Research Article

Prevalence and pattern of anemia among persons reported for blood donation at a tertiary care center in western part of Rajasthan

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Abstract

Background: In current medical and surgical practice, blood transfusion can be a vital, life-saving remedy. But it requires an adequate supply of safe blood from a healthy donor. For this, proper healthy and safe donor selection is necessary. Most common cause of deferral in blood donation is anemia.

Objective: To assess the prevalence and pattern of anemia in blood donors.

Materials and Methods: This study was conducted during the period from February 2015 to June 2015 in Sardar Patel Medical College, Department of Transfusion Medicine. The study included 11,635 volunteers who reported to donate blood. Hemoglobin estimation was done by using HemoCue 301. Morphology of anemia was estimated by peripheral blood film examination and complete blood count. Serum ferritin was estimated by electrochemiluminescence. All the data were tabulated and statistically analyzed by using SPSS software.

Result: Overall incidence of deferral was 7.5%. The prevalence of anemia among donors was 1.7%. The prevalence of anemia among female donors was higher than male donors (26.4% vs. 1.1%). Mild anemia (67%) was the most common type of anemia. Most common morphological type of anemia was microcytic hypochromic anemia (57%). Iron deficient anemia (62.5%) was the most common cause of anemia.

Conclusion: Female donors particularly of the reproductive age group were more commonly affected than male donors. The data of our study showed that there was a need to understand the problem and to educate the regular donors regarding iron deficiency and iron supplementation.

KEY WORDS: Blood donor, anemia, hemoglobin, blood bank

Introduction

In current medical and surgical practice, a blood transfusion can be a vital, life-saving procedure. But it requires an adequate supply of safe blood from a healthy donor. For this, proper healthy and safe donor selection is necessary in addition to the laboratory screenings of blood bags for infectious diseases. However, deferrals of donors lead to loss of precious blood components available for transfusion. For preventing this, we should have the knowledge about the causes of permanent and temporary deferral and it should be practically implemented for safe donor selection. Blood donors are deferred because of several reasons, either temporarily or permanently. Deferrals can be categorized as temporary short term (1–56 days), temporary long term (57–365 days), and multiple years/permanent (more than 365 days).[1]

A majority of the donor population in a developing country, such as India, is deferred because of temporary but easily correctable cause—anemia. Nutritional anemia is a worldwide problem with the highest prevalence in developing countries

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such as India. By far the most common cause of nutritional deficiency is iron deficiency (ID), 50% of anemia is attributable to ID. ID anemia (IDA) accounts for 841,000 deaths annually worldwide. Africa and part of Asia bear 71% of the global mortality burden.[2]

All donors should be screened for anemia before donation.[3] The minimal hemoglobin cutoff for donor selection was set at 12.5 g% for both male and female donors.[4] Donors with low hemoglobin level were deferred from donation to protect them from developing IDA after a donation and to guarantee that blood units for transfusion met the required standards for hemoglobin content. Each unit of transfused whole blood or packed red cells is expected to increase hemoglobin by about 1 g/dL in a patient of 70 kg weight and who is not having active blood loss.[5] In this study, we aim to assess the prevalence of anemia in our otherwise healthy donor population by estimating the frequency of donor deferral because of anemia. We have also assessed the severity and morphologic type of anemia and serum ferritin level in case of anemia.

Materials and Methods

This prospective study was conducted at Department of Immune Hematology and Transfusion Medicine, Sardar Patel Medical College and Associated Group of Hospitals, Bikaner (Rajasthan), among volunteers who reported to donate blood at the blood bank and outdoor voluntary blood donation camps during the period of February 2015 to June 2015. The study included 11,635 volunteers who reported to donate blood. The study was based on the donor selection criteria laid down by the Drug and Cosmetic Act of India. Informed consent was obtained from all the participants before enrolling into the study. Each donor was evaluated based on the detailed medical history and brief physical examination of donors with regard to hemoglobin, blood pressure, temperature, and pulse rate. Otherwise healthy persons but with the hemoglobin level less than 12.5 g% were deferred and were further studied. Hemoglobin estimation was performed by HemoCue method. Venous blood samples were collected in ethylenediaminetetraacetic acid (EDTA)-anticoagulated tubes and plain tubes from the persons whose hemoglobin was less than 12.5 g% by HemoCue method. Peripheral blood film was prepared and stained with Leishman's stain and examined for morphological typing of anemia. The EDTA-anticoagulated blood was used for complete blood count. The complete blood count was carried out by using fully automated hematology analyzer. Samples collected in the plain tubes were allowed to clot and the serum was obtained. This serum was tested for ferritin level estimation by electrochemiluminescence.

