

IMPACT ON CALCIUM AND MAGNESIUM LEVELS DURING AUTOMATED
PLATELETPHERESIS IN NORMAL DONORSDr. Atiar Rahman^{*1}, Dr. Farah Anjum Sonia², Dr. Sheikh Saiful Islam Shaheen³, Dr. Kashfia Islam⁴, Dr. Iffat Ara Akbar⁵, Dr. Zia Uddin Ahmed⁶ and Dr. Shahanj Parveen⁷¹Associate Professor, ^{2,3}Assistant Professor, ⁷MD Resident, Department of Transfusion Medicine, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh.⁴Assistant Professor, Department of Transfusion Medicine, Dhaka Medical College, Dhaka, Bangladesh.⁵Assistant Professor, Department of Transfusion Medicine, International Medical College, Dhaka, Bangladesh.⁶Junior Consultant, Department of Transfusion Medicine, BRB Hospitals Limited, Dhaka, Bangladesh.***Corresponding Author: Dr. Atiar Rahman**

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ABSTRACT

Background: Utilization of apheretic platelet is increasing day by day due to rapid up gradation of technology in Transfusion Medicine. In Bangladesh requirement of apheretic platelet is increasing due to adoption of advance treatment. Physician are using apheretic platelet due to some advantages over random donor platelet. Though it is a blood donation procedure there is little concern about donor adverse reaction and biochemical changes due to citrate utilization. **Objective:** The aim of our study was to evaluate biochemical changes especially in Calcium and Magnesium during collection of platelet by apheretic procedure. Our goal was to also evaluate effect of citrate in these two elements. **Method:** It was a observational study which will be carried out at Transfusion Medicine department, Bangabandhu Sheikh Mujib Medical University, Dhaka from July 2019 to June 2020. Healthy donors was underwent intermittent flow cell separator (MCS 3p, Hemonetics, Braintree, MA, USA). Serum levels of total calcium (tCa) and Mg (tMg) will be measured before, during and after the procedures. **Results:** Our study showed that there was significant change in Calcium level (P <0.001). Serum calcium level fell from 9.24±0.72 mg/dl to 8.43±1.38. But after donation there was no significant change in Magnesium level (P=0.939). **Conclusion:** Our study showed almost 9% reduction of serum calcium level after platelet donation. But there was no significant change in serum Magnesium level which is good sign for aphaeretic platelet donation.

KEYWORDS: Apheretic platelet, biochemical, citrate, anemia, thrombocytopenia.**INTRODUCTION**

Apheresis is a procedure to collect either one or more specific blood component such as platelet (Platephesis), plasma (Plasmapheresis) or stem cell collection. Platepheresis is a procedure in which whole blood is processed from donor, platelet are separated alone and other blood components are returned to the donors. The repeated platepheresis donation might lead to a great amount of cell loss and clinically significant problem in donors such as transient thrombocytopenia, anemia and biochemical changes.^[1] Collection of platelets by means of apheresis requires citrate infusion in order to prevent the clotting of extra corporeal blood in the apheresis circuit.^[2] Citrate known to chelate cations, particularly the free bioactive blood calcium needed by the coagulation factors, also chelates magnesium (Mg).^[3] The reduced calcium (Ca) and magnesium (Mg), in most of the donors are considered physiological and of little consequences.^[4] The standard citrate infusion rate for platephersis procedure is to prevent the accumulation of toxic level in the donor and; half-life of infused citrate is

36_+18 min, which is infused at higher a rate than its removal.^[5] It is reported that the ratio of 12:1 is the ratio of whole blood to citrate anticoagulant. Although donors can generally tolerate up to 20% decrease in ionized calcium level.^[6] However, repeated platelet donations or during prolonged plateletpheresis, citrate accumulation may outpace its metabolism, resulting in hypocalcaemia or hypomagnesaemia, which may cause significant donor discomfort.^[7] Several studies showed that 16-50% platepheresis donor developed citrate related reactions. Magnesium level decrease up to 30-50% depending on procedure performed, and citrate infusion rate may also result from increased urinary excretion of magnesium which occur during and after apheresis. Although the drop of magnesium level is faster and take longer time to recover when compared with calcium levels, symptoms are very similar to that of hypocalcaemia. At times, this donor discomfort may be severe enough to require hospitalization of the donor. Manifestations of hypocalcaemia and hypomagnesaemia are almost similar, and some symptoms may be falsely attributed to

