Original Article

A single-centre study of vasovagal reaction in blood donors: Influence of age, sex, donation status, weight, total blood volume and volume of blood collected

Joseph Philip, R. S. Sarkar, Neelesh Jain

Department of Transfusion Medicine, Armed Forces Medical College, Pune, India

Access this article online
Website: www.ajts.org
DOI: 10.4103/0973-6247.126690
Quick Response Code:

Correspondence to:
Dr. Joseph Philip
Department of Transfusion Medicine, Armed Forces Medical College, Pune - 40, India.
E-mail: eoj_in@yahoo.com

Abstract

Context: Vasovagal reactions (VVRs) in blood donors. **Aim:** To find an association of age, sex, donation status, weight, total blood volume and volume of blood collected with occurrence of immediate VVR. **Settings and Design:** Retrospective single-centre study. **Materials and Methods:** The study was conducted from March 2000 to November 2010 at a tertiary care blood transfusion centre. All VVRs with or without syncope occurring during or at the end of donation were noted. **Statistical Analysis Used:** For qualitative association, χ^2-test was used. Unpaired '*t*' test was used for assessing difference between two groups with respect to VVR status. Simultaneous impact of all risk factors was assessed using multivariate logistic regression analysis. The data entry software SPSS (version 17.0) was used for statistical analysis. A *P*-value <0.05 was considered statistically significant. **Results:** Overall 1085 VVRs were reported in relation to 88,201 donations, resulting in an overall VVR rate of 1.23%, that is, an incidence of 1 in every 81 donations. Donors with low blood volume, first-time donors, with low weight and female donors had higher absolute donation VVR rates than other donors. **Conclusions:** Donation-related vasovagal syncopal reactions are a multifactorial process determined largely by weight, age, first-time donor status and total blood volume. Our study reinforces the fact that blood donation is a very safe procedure, which could be made even more event-free by following certain friendly, reassuring practices and by ensuring strict pre-donation screening procedures.

Key words:

Blood donor, first-time donors, total blood volume, vasovagal reaction, volume of blood collected

Introduction

Although blood donation is considered safe, there are some inherent risks to donors. Hematoma, thrombophlebitis, risk of infection and vasovagal reactions (VVRs) are among the few complications related to blood donation.[1,2] A VVR is a general feeling of discomfort and weakness with anxiety, dizziness and nausea, which may progress to loss of consciousness.[3] Commonly, there are minor symptoms associated with blood donation. However, rarely, serious and severe symptoms such as loss of consciousness and convulsions or incontinence may occur.[4,5] A VVR is caused by stimulation of the parasympathetic nervous system, which can be further augmented by psychological factors and the volume of blood removed, causing relative hypovolemia.[6,7]

Materials and Methods

This retrospective single-centre study was conducted from March 2000 to November 2010 at our blood transfusion centre, catering to a tertiary care hospital. All whole-blood donations made at the centre were analyzed. Demographic, clinical and other information were documented on a structured questionnaire, set by the State Blood Transfusion Council, Maharashtra. All instruments used in this study, including weighing machine, blood collection monitor and height meter, were matched for their recordings. All donors were subjected to whole-blood phlebotomy for 350-450 ml. According to the standard practice at our centre, after phlebotomy, all donors were advised to rest on the bed for at least 5 min and when they felt well, a drink was offered to them. Data regarding development of only immediate VVR was documented. The severity of immediate VVR was determined using the definition of International Society of Blood Transfusion and European hemovigilance Network. According to this grading, severe VVR is considered as one, which needs hospitalization or intervention, or causes death. Other VVRs such as weakness, dizziness, sweating, discomfort, nausea/vomiting, pallor, anxiety and fainting/syncope with spontaneous recovery are graded as non-severe (mild to moderate). The donors were not followed for monitoring the occurrence of delayed VVR. The

estimated blood volume (EBV) of the blood donors was calculated using the following formula:[8]

$$EBV \text{ in liters} = [0.0236 \times (\text{Height in cm})^{0.725}] \times [(\text{Weight in kg})^{0.425} - 1.229]$$

Statistical analysis

For qualitative association, c^2-test was used. Unpaired '*t*' test was used for assessing difference between two groups with respect to VVR status. Simultaneous impact of all risk factors was assessed using multivariate logistic regression analysis. The data entry software SPSS (version 17.0) was used for statistical analysis. *P*-value <0.05 was considered statistically significant.