Result

Of the total 11,635 persons who presented for blood donation, 866 were deferred because of various reasons giving an overall incidence of 7.5%. Three most common causes for deferral were low hemoglobin (23.1%), low body weight (12.4%), and high blood pressure (8.0%). The prevalence of anemia among donors was 1.7%. Female donors had a very high prevalence of anemia compared with male donors (26.4% vs. 1.1%). Table 1 shows general profile of donors. Mild anemia (67%) was the most common type of anemia according to severity of anemia. Table 2 shows that the most common morphological type of anemia was microcytic hypochromic anemia seen in 114 (57%) donors. Table 3 shows that IDA (62.5%) was the most common cause of anemia.

Discussion

This study was conducted to assess the prevalence and pattern of anemia among otherwise healthy persons reported for blood donation, which is one of the most common causes of donor deferral in the developing countries, even in studied conducted in Western countries. Hemoglobin assessment is an important criterion for blood donor selection. There is no consensus among blood banks on the best method for anemia screening among blood donors. In hospitals and laboratories, the gold standard for hemoglobin estimation is the use of automated hematology analyzer. Screening tests for potential blood donors, however, require quicker, easier, and more cost-effective testing methods that do not require a venipuncture and cause minimal discomfort to the donor. Three tests that are commonly used for primary screening are copper sulfate method, HemoCue, and Microhematocrit. Despite conflicting reports, it has been observed that HemoCue is the method of choice for initial screening of anemia because it is reliable, portable, and easy to use in poor resource settings without requiring extensive training of health workers.[6] Although the use of the unique disposable cuvettes makes this method relatively expensive, the cuvettes for the new HemoCue Hemoglobin 301 version are cheaper than those used for the HemoCue Hemoglobin 201 and are designed for adverse climatic conditions. It is fast and very simple to use so that the cost may be offset by saving on training and supervision time.[7] That is why at our center, we used HemoCue as primary screening method, but the results were ultimately confirmed by running the EDTA venous sample of the persons deferred because of low hemoglobin on an automated analyzer.

In our study, the percentage of donors deferred because of anemia was 23.1%, which was comparable to Chauhan et al.[8] (24.11%) and Mangwana[9] (25.68%). In a blood donation program, where the majority of blood donors were first-time donors it was also a reflection of the prevalence of anemia in the adult population in the community. The prevalence of anemia in our study population was much lower than the prevalence reported in the general population (1.7% vs. 79.2%),[10] probably as majority of our donors were adult males (male donors, 97.6%; female donors, 2.4%). The prevalence of anemia in our study (1.7%) was in accordance with the prevalence of anemia (1.8%) reported by Bahadur et al.[11] in their study, where also the male donors constituted majority of the donor population (male donors, 98.3%; female donors, 1.7%).

Table 1: General profile of donors

Total no. of donors	11,635
Gender distribution	
Males	11,355 (97.6%)
Females	280 (2.4%)
Total no. of deferrals	866 (7.5%)
Deferrals due to anemia	200 (23.1%)
Prevalence of anemia in donors	1.7%
Prevalence of anemia in male donors	1.1%
Prevalence of anemia in female donors	26.4%

Table 2: Morphological types of anemia

Morphological type	Male	Female	Total
Microcytic hypochromic	60	54	114 (57%)
Normocytic normochromic	34	11	45 (22.5%)
Macrocytic normochromic	6	1	7 (3.5%)
Mixed cellular morphology	26	8	34 (17%)
Total	126	74	200 (100%)

Table 3: Causes of anemia

	Deferral due to anemia	Serum ferritin <15 ng/mL (IDA)	Serum ferritin >15 ng/mL (other causes)
Male	126	66	60
Female	74	59	15
Total	200	125	75

IDA, iron deficiency anemia.

The prevalence of anemia was higher among female donors than male donors (26.4% vs. 1.1%).

The most common morphological type of anemia was microcytic hypochromic anemia (114 [57%]), which was in accordance with Joshi et al.[12] (55.53%) and Ahmed et al.[13] (56.6%). Among the 114 cases with microcytic anemia, 82 (71.9%) persons with anemia had IDA (serum ferritin <15 ng/mL), this shows that IDA was the most common cause of microcytic hypochromic anemia. Among the 86 cases with nonmicrocytic type of anemia, 43 (50%) had IDA. This shows that IDA was more common in people with microcytic anemia as compared with those with nonmicrocytic anemia. Tiwari et al.[14] also reported that IDA was more common in persons with microcytic anemia as compared with those with nonmicrocytic anemia. Among the 200 persons with anemia, 125 (62.5%) had IDA, which was in accordance with Fauci et al.[2] (50% of anemia was due to ID). This shows that ID was the most common cause of anemia. In our study, mild anemia was the most common type of anemia (67%). Bahadur et al.[6] also reported that mild anemia was the most common type of anemia (72.5%).