hypocalcaemia; therefore, Calcium supplementation may be a failure in such cases.^[2] The intensified use of new-generation cell separators for collecting high-quality platelet concentrates bears potential risks to the apheresis donors in the form of citrate toxicity, hypovolemia, vasovagal reactions, etc. Magnesium is not only the second most abundant divalent cation in blood; but also involved in many metabolic processes that are closely dependent on its presence (Elin RJ *et al.*,1994) Alterations in magnesium ion activity might also occur during the plateletpheresis, and its variations may have repercussions on both calcium metabolism and parathormone (PTH) response (Rude R *et al.*,1995).^[7,8] However to our best knowledge there is no such information is available regarding Calcium and Magnesium level during automated plateletpheresis donors in our country. So this study will be helpful to evaluate the impact of plateletpheresis on the biochemical parameters, namely total Ca (tCa) and total Mg (tMg) of the donors, and requirement of prophylactic calcium and magnesium supplementation. This study will help to reduce hypocalcaemia and hypomagnesaemia induced post donation adverse reactions.

OBJECTIVES

General Objectives

To assess the impact of plateletpheresis on the biochemical parameters like Calcium and Magnesium on the plateletpheresis donors.

Specific objectives

- (1) Measure total Ca (tCa) and Mg (tMg) before plateletpheresis.
- (2) Measure total Ca (tCa) and Mg (tMg) after plateletpheresis.
- (3) Measure the change in Ca (tCa) and Mg (tMg).

MATERIALS AND METHODS

Study design: Prospective observational study.

Place of study: Department of Transfusion Medicine, BSMMU, Dhaka.

Study population: Donors for plateletpheresis will be included in this study in the Department of Transfusion Medicine, BSMMU,Dhaka in between July 2019-June 2020.

Period of study: 12 months after approval of protocol.

Inclusion Criteria

1. Weight > 50 kg
2. Age- 18 to 60 years
3. At least 1 months from last whole blood
4. Donation/3 days from last platelet apheresis
5. Hemoglobin > 12.5 gm/dl
6. Platelet count > 150 x 10⁹/L
7. Absence of any illness
8. No consumption of non-steroidal anti-inflammatory drugs for last 7 days

9. Negative test for HIV, Hepatitis B, Hepatitis C, malaria, Syphilis and ABO and Rh identical donor for the patient.
10. Adequate venous accesses.

Exclusion criteria

1. Currently taking an antibiotic and other medication for an infection.
2. Taken aspirin or anything that has aspirin in last 48 hours.
3. Pregnant female donor.
4. Vaccinations within 8 weeks.
5. Donated a double unit of red cells using an apheresis machine
6. Had a blood transfusion within last 1 year.
7. Had sexual contact with anyone who has HIV/AIDS or has had a positive test for the HIV/AIDS virus.
8. Had sexual contact with a prostitute or anyone else who takes money or drugs or other payment for sex
9. Had a bleeding condition or a blood disease.
10. Had any problems with heart or lungs.
11. Used clotting factor concentrates.
12. Suffering from any systemic disease or malignancy.

Screening method

The preliminary screening panel for each patient will be included the complete history, physical examination and the necessary laboratory tests.

Sampling method: Purposive sampling.

Demographic and clinical variables

Age, sex, height, weight of donor.

Methodology of data collection

Apheresis

The study will include plateletpheresis procedures performed on healthy male volunteer donors who had given informed consent (Drug Controller of India, eligibility criteria). No prophylactic Ca or Mg supplementation will be administered to any of the donors. All procedure will be performed by (Hemonetics, Braintree,MA, USA).

Sampling

Blood samples for laboratory analysis will be obtained from the sterile port placed on the apheresis circuit. A sample of 5 mL in plain vials will be obtained at 0 min(baseline), and 30 minutes after the end of the procedure. Samples will be centrifuged; the supernatant will be removed and used for measuring tCa and tMg.

Analysis

Using Atomic Absorption Spectrophotometer (Perkin Elmer, A-Analyst-300, Norwalk, CT, USA), tCa and tMg will be measured.

RESULTS

Table-1: Age distribution of the study donors (n=156).

Age (years)	Frequency	Percentage (%)
<30	2	1.3
30-40	127	81.4
41-50	25	16.03
51-60	3	1.9
Total	156	100

Table 1 shows that majority of study donors were between 30-40 years of age (81.4%). 1.3% of study donors were <30 years of age and 16.03% of study donors were 41-50 years of age.

