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Vasovagal reaction among whole blood donors in Hospital Pulau Pinang. A statistical-epidemiological study

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Abstract:

CONTEXT: Whole blood donation is generally considered a safe procedure; however, a small percentage of donors could develop vasovagal reactions (VVRs) during or after completion of blood donation.

AIMS: This study was undertaken to establish the prevalence of VVR among whole blood donors in Hospital Pulau Pinang and to investigate factors that lead to its occurrence.

SETTINGS AND DESIGN: A cross-sectional study was conducted involving 27,890 whole blood donations in 2016.

SUBJECTS AND METHODS: For each donation, donor's demographic and blood donation-related information was extracted from the blood bank database.

STATISTICAL ANALYSIS USED: Qualitative data including age group, sex, race, frequency, and location of donation were analyzed using Chi-square tests, while blood pressure was analyzed using *t*-test.

RESULTS: Overall, 425 cases of VVRs were reported, resulting in a VVR rate of 1.5% (one event in every 65 donations). We found a statistically significant association ($P < 0.05$) between the occurrence of VVRs with the young age group, female gender, Indian race, first-time donor, lower predonation blood pressure, and donation performed in a mobile donation campaign. The most common vasovagal symptoms are lightheadedness (88%), followed by nausea (5.4%), muscle twitching (3.5%), vomiting (1.4%), loss of consciousness <30 s (1.4%), and paresthesia (0.2%).

CONCLUSIONS: The prevalence of VVRs among whole blood donors in Hospital Pulau Pinang appeared to be low. Our study reaffirms that blood donation is a relatively safe process, and the incidence of VVR can be further reduced by ensuring strict screening procedure before blood donation.

Keywords:

Blood bank, blood donation, vasovagal reaction

Introduction

Whole blood donation is generally considered a safe procedure; however, a small percentage of donors could develop adverse reactions during or after completion of blood donation. According to Kumari, adverse event can be defined as the symptoms or signs of donor discomfort of sufficient severity such that either the donor called for the attention of staff or they were

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noticed by staff, provided that the pain at the time of venepuncture was excluded.^[1]

The International Society of Blood Transfusion Working Party on Haemovigilance together with other organizations has classified the occurrence of adverse reactions into local symptoms, generalized symptoms, complication related to apheresis, allergic reactions, and other complications.^[2] The local symptoms are mainly caused by problems related to venous access such as hematoma, pain, inflammation, nerve injury, and arterial

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injury. For generalized symptoms, the donor can manifest symptoms of vasovagal reactions (VVRs) such as hypotension, bradycardia, pallor, sweating, lightheadedness, nausea, and vomiting, which are often self-limiting.^[1] In rare cases, donors can develop severe form of vasovagal attack which results in convulsion or even loss of consciousness. The vasovagal attack can also be divided into having no loss of consciousness, loss of consciousness with or without injury, or adverse reaction happening beyond the donation site.^[2] More severe complications such as myocardial infarction, cardiac arrest, and cerebrovascular accident may occur; however, it is rarely seen as the susceptible donor is deferred from donating during the counseling session.

VVR is one of the main reasons people find blood donation unpleasant.^[3] In general, the frequency of VVR in multiple studies ranges from 0.37% to 1.28%.^[4-6] Although adverse donor reaction is known to have a very low occurrence, it can have a negative impact on the return rate of the affected donors in the long run.^[7] Donors who are at increased risk of VVR should be counseled and advised for predonation hydration which can help dampen the vasovagal attack.^[8] Donors who are precounseled will be able to tolerate the reaction better as they are already aware of the possibility of developing such symptoms.^[9]

The incidence of VVR can vary between populations. A study done by Agnihotri *et al.* in 2012 showed that the VVR rate among whole blood donors was 1.6% from a total of 37,896 whole blood donations. They found a significant association between VVR with young age, lower weight, first-time donation status, female gender, and nature of blood donation site.^[10] A study done by Dogra *et al.* in 2015 also reported a similar finding, however, with lower rate of reaction of 0.365% from a total of 29,524 donations.^[11]

Another study done by Rahman *et al.* in 2011 noted that the incidence of VVR in Bangladesh was 0.37%, in which male donor had a rate of 0.33% and female donor had a rate of 0.67%. Female donors were found to have significantly higher chances of developing VVR ($P = 0.001$) compared to male. 78.8% of them were new donor, and 28.8% were regular donor. The symptoms that manifest during VVR arranged according to frequency were sweating (86.3%), nausea and vomiting (80.8%), pallor (67.1%), dizziness (39.7%), loss of consciousness and fainting, increased rate of respiration (30.1%), anxiety (16.4%), and vertigo (1.4%).^[4]

As there are no local data available for the prevalence of VVR in our country, it is essential for this study to be done to explore the rate of VVR and factors that can contribute to its occurrence in our multiracial local

population. Determination of such factors can greatly assist clinicians in reducing the incidence of the reaction in accordance to hemovigilance initiatives. This can ultimately result in better retention of blood donors to maintain a constant and reliable supply of blood for the future usage.

