 182 first-time prospective blood donors with anaemia were determined and morphological classification of the anaemias were undertaken based on red cell indices. Out of 182 anaemic donors, 56.6% had microcytic hypochromic anaemia, 19.2% had macrocytic anaemia, 17.6% had dimorphic anaemia and 6.6% had normocytic normochromic anaemia. The heterogeneous pattern of morphological classes of anaemia was indicative of diverse aetiological factors, hence empirical therapy with haematinics may ineffective or hazardous in many cases of anaemia among first-time blood donors in Nigeria. It is therefore necessary for blood banks in Nigeria to have standard guidelines for investigating anaemic donors before embarking on therapy.

Key Words: Anaemia; Haematinics; Blood donors.

Introduction

The World Health Organization recommends that blood donation should in all cases be absolutely voluntary. However, in Nigeria, voluntary donors are relatively scarce, hence family replacement and commercial donors have become major sources of blood[1,2]. The suitability of prospective donors should be determined by a pre-donation assessment of general health, medical and social history, weight and blood pressure[3]. Healthy persons who are between the ages of 18 and 65 years with haemoglobin (Hb) levels of not less than 13.5 g/dl in males or 12.5 g/dl in females are acceptable as donors if they test negative for transfusion transmissible infections, but pregnant and lactating mothers are not accepted for allogeneic blood donation[3]. Moreover, in developed nations that have well established blood transfusion services, donors are routinely subjected to extensive assessment of their biochemical and haematological parameters to allow sufficient insight in to the donors' health.

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The Nigerian national blood transfusion service is still at a formative stage and can not satisfy the national requirement for donor blood. Hence the responsibility of donor recruitment and testing is virtually relegated to individual hospital blood banks where prospective donors are routinely tested for infectivity markers of syphilis, hepatitis B and C as well as HIV 1 and 2, but the only routinely measured pre-donation haematological parameter is the Hb level, which is usually determined as an isolated parameter by CuSO4 gravimetric method or the HemoCue photometric method. Most Nigerian blood banks do not have standard guidelines for dealing with prospective donors who fail the pre-donation Hb estimation due to anaemia. In most cases, such persons are simply deferred as donors and empirically treated with iron and folic tablets based on the assumption that their anaemia is due to iron or folic acid deficiency without further investigations. This practice is rampant in most blood banks but is commoner in rural and secondary health care institutions that usually lack established clinical and laboratory haematology services. This practice emanated from the fact that previous studies on donor anaemia were essentially conducted on donor groups comprising predominantly of regular repeat donors in whom the anaemia was almost entirely microcytic hypochromic attributed to iron depletion secondary to repeated donations[4]. However, we believe that the pattern of anaemia among first-time donors (donation naïve) maybe different as it would not be a mere reflection of iron deficiency due to previous donations.

In this paper we studied the haematological parameters and red cell indices of anaemic first-time prospective blood donors and reviewed the clinical implications of empirical use of haematinics in Kano, northwest Nigeria.

Materials and Methods

This is a prospective study conducted during the year August 2007 to July 2008 at the blood bank of Aminu Kano Teaching Hospital (AKTH), Kano, northwest Nigeria. Donors were routinely tested for infectivity markers of syphilis, hepatitis B and C as well as HIV 1 and 2[3]. Pre-donation Hb levels were estimated using the HemoCue 301 System (USA), and minimum Hb levels of 13.5g/dl and 12.5g/dl were used as cut-off values for male and female donors respectively[3].

All first-time prospective voluntary and family replacement blood donors that passed the infectivity makers screening but failed the Hb estimation test were studied. Commercial donors were not included in this study. The age and gender of donors were documented and venous blood sample (2 ml) was taken in EDTA anticoagulant from each subject and processed by Celltac Alpha MEK 6400 blood analyzer, which determined the full blood count parameters including the levels of Hb, red cell indices (MCV, MCH and MCHC), red cell distribution width (RDW), white blood cell (WBC) and platelet counts. In this study, normal ranges of red cell indices were taken as MCV: 76-96fl, MCH: 27-32 pg and MCHC: 30-35 g/dl[5].

The subjects were categorized into three groups based on their red cell indices: normocytic normochromic if they had normal indices, microcytic hypochromic if they had low indices and macrocytic if they had high indices. The normal range of RDW in this study was taken as 11.5%-14.5%[5]. WBC and platelet counts were evaluated separately for each of the three categories. In each case, Leishman stained blood film were reviewed in order to confirm auto-analyzer results and verify red cell morphology[6]. Dimorphic anaemia was diagnosed if dual red cell populations were seen on blood film[6]. The mean and standard deviation of each of the haematological parameters studied were determined using computer soft ware SPSS version 11.0. Statistical comparisons of mean values were based on Student's t-test and a p-value of less than 0.05 was taken as significant.