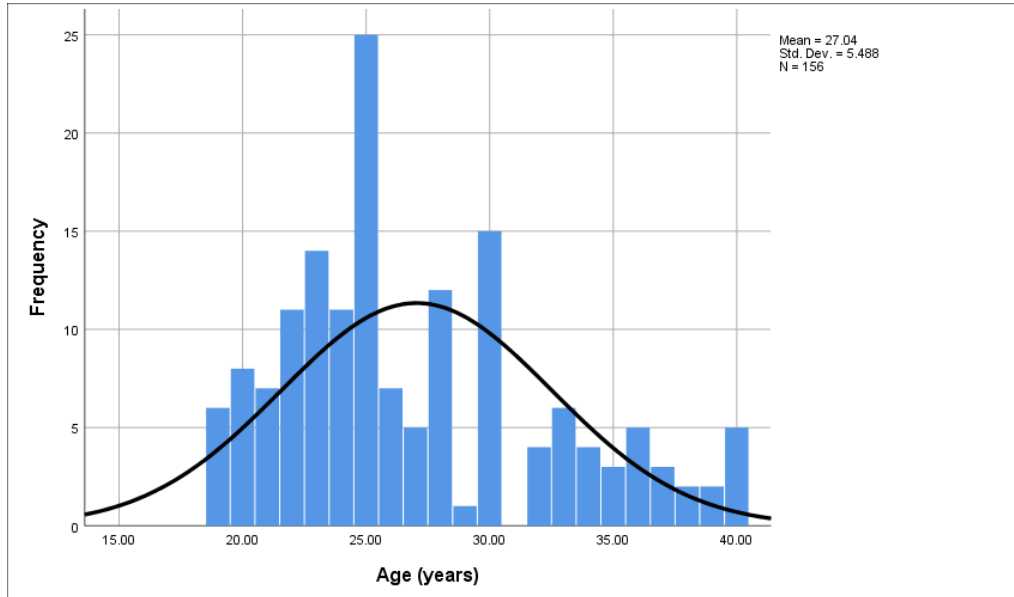


Figure-1: Histogram showing the age distribution of the patients.

Table-2: Gender distribution of the study patients (n=156).

Gender	Frequency	Percentage (%)
Male	153	98.1
Female	3	11.9
Total	156	100.0

Table 2 shows that majority of apheretic platelet donors were male (98.1%) and female donors were 11.9%.

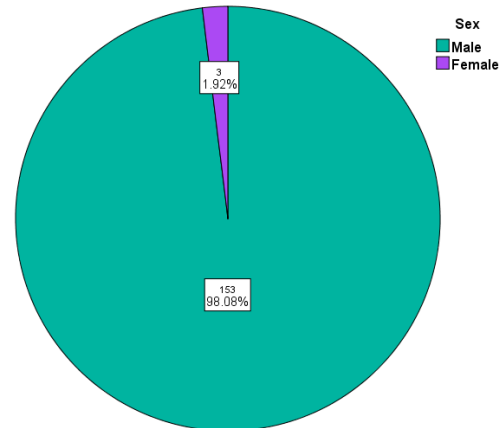


Figure-2: Pie diagram showing the sex distribution of the study patients.

Table-3: Comparison of serum Calcium and serum Magnesium pre and post (n=156).

	Preoperative (n=156) Mean±SD	Postoperative (n=156) Mean±SD	p-value
S. Magnesium	2.04±0.26	2.04±0.92	0.939 ^{ns}
S. Calcium	9.24±0.72	8.43±1.38	<0.001*

Paired t-test was done, *significant, ns= not significant

Table 3 shows that there was significant change in Calcium level after apheretic platelet donation.

