**ORIGINAL ARTICLE**

# Platelet Count after Single Donor Platelet Transfusion in Patients of Acute Leukemia Receiving Induction Chemotherapy

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## ABSTRACT

**Objective:** To determine platelet count after single donor platelet transfusion in 24 hours and study confounding effect of induction chemotherapy on platelet count.

**Patients and Methods:** This cross-sectional interventional study was carried out at Oncology Ward, Jinnah Hospital, Lahore. Sixty patients of acute leukemia were included. Admitted, diagnosed cases of acute leukemia with platelet count <20x10$^3$/µl, without fever were included. Patients on antibiotic, having fever, and with platelets count of >20x10$^3$/µl were excluded.

**Results:** Out of total 60 cases, 55 patients (91.6%) showed increment in their platelets count while 5 patients (8.3%) showed no increment. After chemotherapy, among acute myeloid leukemia (AML) patients those on anthracycline, 20 out of 27 maintained increments while those on cytosar showed no increment. In acute lymphoid leukemia (ALL) patients, (on L-asparaginase) 30 out of 33 cases did not maintain increment while in 3 cases no net change was seen.

**Conclusion:** Single donor platelets transfusion increased platelets count in AML and ALL patients. This increment is maintained after chemotherapy.

**Key words:** Platelet count, Single donor, Platelet Transfusion, Acute leukemia, Induction Chemotherapy

## INTRODUCTION

Platelets are very essential and important components of hemostasis. They are formed in bone marrow by megakaryocytes. They are membranous particles containing various types of granules inside, which take part in various hemostatic activities.[1] Quantitative and functional competency is mandatory for normal coagulation. Normal range of platelet count in humans is 150-450x10$^3$/µl. Generally, 70% platelets are in circulation while 30% are sequestered in spleen. Decrease in number of circulating platelets is called thrombocytopenia.[2] Platelets quantitative and functional competency is assessed by bleeding time and aggregometry (aggregation studies) also called platelet function tests. There are multiple causes of thrombocytopenia. The important ones are, aplastic anaemia, bone marrow metastasis, immune thrombocytopenic purpura [ITP] (idiopathic), thrombotic thrombocytopenic purpura (TTP), chemotherapy, radiotherapy, viral infections, certain drugs, and diseases like typhoid and malaria etc.[3,4]

Chemotherapy given for the treatment of acute myeloid leukemia and acute lymphocytic leukemia is of different combinations. In acute myeloid leukemia the common regimen given as induction chemotherapy is as follows: anthracycline, cytosar, cytarabine (Ara-C), duanorubicin, mitoxantrone and etoposide (vepsid), idarubicin (Zavedos), fludarabine (fludara).[5] Commonly used induction chemotherapeutic agents in ALL are asparaginase, cyclophasphamide, vincristine, immitanib (in Philadelphia chromosome+ve ALL patients), amsacrine etc.[6] All these chemotherapeutic agents cause thrombocytopenia.[7]

Effect of chemotherapeutic agents are of varying degree depending upon dose and duration of regimen.[8] The platelet count below 10x10$^3$/µl is considered dangerous as bleeding is common at this level, so WHO recommends that platelets must be transfused at this count. Platelet count of 50x10$^3$/µl is considered safe to avoid untoward sudden drop and incidental bleeding.[9,10]

200 ml of plasma suspended platelets obtained by single donor platelets (SDP) preparation contain 3x10$^{11}$ platelets. Shelf life of platelets is 3-5 days platelets are preserved at room temperature (22-25°C). Indications for platelets transfusion are failure of platelet production (aplastic anaemia)

chemotherapy and radiotherapy.[11] Prophylactic platelet transfusions are given in acute leukemia, aplastic anaemia aggressive chemotherapy, massive blood transfusion, major surgery etc. Platelets can also be transfused therapeutically in condition such as active bleeding with platelet count <50x$10^3$/µl, DIC (Disseminated Intravascular Coagulation) with platelet count of <100x$10^3$/µl, active bleeding with platelet function defects etc. Transfusion of single unit of platelets usually produces an increment of 5-7x$10^3$/µl. ABO and Rh compatibility protocols are followed for planned platelet transfusion.[11,12]

Platelets yield from single donor depends upon platelet count of donor, body weight, and platelets collection method (plasma apheresis machine or manual method). Platelets increment is also affected by a phenomenon called platelet refractoriness. In this condition there is repeated failure to achieve satisfactory increase in platelet count after platelets transfusion. It can be due to genetics, sepsis, DIC, and platelet alloimmunization (immune refractoriness). Single donor platelets have advantages of overcoming this problem of Alloimmunization other advantages are the increase in number of platelets is more (comparatively) in single donor platelet transfusion than with multidonor platelets concentrate. The transfusion reaction and septic reactions are less likely due to lesser chances of antibody formation.[13] The alloantibody formation is not seen in single donor platelet transfusion while it is more commonly seen in multidonor platelets transfusion.

