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CHANGE IN SERUM MAGNESIUM LEVEL IN PRE AND POST HEALTHY PLATELETPHERESIS DONORS.

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ABSTRACT

Background: Plateletpheresis (more accurately called thrombocytapheresis or thrombapheresis, though these names are rarely used) is the process of collecting thrombocytes, more commonly called platelets, a component of blood involved in blood clotting. The term specifically refers to the method of collecting the platelets, which is performed by a device used in donation that separates the platelets and returns other portions of the blood to the donor. Platelet transfusion can be a life-saving procedure in preventing or treating serious complications from bleeding and hemorrhage in patients who have disorders manifesting as thrombocytopenia (low platelet count) or platelet dysfunction. This process may also be used therapeutically to treat disorders resulting in extraordinarily high platelet counts such as essential thrombocytosis.[1] We planned this study to observe the effect of citrate infusion in plateletpheresis donors and to determine whether the biochemical alteration had any clinical consequences and also focus the altered mineral metabolism in first time plateletpheresis donation. **Study design and methods:** The study was conducted on 62 healthy first time voluntary plateletpheresis donors with age group between 21 to 50 years, at Apheresis unit in blood bank Bharati Vidyapeeth Deemed University Medical College & Hospital, Sangli. Plateletpheresis procedures were performed by using cell separator machine Fenwal Amicus Cell Separator (Baxter Healthcare Corporation Deerfield IL USA). Biochemical values of serum magnesium were measured in all 62 donors, pre and post apheresis procedure. **Result:** We observed that the serum magnesium decreased significantly in the plateletpheresis donors ($p < 0.001$) after each procedure in all donors. **Conclusion:** Infusion of Acid Citrate Dextrose an anticoagulant and its catabolic reactions possibly responsible for the altered levels of serum magnesium .In the context we suggest the donor should be screened for biochemical investigation serum magnesium along with the serological and hematological investigation at first time plateletpheresis donation. These biochemical investigations will be definitely useful in providing the transfusion consultant in the management of plateletpheresis complications.

KEYWORDS: ACD infusion; Biochemical levels; Citrate side effect; Hypomagnesaemia; Plateletpheresis.

INTRODUCTION

Apheresis is a Greek word which means “to carry away”, a technique in which whole blood is taken and separated. From the separated portion, the desired portion (e.g. Plasma or Platelet) is removed and the remaining portion is returned to the circulation. Millions of donors have donated blood by apheresis since its introduction in sixties of the previous century.[1] Various studies on automated plateletpheresis have been conducted to high quality of platelet concentration and its relation to the biochemical parameters. However, safety issues with regards to post procedure, serum calcium and magnesium depletion in donors undergoing plateletpheresis have been only minimally explored. Citrate is the medium used during process of plateletpheresis which lead to increased concentration of citrate in blood. Citrate causes interference in the ionic balance by binding with positive extracellular ions like calcium, magnesium etc. it lead to decreased availability of these important bimolecules, causing its hypo condition. Increased citrate further metabolized to bicarbonate which alter the pH of blood. Acute and moderate side effect observed during plateletpheresis may be due to altered biochemical parameters.

The benefit of therapeutic apheresis is the ability to rapidly, safely, and isovolemically reduce the concentration of a pathological factor or a component of blood (eg, immunoglobulin, leukemic cells). However, even with experienced facilities and personnel, apheresis carries risks. In therapeutic apheresis, the overall rate of adverse events is 5%. These adverse events include, but are not limited to, transfusion reactions. Nausea, vomiting, hypotension, and vasovagal reactions occur

with 2% frequency, and pallor, tachycardia, respiratory distress, muscle spasms, or chills/rigors, occur with 1% frequency. In addition, apheresis patients require venous access. While peripheral venipuncture is preferable, some patients may require insertion of an apheresis catheter, which carries risks such as hematomas, venous sclerosis, thrombosis, bleeding, and infection.[9,10] Acute citrate induced side effect during blood collection by apheresis frequent, but usually harmless. Peripheral tingling, slight malaise and nausea are reported by many apheresis donors but are easily relieved by oral calcium tablets.[1, 2, 6] Magnesium is a divalent cation which has a similar affinity to citrate as calcium. [6,11]

Assessment of certain biochemical parameters and their derangement in plateletpheresis donors in case of pre and post plateletpheresis, certain biochemical investigation are definitely helpful in providing the guideline for the transfusion consultant in the management of plateletpheresis. Therefore the estimation of serum magnesium was performed in pre and post plateletpheresis donor.

