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Platelets Transfusion Practice at Butaro Cancer Centre of Excellence in Rwanda

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ABSTRACT

Background: To respond to the high demand of hospitals for the lack of enough platelets, in 2015, Rwanda national centre for blood transfusion introduced apheresis to produce more platelets. The high increase of impaired bone marrow among cancer patients was declared to be the main cause of the urgent demand of transfused platelets. The aim of this study was to describe the practice of platelets transfusion at Butaro cancer centre.

Methodology: A retrospective study of 238 patients who received platelets transfusions at Butaro Cancer Centre of Excellence within a period of 24 months was carried out. Laboratory register books for blood transfusion, patients' chart files and open clinic patient information software were used to identify all patients who received platelets transfusion at BCCOE during the study period. A collection form was used to record all the required data.

Results: A sum of 209 (87.8%) of receivers of platelets transfusion were cancer patients. Majority of those cancer patients had acute lymphoblastic leukaemia. Out of 1318 platelets units requested, only 925(70.2%) were received of which 573(43.4%) were O Rhesus positive. Among diagnosed cancers, Lymphomas (Chi square =7;P=.01) was statistically significant to be associated with the increase rate of platelets after transfusion. The combination of all diagnosed cancers (Chi square=11;P=.03) were associated with the increase rate of platelets after transfusion.

Conclusion: Regardless the indication of platelets transfusion, the increase of platelet count was observed after each transfusion. Ministry of health has to ensure the availability of platelets for a good care of thrombocytopenic patients of whom cancer patients are the most.

BACKGROUND

Platelets are clotting agents present in the blood cells. They work in conjunction with cytokines, clotting factors, and growth factors to arrest blood bleeding.[1]The quantity of platelets that can be removed from one unit of whole blood is known as platelets unit.[2] Apheresis procedure can be followed for platelets collection. It involves collecting platelets from a single donor but using apheresis machine.[3] Apheresis platelets have a higher residual plasma content compared with whole blood pooled platelets. Apheresis platelets are significantly costlier than whole blood pooled platelets.[3]Thrombocytopenia is often caused by a chemotherapy treatment and has to be rectified to increase platelet count. Platelets transfusion was reported to be a vital aspect of managing thrombocytopenia.[4]

Platelets transfusion have to be used in a proper way and when needed. A threshold concentration of 10,000 platelets/µl is often utilised in haematological malignancies. In patients with solid tumours, platelets transfusion is usually administered for a few days, possibly at a higher platelet level.[5,6] Excessive limitation of platelets production may expose patients to platelets concentrate shortages.[7] Platelets transfusion is found on the WHO list of important medicines since they decline mortality in acute leukaemia patients.[8] In the UK, and abroad there has been a recent rise in platelet component demand. Currently up to 67% of all platelets are used in the management of patients with haematological malignancies.[9]

Cancer patients often need to be transfused platelets if their bone marrow is impaired and therefore is not able to make enough platelets.[10]The platelets are not supplied constantly as most of the donors are not available always for this exercise. Other challenges include the significant increasing risk of product bacterial contamination due to its storage conditions, the very short shelf life, platelets refractoriness, and the limited equipment needed to produce platelets.[11] In Rwanda, blood transfusion services started in 1976 and at this time to produce platelets, ordinary method which required at least six regular blood donors to pr-

oduce a single dose of platelets was used. In order to respond to the increasing demand of hospitals for platelets and other blood components, in 2015, Rwanda national centre for blood transfusion introduced apheresis technology to produce more platelets. With this medical technology whole blood from a donor is removed and separated into individual components so that one particular component such as platelets can be collected.

However, more efforts are still needed in terms of recruiting sufficient blood donors, especially those with rare groups as well as developing new technologies for long conservation of platelets while producing sufficient quantity of platelets so that all demands are adequately responded.[12]

In Rwanda, at Butaro cancer centre of excellence (BCCOE), the number of platelets transfusion has increased more than transfusions of other blood components and majority of patients in need of platelets transfusion are from oncology department. Therapeutic platelets transfusion (platelets transfusion given when patient bleeds) or prophylactic platelets transfusion (platelets transfusion given to prevent bleeding especially when platelet count is below a given trigger level) are often needed to avoid bleeding that can be fatal to the cancer patient.[13] However, challenges and data related to the availability of platelets for transfusion have been observed at BCCOE but not yet well reported. The description of platelets transfusion practices related to platelets transfusion at BCCOE are therefore necessary. The objective of the study was to describe the current practices of platelets transfusion at BCCOE.

