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ORIGINAL ARTICLE

Vasovagal reactions in blood donors during or immediately after blood donation

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SUMMARY. The aim of the study was to estimate the type, incidence and causes of donor adverse reactions during and after blood donation in a Greek Blood Bank, where medical staff is responsible for donor selection. 12 173 blood donors were studied for adverse reactions. One-hundred and seven (0·87%) donors had a vasovagal reaction during or after blood donation. Donors who gave blood occasionally had a significant greater incidence of reactions compared with volunteer donors (1·15 versus 0·53%) ($P < 0·001$). There was no significant difference between men and women (0·85 versus 0·95%). First-time donors (1·7 versus 0·68%) and those under 30 years (1·15 versus 0·71%] had a significant greater possibility to have a reaction ($P < 0·001$). Twenty-two of 107 (20·5%) donors had a syncopal reaction. There was not a causative correlation of haematocrit, haemoglobin, systolic and diastolic blood pressure, pulse rate and weight in women (except weight in men) in developing a reaction. The stressing experience of phlebotomy was the reason for the higher frequency of a reaction.

The incidence of reactions in our donors is lower than in other studies, and the possible reason for this is that only physicians are responsible for the selection of donors and trained personnel are careful of them during the donation process.

Key words: blood donation, blood donors, vasovagal reactions.

Although for most of the blood donors the procedure of blood donation is simple and without complications, sometimes adverse reactions may occur. The vasovagal reactions, mainly with syncope, are the most common ones and include a lot of symptoms such as pallor, weakness, sweating, nausea, dizziness, loss of consciousness, convulsions and involuntary passage of urine or faeces. Syncope possibly is a hysterical reaction to the sight of blood or the result of a blood pressure fall. Concerning adverse reactions, the vasovagal ones have been mainly evaluated in previous studies, but donors' arm injuries such as bruises and haematomas (Newman, 1997; Newman & Graves, 2001), arterial puncture phlebotomy (Newman, 2001), neurologic needle injuries (Newman & Waxman, 1996) and traumatic injuries (Newman, 1997; Newman & Graves, 2001) have also been documented.

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The purpose of this study was firstly to find the incidence of adverse reactions in blood donors during or immediately after blood donation in a blood bank of a tertiary University Hospital in Greece and secondly to define the contributory role of donors' biological factors in adverse reactions in blood donors. These factors are type of blood donation (volunteer donors or occasional ones who are people from the family or friendly environment of the patients), frequency of blood donation (first-time or repeat donors), age, sex, body weight, values of haematocrit (Ht) and haemoglobin (Hb), blood pressure and pulse rate before blood donation.

MATERIALS AND METHODS

Blood collection

The present study was conducted in our Blood Bank at the University Hospital of Ioannina, and only blood donors who gave blood at the hospital were included. It is remarkable that the Greek Blood Service System is decentralized. Every hospital has its own blood bank,

in which blood donation, blood testing and preparation of blood products are performed. Experienced physicians in blood banking perform the selection and physical examination of blood donors.

Each blood donor must meet acceptability criteria before being subjected to phlebotomy. These criteria presuppose age between 18 and 64 years, minimum weight 50 kg (110 lb) and a good general health without evidence of transfusion-transmitted diseases. A questionnaire concerning the medical history and the medical situation of donor's health has to be filled in by every potential blood donor, and then the responsible physician checks the donor's vital signs (arterial pressure and pulse rate). The pulse rate should be regular and between 50 and 100 beats per minute. The blood pressure should not exceed 180 mmHg systolic and 100 mmHg diastolic. Special note is taken for poor physique, debilitation, undernutrition, mental instability, stress, tiredness and sleeplessness (sleep under 5 h last night). Before phlebotomy, Hb and Ht are measured, and their values should be higher than 13·5 g dL^{-1} and 40% for male donors and 12·5 g dL^{-1} and 38% for female donors, respectively, according to the guidelines of the European Council and Greek law for selection of blood donors.

