Iron Stores in Autologous Blood Donors

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Abstract

Depletion of body iron stores is a major factor limiting regular blood donation in volunteer donors. Autologous blood donors are requested to donate more frequently. To determine iron stores in autologous donors, 9 men and 10 women studied gave a total of 24 donations before their elective surgery (range 1-2 donations). All donors were tested for serum ferritin (SF) and hemoglobin (Hb) level. Iron supplements were taken by 88.89 per cent of men and 90 per cent of women. Mean SF before donations was 147.75 ng/mL in men and 53.19 ng/mL in women. After donations, mean SF decreased to 124.26 ng/mL in men and 38.81 ng/mL in women. None of them had depleted iron stores (SF≤15 ng/mL). In conclusion, iron supplementation was beneficial in maintaining body iron stores in autologous blood donors.

Key word : Autologous Donor, Serum Ferritin, Iron Store, Iron Depletion.

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Concern about blood transfusion associated diseases (hepatitis, AIDS, etc), alloimmunization and immunological incompatibility have led to the practice of autologous blood donation (ABD)[1]. Previous studies have demonstrated that this technique is generally effective in reducing homologous blood exposure, but not every patient will however, maintain a sufficient hematocrit (Hct) to donate enough blood to meet their needs at the time of surgery[1,2]. Moreover, ABD may cause iron loss induced by serial phlebotomy in a relatively short interval which could be one of the limiting factors in erythropoiesis[3]. In these patients, the risk of requiring additional homologous blood is increased.

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Previous investigations have demonstrated a close relation between serum ferritin (SF) level and size of body iron stores[4]. This study was undertaken to evaluate the risk of homologous blood exposure and iron stores in autologous donors undergoing elective surgery.

MATERIAL AND METHOD

Nineteen patients scheduled for elective surgery participated in this study: 10 women and 9 men (mean age, 29.8 years; range, 16-61). To be eligible for autologous blood donors, the patients had to be healthy and had a hematocrit level above 33 per cent. A total of 24 donations (range 1-2 units) were collected at the frequency of 1-week intervals, with the last donation being more than 72 hours before operation.

At each donation, not more than 13 per cent of donors' blood volume was taken. Blood samples were collected at the entry and subsequent visits and were analyzed for complete blood count by using Technicon H3 RTX (Bayer Diagnostic) or Cell Dyn 3500 (Abbott Diagnosis) and sera were stored at -20°C for determination of serum ferritin levels. The sera were thawed on the day of the assay and measured for ferritin levels by an automated microparticle enzyme immunoassay (MEIA) Axsym system, Abbott Laboratories, Abbott Park, IL. Each patient was placed on daily iron supplement. The diagnosis of depleted iron store was based on serum ferritin values of less than 15 ng/mL according to WHO cut-off levels.

RESULT

All patients included in this study successfully donated 1-2 units of blood in the 14-day period prior to operation. Their initial clinical and laboratory data are listed in Table 1. Distribution of elective surgical procedure is shown in Table 2. All had normal iron store at the beginning of autologous donation. None had depleted iron store after donations (Table 3).

Table 1. Clinical and laboratory data (mean and range) in autologous donor at the first visit.

	Values	
	Male	Female
Mean age, years	30	29.7
(range)	(16-61)	(16-48)
Mean weight, kg	60.2	53.8
(range)	(52-72)	(46-67)
Mean hemoglobin, g/dl	14.2	11.9
(range)	(13.0-15.2)	(10.8-13.7)
Mean serum Ferritin, ng/mL	149.8	53.2
(range)	(87.3-276.9)	(22.1-107.6)

Table 2. Distribution of elective surgical procedures in patients donating autologous blood.

	Number of Patients		Total
	Male	Female	
Orthopedic	1	2	3
Oral & Maxillofacial	8	4	12
Gynaecological	0	3	3
Abdominal	0	1	1
Total	9	10	19

DISCUSSION

The safety of autologous blood donation (ABD) may be presumed by the exceptional growth of this procedure, but further studies of the risks and benefits of ABD are still important. Since auto-

Table 3. Serum ferritin and Hb level (mean and range) in autologous donors before and after donations.