MATERIAL AND METHODS

Proposed research work was carried out in Department of Biochemistry, Bharati Vidyapeeth Deemed University Medical College & Hospital, Sangli. Period of the study was from October 2012 to September 2013. The study has been approved by Institute of Ethical Committee (IEC/ 18).

The study was conducted on 62 healthy first time voluntary plateletpheresis donors with age group between 21 to 50 years, at Apheresis unit in blood bank Bharati Vidyapeeth Deemed University Medical College & Hospital,Sangli. Details of plateletpheresis were explained to each donor who gave their consent before the procedure. Average weight of donors was 75.5 kg and average height was 5 feet 6 inch. The mean hematological value of apheresis donor for platelet was 301 x 10^3 / comm. and haematocrit average was 43.20%. The average time taken for every procedure was 62.7 minutes and average product volume was 311.5 ml. All procedures were performed by using cell separator machine Fenwal Amicus Cell Separator (Baxter Healthcare Corporation Deerfield IL USA).

All plateletpheresis procedures were performed following the departmental standard operating procedure (SOP) using closed system apheresis kits and ACD anticoagulant in the proportion of 1: 12. The end point of each procedure was based on the target yield of 3 X $10^{[11]}$ platelets per unit maintaining a blood flow rate for all collections at 50-80 ml/min. During procedure donors were under the influence of soft instrumental music. To measure the pre and post donation biochemical analytes, whole blood sample (5ml) was collected in plain vial just before and within 30 min after completion of the procedure, taking all aseptic precautions serum magnesium, was measured on fully automated analyzer and semi auto analyzer (Star take and Tulip).

Statistical Analysis

All graphics and statistical comparisons were performed with spreadsheet software (Excel, Microsoft). The statistical analysis was done using the ANOVA and "t" test. All results were calculated as mean ± SD and a "p" value of <0.05 was considered statistically significant. Mean values were compared using the paired 't' test. bivariate correlation is obtained to check the relationship between serum magnesium in pre and post plateletpheresis donors.

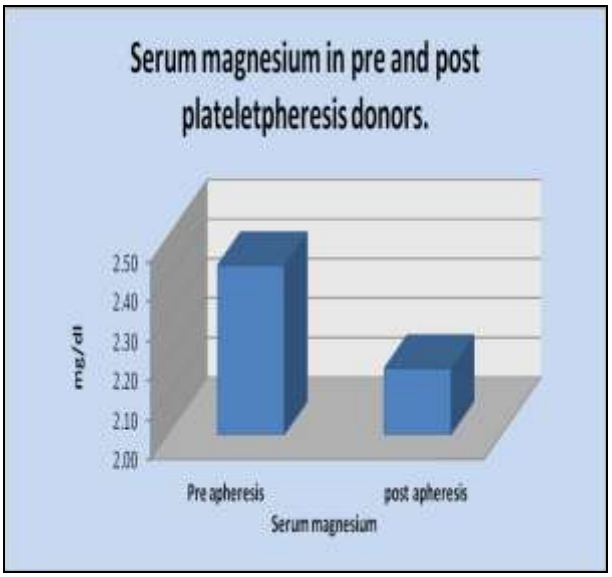
RESULT

After each procedure, serum magnesium was found decreased significantly in donors (P < 0.001). graph No. 1 we observed significantly decreased level of serum magnesium in post procedure as compared to pre procedure (P < 0.001) in plateletpheresis donors. The level of serum magnesium pre procedure was 2.43 mg/dl and that of post procedure was 2.16mg/dl. The difference between pre and post procedure was 0.27mg/dl

Table No.1: Concentrations of serum Magnesium in pre and post plateletpheresis donors.

Serum Magnesium	Mean mg/dl ± S.D.	Std. Error Mean	"t"	"p" value
Pre plateletpheresis	2.43±0.28	0.036	7.60	0.001
Post plateletpheresis	2.16±0.16	0.021		

- Values are expressed as mean ± S.D. statistical comparison between concentration of serum magnesium in pre and post plateletpheresis donors.
- Decreased mean level of serum magnesium in post plateletpheresis donors is highly significant (P< 0.001).