## PATIENTS AND METHODS

This cross-sectional interventional study was carried out at Oncology Ward, Jinnah Hospital, Lahore. Sixty patients (irrespective of age and sex) of acute leukemia were included. Admitted and diagnosed patients of acute myeloid leukemia and acute lymphoid leukemia with platelet count <20x$10^3$/µl, having fever patient and recent platelet transfusion (fresh from single donor) were included. Those patients who received stored platelets transfusion (>3 days old), parenteral heavy antibiotics, with high temperature (>101°F) for last 24-48 hours and platelet count of >20x$10^3$/µl were excluded. Donors with body weight of more than 50 Kg and platelet count of 200x$10^3$/µl or more and blood group cross-match compatibility were selected after taking complete history and clinical information. The pre-transfusion platelet count of patients was determined on sysmek Kx21. Platelets were collected from selected donors by automated Apheresis machine using special kit with LRS filters. This was a bed side procedure performed at plasma apheresis unit located at Pathology Department, Allama Iqbal Medical College, Lahore under hygienic conditions. Platelets were collected in a special bag provided with apheresis kit. Before start of Apheresis procedure blood pressure and pulse of donors were recorded. Platelets bags were stored at room temperature and not in refrigerator to increase their half life. The single dose (Mega dose) of platelets was about 200 ml. It was transfused to (ABO compatible) patients in about 6 hours. Post-platelet transfusion platelets count was determined in 6 hours again on systmex K21 and these counts were verified on smear stained by Giemsa stain. A third plate count was taken of each enrolled patient after chemotherapy was given with in 24 hours.

## RESULTS

Among total 60 patients, 55 patients (91.6%) have increment in plates and 5 patients (8.4%) have no platelets increment before chemotherapy (Table 1). Table 2 showed the acute myeloid leukemia cases on anthracycline and cytosar after chemotherapy, 34 patients (100%) have platelets increment. According to acute lymphoid leukemia cases on L-asponginase after chemotherapy, 30 patients (90.3%) have no platelets increment and 3 patients (9.7%) have platelets increment was seen (Table 3).

**Table 1:** Frequency of patients before chemotherapy (n = 60)

| Status of platelets | No. | % |
|---|---|---|
| Platelets increment | 55 | 91.6 |
| No platelets increment | 5 | 8.4 |

**Table 2:** Frequency of patients after chemotherapy in AML cases on anthracycline and cytosar (n = 34)

| Status of platelets | No. | % |
|---|---|---|
| Platelets increment | 34 | 100.0 |
| No platelets increment | - | - |

**Table 3:** Frequency of patients after chemotherapy in ALL cases on L-asponginase (n = 33)

| Status of platelets | No. | % |
|---|---|---|
| No platelets increment | 30 | 90.3 |
| Platelets increment | 3 | 9.7 |

## DISCUSSION

In this study it is proved that increase in platelet count was significantly greater with single donor platelet transfusion rather than random donor platelet transfusion. This was also observed by Enein et al.[6] In their study yield of platelets in single donor platelet transfusion using plasma apheresis procedure by automated machine was greater than random donor normal methods. They also concluded that this procedure of plasma apheresis is of clinical and economic advantage as well. In this procedure only platelets are extracted, rest of the blood components are returned back into the donor's body. The donor selection criteria like age, weight, platelet count, also affect platelet yield. There is also a strong relationship between pre-donation platelets count and platelets yield.[9]

Moreover 4-8 units (doses) of random donor platelets are required as compared to single unit (dose) of single donor platelet transfusion (SDP).[14,15] ABO compatible platelets transfusion has a positive effect on platelets increment. In contrast, ABO incompatible platelets transfusion has negative effect on platelet increment which is less likely in single donor platelet transfusion.[16]

The platelets stored at lower temperature (in refrigerator) have very short half-life. So the transfusion of platelets stored at lower temperatures or those kept for more than 48 hours have less increase in platelets count as compared to freshly extracted and transfused platelets. Chemotherapeutic agents used in acute myeloid leukemia in these patients were anthracycline and cytosar. Cytosar causes negative effect on platelet increment which is also shown by various studies[17,18] while anhtracycline caused no significant negative effect.

Similarly L-asparaginase used in the treatment of acute lymphoblastic leukemia causes negative effect on platelet increment.[19] To summarize, it is worth mentioning that single donor platelet transfusion performed with all the protocols gives best yield and increment in platelets count. Moreover donor criteria as mentioned before, if adopted and followed gives better yield of platelet from these donors.

## CONCLUSION

We concluded from this study that platelet count after single donor platelets transfusion prior to chemotherapy dose was greater than with multidonor platelets transfusions as given in the results. Although there were some individual variation in 1-2 cases but the average increase in platelet count was prominently more in single donor platelets transfusion. Overall effect of chemotherapy in AML cases on anthracycline was that increase in platelets count was maintained but for those on cytosar the increment in platelet count was not maintained. In ALL cases in about 97% of patients on L-asparginase the increment in platelet was not maintained while a smaller percentage (3%) showed no net change. On the whole, the effect of chemotherapy on platelet count is variable.

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