METHODS

Butaro Cancer Centre of Excellence

The study was carried out at BCCOE, an outstanding facility built on top of a hill in remote Burera district in Northern Rwanda. This centre of excellence was developed by Partners in Health and Rwanda Ministry of Health, and has become home to thousands of Africans fighting deadly cancer disease. Located next to the Butaro district hospital, the Butaro Cancer Centre of Excellence offers a spectrum of diagnostic oncology and treatment services, including chemotherapy, surgery, a pathology laboratory, counselling, and palliative care.

The centre is designed to facilitate patient and staff flows, and comfortably accommodate patients and their attendants during extensive treatment regimens. Patients enter from the south wing, with its interior and exterior waiting rooms. From there, they proceed to a nearby consultation room, and then into the expansive chemotherapy infusion space. The centre is at 90 km from the capital Kigali, and 48 km from the Ruhengeri regional centre of blood transfusion.

Study Design

This was a retrospective study carried out from 1st January 2016 to 31st December 2017.

Study Population

The study population included238 patients who received platelets transfusion at BCCOE within the study period.

Inclusion and Non-inclusion Criteria

To be included in the study, a person must have been a patient who received platelets transfusion at BCCOE from January 1, 2016 to December 31, 2017. Realised platelets transfusion before and after the study period were excluded from the study.

Data Collection

Laboratory register books for blood transfusion, patients' chart files and open clinic patient information software were used to identify all patients received platelets transfusion at BCCOE during the study period. A collection form was used to record all the required data.

Ethical Consideration

Ethical approval was obtained from both INES-Ruhengeri and BCCOE ethical committees. Only data routinely collected for clinical purposes were used in this study. In addition, to ensure confidentiality of the patients included in the study, extracted data did not contain names of the study participants.

Statistical Analysis

The collected data were analysed by Statistical Package for the Social Sciences for Windows version 22.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics was used to analyse the frequencies, percentages, medians, means and interquartile range. Chi square test was performed to test for the association between disease type and changes in platelets count after transfusion. The level of significance was α=0.05

RESULTS

Profile of Patients Who Received Platelets Transfusion at Butaro Cancer Centre of Excellence

About 238 platelets transfusion were realized. Both male and female patients were represented. The age was categorized in 2 groups (<15 and ≥15 years). More than a half of participants were less than 15 years. There was a high discrepancy between the number of requested platelets and the number of received platelets in all cases (Table 1). The median baseline platelet count was 10 × 10^3/µl with interquartile range of 4 × 10^3/µl to 20 × 10^3/µl (Figure 1). The majority of requested platelets were O Rhesus positive and the least blood type was AB Rhesus negative (Table 2).

Changes in Platelet Count After Transfusion Among Patients With Different Cancers

Table 3 signposts the association between types of cancer studied and the increase rate of platelets transfused. Lymphomas (Chi square=7; *P*=.01) was significantly associated with the increase rate of platelets after transfusion. AML (Chi square =0.03; *P*=.09), ALL (Chi square =.04; *P*=.84), Other malignancies (Chi square=2; *P*=.16), Benign (Chi square =2; *P*=.16) were not partially statistically significant to be associated with the rate increase platelets transfused. All diagnosed cancers (Chi square=11; *P*=.03) were associated with the rate increase of platelets after transfusion.

PlateletsTransfusion Requested and Received Based on Blood Types

Among 238 realised platelet transfusions, the predominant patients were the ones suffering from acute lymphoblastic

TABLE 1: Profile of Patients Who Received Platelets Transfusion at Butaro Cancer Centre of Excellence

Variables	Transfused platelet units	Platelets units requested	Average number of platelets units requested per patient	Platelets units received	Average number of platelets units received per patient
Age (year)					
< 15	125 (52.5%)	690 (52.4%)	6.1	491 (37.2%)	3.9
≥ 15	113 (47.5%)	628 (47.6)	4.8	434.5 (33%)	3.8
Sex					
M	125 (52.5%)	708 (53.7%)	5.7	494 (37.4%)	4.0
F	113 (47.5%)	610 (46.3)	5.4	431.5 (32.7%)	3.8

TABLE 2: Percent, Average and Differences of Requested, Received and Transfused Platelets Units