A trained nurse performs the phlebotomy in a separate room in the blood bank with a 16-G needle as the donor laid in a supine position. The blood is collected in blood bags made by Pall, MacoPharma and Kawasumi manufacturers, and the quantity of the collected blood should not exceed 450 mL. Furthermore, 15 mL blood is also collected in blood tubes for post-donation serological and immunohaematological tests. When blood donation is completed, the donors remain laid for about 10 min and if they feel well, they can sit up and have a light meal and refreshments in the blood collection room, being under careful attendance for 15 min at least. If they are feeling well, they can leave the hospital. The nurse then gives some advice to them for the actions that they must do if a post-donation complication occurs, including the blood bank telephone number, which provides access to needed medical care 24 h a day, 7 days a week, since our Blood Bank is a Department of the University Hospital of Ioannina.

Study design

This was a prospective study, which started from 1 November 2000 and lasted until 25 May 2003, and blood donors who donated blood in our hospital blood bank were included. We analysed 12 173 blood donors (9240 men and 2933 women). Among them, 6769 (55·6%) were replacement occasional donors (from the close friendly and family environment of the patients) and the rest 5404 (44·4%) were volunteer ones. 2338 (19·2%) [1476 men, 862 women] were first-time donors and 9835 (80·8%) [7764 men, 2071 women] were repeat donors. The average values of systolic and diastolic blood pressure, pulse rate, body weight, Hb and Ht before blood donation for the total number of the studied blood donors are as follows: mean systolic and diastolic blood pressure 127/84 mmHg for men and 121/82 mmHg for women, mean pulse rate 78 for both men and women, mean body weight 83·2 kg for men and 64·1 kg for women, mean Ht and Hb values 45%/15 g dL^{-1} for men and 40·4%/13·5 g dL^{-1} for women.

The control group was the total number of donors without any reaction who gave blood during the period of the study. The latter group was matched with the group of donors who had a reaction and the above factors were compared and estimated.

Data collection

Blood donors' serial number, the date of blood collection and other characteristics were recorded. The collection staff (trained nurses experienced in phlebotomy) is required to report every case of a donor reaction during or 30 min after the blood donation on a Donor Reaction Report Form (Appendix). This standardized form includes the biological characteristics of the donor, the symptoms of the adverse reaction and if the donor was sleepless, tired or stressed before blood donation and any donor concealed this situation during the medical interview and examination. The responsible physician who examined the donor fills in the report form and asks the donor about sleeplessness, tiredness or stress. The scale is 'a little tired or stressed' and 'very tired or stressed' (the latter donors are excluded from blood donation). Concerning sleeplessness, the limit is less than 5 h of sleeping last night.

Statistical analysis

We used the χ^2 test to compare sex, age, type and rate of blood donation in the two groups and the *t*-test was used to correlate the blood donors' characteristics (mean weight, blood pressure, pulse rate, Ht and Hb).

RESULTS

Incidence

One-hundred and seven (79 men, 28 women) (0·87%) of 12 173 blood donors had a symptom that was

connected to a vasovagal reaction. These symptoms were pallor, weakness, sweating, nausea, vomiting, dizziness, loss of consciousness, convulsions and involuntary passage of urine or faeces. Only three of these donors had similar symptoms in previous donations. The symptoms occurred during (50 donors) or immediately after blood donation (56 donors), while they still were at premises, and only one blood donor had loss of consciousness outside blood bank, 45 min after phlebotomy. Tables 1 and·2 summarizes the characteristics of blood donors with vasovagal reactions concerning the age, sex, type of donation, frequency of donation and the average predonation values of arterial pressure, pulse rate, body weight, Hb and Ht. Replacement occasional donors (who gave blood for their friends or relatives' patients) had a significantly higher incidence [78 of 6769 (1·15%) versus 29 of 5404 (0·53%)] ($P < 0·001$) of a vasovagal reaction compared with volunteer blood donors. There was no significant difference in the occurrence of adverse reactions between men and women [79 of 9240 (0·85%) versus 28 of 2933 (0·95%)]. The first-time donors [40 of 2338 (1·7%) versus 67 of 9835 (0·68%)] and those who were younger than 30 years [54 of 4676 (1·15%) versus 53 of 7497 (0·71%)] had also a significantly higher ($P < 0·001$) incidence of reactions. The body weight of the male donors with adverse reactions was significantly smaller ($P < 0·001$) than that in the control group (male donors without any reaction) ($79·1 \pm 1·1$ versus $83·2 \pm 0·03$). Moreover, six blood donors had a haematoma at the site of phlebotomy (0·05%).