Subjects and Methods

We conducted a cross-sectional study involving 27,890 whole blood donations in 2016. For each donation, donor's demographic and donation data such as age, gender, race, predonation blood pressure, site, and regularity of donations were extracted from our blood bank Hemoline Database System and analyzed using SPSS (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.). The inclusion criteria include all whole blood donors who have made donation in our blood bank center or mobile donation site in 2016, while autologous and apheresis donors were excluded from this study.

Demographic and VVR data are presented as descriptive with numbers and percentages are shown, whereas the factors such as age groups, genders, races, locations, and frequency of donations are analyzed using Chi-square test. For predonation blood pressure analysis, the mean pressures are compared using *t*-test. A $P < 0.05$ was considered statistically significant (confidence interval [CI] = 95%).

Results

We have recorded a total of 27,890 successful whole blood donations done in 2016 in Hospital Pulau Pinang. Overall, 425 VVR events were reported which account to VVR rate of 1.5%.

Table 1 shows the demographic distribution of the whole blood donors donated in 2016. Table 1 also reveals that most of the donors are from the age group of 26–35 years (8610 donors; 30.9%), and the least number of donors are from the age group of 56–65 years (549 donors; 2%). Most of them are male donors accounting to 18,179 donors (65.2%). Chinese donors make up the majority of the blood donors, which were 16,266 donors (58.2%). Most of the donors, i.e. 20,442 (73.3%), donated whole blood during mobile donation campaign, while in-house donation at Hospital Pulau Pinang only accounts for 26.7% of the donations. Regular donor still forms the majority of the donor pool with 17,065 (61.2%) of them returning to donate their blood again, while 10,825 (38.8%) are first-time donors.

Table 2 depicts the signs and symptoms of VVR experienced by 425 whole blood donors in Hospital

Pulau Pinang in 2016. From Table 2, it can be concluded that the most common VVR is the symptom of lightheadedness which accounts for 88% (374 cases) of the reaction. This is followed by nausea (23 cases; 5.4%), muscle twitching (15 cases; 3.5%), vomiting (6 cases; 1.4%), loss of consciousness <30 s (6 cases; 1.4%), and paresthesia (1 case, 0.2%).

On statistical analysis [Tables 3 and 4], a significant association was found (CI = 95%) between factors of age group ($P < 0.05$), gender ($P < 0.05$), race ($P < 0.05$), location of donation ($P < 0.05$), frequency of donation ($P < 0.05$), and predonation blood pressure ($P < 0.05$), with occurrence of VVR.

Discussion

Blood banks hold a huge responsibility in ensuring the safety of the blood donors during the donation process. Adverse event such as VVR is one of the major concerns as it can greatly impair the donor return rate in the future.^[12]

Table 1: Demographic data

Donor characteristics	n (%)
Age (years)	
17-25	7859 (28.2)
26-35	8610 (30.9)
36-45	6981 (25.0)
46-55	3891 (14.0)
56-65	549 (2.0)
Gender	
Male	18,179 (65.2)
Female	9711 (34.8)
Race	
Malay	8226 (29.5)
Chinese	16,266 (58.3)
Indian	2382 (8.5)
Other	398 (1.4)
Foreigner	618 (2.2)
Location	
In-house	7448 (26.7)
Mobile	20,442 (73.3)
Frequency	
First time	10,825 (38.8)
Regular	17,065 (61.2)

Table 2: Vasovagal reaction signs and symptoms

Signs and symptoms	n (%)
Lightheadedness	374 (88.0)
Nausea	23 (5.4)
Vomiting	6 (1.4)
Loss of consciousness <30 s	6 (1.4)
Muscle twitching	15 (3.5)
Paresthesia	1 (0.2)

Our study reveals that the rate of VVR among whole blood donors is 1.5%, which is an incidence of one VVR in every 65 donations. This finding is fairly similar with other studies reported around the world. A study done by Philip *et al.* in India, for example, showed that the rate of VVR in their population is 1.23% in relation to 88,201 donations.^[5] Similarly, another study done by Wiltbank *et al.* showed a VVR rate of 1.43% from total records of 422,231 allogeneic whole blood donations.^[13] However, these two studies showed similar VVR rate with our center; study done in Greek, however, showed a lower VVR rate of 0.87% in relation to 12,173 donors, which is nearly half of VVR rate found in our hospital. This difference in VVR rate is due to a smaller number of donors, and the difference in donor selection criteria by the experienced physicians, which affects the incidence of VVR.^[6]

There are many risk factors that can lead to the development of VVR. Previous studies conducted around the world have reported association of multiple factors such as age, gender, weight, and volume of blood collected with increased incidence of VVR.^[5] However, there is no local study was found exploring these risk factors for Malaysian population. In this study, we found a significant association of factors such as age group, gender, race, frequency of donation, location of donation, and predonation blood pressure with increased incidence of VVR. These findings are found to be similar with various studies done in other countries.

