EDORIUM Journals

Int J Blood Transfus Immunohematol 2022;12:100068Z02IL2022.
www.ijbti.com

RESEARCH ARTICLE PEER REVIEWED | OPEN ACCESS

Blood donation and anemia: A case report

Ilham Lemssahli, Khadija Hajjout, Abdelkader Belmekki

ABSTRACT

Introduction: Hemoglobin (Hb) testing before whole blood donation is one of the critical parameters of transfusion safety. It prevents the development of donation-induced anemia and avoids the collection of anemic donors. Blood collection from an anemic donor may expose him to complications and does not provide the recipient with the expected benefit about the risks involved. However, blood donation is made without prior Hb testing in Morocco.

Case Report: A 20-year-old woman who donated blood for the first time had a regular clinical examination. The donor presented a severe malaise following the donation, requiring hospital treatment. The donor had profound anemia following this donation.

Conclusion: Introducing pre-donation Hb testing is a requirement for the safety of the donor and the quality of the product transfused to the recipient.

Keywords: Anemia, Blood donation, Hemoglobin test

How to cite this article

Lemssahli I, Hajjout K, Belmekki A. Blood donation and anemia: A case report. Int J Blood Transfus Immunohematol 2022;12:100068Z02IL2022.

Article ID: 100068Z02IL2022

Ilham Lemssahli[1,2], Khadija Hajjout[1], Abdelkader Belmekki[2]

Affiliations: [1]Regional Blood Transfusion Centre–Rabat, Madinat Al Irfane, Avenue Allal Al Fassi, Rue Mfdel Charkaoui Institut, Rabat, Morocco; [2]Faculty of Medicine and Pharmacy, Med V University–Rabat, Morocco.

Corresponding Author: Ilham Lemssahli, MD, PhD in process in Health Sciences; Responsible for Hemovigilance in Regional Blood Transfusion Centre–Rabat, Morocco; Email: lem.ilham@hotmail.fr

Received: 28 December 2021
Accepted: 24 February 2022
Published: 23 March 2022

****

doi: 10.5348/100068Z02IL2022CR

INTRODUCTION

According to legal or regulatory standards, the determination of hemoglobin (Hb) levels in candidate blood donors is performed systematically in several countries [1]. The Hb level is the only pre-donation control that can prevent the development of donation-induced anemia and avoid collection in donors who are already anemic.

The impact of these donations is multi-faceted, on the one hand on the quality of the red blood cells intended for patients and on the other hand for the donors themselves, exposing them to physical and psychological complications [2].

A low Hb level is a deferral criterion for blood donors (BD). However, in Morocco, blood donation is made without prior Hb test, essentially by a limited physical assessment to determine whether the donor is suitable for blood donation, including ocular conjunctival examination to rule out any suspicion of anemia [3, 4].

This article aims to provide scientific arguments for the systematic introduction of the pre-donation Hb test to determine the ability for whole blood donation in blood centers and to complement it with other investigations.

CASE REPORT

We report a case of a 20-year-old woman (AA) who presented at the mobile site on November 17, 2021, for her first experience of whole blood donation. The medical examination of the donor and the medical and surgical history did not reveal any contraindications to complete blood donation.

The donor's blood pressure was 115/75 mmHg, weight was 53 kg, the examination of the ocular conjunctiva was normally stained.

During the donation, she became unwell, intensely pale, then lost consciousness afterward, which had led her to stop the blood donation immediately. The bag of blood was at 300 mL.

Initial treatment was carried out at the collection site and then transferred to the hospital as the donor's condition remained serious.

A blood cell count and ferritinemia levels were performed. Laboratory test results (Table 1) showed a significant microcytic hypochromic anemia with lymphopenia. A serum ferritin level of less than 1.50 ng/mL.

The analysis results indicated that the donor has severe iron deficiency anemia revealed by the blood donation.

Therefore, the hemovigilance coordinator conducted a thorough interview with the donor. The questioning revealed a clinical history favoring anemia did not research during the medical screening: the donor reported heavy menstrual bleeding lasting more than eight days, a feeling of permanent fatigue and a lack of appetite for some months.

Subsequently, the donor was prescribed 200 mg/day of iron for two months, followed by iron consolidation therapy.

Monthly blood tests controlled her anemia; the hemovigilance coordinator had also prescribed a ferritin level check and advised an iron-rich diet for her.

On 12/24/21, the donor made her first blood count control (Table 2). There was a clear improvement in blood count values from the first month of iron treatment.