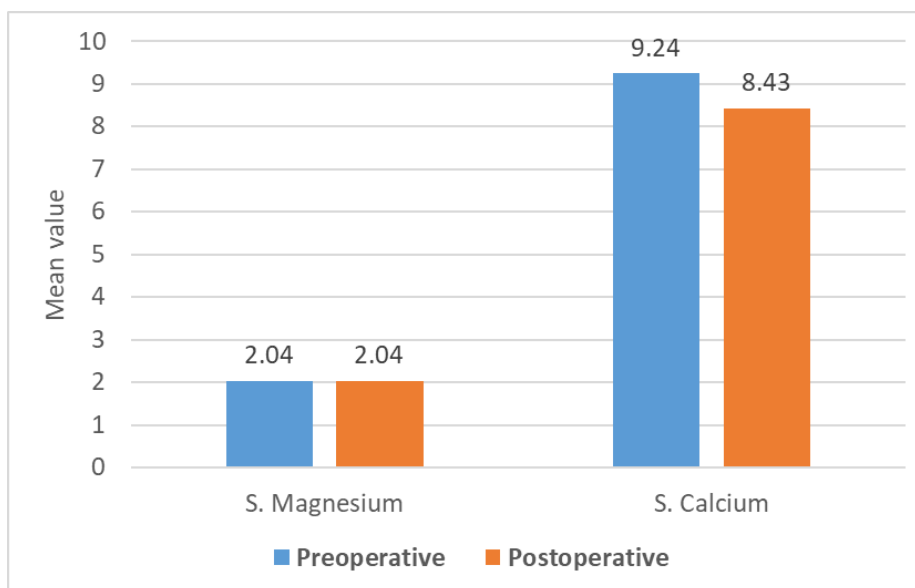


Figure-3: Bar diagram showing the pre and post-aphaeretic serum magnesium and serum calcium.

DISCUSSION

The study was carried out at Transfusion Medicine department, Bangabandhu Sheikh Mujib Medical University from July 2019 to June 2020 over 156 apheretic blood donors. The study was an attempt to find out impact of plateletpheresis on the biochemical parameters like Calcium and Magnesium on the plateletpheresis donors. In this study total 156 donors were included among majority was male 153(98.1%) and rest were female 3 (11.9%) (Table II). Majority (81.4%) of apheretic blood donors were between 30 to 40 years of age. Our study showed that there was significant change in Calcium level ($P < 0.001$). Serum calcium level fell from 9.24 ± 0.72 mg/dl to 8.43 ± 1.38 . But after donation there was no significant change in Magnesium level ($P = 0.939$).

Bolan CD et al. showed that the levels of iCa decreased up to 35% in procedures performed without prophylactic Ca, and more than 50% of such procedures were associated with citrate-related complaints, many of which were clinically significant. In contrast, only 20% of procedures performed with prophylactic Ca were associated with symptoms, most of which were mild.^[9]

Toffaletti J et al studies on plateletpheresis have reported a modest reduction in tMg^{++} and tCa^{++} , a significant drop in ionized calcium and magnesium, and a quick rise in PTH with a continuous decrease thereafter.^[10]

CONCLUSION

Our study showed almost 9% reduction of serum calcium level after platelet donation. But there was no significant change in serum Magnesium level which is good sign for aphaeretic platelet donation. This study denotes the requirement of calcium supplementation before procedure. This study also signifies the requirement of serum calcium evaluation before starting procedure to

reduce post donation complication due to citrate toxicity which represent as hypocalcaemia.

REFERENCES

1. Suresh B, Arun R, Yashovardhan A, Deepthi K, Babu K, Jothibai D. Changes in pre-and post-donation haematological parameters in plateletpheresis donors. *J Clin Sci Res*, 2014; 3: 85–89.
2. Mercan, D., Bastin, G., Lambermont, M. & Dupont, E. Importance of ionized magnesium measurement for monitoring of citrate anticoagulated plateletpheresis. *Transfusion*, 1997; 37: 418–422.
3. Bennett, MW., Webster, NR., Sadek, SA. Alterations in plasma magnesium concentrations during liver transplantation. *Transplantation*, 1993; 56: 859–61.
4. Farrokhi, P., Farahmand, H., Bismuth, A., Suarez, C., Ducot, B., Gillon, M.C., Debat, P., Laskowski, P. & Pinon, F. How to stabilize the level of ionized calcium and citrate during plateletpheresis. *Vox Sanguinis*, 1998; 74: 7–12.
5. Solanki A, Agarwal P. Comprehensive analysis of changes in clinically. *Asian J Transfus*, 2015; 9: 124-128.
6. Lee G., Arepally G. Anticoagulation techniques in apheresis: from heparin. *J Clin Apher*, 2012; 27: 117–125.
7. Elin RJ. Magnesium: The fifth but forgotten electrolyte. *American Journal of Clinical Pathology*, 1994; 102: 616–22.
8. Rude R. *Principles and Practice of Endocrinology and Metabolism*. 2nd ed. Philadelphia: JB Lippincott, 1995.
9. Bolan, CD., Greer, SE., Cecco, SA., Oblitas, JM., Rehak, NN., Leitman, SF. Comprehensive analysis of citrate effects during plateletpheresis in normal donors. *Transfusion*. *Transfusion*, 2001; 41: 1165-71.

10. Toffaletti J, Nissenson R, Endres D, McGarry E, Mogollon G. Influence of continuous infusion of citrate on responses of immunoreactive parathyroid hormone, calcium and magnesium components, and other electrolytes in normal adults during plateletapheresis. *Journal of clinical endocrinology and metabolism*, 1985; 60: 874-9.