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Original Research Article

Effectiveness of Platelet Transfusion in Dengue Fever

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ABSTRACT

Background: Dengue fever has become the major public health problem caused by arboviral infection of humans which leads to thrombocytopenia in severe cases. The transfusion of platelets is indicated for the prophylaxis and treatment of haemorrhage in patients with thrombocytopenia. However, some patients do not achieve the appropriate platelet count increment following transfusion. Hence studying the efficacy of platelet transfusion by calculating Corrected count increment(CCI) and platelet percentage recovery(PPR) provides adequate knowledge and usage of platelets in life saving.
Aim: To assess the effectiveness of platelet transfusion in dengue fever.
Materials and methods: Post transfusion platelet parameters are compared with Pre transfusion parameters. The values of Platelet count, CCI and PPR are calculated.
Results: Out of 44 serologically diagnosed dengue cases who received platelet transfusion only 34 (77.3%) patients showed good response whereas 10 (22.7%) patients with bleeding manifestations, hyperpyrexia showed poor response to platelet transfusion or refractoriness.
Conclusion: Platelet transfusion did not prevent development of severe bleeding or shorten time to cessation of bleeding. Therefore, platelet transfusion should not be routinely done in the management of dengue fever. The identification of cause for non responders and treatment gives good outcome, instead of increasing the number of units of transfusion. In doing so extraneous usage of platelet transfusion can be avoided. Therefore, assessing the effectiveness of platelet transfusion can be emphasized in transfusion therapy for the development of specific guidelines for the optimal utilization of platelets.

Keywords: Dengue fever, Platelets

INTRODUCTION

Dengue fever has emerged as a major public health problem and most important arboviral infection endemic to many tropical countries and its incidence is increasing globally. Thrombocytopenia is common in acute dengue infection. [1-4] With an increase in the global burden of this arboviral infection, health care services are continuously striving to improve patient management and searching for innovative approaches to control vector transmission. [5,6] The causes for thrombocytopenia range from idiopathic, infectious to malignancies. Infections predominantly present as febrile illness and may have associated thrombocytopenia. The low platelet count can be considered as the diagnostic marker of some common infections. [6]

The transfusion of platelets is indicated for the prophylaxis and treatment of hemorrhage in patients with thrombocytopenia or with primary or secondary functional disorders of platelets. Platelet transfusions have greatly reduced

the incidence of major hemorrhagic complications associated with the management of haematological and oncological disorders. However, some patients fail to receive the full benefit of platelet transfusions because they do not achieve the appropriate platelet count increment following transfusion. [6-8]

Hence studying the efficacy of platelet transfusion in both prophylactic and therapeutic use provides adequate knowledge and importance of platelets in life saving.

MATERIALS AND METHODS

The EDTA samples of pre transfusion values of patients with thrombocytopenia such as platelet count and mean platelet volume were calculated over a period of 18 months. Within 1 hour following platelet transfusion, parameters corrected count increments (CCI), Platelet percentage recovery (PPR) are evaluated. Post transfusion parameters are compared with Pre transfusion parameters. The values of Platelet count, CCI and PPR are calculated by,

1. Automated hematology analyzer (HORIBA, ABX Pentra DF 120)
2. CCI = $\frac{\text{(Post- pre transfusion platelet count)} \times 10^{11} \text{ X BSA}(m^{2})}{\text{Number of units transfused}}$
3. PPR = $\frac{\text{Platelet increment x } 10^{3} \text{ X estimated total blood volume}}{\text{Number of platelets transfused}} \times 100$

where, BSA (Body surface area)m^2 = √Height(cm) x Weight(kg) / 3600
(The Mosteller formula)

RESULTS

Out of 44 serologically diagnosed dengue cases, the maximum percentage of patients were in the age group 21 to 40 (38.6%) followed by 41 to 60 (34.14%) with male to female ratio of 1.3:1 (Table 1 and 2). Majority of the patients (52.27%) were in the platelet count range of 0 to 20000/µL followed by 20001 to 50000/µL (31.81%) (Table 3). The post transfusion platelet count showed increment with each unit of transfusion except for 10 cases with bleeding manifestations where the increment was very minimal. The corrected count increment (CCI) and platelet percentage recovery (PPR) was calculated on first two consecutive transfusions (Table 4). The number of platelets in each unit ranges from 0.4 to 1.8 x 10^{11} in PRP-PC method. Considering each unit should contain minimum of 4 x 10^{10} platelets, response to platelet transfusion can be found by calculating corrected count increment (CCI) and platelet percentage recovery (PPR).

Table 1: Age distribution of Patients with Dengue fever.

