Original Article

The cost of blood in paediatric oncology patients

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Abstract

Introduction: Consumption of blood products is significant aiming to treat low cell counts and improve quality of life however 9% to 44% of the total consumption in centres abroad are unjustified. We reviewed thresholds at which blood products were administered and costs incurred by administering blood products at the local paediatric oncology ward at Mater Dei hospital and assessed whether they were inkeeping with local guidelines.

Methods: Patient files were analyzed retrospectively for demographics, disease, type and amount of blood products used from January to May 2013. The costs involved were obtained from the Blood Bank at Mater Dei Hospital. The standards used were the protocol by HBB regarding administration on KURA and 'Supportive care protocols' in paediatric oncology and haematology.

Results: Nine children were given blood products. Red cell products (RCP) use ranged from 0-10 units. and platelets derived products ranged 0-12 units per patient. haemoglobin levels and platelet counts before transfusions ranged from 3.1 to 8.6g/dL and 9 to $60x10^9$/L respectively. The total cost for the department was €17,950 while the total amount spent for tests done prior to ordering products was €3,276 out of 22 RCP requests for transfusion only once were RCPs transfused above the standard 7g/dL. Platelets were requested 26 times. Documentation regarding the reason for administration was lacking in patient files.

Conclusion: The use of blood products is dependent on patient needs and is not influenced by prices. Thresholds at which platelets and RCP are admnistered vary according to the clinical scenario. Rising costs and shrinking donor pools require blood products to be used judiciously.

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Introduction

Malta has offered blood product transfusion services since the nineteen thirties, then at the Central Civil Hospital. New premises for the Donation Area of the National Blood transfusion Service (NBTS), opened in 2007, are now available for people to donate blood.[1] Despite the consumption of blood products being significant costs for unjustified blood transfusion account from 9% to 44% in centers abroad.[2]

Transfusions provide a treatment and improve the quality of life for patients suffering from chronic diseases.[3] Alternatives to transfusions may prove to have adverse or suboptimal effects making transfusions best practice in anaemia, thrombocytopenia, and in the context of a haematological malignancy. In these situations, specialised blood products may also be required.[4]

In 2000/1 the UK average cost of blood products (adult red blood cells, adult fresh frozen plasma, adult platelet concentrate, adult cryoprecipitate, paediatric products) had a 256% increase compared to 1994/5. This cost is burdened by a shrinking donor pool, an ageing population and more

specialised rigorous treatments.[5-7]

Attempts at comparing the complete cost of blood transfusions by centres has been difficult. Costs are usually compared between red cell products (RCP) as these are the commonest units used. Intangible costs for the centre and society are also generally not included.[8]

What are the current available alternatives to blood transfusions? "Supportive Care protocols of Paediatric Haematology and Oncology" provide guidelines on the management of blood products at Rainbow ward.[9] From them local guidelines have been established, namely the 'Guideline on administration of blood components'.[10] Cytomegalovirus (CMV)-negative (–ve) platelets are used in newly diagnosed leukemics until CMV status is known, or CMV negative recipients. Apheresis platelets arise from a single donor and are preferred from pooled platelets as they reduce the exposure to multiple donors preventing future transfusion reactions due to alloimmunisation. Irradiated RCP are used in recipients with allogeneic bone marrow, peripheral blood stem cell transplants or harvesting, Hodgkin's disease etc. Graft-versus-host disease is therefore prevented by inactivating lymphocytes in donor components.[10]

Aims

To research the amount, cost and cell indices at which blood products are used in Rainbow Ward at Mater Dei Hospital, between the months of January and May 2013 including:

- red cell products,
- CMV-ve red cell products,
- pooled platelets,
- irradiated pooled platelets,
- apheresis platelets.
- irradiated apheresis platelets

Method

Authorization from the Data Protection Officer at Mater Dei Hospital was obtained to review the files of patients admitted to Rainbow ward between the months of January to May 2013. Patient files were analysed retrospectively for:

- age,
- gender,
- disease,
- type and amount of blood products used.

Exclusion criteria included:

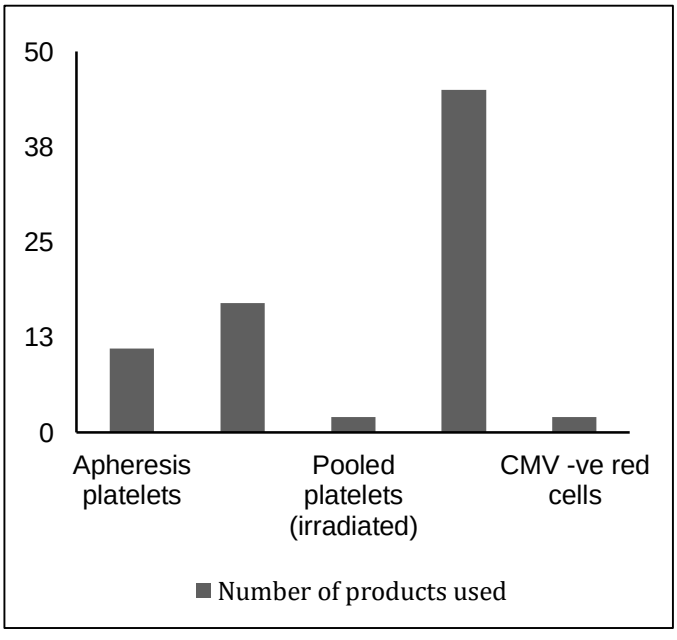
- patients transfused outside Rainbow ward,
- patients who were above 16 years of age,
- patients receiving transfusions outside the set time frame.