Table 1: Blood cell count

Blood cell count	Result	Reference interval
Red blood cells	3.45 × 10^6/UL	(4.0–5.2)
Haemoglobin	5.1 g/dL	(11.5–15.5)
Haematocrit	20.0 %	(37–47)
MCV	58.0 µm^3	(79–99)
MCH	14.8 pg/dL	(27–32)
MCHC	25.5 %	(32–36)
RDW	22.7%	(11.0–14,5)
Circulating erythrocytes	0.1 pour 100 GB	
White blood cells	10.64 × 10^3 UL	(4.0–10.0)
Neutrophils	9.40 × 10^3/UL	(1.5–7)
Lymphocytes	0.82 × 10^3/UL	(1.0–4.0)
Monocytes	0.39 × 10^3/UL	(0.2–1.0)
Eosinophils	0.01 × 10^3/UL	(0.1–0.4)
Basophils	0.01 × 10^3/UL	(0–0.1)
Platelets	326 × 10^3/UL	(150–400)
Platelet immature fraction	39.3%	

Abbreviations: MCV: mean corpuscular volume; MCH: mean corpuscular hemoglobin; MCHC: mean corpuscular hemoglobin concentration; RDW: red cell distribution

DISCUSSION

The primary obligation of blood transfusion services is to protect the health of the donors. Indeed, good transfusion practice, legal or regulatory standards recommend assessing Hb levels during clinical screening before blood donation [1].

Table 2: Blood count control

Blood cell count	Result
Red blood cells	5.00 × 10^6/UL
Haemoglobin	11.2 g/dL
Haematocrit	39.7%
MCV	79.4 µm^3
MCH	22.4 pg/dL
MCHC	28.2 g/dL
RDW	12.3%
White blood cells	5.5 × 10^3/UL
Neutrophils	3.1 × 10^3/ULl
Lymphocyts	1.9 × 10^3/UL
Others	0.5 × 10^3/UL
Platelets	303 × 10^3/UL

Abbreviations: MCV: mean corpuscular volume; MCH: mean corpuscular hemoglobin; MCHC: mean corpuscular hemoglobin concentration; RDW: red cell distribution

The whole blood donation reduces the Hb level by 1 g/dL and a loss of approximately 320 mg of iron [5].

Pre-donation anemia occurs when the Hb level is below the regulatory threshold [1].

Hemoglobin monitoring

In France, according to European directives 2004/33/E.C., Hb testing is required for candidates, who have never donated blood, who have not contributed for two years, donors whose last sample analysis appeared with a Hb level at the limit of the thresholds, between 12 and 12.5 g/dL for women and between 13 and 13.5 g/dL for men, and for donors during the medical interview, reveal a clinical history in favor of anemia.

Before possibly donating blood, each new candidate will participate in a capillary Hb test measured with a portable hemoglobinometer. The cut-off level is 12 g/dL for women and 13 g/dL for men. This threshold is lower than other European Union countries, 12.5 g/dL for women and 13.5 g/dL for men [6].

A venous blood count will check this test if the Hb level is low [7]. Depending on the Hb test results, the donor can be declared able to donate blood or not capable, as the Hb level is too low and generates a temporary contraindication of six months.

When anemia is detected, the results are referred to the donor's doctor to identify the cause of the anemia [7].

In the United Kingdom, before donating, the Hb was assessed in a capillary sample. The minimally acceptable Hb level for whole blood donation is 13.5 g/dL for men and 12.5 g/dL for women.

If the donor has a low level, a secondary venous sample is taken and run through a Hemocue machine. Depending on the Hb thresholds, a donor suitability decision is made [8].

In Canada and Australia, the pre-donation Hb test uses a capillary Hb test as part of the donor qualification process. The Hb level must be at least 12.5 g/dL for women and 13 g/dL for men [9].

The Red Cross measures donor Hb on a capillary sample obtained from a fingerstick using a portable hemoglobinometer in the United States.

The US Food and Drug Administration (FDA) and the Association for the Advancement of Blood and Biotherapies (AABB) have redefined the minimum acceptable Hb level for voluntary allogeneic blood donation.

Since May 2016, male donors' minimum acceptable Hb threshold has been 130 g/dL (hematocrit, 39%) instead of 125 g/dL. As for women, the Hb acceptance threshold remains unchanged at 125 g/dL [10].

In Morocco, like other Maghreb countries, such as Tunisia and Algeria, blood donations are made without prior Hb testing.