In the same period of this study, we recorded 1530 (11·2%) blood donors [862 (6·3%) men and 668 (4·9%) women] who were excluded from blood donation for reasons that are included in the guidelines of European Council and Greek law for blood donor selection. Furthermore, our physicians excluded the donors who were (or looked so) very tired [47 (0·34%)], very stressed [39 (0·28%)], had slept under 5 h last night [238 (1·7%)] and women under menstruation [50 (0·36%)]. These criteria are based on our physicians' experience and are included in the European and AABB guidelines about blood donor general appearance and lead to increased rate of adverse reactions. So, the total number of rejected blood donors was 1904 (13·5%).

Clinical characteristics of reactions and changes in vital signs

Table 3 summarizes the symptoms in order of frequency. Weakness (64%), sweating (47·6%), pallor (38·2%), headache (14%), dizziness (11·2%) and nausea (8·4%) were the most common symptoms. Loss of consciousness occurred in 22 cases (20·5%), and the most of them (17) were characterized moderate, whereas the rest were serious, accompanied with convulsions (3) and cyanosis (1). One blood donor had a loss of consciousness 45 min after the phlebotomy followed by a nose fracture. All the donors with a reaction were restored in the blood bank, and their admission to the hospital was not necessary. In 87% of the cases, a decrease in systolic and diastolic blood pressure was recorded and also in 68% of the cases a decrease in pulse rate was found. An increase in pulse rate was found in 12% of the cases, and 1·8% of the blood donors with reactions developed arrhythmia.

Table 1. Distribution of the blood donors with some reaction according to their age, sex, type and frequency of blood donation

Type of blood donors	Age	Repeat blood donors	First-time donors	Replacement donors	Volunteer donors
Male donors with some reaction	18–30	27	17	33	11
	31–40	16	5	16	5
	41–50	9	2	8	3
	>50	3	0	2	1
Total number of male donors with some reaction		55	24	59	20
Female donors with some reaction	18–30	3	11	10	4
	31–40	5	4	6	3
	41–50	2	0	1	1
	>50	2	1	2	1
Total number of female donors with some reaction		12	16	19	9
Donors with some reaction in total		67	40	78	29

Table 2. Mean blood pressure, pulse rate, body weight, haematocrit (Ht) and haemoglobin (Hb) of the blood donors with some reaction

Blood donors with some reaction	Age	Mean systolic blood pressure	Mean diastolic blood pressure	Mean pulse rate	Mean body weight	Ht	Hb
Male	18–30	125	88	77	78	46	15·2
	31–40	122	83	78	82	45·5	15·1
	41–50	127	86	82	78	45·3	15
	>50	127	85	80	70	42·6	14·5
Female	18–30	118	80	82	61·8	40·2	13·3
	31–40	115	78	76	66	40·8	13·5
	41–50	135	75	72	61	38	12·5
	>50	116	80	80	72	39	12·9

DISCUSSION

Our study showed that the incidence of adverse reactions concerning vasovagal ones in blood donors is 0·87%. This percentage is smaller than the ones reported by other authors (2–3%), given that in our volunteer blood donors the incidence of vasovagal reactions is much lower (0·53%) (Newman, 1997). We believe that the most possible explanation for this difference is the fact that the physical examination and selection of blood donors is performed by experienced physicians and therefore we take a better evaluation of blood donors who have predisposition to complication. An additional reason for this difference is possibly the small number of donors who donate blood every day (approximately 20 donors per day) in our Blood Bank.

As reasons related to a reaction, some donors reported stress (66%), tiredness (29%), sleeplessness (15%) or a combination of these factors, which the donor concealed during the physical examination before blood donation. The donors who conceal some of these factors are mainly replacement donors, trying to give blood for their relatives or friends.

