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ASSESSING THE EFFICACY OF ELECTROLYTE SOLUTION AS PRE-DONATION THERAPY IN PREVENTING VASOVAGAL REACTIONS AMONG FIRST TIME BLOOD DONORS

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Abstract

Introduction:
In response to the increasing need for blood transfusions and the shrinking pool of donors, it is essential to recruit and retain young, first-time blood donors. Vasovagal reactions (VVRs) during blood donation, which range from mild symptoms to severe instances of loss of consciousness, pose a significant barrier to donor retention. This study explores the effectiveness of using an electrolyte solution as pre-donation hydration therapy to reduce the occurrence and severity of VVRs.
Aim:
To evaluate the impact of administering 200mL of electrolyte solution versus 250mL of water on the occurrence and severity of vasovagal reactions in first-time blood donors.
Materials and Methods
A six-month randomized controlled study was carried out in the Department of Transfusion Medicine at a tertiary care hospital in Tamil Nadu. The study population comprised 514 first-time male blood donors between the ages of 18 and 60. Participants were randomly divided into two groups: one group received 250 mL of plain water (control), while the other was given 200 mL of an oral electrolyte solution (intervention group). The designated fluids were administered 20–30 minutes prior to the donation procedure. All vasovagal reactions were monitored and categorized based on the criteria set by the American Association of Blood Banks (AABB)
Results:
Among the 514 donors, 17 (3.29%) experienced adverse reactions, with 11 (4.3%) in the control group and 6 (2.33%) in the test group. The majority of reactions were mild (Grade 1). Chi-square analysis yielded no significant association between the type of pre-donation hydration and the severity of vasovagal reactions ($p = 0.633$).
Conclusion:
The study found no statistically significant difference between water and electrolyte solution in reducing VVRs among first-time blood donors. While pre-donation hydration with either fluid can help mitigate VVRs, further research with larger sample sizes and including female donors is needed to confirm these findings and explore the impact of different pre-donation hydration therapies. Reducing VVRs is crucial for improving donor safety and retention, ultimately enhancing the blood donor pool.

Keywords- Vasovagal reactions, blood donation, electrolyte solution, donor retention, first-time donors, donor welfare, pre-donation hydration

INTRODUCTION:

In light of the growing concerns over transfusion transmissible diseases, the most dependable are those who donate blood voluntarily on a regular basis. Therefore, it is crucial to focus on strategies to recruit and retain young, first-time blood donors to expand and reinforce the donor pool. Increasing need for blood transfusions, shrinking pool of donors, and instances of blood misuse highlight the urgent need to improve blood transfusion practices. These factors also justify the promotion and investment in high-quality blood donation process. (1) Several factors can influence an individual's decision to donate blood again. Despite being considered safe, occasionally adverse reactions may arise during blood donation. They can be "any physical or psychological abnormality that a healthy donor experiences before, during or after phlebotomy process" (2) One significant barrier to donor retention is experiencing syncopal reactions, which range from milder symptoms like diaphoresis, dizziness and light headedness to severe instances of loss of consciousness leading to injury (3) (4) (5) (6) Unpleasant symptoms and signs related to blood donation can dissuade individuals who are both healthy and altruistic from committing regular, recurring voluntary blood donations (7). As per data collected from standardized forms used to report adverse reaction, around 1.5% to 7.5% of whole blood donors had moderate to severe vasovagal reactions . These reactions are more common among first-time donors, yonder individuals and female donors (8) (9) (10) (11) When aggregating donors from various ethnic groups into a single category, the overall rate of donor reactions was 12.1% in 2004, 10.9% in 2005 and 11.5% for the combined statistics of 2004 and 2005 (3) (4) (5) (12) The Blood Donor Return Rates from whole blood and apheresis donations that induced a vasovagal reaction and fatigue are significantly lower than those from donations without a vasovagal reaction. Reducing these syncopal reactions could improve willingness to donate in the future, safety and convenience of the donor, thus enhancing a donor pool which is safe. Therefore, implementing measures to reduce the incidence of adverse donor reactions is crucial.(12) (13) (10) Even the loss of some healthy individuals who are fit to donate, are interested to do so at least once, and who can potentially become voluntary, regular, long-term and repeat blood donors warrants significant consideration (14) Current practice at blood centers is generally to offer refreshments post-donation. Several interventions, including caffeine intake, muscle tension applied to leg muscles, and donor distraction have been tried with varying success. Notably, applying muscle tension to calf muscles during donation has been effective in reducing the occurrence of vasovagal reactions. (15) However salt loading before phlebotomy didn't show any significant decrease statistically in vasovagal reactions (16) Research focusing on pre-donation hydration for lowering the occurrence of post donation vasovagal reactions should be prioritized. This approach is cost-effective, straightforward to administer, lacks inherent complications and is applicable in routine settings (17) (15) (16) As per published data, acute intake of approximately 500 mL of drinking water is shown to raise systolic blood pressure (SBP) by 30-40mmHg. This effect, lasting about an hour, is observed in individuals having autonomic failure because of heightened sympathetic nervous system activity. One suggested explanation involves the physical stretching of the gastric wall and the resulting decrease in osmolality within the portal venous system. In the broader population, this approach enhances orthostatic tolerance with negligible effects on blood pressure.This approach is noted to reduce vasovagal reactions in donors. (18) (19) (20) (21) (22) Salt supplementation in those experiencing syncope is found to improve plasma volume, leading to improved orthostatic tolerance and reduced baroreceptor sensitivity. Studies have confirmed that higher salt intake prolongs the time to fainting during body tilt experiments. This beneficial effect on blood volume from salt loading persists for at least 24 hours (23) (24) (25)