The hemoglobin (gm/dl) and serum (ng/ml) ferritin was found to be lower among the female donors (8.97 ± 1.44 and 12.43 ± 19.24) than the male donors (9.82 ± 1.97 and 18.31 ± 15.85). Our findings were consistent with the previous report by Erhabor et al.,[15] which stated that the hemoglobin, packed cell volume, and ferritin were significantly higher among the male donors (14.2 ± 2.0, 44 ± 4.0, and 78.02 ± 49.10) compared with female donors (12.35 ± 2.5, 42 ± 3.0, and 42.2 ± 32.13), which indicated that there was a significantly high prevalence of anemia among female donors. This may be due to menstrual losses, deliveries without proper intervals, abortions, and is compounded by the poor diet available to the women in many social settings in India. The number of persons with anemia was more in the age group of 18 to 40 years (because most of the donor population belonged to this age group), but mean hemoglobin and mean serum ferritin was lower in the age group of above 40 years. This shows that mean hemoglobin and mean serum ferritin decreases as the age increases. Yaranal et al.[3] reported that the comparison of serum ferritin levels in different age groups showed that the serum ferritin decreases as the age increases. The mean hemoglobin and mean serum ferritin were found to be lower in voluntary blood donors (9.36 ± 1.75 and 10.4 ± 2.03) than the replacement donors (15.07 ± 17.02 and 19.42 ± 18.44). Ali et al.[16] also reported that the hemoglobin and ferritin levels were significantly lower among regular voluntary remunerated blood donors (13.50 ± 0.00 and 34.88 ± 0.00) compared with family replacement donors (14.10 ± 2.40 and 74.12 ± 45.20), respectively. The mean serum ferritin level in first-time donors was 19.6 ng/mL (standard deviation [SD] = 19.72), which was higher than in donors of the groups II and III: 14.14 ng/mL (SD = 5.24) and 5.93 ng/mL (SD = 2.24), respectively. Yaranal et al.[3] reported that the mean serum ferritin level in first-time donors was 49 μg/L (SD = 25.85) in men and 21.59 μg/L (SD = 2.06) in women, which was higher than in the donors of the groups II, III, and IV: 45.74 μg/L (SD = 15.05) and 19.7 μg/L (SD = 4.06), 32.73 μg/L (SD = 19.06) and 18.35 μg/L (SD = 3.91), and 23.02 μg/L (SD = 12.05) and 8.5 μg/L (SD = 0.0), respectively. Comparing the concentration of serum ferritin in first-time and regular donors (groups II, III, and IV), it was seen that ferritin levels decreased with increasing number of donations.

Just determining the hemoglobin is not a good measure for the status of iron stores and it is not sufficient to ascertain the ability for donation. Measuring the ferritin level is the best test to evaluate the iron stores and can be used as a criterion to ascertain the donor's eligibility for donation. IDA accounted for only 62.5% of all the cases with anemia in this study, so there was a grave need to determine the serum ferritin levels before starting the oral iron supplementation because irrational use of iron supplementation can lead to various adverse effects of iron. Hence, serum ferritin evaluation needs to be included in predonation testing of blood donors. Assay of serum ferritin was recommended in first-time female donors for donor safety and in male voluntary donors if more than one donation is given per year. Furthermore, voluntary blood donors who donated more than once a year should receive iron supplement after assessment of the serum ferritin levels. Iron store depletion was a common side effect of whole blood donation. Early recognition and reversal of excessive iron loss may

avoid symptomatic iron store depletion in blood donors and may reduce the loss in voluntary donor pool because of IDA. So in our study, deferred donors with anemia were further made to undergo a workup for serum ferritin so that they can be appropriately treated. This shall be a major contribution toward improving public health and also in enabling and motivating prospective donors to return for blood donation.

Limitation of the Study

The study population was mostly dominated by adults (male donors) so the actual prevalence of anemia in general population was not reflected by this study. In our study, the serum ferritin estimation was done only in donors with anemia, not in all persons who came for blood donation, so persons with ID but haemoglobin >12.5 gm/dl were not deferred & can develop IDA by donating blood.

Conclusion

This study proved that female donors particularly of the reproductive age group were more commonly affected than male donors. Most common cause of anemia is the nutritional deficiency of iron. Rationalization and revalidation of the strategies should be done to educate, motivate, and treat donors deferred because of anemia/low hemoglobin, so that they can be recruited again. As the number of donations increased, there was a subsequent decrease in hemoglobin and serum ferritin. This showed that repeated blood donation induces iron depletion and IDA. IDA accounted for only 62.5% of all the cases of anemia in this study, so there was a grave need to determine the serum ferritin levels before starting the oral iron supplementation. Thus, this study showed the importance of measuring the serum ferritin.

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