

# Orthostatic hypotension after whole blood donation with various physiologic strategies to prevent fainting responses

Ganashree C.P<sup>1</sup>, Aparna M<sup>2\*</sup>, Amrutha A.M<sup>3</sup>, Vijayalakshmi M<sup>4</sup>, Prashanth G<sup>5</sup>

<sup>1</sup>Associate Professor, <sup>2-4</sup>Assistant Professor, <sup>5</sup>Professor, <sup>1,2</sup>Dept. of Physiology, <sup>3,4</sup>Dept. of Community Medicine, <sup>5</sup>Dept. of General Medicine, Basaveshwara Medical College & Hospital, Chitradurga, Karnataka, India

**\*Corresponding Author: Aparna M**

Email: ganashree@hotmail.com

Received: 10<sup>th</sup> November, 2018

Accepted: 6<sup>th</sup> December, 2018

## Abstract

**Introduction:** Donating blood is a generous life-saving gift. It is important to take care of blood donors as health care aspect. Vasovagal reactions occur in 2-5% blood donations. The orthostatic effects superimposed on a hypovolemic state after the donation. Hence this study may become reference base for the protocol.

**Objective:** To compare orthostatic hypotension without and with various physiologic strategies to prevent fainting responses before and after whole blood donation.

**Materials and Methods:** The present study was conducted from July 2016 to Feb 2017. 200 voluntary blood donors were included. They were divided into four groups A, B, C, D. (50 each) Group A as controls (without physiology strategies), group B (Salt water was given), group C (Lower body muscle tension was advised and group D (Both the strategies are applied). Orthostatic hypotension was measured before and immediately after blood donation, 5 minutes, 10 minutes and 15 minutes after blood donation.

**Results:** There was orthostatic hypotension after blood donation, with and without physiologic strategies compared to before blood donation.

1. There was decline in number of donors getting orthostatic hypotension after applying these physiologic strategies compare to without any physiologic strategies.
2. Number of blood donors with orthostatic hypotension was more immediately after blood donation compare to after 5, 10 and 15 minutes after blood donation but improvement was not statistically significant.

**Conclusion:** Physiologic strategies may be advised to prevent fainting responses but need further studies to consider as protocol & compulsory and it is better to advice rest for minimum of 15 minutes.

**Keywords:** Orthostatic hypotension, Blood donation, Physiologic strategies, Salt water supplementation, Lower body muscle tension.

## Introduction

Blood donation is when a person voluntarily has blood drawn and used for transfusions and/or made into biopharmaceutical medications. Donating blood is a generous life-saving gift.

The amount of blood removed during a whole blood donation is 500 ml and 40-50 ml for testing (540ml).<sup>1</sup> The same amount of blood gets pooled downward rapidly during stand up from a supine position (300-800ml),<sup>2</sup> this causes fainting and orthostatic intolerance. In India amount of whole blood donation is 350ml.<sup>3</sup>

Vasovagal reactions occur in 2-5% blood donations.<sup>1</sup> Syncope occasionally leads to injury. Prevention of vasovagal reaction in blood donations is thereby an important issue.

Orthostatic hypotension is a physical finding defined by the American Autonomic Society and the American Academy of Neurology as a systolic blood pressure decrease of at least 20 mm Hg or a diastolic blood pressure decrease of at least 10 mm Hg within three minutes of standing. When we stand up from sitting or lying down, our blood vessels respond to gravity by narrowing to prevent our blood pressure falling. This ensures a steady supply of oxygenated blood to the brain.

Orthostatic hypotension is a form of low blood pressure. It happens when the blood vessels do not constrict

(tighten) as you stand up. It is usually a symptom of an underlying disorder rather than a disease in itself. The condition is also known as postural hypotension.

Everyone is likely to experience a mild form of postural hypotension at some time.

The physiologic mechanisms are direct effects of removal of 540ml of whole blood, the psychological stress of instrumentation and giving blood (i.e., fear of needles, pain, and the sight of blood), and the orthostatic effects superimposed on a hypovolemic state after the donation.<sup>4</sup>

Lower body muscle tensing, plasma volume expansion, and water drinking have been applied as physiologic strategies to prevent syncope in patients with orthostatic intolerance,<sup>5</sup> but it is not well known how these strategies should be applied or combined before, during, and after whole blood donation.<sup>5</sup> Hence this study may become reference base for the protocol.

## Aims and Objectives

To compare orthostatic hypotension without and with various physiologic strategies to prevent fainting responses before and after whole blood donation.

## Materials and Methods

### Source of Data

**Type of Study:** Comparative study.

**Site of Study:** Basaveshwara Medical College & Hospital, Chitradurga.

**Source of Data:** Healthy volunteers of blood bank, Basaveshwara Medical College & Hospital, Chitradurga

**Study Period:** July 2016- Feb 2017 (8 months)

**Sample Size:** 200.

**Ethical Clearance:** Obtained from Institute's ethical committee.

**Sampling Technique:** Random sampling technique.

**Informed Consent:** They were explained about the procedure in detail which is non-invasive in nature and informed consent was taken.