Graph No.2: Concentration of serum Magnesium in pre and post plateletpheresis.

DISCUSSION

Millions of donors have donated blood by apheresis since its introduction in sixties of the previous century.[1] The apheresis is an efficient method to collect one or more specific blood component, such as platelets, (plateletpheresis), plasma (plasmapheresis), and peripheral blood stem cell.[1] The advantage of apheresis includes the collection of standardized high quality product, the possibility of collecting more than one product from single donor, cost effectiveness, a higher donation frequency and more specific collection and supply of blood components tailored to donors and recipients needs.[1] In therapeutic apheresis , whole blood is removed from the patient into an instrument that separates its components via a centrifugation process. The goal is to selectively remove a substantial proportion of one or more components while returning the remaining components to the patient or donors, with or without replacement of the removed component. The rationale to use therapeutic apheresis can be based on knowledge of the disease pathophysiology or evidence that therapeutic apheresis is clinically beneficial. Many patients admitted to the critical care or general medicine services may benefit from apheresis. Donors safety issue in plateletpheresis have, received relatively little attention.

In our study we focused more on donors' safety so that we plan the study to investigation serum magnesium in pre and post plateletpheresis donors and whether the biochemical alteration had any clinical consequences. Presently, there is no history or record available for previous biochemical investigation for those donors who donate plateletpheresis first time. Most of blood bank centers did only serological and hematological investigations. So, we suggest that the donor should be screened for biochemical investigations, which have been include in our study along with the serological and hematological investigation. These biochemical investigations will definitely useful in providing the guideline for the transfusion consultant in the management of complication in plateletpheresis.

We observed significantly decreased level of serum Magnesium in post procedure as composed to pre procedure ($P<0.001$) in plateletpheresis donors (Table No. 1 and graph No. 1). the level of serum magnesium pre procedure was 2.43 mg/dl and that of post procedure was 2.16 mg/dl. The difference between pre and post procedure was 0.27 mg/dl. Determination of changes in magnesium activity during citrate infusion would therefore help in the assessment of its role in the side effects of plateletpheresis. Hypocalcaemia and hypokalemia are usually associated with hypomagnesaemia. Release of calcium from the saecoplasmic reticulum is inhibited by magnesium. Thus hypomagnesaemia result in an increased intracellular calcium level may also be the cause of decreased plasma calcium level.[13] R. Swaminath et, al. in 2003 reported that proximal tubular magnesium reabsorption is proportional to sodium reabsorption, and a reduction in sodium reabsorption during long term intervenes fluid therapy may result in magnesium deficiency.[14]

S. Rapoport et, al. in 1949 reported that, the pH value of 5.03 for the acid preservative, which corresponds in composition to a solution of disodium citrate, may be predicted from the molar ratios of sodium citrate and citric acid present in it, on the basis of the known pK values of the 3 acid groups of citric acid. When ACD solution is added to blood, only the citric acid significantly affects the pH of blood, since at the pH range prevailing in blood, trisodium citrate has an insignificant buffering power. This causes metabolic acidosis and phosphate depletion, which leads to increase the urinary pH and increase the urinary excretion of citrate, may result in hypomagnesaemia.[15]

D. Mercan et,al. in 1997 observed that an acute and steep drop in ionized magnesium occurs during citrate administration.[17] Other researchers whose results support our results are: Rebeyka et, al., 1990; Kulkarni et, al., 1992; Rude, 1995; Mercan et, al., 1997. Assessment of change in magnesium activity during citrate infusion would be supportive to establish of its role in the side effect of plateletpheresis.

CONCLUSION

In our study we observed the declined levels of serum magnesium after the first time plateletpheresis procedure in donors. It shows impact of procedure and altered mineral metabolism in first time plateletpheresis donation. This shows the severity of altered mineral metabolism. Hence we conclude that our mineral index Mg^{+2} may helpful to mention mineral metabolism during procedure of plateletpheresis.

Hypocalcaemia is common manifestation in hypomagnesaemia. Symptomatic hypocalcaemia is usually seen in moderate to severe magnesium deficiency and there is a correlation between serum magnesium and calcium concentrations. Even mild degree of magnesium depletion can cause a significant decrease in serum calcium concentration. Magnesium therapy may be beneficial to restore serum calcium concentration to normal.

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