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Transfusion Medicine

Transfusion Effectiveness of Single Donor Apheresis Platelet over Random Donor Platelet; A Comparative Study

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Abstract **Original Research Article**

Background: Platelet transfusion performs a key function in treatment for patients with thrombocytopenia. The use of single donor apheresis platelet results in better post-transfusion recovery & survival than random donor platelet. Activation of platelet depends on their preparation and storage and this may be one of the factors responsible for storage related change in platelet membrane proteins. In transfusion medicine laboratory we commonly prepare platelet concentrates from whole blood, platelet rich plasma, buffy coat and single donor plateletpheresis. ***Objective:*** The aim of the study was to evaluate the transfusion effectiveness of single donor apheresis platelet over random donor platelet. ***Methods:*** This is an observational study. This study was carried out on 125 dengue patients the find out about the population including male and female patients in the Department of Transfusion Medicine, Bangabandhu Sheikh Mujib Medical University, Chittagong Medical College Hospital, Bangladesh and Samorita Hospital & Medical College, Dhaka, Bangladesh. The duration of the period from July 2021 to December 2022. The period from data was entered in MS Excel and Statistical analysis was done using SPSS-24. Results: The total study population was 125 patients aged 10 – 40 years, 17(13.6%) were ≤10 years, 49(39.2%) were 11-20 years, 37(29.6%) were 21-30 years and 22(17.6%) were 31-40 years. Sex distribution of the population where, 85(68.0%) were male and 40(32.0%) were female. ***Conclusion:*** Single-donor apheresis platelet transfusions produced higher platelet counts, whereas random donor platelet also effective in preventing hemorrhage.

Keywords: Single-donor apheresis platelet, Random donor platelet, Platelet rich plasma, Platelet concentrate.

INTRODUCTION

Platelet transfusion is one of the most vital types of support therapy for thrombocytopenic patients and platelet function disorder including dengue, leukemia, multiple myeloma, sepsis and aplastic anaemia. Automated platelet (PLT) apheresis has the gain of reducing the danger of expanded donor exposure per transfusion, preventing alloimmunization, PLT refractoriness and transmission of infectious diseases. [1] Platelet transfusion refractoriness is a frequent problem for multi transfused patients. In the context of acute myeloid leukemia (AML), refractoriness charges of up to 27% have been reported. [2,3] Contributing causes include alloimmunization, splenomegaly, fever, frequent infections and use of amphotericin. [4,5] The use of fresh platelets outcomes in higher post-transfusion recuperation and survival than does the use of platelets that have been stored earlier than transfusion. [6] Blood facilities many times put together platelet concentrates from both multiple units of whole blood and single-donor plateletpheresis collections. Several techniques have been introduced to transfusional practice, in an attempt to decrease the problem: leukoreduction, use of ultraviolet irradiated products, dose-based platelet transfusion trials, use of ABO-identical platelet concentrates, HLA-matched platelet transfusions and use of single-donor apheresis platelets (SDAP) products. [7] The use of SDAP or greater doses of platelets is nevertheless controversial and related with greater costs. Some authors suggest the use of SDAP due to much less publicity to multiple

donors, ensuing in smaller risk of illness with infectious ailments and decrease risk of growing alloantibodies. [8].

Both platelet concentrates derived from whole blood or single donor platelets (SDP) received from a single donor through apheresis are indicated to deal with acute hemorrhage secondary to thrombocytopenia or to provide prophylaxis from hemorrhage in patients with bone narrow aplasia. Currently platelet transfusion treatment is constrained via a number of concerns, inclusive of the consequences of alloimmunization in chronically transfused patients and septic reactions brought about by way of bacterial contamination. [9] There is debate about which platelet product need to be used; many transfusion services want the essential use of platelet concentrates, whereas others choose SDP. This evaluation will talk about 5 areas that must be considered when thinking about the use of SDP or Platelet concentrates: (1) the influence on infectious complications, (2) transfusion response rate, (3) leukodepletion, (4) discount of transfusion frequency in sufferers with bone marrow suppression and, (5) the treatment and prevention of alloimmunization. The authors accept that SDP presents important benefits over platelet concentrates for most of these issues, especially when improved patient care is given most important emphasis.

METHODOLOGY

This is an observational study. This study was carried out on 125 dengue patients the find out about the population including male and female patients in the Department of Transfusion Medicine, Bangabandhu Sheikh Mujib Medical University, Chittagong Medical College Hospital, Chattogram, Bangladesh and MH Samorita Hospital & Medical College, Dhaka, Bangladesh. The duration of the period from July 2021 to December 2022. After collection, the data were checked and cleaned, followed by editing, compiling, coding and categorizing according to the objectives and variable to detect errors and to maintain consistency, relevancy and quality control. The choice of treatment was made by the patient after a full discussion with the multidisciplinary team consisting of internal medicine and transfusion medicine specialist. The data for this study about had been accumulated from patients' medical information. Statistical evaluation of the results used to be got via the use of a window-based computer software program devised with Statistical Packages for Social Sciences (SPSS-24).