**Inclusion Criteria:** Normal healthy voluntary blood donors aged between 18-40 years

**Exclusion Criteria:**

1. History of Hypertension
2. Diabetic mellitus
3. Pregnancy
4. Orthostatic hypotension

**Method of Collection of Data**

Two hundred volunteers of blood donation camp and blood bank were selected for study. Written informed consent with relevant data (name, age, sex) was taken. Pulse and B.P was recorded 30 min before blood donation.

Orthostatic hypotension was noted 30 min before blood donation, immediately and at 5min, 10min and 15min after blood donation. Subjects were divided into four groups (50 each A, B, C and D).

**Group A:** Controls. Physiologic strategies were not applied to prevent fainting responses.

**Group B:** Salt water was given. Salt 1.2gm was measured using and dissolved in 500ml bottled water. It was given 30min before blood donation.

**Group C:** Lower body muscle tension was advised. (Leg crossing, leg and abdominal muscle tensing, buttock clenching). Lower body muscle tension was advised for

duration of 5 to 10 seconds and a frequency of 3 times per minute during first part of phlebotomy (first one third duration of blood donation, first 3min). It was advised again when the bag is nearly full, the tubing was clamped and needle was removed.

**Group D:** Both physiologic strategies of B and C were applied.

**Procedure to Measure Orthostatic Hypotension**

Blood pressure was recorded using sphygmomanometer in supine position after at least 5min of complete bed rest and then after standing within 3min. Subjects with fall in blood pressure >20/10 mm of Hg were considered as orthostatic hypotension.

**Statistical Analysis**

Data was entered in Microsoft excel, analysis was done using Statistical package for social sciences version 16 (SPSS-16) for windows. Pearson's test was used in studying correlation between parameters. 'P' value  $\leq 0.05$  was considered as statistically significant.

**Results**

The study group comprised of 200 subjects. Orthostatic hypotension was measured before and after blood donation. Following results were noted for various groups.

**Table 1: Physiological measurements before blood donation**

Parameters	Mean (SD)
Age	26.95 (7.62) Years
Heart Rate	76.6 (3.92) bpm
Systolic blood pressure	126.97 (10.64) mmHg
Diastolic blood Pressure	79.4 (5.21) mmHg

**Table 2: Orthostatic hypotension in different groups and at different time intervals before and after blood donation**

	Groups				Total
	A	B	C	D	
Before	0	0	0	0	0
Immediately	22	19	17	15	73
5 MIN	18	11	9	5	43
10 MIN	7	4	3	2	16
15 MIN	4	2	1	2	9

There was increase in number of donors getting orthostatic hypotension after blood donation. Declined by applying physiologic strategies and at 5, 10 and 15 minutes, but however there was no statistical significant difference between groups ( $p=0.88$ )

**Discussion**

**Before Blood Donation**

Orthostatic Hypotension was not considered before blood donation.

Supported by between arriving at the donation site and the venipuncture, the fainting rate is extremely low

(0.004%).<sup>6,7</sup>

Factors associated with VVS before venipuncture are donor's young age and inexperience, that is, first-time status.<sup>6</sup>

**During Blood Donation**

No Change in Orthostatic Hypotension

Central blood volume is decreased after a donation of 540 ml of whole blood. This implies that cardiac filling pressures will be subnormal and that the capacity to buffer orthostatic reductions in central blood volume is limited.<sup>8-11</sup>

## After Blood Donation

### In Group A

There was increase in number of donors getting orthostatic hypotension after blood donation compare to before blood donation.

This may be due to peripheral pooling of blood after standing from supine position and loss of blood about 350 to 500ml after blood donation.

### In Group B

After salt water supplementation number of donors with orthostatic hypotension was less compared to controls.

This may be due to plasma volume expansion there by the blood volume due to salt supplementation.

### In Group C

Number of blood donors with orthostatic hypotension was less compared to controls.

This may be due to The mechanism underlying the effectiveness of these maneuvers is a static contraction of the skeletal muscles in the legs, buttocks, pelvic region, and abdominal wall resulting in emptying of large capacitance veins and thereby in an increase in central blood volume, cardiac filling pressures, stroke volume, and cardiac output.<sup>12,13</sup>

### In Group D

Number of blood donors with orthostatic hypotension was less compared to controls.

This may be due to both the mechanisms explained above

### Immediate After Blood Donation

Number of blood donors with orthostatic hypotension was more immediately after blood donation compare to after 5, 10 and 15 minutes after blood donation.

This may be due to effect of progressive volume depletion induced by removal of 540 ml of blood during donation in combination with the psychological stress of the instrumentation (i.e., fear of needles, pain, and the sight of blood)<sup>14-17</sup> is a likely explanation for the peak fainting rate around the time of removal of the needle.

### After 5, 10 and 15 Minutes of Blood Donation

There was negative co-relation (statistically not significant) improvement in orthostatic hypotension.