To our knowledge, no published studies currently assesses the impact of using electrolyte solution as predonation hydration therapy in donors.Hence, a study involving whole blood donors to evaluate the effects of administering 250ml of electrolyte solution on immediate vasovagal reaction following blood donation was conducted.

MATERIALS AND METHODOLOGY:

This is a randomized controlled trial with a study period of six months from October 2023 to March 2024 at the Department of Transfusion Medicine of a tertiary care hospital in Tamil Nadu. Ethical clearance was obtained. Our study included a total of 514 donors who visited our hospital's blood center. The participants were assigned to two groups in an alternating manner. Every other donor was designated as a test or control. One group consumed 250 ml of water 20-30 minutes prior to donation and the test group consumed 200ml of electrolyte solution 20-30 minutes prior to blood donation. Both groups consisted of only first time donors. Informed consent was obtained from all the donors

Inclusion criteria:

Male donors aged between 18-60 years who met all the donor eligibility criteria. First time donors were chosen for the study because they represent an optimal group for assessing interventions aimed at reducing reactions, given that they generally experience a higher incidence of reactions compared to repeat donors. (7) (26) (27)

Exclusion criteria:
Donors who have previously experienced vasovagal reactions for reasons unrelated to blood donation, as well and those who didn't consent for their study.

Sampling method:
Sample randomization was done with a random number table. A number sequence was generated randomly and given to each donor in a sealed paper slip. Eligible donors randomly chose one slip with the number from the lot. Donors who picked odd numbers were allocated to the control group and even number to the intervention group.

In the experimental group, the intervention involved having donors drink 200mL of commercially available electrolyte solution. Donors belonging to the control group were made to drink 250 mL of bottled water. The donors in both the groups were made to wait 20 mins before entering the phlebotomy room.

Blood collection followed the standard protocol. A total of 350mL of whole blood was collected into blood bags with 49mL of CPDA (Citrate Phosphate Dextrose Adenine anticoagulant. The outcome assessor, a phlebotomy nurse in the phlebotomy room, was blinded to the group assignments of the donors. The primary outcome measured in this study was the occurrence of vasovagal reactions. The secondary outcome was the severity of vasovagal reactions categorized as mild, moderate, severe and severe with injury as per the Association for the advancement of Blood and Biotherapies (AABB) working classification criteria. (Figure 1)(6) (27)

Figure 1: Classification of Vasovagal Reactions (AABB)

1. Mild vasovagal reactions (Grade 1)- Cold extremities, chills, feeling of warmth, hypotension, extreme light-headedness, dizziness, nausea, vomiting, pallor (pale skin and lips), slow or rapid pulse, twitching
2. Moderate vasovagal reactions (Grade 2)- Symptoms and signs of mild category plus LOC for less than 60 seconds
3. Severe vasovagal reactions (Grade 3)- Symptoms and signs of moderate category plus LOC more than 60 sec, loss of bowel/bladder control
4. Severe vasovagal reaction with injury (Grade 4)- Symptoms and signs of severe vasovagal reactions plus an injury or fall.

Adverse reactions before, during or after blood donation were graded and documented in the adverse reaction reporting form by the staff nurse.
The reactions were graded and recorded. Appropriate remedial measures were taken.

Statistical Analysis: The data analysis was done using SPSS 20. To compare the frequency of the adverse reactions between the two groups, a Chi-square test was employed. A p-value of <0.05 was considered as significant statistically.