RESULTS

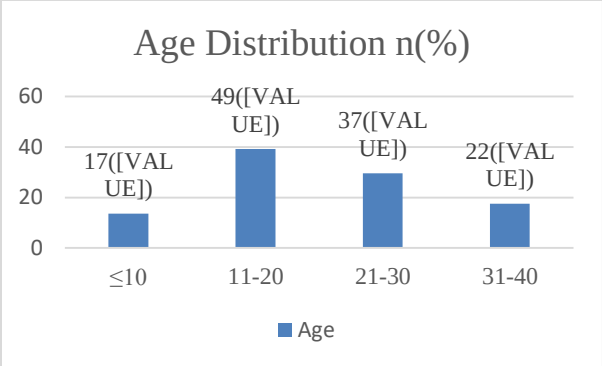

Figure 1: Distribution of the study patients according to age

Figure 1 shows that age distribution of the population, where 17(13.6%) were ≤10 years, 49(39.2%) were 11-20 years, 37(29.6%) were 21-30 years and 22(17.6%) were 31-40 years.

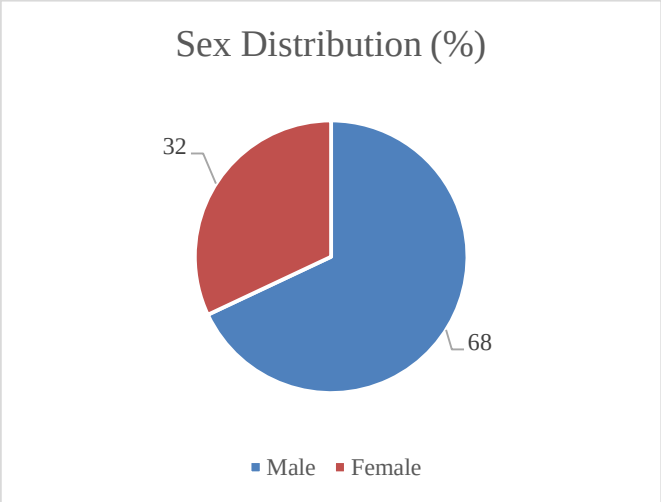

Figure 2: Distribution of patients according to sex

Figure 2 shows the sex distribution of the population where, 85(68.0%) were male and 40(32.0%) were Female. Most of the patients belong to male.

Table I: Distribution of the study according to Classification

Classification	n=125	%
Mild/undifferentiated dengue	6	4.8
Moderate dengue	95	76
Severe dengue	24	19.2

Table I shows the distribution of patients according to Classification, where 6(4.8%) were Mild/undifferentiated dengue, 95(76%) were Moderate dengue and 24(19.2%) were Severe dengue.

Table II: Mean change in platelet count before and after transfusion

	Platelet count
Before Random Donor Platelets	23125
After Random Donor Platelets	42136
Before Single Donor Platelet	27727
After Single Donor Platelet	72750

Table II shows that Mean change in platelet count before and after transfusion. According to Platelet count, 23125 were Before Random Donor Platelets, 42136 were After Random Donor Platelets, 27727 were Before Single Donor Platelet and 72750 were After Single Donor Platelet.

Table III: Mean change in platelet count before and after transfusion.

Parameters	Single Donor Platelet	Random Donor Platelets
Corrected count increments	20200±7400	17800±7600
Percentage recovery	53±19.7%	44.9±20.1%

Table III shows the distribution of patients according to Mean change in platelet count before and after transfusion. When parameter was Corrected count increments, Single Donor Platelet was 20200±7400 and Random Donor Platelets was 17800±7600. And parameter was Percentage recovery, Single Donor Platelet was 53±19.7% and Random Donor Platelets was 44.9±20.1%.

Table IV: Mean duration of hospital stay in both groups

	Mean±SD
Random Donor Platelets	7.4±1.72
Single Donor Platelet	7.45±2.05

Table IV shows that Mean duration of hospital stay in both groups. Here, Random Donor Platelets were 7.4±1.72% and Single Donor Platelet were 7.45±2.05.

DISCUSSION

The higher plasma volumes allowed speedy pump rates; therefore, extra blood passed through the machine as was once the impact of longer process times. The greater PLT counts supposed extra PLTs have been available for collection. [10] Donors with decrease Hb had higher yields, which should be attributed to the increased volume of their processed plasma. These information's have been constant with records received in some other study, when the authors located that each the donor PLT count and Hb concentration influenced PLT yield: a greater PLT count number corresponded to greater yields, whilst Hb confirmed an inverse relationship. [11] The impact of a variety of parameters as utilized in the COBE Spectra model 7.0 during PLT apheresis to optimize the collection efficiency. The impact of PLT apheresis on donors, the blood profile adjustments and the damaging results that took place throughout the procedure. This study shows on separation as well as donor related features, for better clinical and economic advantages. Our present study shows age distribution of the population, where 17(13.6%) were ≤10 years, 49(39.2%) were 11-20 years, 37(29.6%) were 21-30 years and 22(17.6%) were 31-40 years. And sex distribution of the population where, 85(68.0%) were male and 40(31.0%) were female.