By this study, we tried to find whether any biological factor before blood donation is related to a vasovagal reaction. These biological factors were systolic and diastolic blood pressure, pulse rate, body weight and values of Ht and Hb. We found that only the small body weight for the male blood donors was correlated significantly ($P < 0·001$) with adverse reactions.

Table 3. Clinical characteristics of adverse reactions and changes in vital signs

Symptoms	Number of males	Number of females	Total [*n* (%)]
Weakness	54	15	69 (64·0)
Sweating	42	9	51 (47·6)
Pallor	30	10	40 (38·2)
Loss of consciousness	17	5	22 (20·5)
Headache	7	8	15 (14·0)
Dizziness	10	2	12 (11·2)
Nausea	4	5	9 (8·4)
Tingling	3	3	6 (5·6)
Convulsions	3	0	3 (2·8)
Vomiting	0	2	2 (1·8)
Vital signs			
Decreased blood pressure	70	23	93 (87·0)
Increased blood pressure	2	0	2 (1·8)
Stable blood pressure	7	5	12 (11·2)
Decreased pulse rate	56	17	73 (68·0)
Increased pulse rate	9	4	13 (12·0)
Stable pulse rate	14	7	21 (20·0)
Arrhythmia	2	0	2 (1·8)

The AABB guidelines for blood donor selection use different (lower) Hb and Ht values for male donors comparing with European and Greek ones. This possibly has an influence on the result for fewer reactions in our male donors, given that about 92% of the excluded male donors for low Hb values (299 of 1530) were included in the category of Hb values between 12·5 and 13·4 g dL^{-1}. As we mentioned earlier, we rejected 1904 (13·5%) potential donors, and our deferral rate is similar to those reported by other authors (5–24%) (Tomasulo *et al*., 1980; Lim *et al*., 1993; Chaudhary *et al*., 1995).

It is remarkable that only 22 of 107 blood donors with adverse reactions had loss of consciousness (20·5%), and only five of them could be characterized as severe cases. However, none of them was too serious, and there was no necessity for treatment in the hospital. We believe that the smaller incidence of fainting, compared with other studies, is the result of careful attendance during the blood donation and immediately after this. First, a permanent trained nurse is present in the blood donation room who recognizes the first mild symptoms of a reaction immediately and takes the appropriate care to help them, laying the donor with the mild early symptoms of fainting on a bed. Second, after blood donation, while the donors have a light meal, they are under close attendance by the personnel and only when the nurse is sure that the donors feel well allows them to leave blood bank. This process also helps to prevent injuries in the case of fainting. Our findings show that the first-time blood donors who gave occasionally blood for their friends or relatives together with those at a younger age (<30 years) had a higher possibility to have an adverse reaction compared with the repeat, volunteer and older (>30 years) donors. It is expected for the first-time donors to be more anxious than repeat blood donors, because the procedure of blood donation is unknown to them. The stress has direct emotional effect and may affect central neural activity stimulating peripheral vasodilatation (Van Lieshout *et al*., 1991). In addition, studies have shown that stress affects peripheral ventricular baroreceptor sensitivity in young people (Steptoe & Sawada, 1989; Vogele & Steptoe, 1993). Therefore, during the first donation, the donor may experience a vasovagal reaction, and in most cases this experience will determine whether the donor will continue to give blood. It is obvious in this study that people with an adverse reaction during their first donation usually abstain from blood donation process. Only three of 107 donors who reported reactions returned for a next donation, whereas 67 of 107 were repeat blood donors. Among younger blood donors, the percentage of first-time donors is greater than that of the repeat donors, and this is partly an explanation for the higher incidence of adverse reactions in younger donors. It has been shown that healthy, young people have lower ventricular baroreceptor sensitivity, when they are under physical or psychological stress than older people who are haemodynamically more stable (Kapoor *et al*., 1986; Imholz *et al*., 1990). The sensitivity of carotid-aortic baroreceptor, which correlates inversely with ventricular baroreceptor sensitivity, decreases with age (Gribbin *et al*., 1971). Therefore, physiological reasons also explain why younger blood donors have higher incidence of vasovagal reactions.

