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Single Donor Platelet Transfusion in Thrombocytopenic Oncology Patients: A Prospective Observational Study

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Abstract: ***Background: Thrombocytopenia is a frequent complication among oncology patients, resulting from chemotherapy-induced bone marrow suppression, marrow infiltration by malignant cells, radiation therapy, or disease progression. Severe thrombocytopenia significantly increases the risk of bleeding and necessitates platelet transfusion. Single Donor Platelet (SDP) transfusion offers several advantages over random donor platelets by reducing donor exposure and minimizing the risk of alloimmunization and transfusion-transmitted infections. Objective: To evaluate platelet response and clinical outcomes following Single Donor Platelet transfusion in thrombocytopenic oncology patients. Materials and Methods: This prospective observational study was conducted over one year in the Department of Immunohematology and Transfusion Medicine in collaboration with the Department of Oncology, SMS Medical College and Hospital, Jaipur. Two hundred adult thrombocytopenic oncology patients receiving SDP transfusions were enrolled. Demographic characteristics, underlying malignancy, chemotherapy status, fever/sepsis, platelet refractoriness, and platelet counts before and 24 hours after transfusion were recorded and analyzed. Results: A total of 200 patients were included. The mean age was 46.8 ± 14.2 years. Male patients constituted 58.7%, while females accounted for 41.3%. Hematological malignancies comprised 64% of cases and solid malignancies 36%. Chemotherapy was administered to 80% of patients. Fever or sepsis was present in 34%, and platelet refractoriness was observed in 14%. The mean platelet count increased from 9,000 ± 3,200/µL before transfusion to 28,000 ± 8,700/µL after 24 hours, with a mean platelet increment of 19,000/µL. Patients with fever/sepsis and platelet refractoriness demonstrated comparatively lower platelet increments. Conclusion: Single Donor Platelet transfusion effectively improved platelet counts among thrombocytopenic oncology patients. Clinical factors such as infection and platelet refractoriness influenced post-transfusion platelet recovery. Larger multicentric studies are required to identify predictors of platelet response and optimize platelet transfusion practices.***

Keywords: Single Donor Platelet, Thrombocytopenia, Oncology, Platelet Transfusion, Hematological Malignancy, Platelet Increment.

1. Introduction

Thrombocytopenia is one of the most common hematological abnormalities encountered in patients with malignancy and is associated with an increased risk of spontaneous bleeding, treatment delays, and poor clinical outcomes.[1] Bone marrow suppression secondary to chemotherapy remains the leading cause of thrombocytopenia, although marrow infiltration by malignant cells, radiotherapy, sepsis, disseminated intravascular coagulation, and disease progression also contribute significantly.[2]

Platelet transfusion represents the cornerstone of supportive care in thrombocytopenic oncology patients. It is administered prophylactically to prevent bleeding in patients with severe thrombocytopenia and therapeutically in those presenting with active hemorrhage.[3] Current international guidelines recommend platelet transfusion based on platelet count, bleeding risk, and clinical condition rather than platelet count alone.[1,3]

Single Donor Platelet (SDP) concentrates collected by automated apheresis have become increasingly preferred over pooled random donor platelets because they provide a higher platelet yield from a single donor while reducing recipient exposure to multiple donors. Consequently, SDP transfusions decrease the risk of alloimmunization, transfusion-transmitted infections, and other transfusion-related complications.[4,5]

Despite these advantages, the response to platelet transfusion varies considerably among patients. Several immune and non-immune factors influence post-transfusion platelet recovery. Fever, systemic infections, splenomegaly, disseminated intravascular coagulation, ongoing bleeding, chemotherapy, and HLA alloimmunization are well-recognized causes of poor platelet increment following transfusion.[6–8] Platelet refractoriness remains an important clinical challenge in patients requiring repeated platelet support during cancer treatment.