The Moroccan blood transfusion is managed by Law n° 03-94 on the donation, collection and use of blood. According to this law, every donor passes a medical interview and a clinical assessment. The Hb test does not apply to blood donors; the only measures to protect the donor from blood donation-induced anemia are to limit donations. The frequency of blood collection is set at five times a year for men and three times a year for women, the minimum interval between donations is set at two months for men and three months for women [3].

However, many anemic donors go undetected at the medical screening and donate blood. Data from the Health Ministry shows that anemia remains a health problem in Morocco, especially for women. The prevalence of iron deficiency anemia in pregnant women is 37.2% and 32.6% in women of childbearing age [11].

Iron deficiency anemia

The most common cause of anemia worldwide is a martial deficiency. The reasons are prolonged lack due to inadequate dietary iron intake, increased requirements during growth or pregnancy, and increased losses due to menstruation. The World Health Organisation (WHO) recommends a daily intake of 60 mg for women of childbearing age [12].

Several studies focusing on blood donors have shown the severity of anemia in this population.

According to a prospective blood donor (BD) screening study of 15,797 volunteers in the Northern region of Morocco, the Hb level test in donors deemed suitable for donation by the consulting physician showed that 14.5% of women (n=1054) and 3.05% of men (n=245) were anemic at the time of donation. In 58.66% was microcytic hypochromic anemia, 31.64% was normocytic normochromic anemia and normocytic hypochromic anemia in 9.16% [13].

In a similar study, Toumi et al. had examined the blood counts of 1281 blood donor samples; they found that 8.6% of the donors were anemic, with a fourfold higher frequency in women. About 4% of donors had microcytosis correlated with anemia, 68% of which were due to martial deficiency. Iron deficiency anemia occurred 10-fold in women [14].

Another study of 396 voluntary blood donors in the Setif Blood Transfusion Centre in Algeria found that 10.11% of women (n=9) and 8.47% of men (n=26) were anemic at the time of donation. The anemia was normocytic normochromic in 48.57% [15].

In France, the pre-donation deferral rate for whole blood donors was approximately 2.8% due to anemia [5]. In Belgium, donors deferred for low Hb was approximately 2.8% and 9.08% of male and female donors, respectively [1].

In the United Kingdom, the deferral rate is approximately 1.9% in males and 4.4% in females due to anemia [8].

In Canada, low Hb, less than 125 g/L, had deferred 8% and 2% of women and men [9].

In the United States, The American Red Cross has reported that approximately 18% of women and 22% of men had Hb values <125 g/dL and were deferred temporarily from blood donation from July 2014 to June 2015 [10].

However, food fortification with iron has increased but has not prevented iron deficiency (ID) or (IDA) in persons with a high need for iron [16].

Blood donation in this already vulnerable population can cause or contribute to ID and IDA, with recurrent blood donation increasing the risk [17].

The National Health and Nutrition Examination Survey (NHANES 1999–2000) has reported the prevalence of iron deficiency in women aged 20–49 years before a blood donation at 12%.

Decreasing with the onset of menopause to 9% in women aged 50–69 years and 6% in women over 69 years. About 4% of the 20- to 49-year-old women with ID have also iron-deficiency anemia (IDA) [16, 18].

Iron-deficiency anemia is the final stage of iron deficiency, and Hb measurement alone is insufficient to detect blood donors with iron deficiency but without anemia [17, 19, 20].

Besides measuring Hb to protect donor health, some blood donation services are also moving toward measuring ferritin as part of routine testing to monitor iron stores accurately [1, 17]. For example, in Switzerland, ferritin values are determined in all whole blood donors at each donation, in addition to common infectious diseases [1].

In the United States, the American Red Cross performs a ferritin test for donors with a Hb result below 110 g/L and who have a Hb deficiency ≥ three times in 12 months [1].

Recent studies have provided data on the frequency and risk factors for iron deficiency in blood donors:

The Hb and Iron Recovery Study (HEIRS) have shown that 25–35% of regular donors develop iron deficiency [21].

The REDS-II donor iron status evaluation (RISE) study have demonstrated the effects of blood donation intensity on iron and Hb, have shown that there is a high prevalence of iron depletion in frequent blood donors [22].

Other studies have shown that ID is common and correlate strongly with the female gender, frequency of donation and a short inter-donation interval [1, 23, 24].

Goldman et al. reported that the prevalence of ID increases rapidly with donation frequency. Only 20% of women who donated four or more times a year before their blood donation had adequate iron stores. Few male donors are ID, and iron stores are much better maintained than female donors [25].