RESULTS:

A total of 514 first time donors were included in this study among which 257 donors were included in the control group and 257 donors in the test group. The rates of VVR were 4.3% (n=11) and 2.33% (n=6) in the control group and the test group respectively. Grade 1 reactions were generally higher among both the groups. The adverse reactions were recorded and graded. These results are tabulated (Table 1)

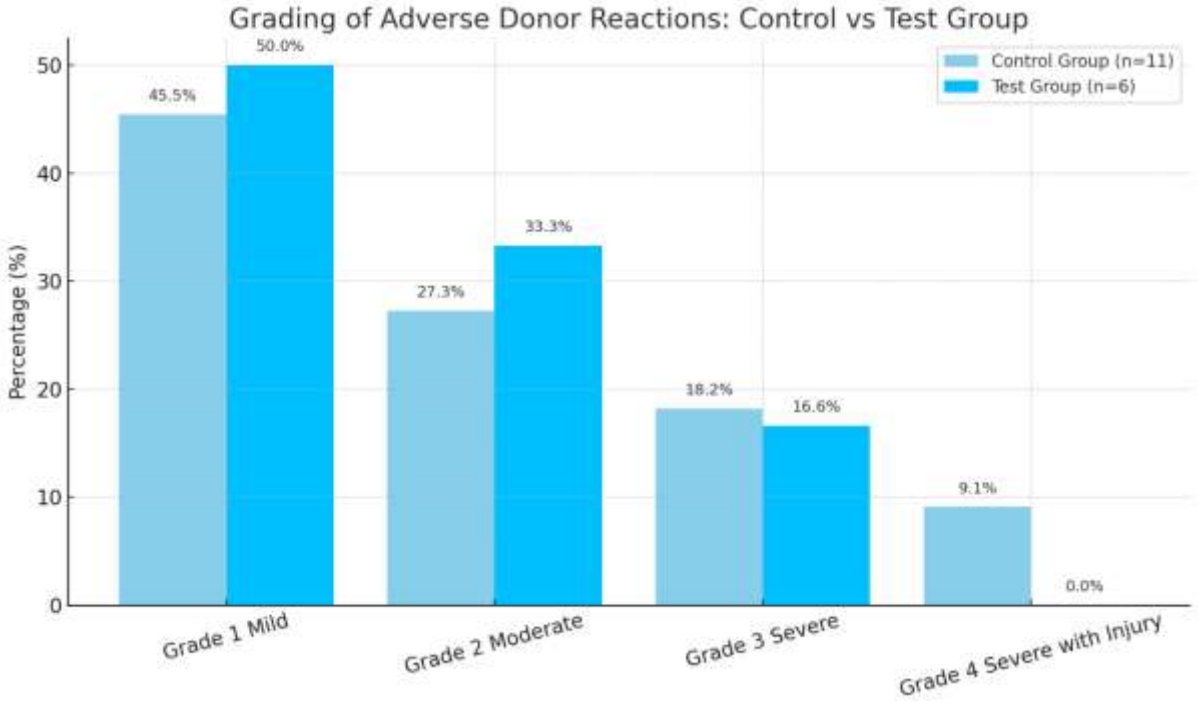
Table 1: Grading of adverse donor reaction among control and test group

GRADING OF ADVERSE DONOR REACTION	CONTROL GROUP (n = 11)	TEST GROUP (n = 6)	TOTAL	x^2	p
GRADE 1 MILD	45.45% (n=5)	50% (n=3)	8 (1.55%)	1.719	0.633
GRADE 2 MODERATE	27.27% (n=3)	33.3% (n=2)	5 (0.97%)		
GRADE 3 SEVERE	18.18% (n=2)	16.6% (n=1)	3 (0.58%)		
GRADE 4 SEVERE WITH INJURY	9.09% (n=1)	0% (n=0)	1 (0.19%)		
TOTAL	100% (11)	100% (6)	17 (3.29%)		

Table 2: Association between electrolyte solution as pre-donation therapy and incidence vasovagal reactions

Vasovagal reactions	Control group	Test group	Total
Present	11	6	17
Absent	246	251	497
Total	257	257	514

Figure 2: The varying percentages of the different grade of adverse reactions among those donors who experienced vasovagal reactions belonging to the control group and the test group.