Assessment of platelet response following SDP transfusion is essential for evaluating transfusion effectiveness, identifying patients with inadequate platelet recovery, and improving transfusion strategies. However, data regarding platelet response among Indian oncology patients remain limited.

Therefore, the present prospective observational study was undertaken to evaluate platelet responses and clinical outcomes following Single Donor Platelet transfusion in thrombocytopenic oncology patients treated at a tertiary care teaching hospital.

Aim

To evaluate the platelet response and clinical outcomes following Single Donor Platelet (SDP) transfusion in thrombocytopenic oncology patients.

2. Materials and Methods

This was a hospital-based prospective observational study conducted to evaluate the platelet response following Single Donor Platelet (SDP) transfusion in thrombocytopenic

oncology patients.The study was conducted over a period of one year.The study was carried out in the Department of Immunohematology and Transfusion Medicine in collaboration with the Department of Medical Oncology and Clinical Hematology, SMS Medical College and Attached Hospitals, Jaipur, Rajasthan, India.A total of 200 adult oncology patients requiring Single Donor Platelet transfusion were enrolled consecutively during the study period.

Inclusion Criteria

- Adult patients (≥18 years) diagnosed with hematological or solid malignancies
- Platelet count <20,000/µL or requiring SDP transfusion as decided by the treating clinician.
- Patients receiving Single Donor Platelet transfusion.
- Patients willing to provide written informed consent.

Exclusion Criteria

- Patients with incomplete clinical or laboratory records.
- Patients who refused to participate in the study.
- Patients receiving SDP transfusion outside the Department of Oncology.
- Patients in whom post-transfusion platelet counts could not be obtained.

After obtaining written informed consent, demographic and clinical details were recorded using a predesigned case record form. The following information was collected: Age and gender, Type of malignancy, Chemotherapy status, Presence of fever or sepsis, History of previous platelet transfusions, Platelet refractoriness, Pre-transfusion platelet count, Twenty-four-hour post-transfusion platelet count

All Single Donor Platelet units were collected by automated apheresis using standard operating procedures followed in the Department of Immunohematology and Transfusion Medicine. Compatibility testing and transfusion were performed according to departmental protocols. Patients were monitored during and after transfusion for any adverse transfusion reactions.

The primary outcome measure was the platelet response following SDP transfusion, assessed by the increase in platelet count 24 hours after transfusion.

The secondary outcome measures included:, Mean platelet increment following SDP transfusion, Distribution of underlying malignancies, Effect of fever or sepsis on platelet response, Frequency of platelet refractoriness.

3. Results

A total of 200 thrombocytopenic oncology patients receiving Single Donor Platelet (SDP) transfusions were enrolled in the study. The mean age of the study population was 46.8 ± 14.2 years. Male patients constituted 117 (58.5%), while 83 (41.5%) were females.

Hematological malignancies were the most common indication for SDP transfusion, accounting for 128 (64.0%) patients, whereas 72 (36.0%) patients had solid malignancies. Chemotherapy was being administered to 160 (80.0%) patients at the time of transfusion. Fever or sepsis was present in 68 (34.0%) patients, and 28 (14.0%) patients had evidence of platelet refractoriness.

Among the 128 patients with hematological malignancies, acute myeloid leukemia (AML) was the most common diagnosis, observed in 42 (32.8%) patients, followed by acute lymphoblastic leukemia (ALL) in 28 (21.9%) patients. Non-Hodgkin lymphoma (NHL) accounted for 18 (14.1%) cases, multiple myeloma for 16 (12.5%), chronic myeloid leukemia (CML) for 10 (7.8%), aplastic anemia/bone marrow failure syndromes for 8 (6.3%), and other hematological disorders for 6 (4.7%) patients.

Among the 72 patients with solid malignancies, gastrointestinal cancers were the most common, accounting for 18 (25.0%) patients. This was followed by breast cancer in 14 (19.4%), gynecological malignancies in 12 (16.7%), lung cancer in 10 (13.9%), head and neck cancers in 8 (11.1%), genitourinary malignancies in 6 (8.3%), and other solid tumors in 4 (5.6%) patients.