A problem exists in the Greek Blood Service System to cover all the blood supplies from volunteer blood donors, and about half of the annual selected blood units are given by replacement, occasional donors from the friendly and family environment of the patients. Apart from other related problems, concerning the sufficiency of blood supply and the safety of blood transfusion, this difficulty seems to be associated with higher incidence of adverse reactions, because the latter donors conceal some deferral factors. In the present study, replacement donors had a significantly higher incidence ($P < 0{\cdot}001$) for reaction compared with volunteer donors. This finding is attributed to the fact that the replacement donor gives blood under the pressure to cover the needs in blood for the donor's friend or relative patient, and this type of donor is usually anxious, because of the urgent situation of the patient's health.

In conclusion, the careful selection and evaluation of blood donors by experienced physicians and the presence of trained nurses in the donation room who closely attend the blood donors during and immediately after blood donation play an important role in the prevention of the adverse reactions. In Greece, we have to make efforts to revert replacement donors to volunteer ones who will regularly give blood. This policy will further decrease the adverse reactions in blood donors.

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REFERENCES

Chaudhary, R.K., Gupta, D. & Gupta, R.K. (1995) Analysis of donor-deferral pattern in a voluntary blood donor population. *Transfusion Medicine*, **5**, 209–212.

Gribbin, B., Pickering, T.G., Sleight, P. & Peto, R. (1971) Effect of age and high blood pressure on baroreflex sensitivity in man. *Circulation Research*, **29**, 424–431.

Imholz, B.P., Damdrink, J.H., Karemaker, J.M. & Wieling, W. (1990) Orthostatic circulatory control in the elderly evaluated by non-invasive continuous blood pressure measurement. *Clinical Science*, **79**, 73–79.

Kapoor, W., Snustad, D., Peterson, J., Wieand, H.S., Cha, R. & Karpf, M. (1986) Syncope in the elderly. *The American Journal of Medicine*, **80**, 419–428.

Lim, J.C., Tien, S.L. & Ong, Y.W. (1993) Main causes of pre-donation deferral of prospective blood donors in the Singapore Blood Transfusion Service. *Annals of the Academy of Medicine Singapore*, **22**, 326–331.

Newman, B.H. (1997) Donor reactions and injuries from whole blood donation. *Transfusion Medicine Reviews*, **11**, 64–75.

Newman, B.H. (2001) Arterial puncture phlebotomy in whole-blood donors. *Transfusion*, **41**, 1390–1392.

Newman, B.H. & Graves, S. (2001) A study of 178 consecutive vasovagal syncopal reactions from the perspective of safety. *Transfusion*, **41**, 1475–1479.

Newman, B.H. & Waxman, D.A. (1996) Blood donation-related neurologic needle injury: evaluation of 2 years' worth of data from a large blood center. *Transfusion*, **36**, 213–215.

Steptoe, A. & Sawada, Y. (1989) Assessment of baroreceptor reflex function during mental stress and relaxation. *Psychophysiology*, **26**, 140–147.

Tomasulo, P.A., Anderson, A.J., Paluso, M.B., Gutschenritter, M.A. & Aster, R.H. (1980) A study of criteria for blood donor deferral. *Transfusion*, **20**, 511–518.

Van Lieshout, J.J., Wieling, W., Karemaker, J.M. & Eckberg, D.L. (1991) The vasovagal response. *Clinical Science*, **81**, 575–586.

Vogele, C. & Steptoe, A. (1993) Anger inhibition and family history as modulators of cardiovascular responses to mental stress in adolescent boys. *Journal of Psychosomatic Research*, **37**, 503–514.

APPENDIX

Report form for blood donors' adverse reactions

Date
Blood donor's number
Blood donor's name
Age
Sex
Loss of consciousness
Sweating
Convulsions
Haematoma
Weakness
Headache
Any other symptom
Number of past blood donations
Blood pressure before
Blood pressure after
Pulse rate before
Pulse rate after
Ht
Hb
Body weight
Tiredness
Sleeplessness
Stress