Corrected Count Increment Analysis After Thrombocyte Apheresis Transfusion At Wahidin Sudirohusodo Hospital

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Abstract.

Background: Platelet transfusion plays a role in preventing and treating bleeding in patients with thrombocytopenia. Transfusion failures can sometimes reach 24-44%. The success of platelet transfusion is assessed using several formulas, including Post-transfusion Platelet Increment (PPI), Percentage Platelet Recovery (PPR), and Corrected Count Increment (CCI). CCI is more accurate and most widely used to assess transfusion success. Transfusion is considered successful if the CCI value one hour after transfusion is ≥ 7.5x10^9/µL or ≥ 4.5 x10^9/µL after 24 hours. Purpose: The aim of this study was to analyze the effectiveness of platelet transfusion, using Corrected Count Increment (CCI) after apheresis platelet transfusion in patients with thrombocytopenia and identify factors that influence this outcome, such as age, gender, and underlying diagnosis at Wahidin Sudirohusodo Hospital Makassar. Methods: This study is a retrospective study by taking secondary data from medical records of patients aged ≥ 18 years, who having weight and height / length data and routine blood counts results for thrombocytopenia <150,000 / µL at Wahidin Sudirohusodo Hospital Makassar from January 2023 to December 2023. The research sample was analyzed using the results of CCI calculations using data processing software. Data analysis using the Kolmogorov-Smirnov test for data normality, the chi Square test, Wilcoxon statistical test results are significant if the p-value <0.05. Results: The results of the data analysis found proportion of CCI after apheresis platelet transfusion was found to be significantly higher (p < 0.001) in the group with increased platelet values. The results of CCI analysis with gender, age, malignant and non-malignant diagnoses showed no significant relationship (p > 0.05). Conclusion: In this study, the effectiveness of apheresis thrombocyte transfusion can be assessed by CCI, which is influenced by height and weight, as well as an increase in platelet values. There is no relationship between gender, age and diagnosis (malignancy and non-malignancy) with CCI values.

Keywords : *Thrombocyte apheresis transfusion; Corrected count increment (CCI); Thrombocytopenia and Platelets.*

I. INTRODUCTION

Platelet transfusion plays an important role in the management of thrombocytopenia cases. Types of platelet product include thrombocyte concentrate (TC) and thrombocyte apheresis (TA). Platelet blood components for transfusion can be obtained from two methods: manual pooling method and the apheresis machine method.[1] Platelets obtained using centrifugation techniques are TC derived from pooled whole blood centrifuged to a volume of approximately 50-60 mL. Platelets were obtained from a single donor through the apheresis process using automated cell separation equipment. The retrieved volume and equivalent platelet content are equivalent to 4-6 units of concentrate. [2,3,4]The American Society of Hematology (2013) states that platelet transfusion is useful as a prophylaxis in the prevention of bleeding and as a therapy to treat bleeding in patients with thrombocytopenia. In clinical practice, several platelet transfusion failures were found. The results of several studies reported platelet transfusion failure reaching 24-44%.

[5]Assessing the success rate of platelet transfusion can use several, including Post-transfusion Platelet Increment (PPI), Percentage Platelet Recovery (PPR), and Corrected Count Increment (CCI). Calculation of the success rate of platelet transfusion using the CCI formula is less practical because it requires data on the number of platelets transfused, but some hospitals use it because it is considered more accurate in determining the success rate of platelet transfusion.[6,7] Corrected Count Increment is the difference of Platelet Increment (PI (µL)) multiplied by each unit of body surface area (Mosteller Body Surface Area (BSA (m^2) formula) and divided by one dose of thrombocyte apheresis transfusion. Platelet transfusion was considered successful or achieved if the CCI number within 1 hour was ≥ 7.5x10^9/µL or ≥ 4.5x10^9/µL within 24 hours after transfusion. Research conducted in 2019 found that out of 242 samples, 135 samples were unsuccessful

(55.8%) and the correlation test between age and CCI found a significant negative correlation and the characteristics of disease diagnosis influenced the success of transfusion. [7]

II. METHODS

This study is a retrospective study that takes secondary data from the medical records of patients aged ≥ 18 years, who weight and height/length data and routine blood count results of thrombocytopenia < 150,000/uL at Wahidin Sudirohusodo Hospital Makassar from January to December 2023. Routine blood count results before and after TA transfusion take from the patient's medical record were used to calculate the CCI value with the following formula:

$$\text{BSA } (m^2) = \sqrt{\frac{height\ (cm)\ x\ weight\ (kg)}{3600}} \quad CCI = \frac{Platelet\ Increment\ (x\ 10^3)\ x\ BSA}{Platelet\ transfused\ (x\ 10^{11})}$$