Blood type	Number of patients transfused (%)	Platelets units requested	Average number of requested platelets units per patient	Platelets units received	Average number of received platelet units per patient	% of received platelets units used by patients	Difference between requested & received platelets units
O Rhesus +	122 (45.0)	729 (55.3%)	6	573 (43.4%)	4.4	21.3	-156
O Rhesus -	14 (5.2)	104 (7.9%)	7.4	67 (5%)	4.8	20.9	-37
A Rhesus +	51 (18.8)	242 (18.4%)	4.7	160 (12.1%)	3.1	31.9	-82
A Rhesus -	5 (1.8	22 (1.7%)	4.4	16 (1.2%)	3.2	31.3	-6
B Rhesus +	38 (14.0)	192 (14.6%)	5.1	121 (9.1%)	3.2	31.4	-71
B Rhesus -	38 (14.0)	21 (1.6%)	4.2	16.5 (1.25%)	3.3	30.4	104
AB Rhesus +	3 (1.1)	8 (0.6%)	2.7	8 (0.6%)	2.7	37.5	0
AB Rhesus -	0 (0.0)	0 (0.0%)	0	0 (0.0%)	0	0.0	0

TABLE 3: Changes in Platelet Count After Transfusion Among Patients With Different Cancers

Cancer diagnosis	Average baseline platelet count (x103 per µl)	Average increase of platelets count after transfusion (x103 per µl)	% changes in platelet count after transfusion	Chi square	P value
ALL	13.9	17.8	12.3	0.04	.84
AML	8.8	11.5	13.3	0.03	.86
Lymphomas	29.3	16.1	-29.1	7	.01
Other malignancies	17.4	31.4	28.7	2	.16
Benign	12.2	22.7	30.1	2	.16

ALL: Acute Lymphoblastic Leukemia, AML: Acute Myeloid Leukemia

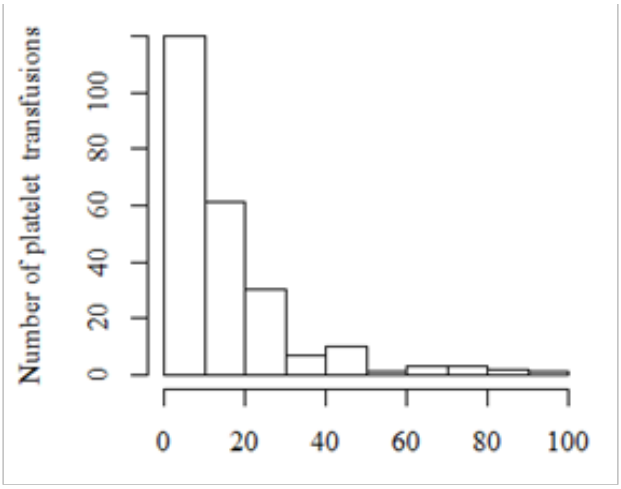
leukaemia (ALL) and were the most who received platelets transfusion. Acute myeloid leukaemia (AML) patients and lymphomas were the least likely of diagnosis to receive platelets transfusion (Table 3). Among platelets transfusion done during the study period, cancer patients (ALL, AML, lymphoma and others) received the most platelets transfusion, while non-cancer patients were the least to be transfused. There was statistical significant association (Chi square= 3.938; *P*= .05) between high platelets transfusion and cancer. The overall association

TABLE 4: Association Between Cancer Status and Platelets Transfusion Rate

	Cancer status					
	Cancer	Non-cancer	Total	X2	df	*P value*
Platelets transfusion						
High	98 (46.9)	6 (20.7)	104 (43.7)	3.938		
Low	111 (53.1)	23 (79.3)	134 (56.3)	3.1		
Total	209	29	238	7.038	1	.01

between platelets transfusion and cancer was statistically significant (Chi square= 7.038; *P*= .01) (Table 4).

FIGURE 1. Baseline Platelet Count



Threshold for platelet transfusion (x1000 cells/ul)

DISCUSSION

Platelets transfusion practice at Butaro cancer centre of excellence were assessed. Among platelets transfusion realised, the platelets transfusion was more frequent in individuals with younger age compared to older age. This could be due to the high incidence of bleeding occurring in patients with leukaemia, and also the demand for chemotherapy treatment becomes higher in this group of age.[14] The male patients were observed as an exposed group to the lack of platelets in the blood, and the demand of platelets transfusion was higher than that of female. The previous studies reported that male patients are the most affected by acute leukaemia and this type of cancer requires high platelets transfusion treatment.[15]

The transfusion of allogeneic platelet products contributes to haemostasis, however, immunisation could make it difficult to manage other complications associated with cancer.[10] The present study reported the low number of platelets transfused compared to what was requested by the patients (table 1). This could be associated with the limited storage conditions that do not allow the long storage of platelets, but also the lack of equipment to produce enough platelets can contribute to this discrepancy. Similar findings were reported by Lambert et al.[11] The median turnaround time to get the requested platelets was 1 day (interquartile range, 1 to 2).