Iron deficiency anemia is a fundamental reason for blood donor deferral. Maintaining healthy iron levels will allow donors to safely continue donating, thereby ensuring a robust blood supply for patients in need [21].

Iron dietary or iron supplementation

A study by Goldman et al. reported that the vast majority of donor recommendations continue to highlight the importance of a balanced diet, and some give more specific advice on iron-rich foods, including heme-containing meats, and iron-rich vegetables [1].

However, many studies show that dietary recommendations alone do not protect against iron depletion [1].

Other studies have evaluated the effects of iron supplementation after blood donation.

The Recipient Epidemiology and Donor Evaluation Study-III (REDS-III) have measured the effect of low dose daily iron supplementation on the recovery time of Hb and iron lost after a unit of blood donation. The study has highlighted the importance of maintaining iron levels after blood donation and shows that the additional iron effectively restores Hb, even in donors with higher iron levels [26].

Kiss et al. evaluated the recovery time following the fall in post-donation Hb and ferritin after iron supplementation or non-supplementation. They found that supplemented donors recovered from iron loss more quickly than non-supplemented donors, 11 weeks versus more than 24 weeks for a return to the ferritin baseline level, the benefit of iron supplementation up to 50 ng/mL ferritin [26].

Cable et al. showed that an 8-week supplementation period allowed for complete recovery of iron loss from a whole blood donation and prevented long-term ID [27].

A more recent randomized controlled trial showed higher Hb and ferritin levels in iron-supplemented donors, as well as faster recovery of both [28].

Despite these studies, many blood donation services do not provide iron supplements to donors. The main reasons are cost, adverse effects of iron supplements, compliance, and ethical concerns [29].

CONCLUSION

Anemia is common in blood donors at higher risk of ID and the clinical consequences of this deficiency, especially women of childbearing age, donors whose Hb level is at just the threshold of eligibility and those who donate frequently. The blood transfusion services must protect the donor's health by ensuring an optimal donor experience and keeping donors returning to give blood. The prevention of donor anemia is an important challenge for the safety of the donor but also for the quality of labile blood products.

WE RECOMMENDED

1. Introduce a systematic pre-donation Hb test for blood donors in all Moroccan blood transfusion centers, which will protect them from the risk of anemia.
2. Identify already anemic donors and refer them to personal physicians for evaluation (as case report).
3. Further medical screening of blood donors to exclude anemia, especially menstruating women at risk of ID due to continuous blood loss, and advise them on an iron-rich diet.
4. Conduct a national study on the health effects of blood donation in whole Moroccan blood donors of their blood counts and ferritin levels.
5. Review the frequency of blood collection among regular donors.
6. Donor iron supplementation is an option to prevent an ID that Morocco needs to investigate.
7. We can secure the blood supply through these measures, protect donors from anemia and ID, and help donors give blood safely, thereby guaranteeing a robust supply for patients who need it.

REFERENCES

1. Goldman M, Magnussen K, Gorlin J, et al. International Forum regarding practices related to donor haemoglobin and iron. Vox Sang 2016;111(4):449–55.
2. Louati N, Ben Amor I, Cheri J, et al. Hemoglobine predon: Interet de l'hemofast. JI M Sfax N°19/20;Juin/Déc 10:20–24. [Available at: https://www.medecinesfax.org/useruploads/files/jim19-20-20-24.pdf]
3. M.S - Direction de la Réglementation et du contentieux. [Available at: https://www.sante.gov.ma/Reglementation/REGLEMENTATIONDESPRATIQUESMEDICALES/2-94-20.pdf]
4. Centre national de transfusion sanguine et d'hématologie. Référentiel des bonnes pratiques transfusionnelles. 3éme version. 2009.
5. Fillet AM, Gross S. Prevention of anaemia in blood donors. [Article in French]. Transfus Clin Biol 2017;24(3):143–7.
6. Vuk T, Magnussen K, De Kort W, et al. International forum: An investigation of iron status in blood donors. Blood Transfus 2015;15(1):20–41.