Age (years)	Frequency	Percentage (%)
0 to 20	7	15.9
21 to 40	17	38.6
41 to 60	15	34.14
61 to 80	5	11.36
Total	44	100

Table 2: Sex Distribution of Patients with Dengue fever

Sex	No of patients	Percentage (%)
Male	25	56.82
Female	19	43.18
Total	44	100.0

Table 3: Range of Pretransfusion Platelet count

Pre transfusion platelet count	Number of patients	Percentage (%)
0 to 20000	23	52.27
20001 to 50000	14	31.81
>50000	7	15.92
Total	44	100

Table 4: Distribution of Corrected Count Increment and Platelet Percentage Recovery

Diseases (n=44)	CCI(mean value)		PPR(%)	
	After 1st unit	After 2nd unit	After 1st unit (%)	After 2nd unit (%)
Dengue(n=34)	18247	19865	50	56.2
Dengue with bleeding(n=10)	4082	4082	11.4	11.4

Table 3: Response to Platelet Transfusion

DIAGNOSIS	Responders	Non-Responders	TOTAL
Dengue	34 (77.3%)	10 (22.7%)	44 (100.0%)

Platelet refractoriness or non responders is defined as a 1 hour corrected count increment CCI ≤5000 on two sequential occasions. Those who showed CCI >5000 were considered as responders.

The platelet percentage recovery (PPR) to define a successful transfusion is considered as >30% at 1 hour post transfusion. The CCI and PPR were calculated for 2 successive transfusions and the response to the platelet transfusions was noted. Among 44 dengue patients, 34 patients (77.3%) were good responders whereas 10 patients (22.7%) showing bleeding manifestations were non-responders (Table 5). The probable causes for refractoriness in our study were bleeding manifestations and fever. Yet further workup needs to be done to rule out other immune mediated causes.

DISCUSSION

In our study the efficacy of platelet transfusion was calculated with pre and post transfusion platelet count, CCI and PPR.

The increment in platelet count was lower in non responders when compared to responders which was comparable with a study of Khan et al. [9] In their study 22 patients (53.6%) were non responders among the treatment group and the platelet count increment is lower in non responders than responders. The possible causes of non responders are immune mediated attack causing destruction to platelets leading to thrombocytopenia. The immune-mediated platelet destruction was found to be of lesser severity in responders when compared to non-responders with same level of thrombocytopenia. Also the patients with lower platelet counts may have higher degree of immune mediated destruction of platelets that lead to poor response to platelet transfusion. In the study of Lye et al, [10] there was a lack of efficacy of platelet concentrate transfusion. Bleeding episodes, platelet percentage recovery (PPR) and platelet count increment were similar between patients given transfusion and patients not given transfusion.

The corrected count increment (CCI) and platelet percentage recovery (PPR) was calculated on first two consecutive transfusions. The number of platelets in each unit ranges from 0.4 to 1.8 x 10^{11} in PRP-PC method. Considering each unit should contain minimum of 4 x 10^{10} platelets, response to platelet transfusion can be found by calculating corrected count increment (CCI) and platelet percentage recovery (PPR). [11-14]

Dengue is an infectious disease causing morbidity and mortality in humans which is caused by dengue virus (DNEV), a human arboviruses of family Flaviviridae, transmitted by mosquitoes of genus Aedes. There are four serotypes in dengue viruses; DENV 1, DENV 2, DENV 3, DENV 4. Thrombocytopenia is considered as one of the criteria by WHO guidelines as an indicator of clinical severity. The pathogenesis of thrombocytopenia in dengue infection is not fully identified and may be multifactorial. The most important factor considered to be causing destruction of platelets is immune-mediated attack. [11] The possible pathogenesis of thrombocytopenia in dengue are; 1. Dengue virus has an effect on bone marrow progenitor cells by inhibiting their function to lessen the proliferative capacity of hematopoietic cells which can induce bone marrow hypoplasia during the acute phase of the disease. 2. This causes platelet consumption due to disseminated intravascular coagulation (DIC), platelet destruction due to rapid apoptosis, lysis by the complement system and by the involvement of antiplatelet antibodies. [15,16]

The presence of antibodies focussed against dengue virus non structural protein 1 (NS1) that showed cross-reactivity with endothelial cells and human platelets, which causes damage to platelets and endothelial cells leading to inflammatory activation. [16]

CONCLUSION

Despite improvement seen in most of the patients with respect to platelet count and clinical outcome in dengue fever

patients, few patients failed to improve. The underlying causes for failure being bleeding manifestations and immune mediated destruction of platelets. Mere transfusion of platelets to these patients showed no response resulting in wastage of platelet concentrates, increased risk of transfusion transmitted infections and man power. But the proper usage of platelet concentrate should be assessed by the clinicians to avoid unwanted transfusion of platelets to the patients. Assessing the efficacy of platelet transfusion in these patients provide a useful data in transfusion therapy and in the clinical outcome of the patients. The efficacy can be assessed by minimum of two units of platelet concentrate transfusion and the response to transfusion can be calculated by the corrected count increment and the platelet percentage recovery. So, by assessing the effectiveness of platelet transfusion, this can be emphasized in transfusion therapy for the development of specific guidelines for the optimal utilization of platelets.

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