	Serum Ferritin (ng/ml)		Hemoglobin (g/dl)	
	Male	Female	Male	Female
Before Donation	147.75	53.19	14.2	11.9
	(87.28-276.90)	(22.05-107.63)	(13.0-15.2)	(10.8-13.7)
After 1st Donation	140.98	39.76	13.14	10.89
	(67.49-289.53)	(17.61-85.09)	(11.7-14.1)	(9.9-12.2)
After 2nd Donation	86.65	29.91	11.77	10.4
	(49.52-149.13)		(11.1-12.1)	

logous donors (AD) have underlying diseases, complications such as vasovagal attack and iron depletion that would be benign in homologous donors (HD) might be accentuated. Several studies reported a greater risk of preoperative autologous donations[5]. None of AD in the present study experienced reactions during phlebotomies. AD return to donate again sooner than HD but may not be able to donate an adequate amount of blood prior to operations because of Hct limitation. They subsequently required transfusion of homologous blood. Previous studies[1,2,6] demontrated that 9-35 per cent of AD still needed homologous blood. It was found from our study that only 1.3 per cent of AD needed homologous blood.

The potential of AD to give blood without developing iron depletion display wide variation. This has been attributed to restricted iron availability and endogenous erythropoietin (Epo) response to short-term multiple unit donation[7,8]. Iron depletion (SF < 15 ng/ml) was found in 10.52 per cent, 36.36 per cent and 20.29 per cent in 1st time female, multiple-time female and multiple-time male blood donors, respectively without iron supplement from our previous study. In this study, all AD were offered iron supplement after phlebotomies. About 88.89 per cent and 90 per cent of men and women claimed to take iron supplement. Mean SF (ng/ml) decreased from 147.75 to 124.26 in men and 53.19 to 38.81 in women. Iron depletion was not found in both AD claiming regular iron intake as well as the small number of AD who never took it. Epo may be beneficial for multiple unit autologous donation by an increasing number of acceptable units[9,10]. However, the use of Epo adds to the cost of ABD and the extra unit of collected blood may not be needed and therefore wasted[11].

SUMMARY

The present study suggests that autologous donation with iron supplement in general, is as safe as homologous donation. None of the autologous donors had donor reactions and iron depletion. It appears that iron supplementation was beneficial. Although the physiological implications of reduced iron stores are unclarified, it seems reasonable to secure appropriate iron stores. This data should provide reassurance to blood collection staff, volunteer and autologous donors, and their physicians as to the safety of blood donation. This strategy could facilitate inventory management and donor exposure to patients.

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จำนวนเหล็กสะสมในผู้ป่วยที่บริจาคโลหิตให้ตนเองไว้ใช้ในการผ่าตัด

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ภาวะจำนวนเหล็กสะสมลดลงที่อาจเกิดได้ในผู้บริจาคโลหิตประจำ เป็นปัจจัยเสี่ยงที่ทำให้ไม่สามารถบริจาคโลหิตได้บ่อยครั้งขึ้น ผู้ป่วยที่บริจาคโลหิตตนเองเพื่อใช้ในการผ่าตัด จำเป็นต้องบริจาคหลายยูนิตในเวลาที่ห่างกันไม่นาน จึงมีโอกาสที่อาจเกิดภาวะนี้ได้ง่าย ผู้ดำเนินการวิจัยได้ทำการตรวจหาระดับ serum ferritin ซึ่งเป็นวิธีที่แม่นยำในการดูจำนวนเหล็กสะสมในผู้ป่วยชาย 9 คน และหญิง 10 คน ซึ่งบริจาคโลหิต 1-2 ยูนิต (ทั้งหมด 24 ยูนิต) ก่อนผ่าตัด ผู้ป่วยชายร้อยละ 88.89 และผู้ป่วยหญิงร้อยละ 90 ได้รับธาตุเหล็กเสริมโดยการรับประทานหลังการบริจาคโลหิต

ผลการวิจัยพบว่าค่าเฉลี่ยของ serum ferritin ก่อนบริจาคโลหิต = 147.75 ng/mL และ 53.19 ng/mL ในผู้ป่วยชายและหญิงตามลำดับ หลังบริจาคโลหิตถึงแม้ค่าเฉลี่ยของ serum ferritin ลดลงเหลือ 124.26 ng/mL และ 38.81 ng/mL ในผู้ป่วยชายและหญิงตามลำดับ แต่ไม่พบว่ามีผู้ป่วยรายใดมีภาวะจำนวนเหล็กสะสมลดลงเกิดขึ้น (serum ferritin $\leq$ 15 ng/mL) โดยสรุปผู้ป่วยที่บริจาคโลหิตให้ตนเองเพื่อใช้ในการผ่าตัด สามารถบริจาคได้โดยไม่ทำให้มีจำนวนเหล็กสะสมลดลง หากได้รับธาตุเหล็กเสริมระหว่างการบริจาค

คำสำคัญ : จำนวนเหล็กสะสม, ผู้บริจาคโลหิตให้ตนเอง, ภาวะขาดเหล็ก

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