Results

During the period of study, a total of 1,502 first-time blood donors, all of them males, were received at the blood bank out of which 182 (12.1%) were deferred due to anaemia. Out of the 182 anaemic donors, 81 (44.5%) were voluntary and 101 (55.5%) were family replacement donors. The demographic and haematological profiles of the anaemic donors are shown on Table 1.

Out of the 182 donors studied, 103 (56.6%) had microcytic hypochromic anaemia, 35 (19.2%) had macrocytic anaemia, 32 (17.6%) had dimorphic (microcytic/macrocytic) anaemia and 12 (6.6%) had normocytic normochromic anaemia. There were no significant differences ($p>0.05$) between the mean ages for the donors that had microcytic

hypochromic anaemia (29 years), macrocytic anaemia (31 years), dimorphic anaemia (29 years) and normocytic normochromic anaemia (30 years). Similarly, there were no significant differences ($p>0.05$) between the mean Hb concentrations for the donors that had microcytic hypochromic anaemia (9.5g/dl), macrocytic anaemia (9.3g/dl), dimorphic anaemia (9.5g/dl) and normocytic normochromic anaemia (9.4g/dl). Donors with microcytic hypochromic, macrocytic and dimorphic anaemia had elevated RDW with mean ± SD values of 17.5 ± 0.5%, 17.1%± 0.4% and 21.3± 0.6% respectively, while donors with normocytic normochromic anaemia had normal RDW with mean ± SD values of 13.3 ± 0.5%.

Table 1: Demographic and Haematological Parameters of Anaemic Blood Donors

	Microcytic Hypochromic Anaemia	**Macrocytic Anaemia**	**Dimorphic (microcytic/ macrocytic) Anaemia**	**Normocytic Normochromic Anaemia**
No. of Donors Affected (%)	103 (56.6)	35 (19.2)	32 (17.6)	12 (6.6)
Age (Mean± SD)	29± 2.5	31± 3	29± 3	30± 1.5
Hb (g/dl)	9.5± 0.5	9.3± 0.4	9.5± 0.4	9.4± 0.4
MCV (fl)	71± 3	108± 5	89± 5	88± 5
MCH (pg)	25± 1.1	36± 1.3	31± 1.2	30± 1.2
MCHC (g/dl)	28± 1.2	32.5± 1.2	32.1± 1.1	32.7± 1.1
RDW (%)	17.5 ± 0.5	17.1 ± 0.4	21.3 ± 0.6	13.3 ± 0.5
WBC Count ($x10^9$/L)	5.8± 1.2	3.5±1	5± 1.3	6± 1.3
Platelet Count ($x10^9$/L)	450± 45	245± 25	220±25	250±30

The WBC counts of donors with microcytic hypochromic anaemia ($5.8x10^9$/L), dimorphic anaemia ($5x10^9$/L) and normocytic normochromic anaemia ($6x10^9$/L) were comparatively similar ($p>0.05$), while the mean WBC count of donors with macrocytic anaemia ($3.5x10^9$/L) was significantly lower than the corresponding values for donors in the previous three classes of anaemia ($p<0.05$). The platelet counts of donors with macrocytic anaemia ($245x10^9$/L), dimorphic anaemia ($220x10^9$/L) and normocytic normochromic anaemia ($250x10^9$/L) were comparatively similar ($p>0.05$), while the platelet count of donors with microcytic hypochromic anaemia ($450x10^9$/L) was significantly higher than the corresponding values for donors in the previous three classes of anaemia ($p<0.05$).

Discussion

The finding of average ages of about 30 years for our subjects was a reflection of the demographic structure of Nigeria as a developing nation with a relatively young population in comparison to the developed countries[7]. Furthermore, despite general reluctance for blood donation among Nigerians, the younger people are relatively more amenable to donor recruitment campaign. The absence of female subjects in this report was a reflection of the general low level of blood donation among the female population in Nigeria. Despite the fact that blood donation is acceptable from healthy females that are not pregnant or breast-feeding, there is a misconception in the general Nigerian population that women are not eligible to donate blood[7].