Results

Overall 1085 VVRs were reported in relation to 88,201 donations, resulting in a VVR rate of 1.23%, with an incidence of 1 in every 81 donations. All donations were done at our transfusion centre only; the demographic data of all the donors are presented in Table 1. As evident from Table 1, all demographic variables have been split into two categories, such as gender (male/female), age (≥45/<45 years), weight (≥55kg/<55kg), estimated blood volume (≥4.5/<4.5 l), volume of blood collected (450/350 ml) and donation status (first time/repeat donor). However, the majority of the donors (71.7%) were less than 30 years old and most of them were male (96.1%). Other diverse group of donors in terms of weight, donation status, total blood volume and volume of blood collected are shown in Table 1. Table 2 depicts the distribution of signs/symptoms of immediate VVR experienced by the blood donors. None of the donors developed a serious VVR. Weakness, discomfort and dizziness were the most common symptoms. It should be mentioned that one or more signs/symptoms such as dizziness, discomfort, sweating, pallor and anxiety were reported by the same donors who felt weakness. Grading non-severe VVR into mild (subjective symptoms) and moderate (objective symptoms) was not possible because in the majority of the donors both mild and moderate VVRs were observed simultaneously. A total 15 (1.4%) donors fainted after blood donation and they recovered spontaneously within the premises of the blood bank after taking rest. Table 3 shows the statistical analysis of VVRs in the blood donors according to their demographic features. As depicted in the table, variables such as female gender in comparison with male, age ≥45 years in comparison with <45 years, weight <55 kg in comparison with ≥55 kg, estimated blood volume <4.5 l in comparison with ≥4.5 l and first-time donors in comparison with repeat donors all showed significant association with occurrence of VVRs in healthy blood donors. Volume of blood collected (450/350 ml) did not show a significant association with VVR. Statistical analyses with *P*-values are shown in Table 3.

Table 1: Donor characteristics with frequency

Donor characteristics	Number (%)	Total donors
Gender		
Female	3440 (3.9)	88,201
Male	84,761 (96.1)	
Age (years)		
≥45	5310 (6)	88,201
<45	82,891 (94)	
Weight (kg)		88,201
≥55	85,997 (97.6)	
<55	2204 (2.4)	
Estimated blood volume (l)		88,201
≥4.5	52,035 (58.9)	
<4.5	36,166 (41.1)	
Volume of blood collected (ml)		88,201
350	48,225 (54.6)	
450	39,976 (45.4)	
Donation status		88,201
First-time donors	31,655 (35.8)	
Repeat donors	56,546 (64.2)	

Table 2: Signs and symptoms related to VVRs and frequency

Signs/symptoms related to immediate VVR	Number of donors n (%)
Weakness	373 (34.4)
Dizziness	154 (14.2)
Discomfort	167 (15.4)
Weakness/dizziness/discomfort	111 (10.2)
Sweating	115 (10.6)
Nausea/vomiting	47 (4.3)
Pallor	31 (2.9)
Anxiety	72 (6.6)
Fainting/syncope	15 (1.4)
Total	1085 (100)

Discussion

Vasovagal syncope is thought to occur as a biphasic process. In the presyncopal phase, there is an increase in both cardiac output and peripheral vascular resistance, which results in slight to moderately elevated blood pressure. This is a normal physiologic response to stress and loss of blood. Classically, during the syncopal phase, there is a sudden reduction in peripheral vascular sympathetic activity, which causes peripheral vascular dilatation and results in blood pooling and hypotension. This vascular response is the main cause of a syncopal reaction.[6,7] In addition to a vascular response, there is often an increase in cardiac parasympathetic activity that decreases the donor's heart rate, but this cardiac response plays an only minor role in causing the syncopal reaction.[9,10] Loss of consciousness occurs when brain perfusion is substantially diminished; systolic blood pressure below 75 mm of Hg is sufficient to cause syncope.[7] The exact mechanism for transition from the pre-syncopal to syncopal phase is not well understood. Central thalamic pathways play a part through the effect of emotions and hyperventilation.[11] The most recent theory, however, is that vasovagal syncope is largely dependent on a donor's peripheral baroreceptor sensitivity, which is influenced by age, emotional stress and hypertension.[10] The magnitude of donor's baroreceptor response is also directly related to the percentage of blood volume that is removed. According to the standard for surveillance of complications related to blood donation prepared by the International Society of Blood Transfusion and European Hemovigilance Network, VVRs are classified as immediate and delayed. Symptoms appearing before a donor has left the donation site are termed as immediate VVRs and those appearing after the donor has left the donation site but within 24 h are classified as delayed VVRs. VVRs occur in 1-5% of blood donations. Symptoms such as dizziness, weakness and pallor are common symptoms, which occur in 0.08-0.34% of blood donors. In 25% of syncopal reactions, the donor develops tetany or convulsive activity.[2] This study was conducted to estimate the prevalence of immediate VVRs in people donating blood at our blood bank. An additional

