Original Article

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Biochemistry Section

The Significance of Evalution of Haematocrit in Plateletpheresis Donors

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ABSTRACT

Background: The collection of platelets by apheresis is considered as a very great progress in transfusion medicine. In present era, many automated cell separation are available each model has tried to improve productivity, quality of plateletpheresis. Further various studies have been done to correlate the quality of platelet concentrates. Also, various biochemical studies have been done on plateletpheresis donors. However, safety issue with regards to post procedure levels of biochemical parameters decreased in donors undergoing plateletpheresis have been only minimally explored.

Objectives: Investigating Haematological and Biochemical parameters (Hematocrit value and Serum Calcium levels) pre and post in plateletpheresis donors.

Materials and Methods: Sixty two healthy first time voluntary plateletpheresis donors at Apheresis unit in blood bank Bharati Vidyapeeth Deemed University Medical College & Hospital, Sangli, Maharashtra, India.

Hematocrit value of plateletpheresis donors were analysed and based on mean value 43.2% considering this as standard in the present study. We categorized plateletpheresis donors in two groups (A) these having value less than 43.2% (n = 36) and Group (B) having haematocrit more than 43.3% (n = 26). Volume of ACD required for donors from both group were noted.

Result: We observed mean of ACD infused in group A plateletpheresis donors was 347.7 ml ± 35.75 SD while group 'B' donors required mean volume ACD to be infused was 379.6 ml ± 46.24 S.D. was statistically significant ($p < 0.005$).

Conclusion: Plateletpheresis induces marked metabolic effects, with sustained changes in serum calcium and haematocrit after ACD infusion, the results show, before procedure (Plateletpheresis) one must consider the haematocrit value along with serum calcium levels in Plateletpheresis donor to avoid severe symptoms of hypocalcaemia.

Keywords: Anticoagulant, Blood Transfusion, Hypocalcaemia

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. 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]. To study the relation between haematocrit value and ACD infusion and the comparison of concentration of serum calcium in pre and post plateletpheresis donors.

MATERIALS AND METHODS

Proposed research work was carried out in Department of Biochemistry, Bharati Vidyapeeth Deemed University Medical College & Hospital, and Sangli, India. Period of the study was from October 2012 to September 2013. The study has been approved by Institute of Ethical Committee (IEC/18/ 2012-13). 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. 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 3×10^{11} platelets per unit maintaining a blood flow rate for all collections at 50-80 ml/min. 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 calcium, were measured on fully automated analyser and semi auto analyser (Star take and Tulip). ABBOT fully automated haematological analyser was used to measured haematocrit value.

RESULT

We observed that average weight of donors was 75.5 kg and average height was 5 feet 6 inch. The mean haematological value of apheresis donor for platelet was 301×10^3 /cumm. 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.

- Values are expressed as mean ACD infusion in ml ± SD statistical comparison between ACD infusion and Haematocrit in plateletpheresis donors [Table/Fig-1].

Group	Haematocrit Mean %	n	ACD infusion in ml. Mean ± S.D	Std. Error Mean	t	p-value
A	< = 43.2	36	347.7 ± 35.75	8.346	-2.892	0.005
B	>=43.3	26	379.6 ± 46.24	7.248		

[Table/Fig-1]: Relation between Haematocrit and ACD in Plateletpheresis donors

Serum calcium	Mean mg/dl ± S.D.	Std. Error Mean	"t"	p-value
Pre Plateletpheresis	9.60 ± 0.385	0.049	22.73	0.001
Post Plateletpheresis	8.47 ± 0.32	0.032		

[Table/Fig-2]: Concentration of serum calcium in pre and post plateletpheresis donors

- ACD infusion was statistically more in Group "B" haematocrit donors as compared to Group "A" haematocrit donors. ($p < 0.005$).
- [Table/Fig-2] showing serum calcium concentration in pre and post plateletpheresis donors.

DISCUSSION

This study is the first small scale investigation of the impact of apheresis on biochemical and haematological changes in plateletpheresis donors. Studies on donor's safety have so far typically focused on investigations of immediate adverse events during the plateletpheresis procedure. Apheresis procedure takes more than 40min for completion. During this period donors get relaxed by soft instrumental music.