A platelets transfusion is usually prescribed for qualitative or quantitative platelet disorders. Liebman[16]reported 150,000 to 450,000/µl as the normal range for counts of platelets. In the present study, most platelets transfusion were given using thresholds of $0 – 50 \times 10^3$/µl in critically ill thrombocytopenic cancer and non-cancer patients. A baseline platelet counts of 10×10^3/µl with interquartile range of 4×10^3/µl to 20×10^3/µl was recorded. Generally, according to Butaro cancer centre's transfusion protocol, a platelets transfusion is indicated whenever platelets count falls below 10,000/µl, or below 20,000/ µl in the presence of severe mucositis, disseminated intravascular coagulation, splenomegaly, infections, anticoagulant therapy, lumbar puncture or higher likelihood of bleeding due to local tumour invasion. Platelets are also transfused when their count falls below 50,000/µl in patients with major surgical procedure, platelets dysfunction or significant bleeding. Similarly, a number of studies such as ones conducted by Habr *et al.*[17]and Fletcher *et al*[10] suggested that platelets transfusion should be given at a threshold level which is below 20×10^3/µl.

Eight possible blood types were observed among platelets transfusion realised. Most of the requested platelets were O Rhesus positive. However, AB Rhesus negative was least blood type realised for platelets transfusion. This could be ascribed to that the most common worldwide blood type is O Rhesus positive and the rarest blood type is AB Rhesus negative.[18]

Platelets transfusion is an important parameter to manage in all types of cancer.[10] Patients with acute lymphoblastic leukaemia (ALL) received more platelets compared to other cancer types, in the present study. In addition, non-cancer patients received few platelets compared to cancer patients in this study. Therefore, there is a significant association between cancer and receiving high number of platelets transfusion. Indeed, ALL is the most common among children,[19] and generally occurs 5 times more than AML.[20] Children occupied the high percentage of the population targeted. Therefore, this is the reason why ALL is the most common diagnosis of patients who recei-

ived platelets transfusion.

Acute lymphoblastic leukaemia is also often associated with thrombocytopenia not only patients with ALL, but also patients suffering from cancer in general they undergo thrombocytopenia due to the use of myelotoxic chemotherapy regimens resulting in hypo-proliferative thrombocytopenia, and the bone marrow involvement by tumour cells.[4] Similar results were reported by Habr *et al*.[17] and they have shown that the vast majority of platelets transfusion are performed among thrombocytopenic hemato-oncological patients where 81.7% of 296 patients who received platelets transfusion had an underlying hematologic malignancy.

Platelets transfusion is found on the WHO list of important medicines since they reduce mortality in acute leukaemia patients.[8] In the present study, the average increase of platelet count (platelet increment) among patients with ALL for each platelets transfusion was greater than that of patients with lymphomas. Patients with AML had the least average increase in all hematologic malignancies. This is due to the lack of treatment for these patients at BCCOE. Regardless the number of platelets transfusion they can get, the disease keeps damaging the bone marrow and prevent it from producing new platelets in circulation.[21] However, the patients with other malignancy rather than haematological malignancy had the highest average increase of platelet count.

Cancer patients often need to be transfused platelets if their bone marrow is impaired and therefore is not able to make enough platelets.[10] The current findings describes the increase of platelets per category of diagnosis. Most of malignancies that were categorized as "other malignancy", are non-haematology ones or solid malignancies. The average increase of platelet count after transfusion in other malignancies was higher than the one in haematology malignancy. This is due to the non-interference of non-haematology malignancies with bone marrow which make platelets. This is in agreement to the study of Hassan *et al*.[22] who reported lower values for thrombocytopenia incidence among solid cancer patients compared to haematological malignancy patients. Generally, despite several conditions that can interfere with the platelet count increase after platelets transfusion, the increase of platelet count after each platelets transfusion was observed in this present study with a big difference from each category of diagnosis.

Limitations of this Study

This is a retrospective study that was carried out at Butaro cancer centre of excellence on all patients who received platelets transfusion within a period of 24 months from 1st January 2016 and 31st December 2017. Since the study was retrospective, and the accessibility of patients was not possible, the study was limited to know why the increase rate of platelets after transfusion was not the same among cancer patients and cancer type.

CONCLUSION

Platelets transfusion practice at BCCOE were studied. Unavailability of platelets was observed. Cancer patients, especially ALL patients, were the ones who received many platelets transfusion compared to non-cancer patients.

To correct thrombocytopenia, platelets were requested and most of them were O Rhesus positive. The increase of platelets count after transfusion was observed in all category of diagnosis

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