This study revealed that 12.1% of our prospective first-time blood donors had anaemia of varied morphological classes. The finding of average Hb levels of about 9g/dl in this study indicated that the subjects suffered mild to moderate anaemia that could not be accounted for by previous blood donations as the subjects were first-time prospective donors. This result is in keeping with previous studies, which revealed that up to 19.5% of apparently healthy Nigerian male adults had asymptomatic mild to moderate anaemia the prevalence of which was related to poor socio-economic conditions[8,9]. The predominance of microcytic hypochromic anaemia in this study was

consistent with the fact that iron deficiency, which is the main cause of microcytic hypochromic anaemia, is also the commonest form of anaemia all over the world[10]. The African nations including Nigeria are particularly affected by iron deficiency due to poverty, poor nutrition and blood loss due to parasitic infections[8,10]. Although thalassaemia trait does significantly contribute to the prevalence of mild microcytic hypochromic anaemia in Nigeria, the finding of elevated RDW in our subjects suggested that iron deficiency rather than thalassaemia trait was the cause of the anaemia[5,11]. Moreover, the finding of an elevated mean platelet count among donors with microcytic hypochromic anaemia was also indicative of the presence of iron deficiency as previous reports had revealed that thrombocytosis was a regular feature of iron deficiency[10,12].

Up to 19.2% of our anaemic donors had macrocytic anaemia, the main causes of which could be megaloblastic anaemia due to folate or vitamin B_{12} deficiencies[13]. However, folate deficiency is more common than vitamin B_{12} deficiency as a cause of macrocytic anaemia in Nigeria[8]. Whereas folate deficiency could be due to poverty and poor nutrition with low intake of green vegetables, vitamin B_{12} deficiency is mainly caused by malabsorption that can be accentuated by poor diet with low content of dairy products and other rich sources of vitamin B_{12}[13]. The finding of a relatively lower mean WBC count in this group of patient was consistent with previous studies in which leucopenia was reported to be a common feature of megaloblastic anaemia[13]. Dimorphic anaemia with dual populations of microcytic hypochromic and macrocytic red cells, which affected 17.6% of our anaemic donors was suggestive of combined iron and folate or vitamin$_{12}$ deficiencies. This was interpreted to be a reflection of poor diet with multiple nutrients deficiencies consistent with low socio-economic status. In contradistinction to the other classes of anaemia that are usually caused by nutrient deficiencies, normocytic normochromic anaemia, which affected 6.6% of our anaemic donors is generally causally related to chronic infections and inflammatory diseases[14]. Chronic infections and inflammations depress erythropoiesis by causing storage iron blockade and attenuating erythropoietin production[14]. The occurrence of normocytic normochromic anaemia in our donors was a reflection of the endemicity of chronic and recurrent infectious diseases including tuberculosis, malaria and HIV/AIDS in Nigeria as a developing nation[15].

The heterogeneous pattern of morphological classes of anaemia seen in this study is indicative of the existence of diverse aetiological factors. Hence, uniform and empirical use of iron and folic in the management of first-time donors with anaemia could have adverse implications in some cases. Such an empirical treatment would benefit those with microcytic hypochromic anaemia since they need iron to synthesize haemoglobin, and folic acid would not cause harm in iron deficient subjects. However, empirical administration of folic acid to donors with macrocytic or dimorphic (microcytic/macrocytic) could potentially result in undesirable consequences. This is because while folic acid would beneficial subjects with macrocytic anaemia due to folate deficiency, it is potentially harmful to subjects with macrocytic anaemia due to vitamin B_{12} deficiency. Folic acid had been reported to precipitate neurological complications in subjects with vitamin B_{12} deficiency[13,16]. Therefore, the empirical use of folic acid in cases of macrocytic anaemia should only be under taken after specific investigations have ruled out the existence of vitamin B_{12} deficiency[13,16]. The empirical use of iron and folic acid in subjects with normocytic normochromic anaemia would be totally ineffective and inappropriate since the anaemia was not caused by nutrient deficiencies. Such patients should be promptly investigated with the aim of identifying and treating any underlying infectious or inflammatory diseases[14]. This is particularly important in a developing nation such as Nigeria where chronic infections such as tuberculosis are endemic with high prevalence[15].

Conclusion

Morphological classification of anaemia in prospective first-time blood donors in northwest Nigeria revealed a heterogeneous pattern suggestive of diverse aetiological factors. Hence, uniform and empirical use of iron and folic in the management of anaemia in first-time blood donors could be ineffective and it might have adverse implications in some cases. It is therefore necessary for all blood banks in Nigeria to have standard guidelines for investigating anaemic donors in order to find the precise causes of their anaemia before embarking on treatment. Appropriate investigations and treatment of anaemia will go along way in shortening the period of donor deferral and promoting donor retention, both of which are essential in Nigeria where donor scarcity is a major problem in the practice of transfusion medicine.

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