The study examined adverse reactions among 514 first-time blood donors, divided evenly into control and test groups of 257 donors each. Overall, 17 donors (3.29%) experienced adverse reactions, with the control group showing a higher rate of 4.3% compared to 2.33% in the test group. Adverse reactions were predominantly mild (Grade 1), with 45.45% in the control group and 50% in the test group falling into this category. Moderate (Grade 2) reactions were observed in 27.27% of control group donors and 33.3% of test group donors. Severe reactions (Grade 3) occurred in 18.18% of control group donors and 16.6% of test group donors. Importantly, the control group had one severe Grade 4 reaction (9.09%), whereas the test group had none.
A total of 8 donors (47%, Control group-29.41%, test group-18%) in the study experienced Grade 1 adverse reactions following blood donation, while 5 donors (29.41%, Control group- 17.64%, Test group- 11.76%) experienced Grade 2 reactions, and 3 donors (17.64%, Control group-11.76%, Test group-5.88%)experienced Grade 3 reactions.

Statistical Summary and Interpretation of table 2

- **Odds Ratio (OR)**: **0.53**
    - This indicates that the odds of experiencing a vasovagal reaction in the **test group** (those who received electrolyte solution) are about half (0.53 times) compared to the control group.
- **P-value (Fisher's Exact Test)**: **0.324**
    - This suggests that the difference is **not statistically significant** at the conventional 0.05 level.
- **Incidence Rate**:
    - **Test Group**: **2.33%**
    - **Control Group**: **4.28%**
- **Relative Risk (RR)**: **0.55**
    - The risk of vasovagal reaction in the test group is about **45% lower** than in the control group.

Inference:

Although both the relative risk and odds ratio indicate a reduced likelihood of vasovagal reactions in those who received the electrolyte solution as pre-donation therapy, the association is not statistically significant ($p = 0.324$). Therefore, while the data suggest a potential protective effect, larger sample sizes or further studies are needed to establish significance

DISCUSSION:

This study examined the impact of using electrolyte solution as predonation hydration therapy in preventing adverse donor reactions in first time donors. The efficacy of water loading pre-donation is well documented across various studies done all over the world (6) (22) (15) (26) (28–30). Our study hypothesized that administering an electrolyte solution would result in fewer vasovagal reactions compared to administering water alone. The participants of the study consisted of only novice donors. They were selected as they are ideal for testing interventions aimed at reducing reaction, as first time donors have significantly higher occurrence of vasovagal reactions. (16) (7) (26). Since this study aimed to evaluate the effectiveness of an intervention, a randomized controlled trial (RCT) design was chosen, as it is the most powerful method for assessing intervention efficacy.

However, the results did not support this hypothesis. Although no previous studies have explored the use of an electrolyte solution for this purpose, our study did not find a statistically significant difference between the two interventions. Specifically, the rates of VVRs were 2.8% in the control group and 1.2% in the test group, but this difference did not reach statistical significance.

The lack of significant difference suggests that while both water and electrolyte solutions may have effect in reducing VVRs, neither intervention proved superior in the study. It is possible that the physiological mechanisms underlying VVRs are not sufficiently influenced by the additional electrolytes, or that the sample size was not large enough to detect a difference between the groups.

Vasovagal syncope is thought to unfold in two distinct phases. Initially, in the presyncopal phase, both cardiac output and peripheral vascular resistance rise, leading to a modest increase in blood pressure. This reaction is typical physiological response to stress and blood loss. During the syncopal phase, a sudden decrease in peripheral

vascular sympathetic activity occurs, causing peripheral vasodilation, blood pooling, and subsequent hypotension. This leads to a syncopal reaction. (31) (32).

Vasovagal reactions in blood donors in India have been reported as follows: 1 in 82 (1.23%) in Pune, 1 in 63 (1.58%) in Chandigarh, 1 in 217 (0.46%) in New Delhi and 1 in 62 (1.6%) in Lucknow (33–36)

The findings of our study show that in the absence of electrolyte solution, 250mL of drinking water can be provided to the donors to safe guard them against vasovagal reactions.

LIMITATIONS:

We must highlight several important limitations of our study. Conducted over a three-month period, this research focused exclusively on the effectiveness of a predonation electrolyte therapy in reducing vasovagal reactions among whole blood donors. The study did not account for other potential confounding factors, such as fatigue, insufficient food intake, or lack of sleep, and donors experiencing these conditions were excluded. Furthermore, the study was limited to male donors and the sample size was relatively small. Future research should aim to include both male and female donors and involve a larger sample size to determine if the results hold statistical significance

CONCLUSION:

Vasovagal reaction among blood donors is an undesired outcome from a blood centes point of view as it will decrease the overall return rates of donors. Pre donation hydration therapy with electrolyte solution or water is an inexpensive but effective way of preventing VVRs. More research has to be done among a larger study population to confirm the benefits. Further studies has to be done to know the impact of different types and amounts of the pre donation therapies. Successfully reducing the incidence of VVRs will enhance the donor safety and retention thereby increasing our donor pool. This will ultimately lead to safer blood transfusions.

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