Table 3: Statistical analysis of study variables affecting frequency of Vasovagal reaction

Variables	Coefficient of constant (b)	Odds ratio (OR)	95% CI for OR		P-value
			Lower	Upper	
Gender	1.075 (b1)				0.0031
Female		2.931	2.451	3.505	
Male		1.00			
Age (years)	1.756 (b2)				
≥45		5.789	4.768	7.028	0.0037
<45		1.00			
Weight (kg)	-1.139 (b3)				
≥55		0.320	0.255	0.402	0.012
<55		1.00			
Estimated blood volume (l)	-2.515 (b4)				
≥4.5					0.034
<4.5		0.081	0.067	0.098	
		1.00			
Volume of blood collected (ml)	-1.756 (b5)				
350					0.074
450		0.173	0.146	0.204	
		1.00			
Donation status	0.942 (b6)				
First-time donors		2.566	2.235	2.946	0.0025
Repeat donors		1.00			
Constant	-1.976 (b0)	0.139			0.000

objective was to determine the association of various factors, such as age, sex, weight, donor status, total blood volume and volume of blood collected, with the clinical characteristics and correlate the frequency of immediate VVRs. In our study, we addressed all these factors individually and the statistical significance of these factors was calculated in which most of the study variables were found to be significantly associated with risk of development of VVRs except one, that is, volume of blood collected. The probability of VVR can be calculated for a single demographic factor, keeping other factors constant by using an equation that is derived from multivariate logistic regression analysis.

$\log(P/1\text{-}P) = b0 + b1 + b2 + b3 + b3 + b4 + b5 + b6,$

where, P = probability of VVR, b0= coefficient for the constant and b1 – b6 = coefficients of constant for various demographic features, included in the study [Table 3].

For example, to calculate the probability of VVR in the low donor body weight (<55 kg) category, the equation will become $\log(P/1\text{-}P)$ = b0 (–1.976) + gender (1.075) + age (1.756) + weight (–1.139) + estimated blood volume (–2.515) + volume of blood collected (–1.756) + donation status (0.942). It means for every additional point in the low donor body weight (<55 kg) category, we expect a 1.139 increase in the log-odds of a VVR, holding all other independent variable constant. Likewise, the probability of VVRs for other study variables can be calculated.

Many of the previous studies have already emphasized the importance of body weight, but there are very few studies, which have mentioned the significance of other donor-related factors, which we studied, as far as VVRs are concerned. Some studies have reported VVRs to constitute 67-95% of all donation-related events, and considered it as a most common type of adverse event related to blood donation.[5] The findings of this study serve to identify vulnerable groups of the population who are at increased risk of developing VVRs due to blood donation. One of the Indian studies has reported a total donor reaction rate of 1.6% with VVR rate of of 0.96% among the general donor population.[4] Another study from India has found an overall donor adverse event rate of 0.6% in which 70% of the reactions is contributed by VVRs.[12] The prevalence of immediate VVRs in our population is comparable to that reported in studies conducted in other countries. A prevalence of 0.9 and 2.6% has been reported by Zervou *et al.*, and Newman.[1,2] In our study, we focused on immediate VVRs because these are easy to observe. A total 1085 out of 88,201 (1.23%) blood donors experienced one or more symptoms of immediate VVRs, which were mild to moderate in severity. All donors developed non-severe VVRs. Only 15 (1.4%) fainted, and they recovered spontaneously without medical treatment or hospitalization. There is a continuous debate about the factors, which place blood donors at high risk of developing VVRs. Previous studies conducted elsewhere have already reported association of various factors such as age, gender, weight, donor status, EBV and volume of blood collected with a higher incidence of VVRs.[1,2,13]