The study population was all thrombocytopenia patients who were treated at Wahidin Sudirohusodo Hospital from January to December 2023. The study samples were all thrombocytopenia patients who had complete medical records (weight and height/length data as well as the results of routine blood count tests before and after thrombocyte apheresis transfusion and thrombocytopenia patients who did not receive anti-coagulant therapy, amphotericin B antibiotic drug or vancomycin antibiotic drug and did not experience transfusion reactions during the transfusion process (transfusion stopped).The research sample was analyzed for CCI calculation results using the Statistical Package for the Social Sciences (SPSS) application. Data analysis used the *Kolmogorov-Smirnov* test for data normality, the statistical test results are meaningful if the p value is <0.05. The ethical feasibility of this study was obtained from the Health Research Ethics Committee of Faculty of Medicine, Hasanuddin University - Hasanuddin University Hospital – Wahidin Sudirohusodo Hospital Makassar with Ethical Clearance number 514/UN4.6.5.31/PP36/2024

III. RESULTS AND DISCUSSION

The study sample obtained was 65 people, consisting of 38 (58.5%) women and 27 (41.5%) men. The distribution of data tested with *Kolmogorov-Smirnov* for gender and age is normally distributed and the results of the CCI distribution of data obtained are not normally distributed and the characteristics of the study sample are shown in table 1 and the characteristics of the CCI variable in table 2.

Table 1. Characteristics of the Research Sample

Characteristic	n (%)
Gender	
Woman	38 (58.5)
Male	27 (41.5)
Age (years)	
≤ 35	18 (27.7)
36-45	11 (16.9)
46-55	16 (24.6)
56-65	12 18.5)
> 65	8 (12.3)
Diagnosis	
Malignancy	51 (78.5)
Nonmalignancy	14 (21.5)
Correct Count Increment Values	
Achieved	31 (47.7)
Not Achieved	34 (52.3)

Table 2. Characteristics of research variables

Variable	n	Min	Max	Median	Mean	SD
Corrected Count Increment	65	-12.4	107.6	4.4	11.0	19.6

Table 3. Comparison of CCI by Gender

Gender	n	Mean	SD	p
Women	38	11.7	22.0	0.448
Male	27	9.9	16.1	

Mean CCI was found to be higher in females (11.7) than in males (9.94), but the difference was not significant (p > 0.05) by Mann-Whitney *test*.

Table 4. Comparison of CCI by Age

Age	n	Mean	SD	p
≤ 35 year	18	13.3	26.7	
36–45 year	11	11.8	17.7	
46–55 year	16	11.3	17.2	0.74
56–65 year	12	7.2	17.4	
> 65 year	8	9.4	13.4	

In the Kruskal-Wallis test analysis, the mean CCI was found to be highest at age <=35 years (13.39) and lowest at age 56-65 years (7.27), but the difference was not significant (p > 0.05)

Table 5. Comparison of CCI by Diagnosis

Diagnosis	n	Mean	SD	p
Malignancy	51	8.60	14.07	0.42
Nonmalignancy	14	19.8	32.14	

Mean CCI was found to be higher in non-malignancies (19.8) than in malignancies using the *Mann-Whitney test ,* but the difference was not significant (p >0.05)

Table 6. Relationship between increases in platelet count and CCI value

Increases of platelet count after thrombocyte apheresis transfusion	CCI Value		Total
	Achieved	Not Achieved	
	n (%)	n (%)	
Increased	31 (66)	16 (34)	47
Not Increased	0	18 (100)	18

Table 6 shows a significant association between increased platelet count after thrombocyte apheresis transfusion and CCI value p = 0.000 (p < 0.001), where the proportion of CCI value achieved was found to be significantly higher in samples with increased platelets.

DISCUSSION

The study sample obtained was 65 people, with more males in both groups. In general, patients had an average age of 46 years. Gender, age and diagnosis were not statistically significant in this study. The results of the analysis of CCI with gender showed that mean CCI was found to be higher in women (11.7) than male, but the difference was not significant (p > 0.05), in line with the journal Goel et al (2021), which states that women with hormonal influences, immune responses and genetic factors can affect the success of platelet transfusion. [11] Mean of Corrected Count Increament was found to be highest at age ≤ 35 years (13.39) and lowest at age 50ish, but the difference was not significant (p > 0.05). Research by Lisdiana et al (2019) found a significant negative correlation: the older the age the lower the CCI, age will greatly affect thrombopoiesis. The results of the analysis of CCI with diagnosis, divided into malignancy and non-malignancy, showed there was no significant relationship between diagnosis and CCI (p > 0.05), but it appears that the proportion of good CCI is higher in non-malignancies than in malignancies, in line with the research of Charles et ell (2023) found that the prevalence of thrombocytopenia was found in haematological malignancies and solid tissue malignancies and the research of Lisdiana et all (2019) found a high rate of unsuccessful *t*hrombocyte apheresis transfusion in malignancy cases (51.7) %. [7,8,11]

IV. CONCLUSION

In this study, the effectiveness of platelet transfusion can be assessed by Corrected Count Increment formulas, which are influenced by body surace area. There was no relationship between the factors of gender, age and diagnosis (malignancy and non-malignancy) with CCI values. In this study, the CCI value was found to be significant with an increase in platelet levels after thrombocyte apheresis transfusion. Further research is needed to see and find the relationship factors of the increase in platelet count of patients by calculating the platelet content contained in each thrombocyte apheresis product and CCI achievement, both in malignancy and non-malignancy patients.

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