7. Contrôle du taux d'hémoglobine pré-don Quels enjeux dans un contexte de forte augmentation des besoins en produits sanguins? – EFS. [Available at: https://www.doc-developpement-durable.org]
8. https://www.blood.co.uk/news-and-campaigns/the-donor-autumn-2018/new-haemoglobin-test
9. The importance of iron for whole blood donors: A Canadian perspective. [Available at: https://professionaleducation.blood.ca/en/transfusion/publications/importance-iron-whole-blood-donors-Canadian-perspective]
10. Requirements for blood and blood components intended for transfusion or for further manufacturing use. [Available at: https://www.federalregister.gov/documents/2015/05/22/2015-12228/requirements-for-blood-and-blood-components-intended-for-transfusion-or-for-further-manufacturing]
11. Ministère de la Santé Rabat Maroc: Enquête nationale sur l'anémie par carence en fer, la supplémentation et la couverture des ménages par le sel iodé. [Available at: https://www.sante.gov.ma]
12. OMS. Directives: Supplémentation intermittente en fer et en acide folique chez les femmes menstruées Suisse. Genève: Organisation mondiale de la Santé; 2012.
13. Bakrim S, Ouarour A, Jaidann K, Benajiba M, Masrar A. Intérêt du dosage de l'hémoglobine prédon dans la sécurité transfusionnelle des donneurs de sang marocains au CRTS de Tanger et de Tétouan (nord-ouest du Maroc). Transfusion Clinique et Biologique 2017;24(3):323.
14. Toumi NH, Najjar MF, Boukef K. Blood donors and anemia. Rev Fr Transfus Hemobiol 1992;35(4):295–8.
15. Bounaas S. Intérêt du dosage de l'hémoglobine pré-don dans la sécurité transfusionnelle des donneurs. Transfusion Clinique et Biologique 2019;26(3):S38–9.
16. Newman B. Iron depletion by whole-blood donation harms menstruating females: The current whole-blood-collection paradigm needs to be changed. Transfusion 2006;46(10):1667–81.
17. Figueiredo MS. Anaemia and the blood donor. Rev Bras Hematol Hemoter 2012;34(5):328–9.
18. Centers for Disease Control and Prevention (CDC). Iron deficiency—United States, 1999–2000. MMWR Morb Mortal Wkly Rep 2002;51(40):897–9.
19. Cançado RD, Chiattone CS, Alonso FF, Langhi Júnior DM, Alves R de C. Iron deficiency in blood donors. Sao Paulo Med J 2001;119(4):132–4.
20. da Silva MA, de Souza RAV, Carlos AM, Soares S, Moraes-Souza H, de Araujo Pereira G. Etiology of anaemia of blood donor candidates deferred by hematologic screening. Rev Bras Hematol Hemoter 2012;34(5):356–60.
21. National Heart, Lung, and Blood Institute (NHLBI). Haemoglobin and Iron Recovery Study (HEIRS). [Available at: https://clinicaltrials.gov/ct2/show/NCT01555060]
22. Cable RG, Glynn SA, Kiss JE, et al. Iron deficiency in blood donors: The REDS-II Donor Iron Status Evaluation (RISE) study. Transfusion 2012;52(4):702–11.
23. Popovsky MA. Anaemia, iron depletion, and the blood donor: It's time to work on the donor's behalf. Transfusion 2012;52(4):688–92.
24. Goldman M, Uzicanin S, Scalia V, O'Brien SF. Iron deficiency in Canadian blood donors. Transfusion 2014;54((3 Pt 2)):775–9.
25. Goldman M, Uzicanin S, Osmond L, Scalia V, O'Brien SF. A large national study of ferritin testing in Canadian blood donors. Transfusion 2017;57(3):564–70.
26. Kiss JE, Brambilla D, Glynn SA, et al. Oral iron supplementation after blood donation: A randomized clinical trial. JAMA 2015;313(6):575–83.
27. Cable RG, Brambilla D, Glynn SA, et al. Effect of iron supplementation on iron stores and total body iron after whole blood donation. Transfusion 2016;56(8):2005–12.
28. Zalpuri S, Romeijn B, Allara E, et al. Variations in hemoglobin measurement and eligibility criteria across blood donation services are associated with differing low-hemoglobin deferral rates: A BEST Collaborative study. Transfusion 2020;60(3):544–52.
29. Smith GA, Fisher SA, Doree C, Di Angelantonio E, Roberts DJ. Oral or parenteral iron supplementation to reduce deferral, iron deficiency and/or anaemia in blood donors. Cochrane Database Syst Rev 2014;(7):CD009532.

****

Author Contributions

Ilham Lemssahli – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Khadija Hajjout – Analysis of data, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Abdelkader Belmekki – Analysis of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Guarantor of Submission

The corresponding author is the guarantor of submission.

Source of Support

None.

Consent Statement
Written informed consent was obtained from the patient for publication of this article.

Conflict of Interest
Authors declare no conflict of interest.

Data Availability
All relevant data are within the paper and its Supporting Information files.

Copyright