The cost of each blood product was obtained from the blood bank at Mater Dei Hospital. Blood products used in this study were divided into: RCPs, CMV-ve RCPs, pooled platelets, irradiated pooled platelets, apheresis platelets and irradiated apheresis platelets. The currency used was the euro. Patient details were anonymised.

Results

Nine children were transfused between January and May 2013, with a range of 0-10 units of RCPs and 0-12 therapeutic doses/units of platelets. The total amount spent for tests used to order blood products was that of 3276 euro, as provided by the Blood Bank at Mater Dei Hospital. 47 units of RCP and 30 platelet blood products were used in all (Figure 1). The haemoglobin range before transfusing RCP ranged from 3.1-8.6g/dl. RCP transfusions occurred 22 times, with only one instance where RCP were transfused above 8g/dl. RCP was the commonest blood product used whereas irradiated platelets were the least used (Figure1).

Figure 1*: Number of units used according to blood product*



Platelet counts before transfusion ranged from 9-60x10^9/liter. Platelets were transfused on 26 occasions, with eleven instances of platelet indices above 20x10^9/L.

The total cost over the five month period for the department was 17,950 euro. The greatest cost per condition was for acute lymphoblastic leukaemia (ALL)-1 – 5375 euro whilst the lowest cost was for ALL-4 at 125 euro. Patients' duration of treatment ranged from weeks to months.

ALL was the commonest condition treated, accounting for four out of nine patients. It was also the most costly per patient due to more frequent use of apheresis platelets (Table 2).

***Table 1**: Data regarding patients and products*

Number of patients	9
Age Range	2-13 years
Mean Age	4 years 8 months
Total Units of RCPs	47
Range of RCP used	0-10 units
Total price of RCPs	5750 euro
Total number of platelet products used	30 units
Range of platelet products used	0-12 units
Total price of platelet products	12200 euro
Range of total cost per patient	125-5375 euro
Mean total cost per patient	1994 euro
Range of haemoglobin on transfusing RCP	3.1-8.6g/dl
Range of platelet count on transfusing platelets	9-60x10^9/l

***Table 2**: Amount spent on blood products per patient*

Condition treated	Cost per blood product (euro)						
	RCP	CMV -ve red cells	Apheresis platelets	Pooled platelets	Pooled platelets irradiated	Irradiated apheresis platelets	Total amount spent
ALL-1	1250	125	3500	500	0	0	5375
ALL-2	625	0	0	250	250	0	1125
ALL-3	375	0	0	0	0	0	375
ALL-4	125	0	0	0	0	0	125
Aplastic anaemia	375	0	1400	250	0	0	2025
Burkitt's lymphoma	250	0	0	250	0	0	500
Nephroblastomatosis	1125	0	2100	1000	0	0	4225
Retinoblastoma	0	0	0	250	0	0	250
Yolk sac carcinoma	1500	0	700	1750	0	0	3950
Total product used	5625	125	7700	4250	250	0	17950

***Table 3**: Prices for blood products before and after 2015 in Malta*[11]

Blood product	Prices according to year (euro)	
	2006-2014	2015
Red cell concentrate	125.00	166.10
Pooled platelets	250.00	346.27
Single donor platelets	700.00	714.90
Fresh frozen plasma	70.00	119.78

Limitations

1. It was unclear at times whether the products requested were actually used due to missing documentation in patient files.
2. The indication for blood product administration was not included.
3. Cycles of chemotherapy and radiotherapy were not noted.
4. Protocol by HBB regarding administration on KURA on administration of blood products specifically for paediatric patients were set up by the haematology working group at Mater Dei Hospital.10
5. Documentation of transfusion having occurred was not documented at times

Discussion

95% of red cell transfusions (*n*=21) were performed with a hemoglobin of less than 8mg/dl. Supportive care protocols recommend transfusions occurring at thresholds of 7mg/dl but patients who are symptomatic, suffering from aplastic anemia or bone marrow failure syndromes have higher thresholds.[11]

43% (*n*=13) of platelet transfusions occurred at levels above 20 $x10^9$/l. Protocols recommend routine transfusion occurring at levels less than 10 $x10^9$/l and less than 20 $x10^9$/l if suffering concurrent illness/bleeding/on anticoagulants. However prior to a potentially hemorrhagic event such as a lumbar puncture or change of central line platelet transfusions are recommended if levels are less than 50 $x10^9$/l. [11]

Over five months 17,950 euro was spent on blood products with an average cost of almost 2000 euro per patient.

Included also was the total cost of the process used to choose blood products for patients. The first process involves “Type and Screen” (T&S). This step checks blood group and antibody detection. If no antibodies are present, compatibility testing is performed by a "Spin and Read" (S&R), which is carried out at room temperature. If the samples indicate an antibody is present compatibility testing is performed by an IAT cross-match. If the S&R or IAT cross match is negative the blood product can then be issued. T&S are performed on each unit of RCP requested, whereas S&R or IAT crossmatch are performed on RCP that are issued but not necessarily transfused. 3276 euro were spent on these processes.[13] On average almost 2000 euro was spent per patient in the five month period (Table 1).

Prices for blood products have remained stable in Malta from the year 2006 to 2014. These prices were changed owing to increasing costs in the production of blood products[11]. This rise reflects the rise in costs shown in other countries however it does not account for other costs such as hospital care, nursing etc.

Conclusion

The use of blood products is dependent on patient needs and is not influenced by prices. Thresholds at which platelets and RCP are admnistered vary according to the clinical scenario. In view of rising costs and shrinking donor pools these resources should be used judiciously. Better documentation would ascertain whether platelet products were used adequately.

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