ACD is used as standard anticoagulant for Plateletpheresis procedure; it is well-known that ACD chelate calcium ions. The acute effects of citrate are recognized and are rapidly reversible because it is metabolized within minutes in the liver, kidneys, and muscles and other compensatory mechanisms, such as the release of PTH that mobilizes calcium from the reservoir in the bones, increases reabsorption of calcium in the kidney and enhances absorption of calcium in the small intestine. While there is clear evidence that short term calcium metabolism is affected by exposure to citrate during apheresis procedures [2]. The present study was carried out to see the relationship between the haematocrit values and biochemical changes in plateletpheresis donors also the quantity of ACD infusion required by each donor and its effect on serum calcium levels has been studied previously (Citrate Toxicity and hypocalcemia) [3], but no study was done previously in relation to Haematocrit value it was found that more the haematocrit value more is the requirement of ACD. Thus citrate toxicity increases and symptoms of hypocalcemia like peripheral tingling, slight malaise and nausea are reported by many apheresis donors but are easily relieved by oral calcium tablets [3].

One more researcher CD Bolan et al., observed, plateletpheresis induces marked acute metabolic effects, with sustained changes evident up to 24 h after the completion of apheresis [3]. Das et al., observed acute ionized hypocalcaemia and hypomagnesaemia after plateletpheresis [2]. He reported that citrate causes hypocalcaemia, citrate chelated calcium ions with resulting unavailability of calcium for coagulation mechanism. Elvedine Landzo et al., prefers a donor with a higher number of initial platelets and lower levels of hematocrits. In this way they can collect a more important yield, have a shorter length of separation and increase the efficiency of platelet collection [4].

Similar observations have been made by previous workers Toffaletti et al., [5]. Also, found similar observation by Mercan et al., [6], Farrokhi et al., [7]. Like the fall in tCa and tMg were modest and not significant, drop in iCa and iMg was statistically significant ($p < 0.001$). In one study, 16% of plateletpheresis donors were found to have symptomatic hypocalcaemia [8]. These data support our results, which indicate that previous biochemical and Haematological investigations are definitely useful for management of donor's safety issue with regards to decrease in biochemical values after plateletpheresis.

LIMITATION

At present all over the world during plateletpheresis used, there is no alternative available to prevent citrate toxicity. Automated technology has improved the quality yield platelet but cannot prevent citrate induced hypocalcemia. At present there is no technology advancement in machine which will measure biochemical and haematological change during procedure automatically.

Future Perspective Study: Further study is defiantly required, Since the limitation of procedure is unavoidable, thus to avoid these biochemical changes, haematocrit value should consider as a surrogate marker to avoid citrate toxicity also improved automated detection of biochemical and haematological changes should be available in machine or alternative to ACD should be available to avoid citrate toxicity.

CONCLUSION

Citrate is the anticoagulant most often used to prevent clotting in the apheresis procedures. Because platelet- depleted blood returned to the donor contains an excess of citrate, the chelation of cations will continue to occur in the donor's vascular system and may cause discomforting symptoms. Before procedure (Plateletpheresis) one must consider the haematocrit value along with serum calcium levels in Plateletpheresis donor to avoid severe symptoms of hypocalcaemia.

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REFERENCES

[1] Karin Amrein, Claudia Katschning, Sabin slpurzyshi, et al. Apheresis affects bone and mineral metabolism. *Bone*. 2010;46:789795.
[2] Das SS, Chaudhary RS, Shukala JS, et al. Calcium and magnésium levels during automated plateletpheresis in normal donors. *Transfusion Medicine*. 2005;15:233-36.
[3] Bolan CD. Cecco SA, Yau YY, et al. Randomized placebo controlled study of oral calcium carbonate supplementation in plateletpheresis II, metabolic effect. *Transfusion*. 2003;43:1414-22.
[4] Elvedine Landzo, Alma Sofo Hafizovic, Vesna Cetkovic, et al. Initial value of Donor Hematocrit anf efficiency of Plateletpheresis. *ACTA INFORM MED*. 2013;21:116-19.
[5] Toffaletti J, Nissenson R, Endres D, et al. Influence of continuous influence of citrate on responses of immunoreactive parathyroied hormone, calcium and magnesium component and other electrolytes in normal adult during plateletpheresis. *Journal of Clinical Endocrinological Metabolism*. 1985;60:874-79.
[6] Mercan D, Bastin G, Lambermant M, et al. Importance of ionized magnesium measurement for monitoring of citrate anticoagulanted plateletpheresis. *Transfusion*. 1997;37:418-22.
[7] Farrokhi.p, Farahmand H, Bismuth.A, et al. How to stabilize the level of ionized calcium and citrate during plateletpheresis. *Vox sanguinis*. 1998;74;7-12.
[8] Boogaerts MA. Side effects of hemapheresis. *Transfusion medicine review*. 1987;I:186-94.

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