In our study, we found a significant association of the above mentioned factors with occurrence of immediate VVRs except volume of blood collected. Any complication due to blood donation is bound to decrease the likelihood of return donations, thus decreasing the pool of eligible blood donors.[13] To minimize these reactions and to maintain our blood donor pool, the following interventions can be done: donor-to-staff ratio can be decreased; waiting time after registration can be minimized; more personal attention can be given to donors; donors can be kept supine on the bed longer before they sit up; can start practicing methods such as to offer fluids before starting phlebotomy; and training blood donors about applying muscle tension exercises.[13-16] These methods have been shown to markedly decrease the development of VVRs among blood donors.[14] The value of decreased syncopal reactions would be improved donor safety, better donor retention, higher donor satisfaction and potentially reduced costs. The prevalence of VVRs in our blood bank is at

least 1.23%. This is comparable to findings of studies conducted in other countries.

In conclusion, donation-related vasovagal syncopal reactions are a multifactorial process determined largely by weight, age, first-time donor status and total blood volume. Our study reinforces the fact that blood donation is a very safe procedure, which could be made even more event-free by following certain friendly, reassuring practices and by ensuring strict pre-donation screening procedures.

References

1. Zervou EK, Ziciadis K, Karabini F, Xanthi E, Chrisostomou E, Tzolou A. Vasovagal reaction in blood donors during or immediately after blood donation. Transfus Med 2005;15:389-94.
2. Newman BH. Donor reactions and injuries from whole blood donation. Transfus Med Rev 1997;11:64-75.
3. France CR, France JL, Patterson SM. Blood pressure and cerebral oxygenation responses to skeletal muscle tension: A comparison of two physical maneuvers to prevent vasovagal reactions. Clin Physiol Funct Imaging 2006;26:21-5.
4. Tondon R, Pandey P, Choudhary R. Vasovagal reaction in 'at risk' donors: A univariate analysis of effect of age and weight on the grade of donor reactions. Transfus Apher Sci 2008;39:95-9.
5. Trouern-Trend JJ, Cable RG, Badon SJ, Newman BH, Popovsky MA. A case-controlled multicenter study of vasovagal reactions in blood donors: Influence of sex, age, donation status, weight, blood pressure, and pulse. Transfusion 1999;39:316-20.
6. Engel GL. Psychologic stress, vasodepressor (vasovagal) syncope, and sudden death. Ann Intern Med 1978;89:403-12.
7. Bernat JL, Vincent FM. Neurology: Problems in Primary Care. 2nd ed. Los Angeles: Practice Management Information Corporation (PMIC); 1993. p. 115-28.
8. Rohra DK, Juriasinghani V, Rai K, Azam SI. Prevalence of immediate vasovagal reaction in blood donors visiting two blood of Karachi. Transfus Med 2010;20:129-33.
9. Greene MA, Boltax AJ, Ulberg R. Cardiovascular dynamics of vasovagal reaction in man. Circ Res 1961;9:12-7.
10. Adler PS, Ditto B, France C, France J. Cardiovascular reaction to blood donation in offsprings of hypertensives and normotensives. J Psychosom Res 1994;38:429-39.
11. Ruetz PP, Johanson SA, Callahan R, Meade RC, Smith JJ. Fainting: A review of its mechanisms and a study in blood donors. Medicine (Baltimore) 1967;46:363-84.
12. Pathak C, Pujani M, Pahuja S, Jain M. Adverse reactions in whole blood donors: An Indian scenario. Blood Transfus 2011;9:46-9.
13. Newman BH, Newman DT, Ahmad R, Roth AJ. The effects of whole blood donor adverse events on blood donor return rates. Transfusion 2006;46:1374-9.
14. Ditto B, Wilkins JA, France CR, Lavoie P, Adler PS. Onsite training in applied muscle tension to reduce vasovagal reactions to blood donation. J Behav Med 2003;26:53-65.
15. Ditto B, France CR. Vasovagal symptoms mediate the relationship between predonation anxiety and subsequent blood donation in female volunteers. Transfusion 2006;46:1006-10.
16. Radar AW, France CR, Carlson B. Donor retention as a function of donor reactions to whole blood and automated double red cell collections. Transfusion 2007;47:995-1001.

Cite this article as: Philip J, Sarkar RS, Jain N. A single-centre study of vasovagal reaction in blood donors: Influence of age, sex, donation status, weight, total blood volume and volume of blood collected. Asian J Transfus Sci 2014;8:43-6.

Source of Support: Institutional, **Conflicting Interest:** None declared.