Exploring the factor of age in relation to VVR in our population, it was found that younger donors are more likely to experience VVR compared to the older donors. Donors in the age group of 17–25 years have significantly higher risk of developing VVR compared to other age range. Our finding is supported by studies done by Sultan *et al.* and Tondon *et al.* in India, which showed positive association between increasing age with lower risk of developing VVR.^[12,14] The reason for this association is due to the fact that younger people have higher carotid-aortic baroreceptor sensitivity compared to the older person, which can cause VVR if stimulation occurs during or after the donation process. As the age of the donors increases, this baroreceptor sensitivity becomes dampened. This explains the reducing incidence of VVR with increasing age of the donors.^[6]

Discussing on racial factor, there is no study found in the literature exploring the effect of different races in Malaysia with the development of VVR to the best of our knowledge. This is because, unlike other blood banks around the world, our center received many donors from various racial backgrounds which consist of Malay, Indian, Chinese, and other races, including the foreigners. In our study, it is found that there is a

Table 3: Association between factors and occurrence of vasovagal reaction

Factor	VVR, frequency (%)	No VVR, frequency (%)	χ^2	P
Age group (years)				
17-25	239 (3.0)	7620 (97.0)	200	<0.05
26-35	126 (1.5)	8484 (98.5)		
36-45	49 (0.7)	6932 (99.3)		
46-55	11 (0.3)	3880 (99.7)		
56-65	0	549 (100)		
Gender				
Male	225 (1.2)	17,954 (98.8)	28.5	<0.05
Female	200 (2.1)	9511 (97.9)		
Race				
Chinese	192 (1.2)	16,074 (98.8)	41.2	<0.05
Foreigner	9 (1.5)	609 (98.5)		
Indian	61 (2.6)	2321 (97.4)		
Malay	160 (1.9)	8066 (98.1)		
Others	3 (0.8)	395 (99.2)		
Frequency				
First time	215 (2.0)	10,605 (98.0)	25.2	<0.05
Regular	210 (1.2)	16,849 (98.8)		
Location				
In-house	22 (0.3)	7426 (99.7)	102	<0.05
Mobile	403 (2.0)	20,039 (98.0)		

VVR = Vasovagal reaction

Table 4: Association between blood pressure and vasovagal reaction

Factor	Mean	SD	t-test	P
Systolic				
No VVR	125.42	15.18	4.35	<0.05
VVR	122.21	12.12		
Diastolic				
No VVR	82.94	9.85	2.95	0.003
VVR	81.52	8.85		
MAP				
No VVR	97.10	9.99	4.67	<0.05
VVR	95.09	8.82		

VVR = Vasovagal reaction, MAP = Mean arterial pressure, SD = Standard deviation

significant association between Indian race and the risk of developing VVR compared to other races. The reason for this association is not clear, and further studies are needed to validate this finding.

In term of genders, VVR in our center is frequently seen and associated among female donors. This finding is supported by the previous studies done in India by Tondon *et al.* and Philip *et al.*^[5,14] Female donors are more prone for VVR as they tend to be more anxious and have different emotional state compared to male donors during blood donations.^[15] However, it is interesting to note that studies done by Zervou *et al.* and Gonzalez *et al.* contradicted this association.^[6,16] This is due to different types of analysis used in their study.

Apart from the association with gender, we also found a significant relationship between locations of donation with the development of VVR. Donors who have donated in blood bank centers are shown to have lower risk of developing VVR compared to donation made during mobile donation campaign. This finding is supported by a study done by Seheult *et al.* in Europe.^[17] The incidence of VVR was lower as blood bank provides optimum condition for blood donation process such as cold environment, comfortable and ergonomic bed, and higher experienced staff per donor ratio, which gives our donor the best experience possible. This in turn reduces the rate of VVR in our blood bank center.

We also found that first-time donors have significantly increased rate of VVR compared to regular donors in our blood bank center. This is expected as the first-time donors lack experience of the blood donation process, thus to be more anxious compared to regular blood donors. This finding is supported by the study done by Zervou *et al.*^[6] The stress faced by the first-time donors has direct effect on their emotions, which can affect the activity of central nervous system which in turn stimulates the peripheral vasodilatation causing the effect of VVR.^[18]

Another factor that showed a significant association with VVR in our study is the donor predonation blood pressure. The mean of systolic and diastolic predonation pressure together with mean arterial pressure was noted to be lower in donor who experienced VVR. This finding was statistically significant and in concordance with studies done by Gonzalez *et al.* in Brazil and Ogata *et al.* in Japan.^[16,19] Low predonation blood pressure can indicate that the donor has dehydration or hemodynamic instability which can predispose them to develop VVR.^[20]

Conclusions

The prevalence of VVRs among whole blood donors in Hospital Pulau Pinang appears to be low. We found that the factor of young age, female donor, Indian race, first-time donor, donation made at mobile campaign, and lower blood pressure are associated with development of VVRs. Our study reinforces that blood donation is a safe process, and the incidence of VVR can be further reduced by ensuring strict screening procedures for better donor selection.

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Conflicts of interest

There are no conflicts of interest.

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