This may be due to supported by study shown higher risk of reactions are those which occur when the donor is upright and when the donor is off site.<sup>7</sup>

### Between Group A, B, C, D

There was negative co-relation (statistically not significant) improvement in orthostatic hypotension.

## Conclusion

The following conclusions can be drawn from the results of this study.

1. There was orthostatic hypotension after blood donation, with and without physiologic strategies compared to before blood donation.
2. There was decline in number of donors getting orthostatic hypotension after applying these physiologic strategies. Compare to without any physiologic strategies.

3. There was maximum decline in orthostatic hypotension when both the physiologic strategies were combined.
4. The improvement in orthostatic hypotension was not statistically significant. So these physiologic strategies may be advised to prevent fainting responses. But need further studies to consider as protocol & compulsory.
5. Number of donors with orthostatic hypotension was maximum immediately after blood donation, declined after 5, 10 and 15 minutes. But improvement was not statistically significant. So it is better to advice rest for minimum of 15 minutes.

**Conflict of Interest:** None.

## References

1. Tomasulo P, Bravo M, Kamel H. Time course of vasovagal syncope with whole blood donation. *ISBT Sci Series* 2010;5(n1):52-58.
2. Smit A, Halliwill J, Low P, Wieling W. Pathophysiological basis of orthostatic hypotension in autonomic failure. *J Physiol* 1999;519(1):1-10.
3. Blood donation [Internet]. En.wikipedia.org. 2018 [cited 26 October 2018]. Available from: [http://en.wikipedia.org/wiki/Blood\\_donation](http://en.wikipedia.org/wiki/Blood_donation)
4. Wieling W, France C, van Dijk N, Kamel H, Thijs R, Tomasulo P. Physiologic strategies to prevent fainting responses during or after whole blood donation. *Transfus* 2011;51(12):2727-2738.
5. Wieling W, Colman N, Krediet C, Freeman R. Nonpharmacological treatment of reflex syncope. *Clin Autonomic Res* 2004;14(S1):i62-i70.
6. Sulochana PV, Mettinamma R, Mathai J, Sathyabhama S. Suspected acute myocardial infarction- An unusual reaction in a blood donor. *Transfus Bull* 2004;12(2):08.
7. Wieling W, Krediet C, van Dijk N, Linzer M, Tschakovsky M. Initial orthostatic hypotension: review of a forgotten condition. *Clin Sci* 2007;112(3):157-165.
8. van Dijk N, Quartieri F, Blanc J, Garcia-Civera R, Brignole M, Moya A et al. Effectiveness of Physical Counterpressure Maneuvers in Preventing Vasovagal Syncope. *J Am Coll Cardiol* 2006;48(8):1652-1657.
9. Willing W, Harms MP, ten Harkel AD, van Lieshout JJ, Sprangers RL., Circulatory response evoked by a 3 s bout of dynamic leg exercise in humans. *J Physiol* 1996;494(Pt 2):601-611.
10. VAN DIJK N, VELZEBOER S, DESTREE-VONK A, LINZER M, WIELING W. Psychological Treatment of Malignant Vasovagal Syncope Due to Bloodphobia. *Pacing Clin Electrophysiol* 2001;24(1):122-124.
11. Öst L, Fellenius J, Sterner U. Applied tension, exposure in vivo, and tension-only in the treatment of blood phobia. *Behaviour Res Ther* 1991;29(6):561-574.
12. Wieling W, van Lieshout J, Hainsworth R. Extracellular fluid volume expansion in patients with posturally related syncope. *Clin Autonomic Res* 2002;12(4):242-249.
13. HARKEL A, LIESHOUT J, WIELING W. Treatment of orthostatic hypotension with sleeping in the head-up tilt position, alone and in combination with fludrocortisone. *J Intern Med* 1992;232(2):139-145.
14. Ten Harkel AD, Baisch F, Karemaker JM. Increased orthostatic blood pressure variability after prolonged head-down tilt. *Acta Physiol Scand Suppl* 1992;604:89-99.
15. Krediet C, de Bruin I, Ganzeboom K, Linzer M, van Lieshout J, Wieling W. Leg crossing, muscle tensing, squatting, and the crash position are effective against vasovagal reactions solely

- through increases in cardiac output. *J Appl Physiol* 2005;99(5):1697-1703.
16. Brignole M, Croci F, Menozzi C, Solano A, Donateo P, Oddone D et al. Isometric arm counter-pressure maneuvers to abort impending vasovagal syncope. *J Am College Cardiol* 2002;40(11):2053-2059.
  17. Ditto B, Byrne N, Holly C. Physiological correlates of applied tension may contribute to reduced fainting during medical procedures. *Ann Behav Med* 2009;37(3):306-314.

**How to cite this article:** Ganashree CP, Aparna M, Amrutha AM, Vijayalakshmi M, Prashanth G. Orthostatic hypotension after whole blood donation with various physiologic strategies to prevent fainting responses. *Indian J Clin Anat Physiol* 2019;6(1):1-4.