The mean pre-transfusion platelet count was 9,000 ± 3,200/µL. Twenty-four hours after SDP transfusion, the mean platelet count increased to 28,000 ± 8,700/µL, resulting in a mean platelet increment of 19,000/µL.

Patients with fever or sepsis and those with platelet refractoriness showed comparatively lower platelet increments following transfusion than patients without these conditions.

4. Discussion

The present prospective observational study evaluated the platelet response following Single Donor Platelet (SDP) transfusion in thrombocytopenic oncology patients treated at a tertiary care teaching hospital. Platelet transfusion remains an essential component of supportive care in patients with hematological and solid malignancies, particularly those receiving intensive chemotherapy or experiencing bone marrow failure.[1,2]

In the present study, the mean age of the study population was 46.8 ± 14.2 years, with a male predominance (58.5%). Similar demographic findings have been reported in previous studies evaluating platelet transfusion practices among oncology patients, where middle-aged adults constituted the majority of transfusion recipients.[3]

Hematological malignancies accounted for 64% of all cases, while 36% had solid malignancies. The predominance of hematological malignancies is expected because these disorders are frequently associated with severe thrombocytopenia resulting from marrow infiltration, intensive chemotherapy, and stem cell suppression. Acute myeloid leukemia (AML) was the most common hematological malignancy in the present study, followed by acute lymphoblastic leukemia (ALL), findings that are consistent with published literature.[4,5]

Among patients with solid tumors, gastrointestinal malignancies represented the largest subgroup, followed by breast and gynecological cancers. Thrombocytopenia in these

patients is generally related to chemotherapy-induced myelosuppression, advanced disease, or bone marrow involvement.[3]

The mean platelet count increased from 9,000 ± 3,200/µL before transfusion to 28,000 ± 8,700/µL at 24 hours after SDP transfusion, producing a mean platelet increment of 19,000/µL. This demonstrates that SDP transfusion effectively improves platelet counts in thrombocytopenic oncology patients. Similar post-transfusion platelet increments have been reported by Slichter et al. and Stanworth et al., who demonstrated that apheresis platelet transfusion provides effective short-term correction of thrombocytopenia.[5,6]

Approximately 34% of patients had fever or sepsis. These patients demonstrated comparatively lower platelet increments following transfusion. Infection is known to reduce platelet survival through inflammatory activation, endothelial injury, disseminated intravascular coagulation, and increased peripheral platelet consumption. Consequently, patients with sepsis often exhibit suboptimal responses to platelet transfusion.[7]

Platelet refractoriness was observed in 14% of patients. Repeated platelet transfusions, HLA alloimmunization, non-immune platelet consumption, splenomegaly, active bleeding, and ongoing infection are recognized causes of platelet refractoriness. Patients with refractoriness generally demonstrate poor corrected count increments despite adequate platelet transfusion, making further evaluation for immune and non-immune causes essential.[8]

The findings of the present study support the routine use of Single Donor Platelets for thrombocytopenic oncology patients because SDP transfusion minimizes donor exposure while providing satisfactory platelet increments. Careful assessment of clinical factors such as fever, sepsis, and platelet refractoriness is necessary to optimize transfusion outcomes and ensure appropriate utilization of platelet components.

5. Conclusion

Single Donor Platelet transfusion resulted in a significant improvement in platelet counts among thrombocytopenic oncology patients. Hematological malignancies constituted the majority of transfusion recipients. Patients with fever, sepsis, and platelet refractoriness demonstrated comparatively reduced platelet responses following transfusion. SDP transfusion remains an effective and safe component of supportive care in oncology practice by providing adequate platelet increments while minimizing donor exposure. Further multicenter studies incorporating Corrected Count Increment, HLA antibody testing, and long-term clinical outcomes are recommended to better identify predictors of platelet transfusion response and optimize platelet utilization.

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