On evaluating the impact of PLT apheresis on donor whole blood counts, it was once located that it diverse extensively amongst a number of donors. [12] PLT apheresis used to be not likely to produce clinically significant thrombocytopenia, as PLTs are most probable launched from the splenic stores all through donation. Also, the rinse cycle in the COBE machine, which happens at the end of the run, enables PLTs remaining in the set to be returned to the donor. [13] Hb loss during this system was once minimal, and donors with Hb of 12 g/dl, donated safely. Similar effects had been located in any other current study. Compared to males, females gave greater yields in a

significantly shorter time. This may want to be attributed to the expanded quantity of their processed plasma due to their decrease Hb. [14] In our study, according to Classification, 13(5.2%) were Mild/undifferentiated dengue, 190(76%) were Moderate dengue and 47(19.8%) were Severe dengue. And according to Platelet count, 23125 were Before Random Donor Platelets, 42136 were After Random Donor Platelets, 27727 were Before Single Donor Platelet and 72750 were After Single Donor Platelet.

Similar studies had been observed when four doses of PLTs in patients with AML were reviewed by eliminating all factors that should have an effect on transfusion efficacy other than the number of PLTs transfused. Platelets were fresh, ABO compatible, and administered in similar medical conditions. Beneficial consequences of higher PLT doses were observed, not only in terms of higher post-transfusion counts but also in longer intervals between transfusions. [15, 16] Having demonstrated the dose effect of PLT transfusion may be helpful to determine an optimal dose of PLTs, Norfolk et al. suggested the optimal dose may be 1.5 U/10 kg body weight. Morrison suggested that 5 U of PLTs were needed for an adult. [17] The NIH consensus suggested 1 U/10 kg physique weight per transfusion and the British Committee for Standards in Hematology proposed a formula taking into account the desired PLT increment, the patient's blood volume, and a recovery factor ensuing in a recommended PLT dose of approximately 3×10^{11} platelet for adults. [18] Studying the impact of blood group on PLT increments, the median increment in patients receiving ABO-compatible PLTs used to be greater in contrast to the increments in patients receiving incompatible PLTs. Apheresis PLTs provide 250–400 ml of plasma from a single donor. This can amplify the impact of an excessive titer isoagglutinin in a donor's plasma that may lead to hemolytic transfusion response. [19] There may additionally be a cumulative impact of repeat out-of-group PLT transfusions over a quick time even though every product had a low titer. Many authorities advise monitoring the quantity of out-of-group plasma acquired every day. [20] Josephson and his colleagues suggest the use of plasma elimination in particular if the volume of isoagglutinin is high. However, most doctors would demand the available PLTs even if they have been out-of-group in emergency situations. Our study shows, according to Mean change in platelet count before and after transfusion. When parameter was Corrected count increments, Single Donor Platelet was 20200±7400 and Random Donor Platelet was 17800±7600.

Thus, PLT transfusion efficacy in recipients is influenced by a variety of factors besides alloimmunization and the patient's clinical condition. These factors include: PLT dose, ABO compatibility, pre-transfusion storage time, and leukocyte contamination. [21] With respect to PLT dose, the SDP product should be transfused entirely and not split. That would not only reduce the need for frequent transfusion support in thrombocytopenic patients but also reduce donor exposure preventing alloimmunization and refractoriness. This technique is totally protected as none of the donors experienced any significant drop in their PLT count, or suffered any serious detrimental events. In order to optimize the efficacy of PLT transfusion, it is essential to take into account the brief storage time, excessive PLT dose, ABO compatibility, as properly as low leukocyte contamination, which is supplied currently through new apheresis machine technology.

Limitations of the Study

The present study was conducted in a very short period due to time constraints and funding limitations. The small sample size was also a limitation of the present study.

CONCLUSION

Platelet transfusions and calculating its dose for dengue patients is pretty variable, however transfusing high-dose platelets such as Single-donor apheresis platelet at an appropriate stage can limit similarly requirement of platelet transfusions, fasten the recovery, decrease the hospital stay, decrease the hazard of transfusion-associated unfavorable reactions, and can in addition reduce the related morbidity and mortality.

RECOMMENDATIONS

A multicenter double blinded study in the divisional/ tertiary hospitals of whole Bangladesh can reveal the real picture. The study period should be long. Multi-disciplinary approach of research work can make a study precise & more authentic in this regard.

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DECLARATION

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