HAEMOGLOBIN INCREMENT BY RED BLOOD CELLS TRANSFUSION IN CANCER PATIENTS WITH ANAEMIA

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Summary

Severe anaemia is usually treated with red blood cell (RBC) transfusion and in some cases moderate anaemia also requires transfusion. Traditionally one unit of red blood cells is transfused to increase the hemoglobin (Hb) level by 1 gm/dl, although no consensus guideline is available in our country. This study was done to see how much hemoglobin level was increased after transfusion of one unit of red blood cells in cancer patients with anaemia in our people. During the period of July 2012 to December 2012, 160 patients were studied in the Department of Transfusion Medicine of National Institute of Cancer Research and Hospital (NICRH), Mohakhali, Dhaka. All patients were aged >18 years of both sexes having a haemoglobin level of <10 gm/dl, and had no transfusion of platelets, plasma or colloid within 24 hours of red cells transfusion or with active bleeding or drain loss. The average increment of haemoglobin level was 0.74 gm/dl (0.74±0.11) gm/dl for each unit of red blood cells transfusion. This rise of haemoglobin level was different from the traditional calculation which was statistically significant (p<0.01). The traditional calculation for correction of anaemia by red blood cell transfusion is not suitable for the people of our country.

Key words

Anaemia; Red cell transfusion; Haemoglobin.

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Introduction

Anaemia is a common problem in cancer patients. Its prevalence and incidence are widely variable ranging from 30% to 90% [1-5]. Anaemia is present in 48% of patients with solid tumour before radiotherapy and in 57% patients at the end of the therapy [6]. The important causes of anaemia in cancer patients are decreased erythropoiesis due to nutritional deficiencies, bone marrow infiltration by tumour cells and marrow suppression by anticancer treatment, and blood loss from the tumor or surgery, and also hemolysis [7,8]. The presence of anaemia causes decreased response to radiotherapy and increased toxicity to chemotherapy [9-12]. Anaemia also shortens the life expectancy in cancer patients [13]. Therefore, correction of anaemia is essential for appropriate anticancer therapy. Usually moderate to severe anaemia are treated by transfusion of red blood cells. EORTC guidelines mention that patients with hemoglobin levels of less than 9 g/dl should be evaluated for the need of transfusions [14]. The ASH/ASCO guidelines suggest that blood transfusions may be an option for the correction of anaemia associated with chemotherapy when hemoglobin levels are less than 10 g/dl [15]. In some cases, mild anaemia also treated by transfusion depending on clinical condition e.g. organ ischemia or inadequate oxygenation, actual bleeding etc.

General guideline for red blood transfusion is as follows [16].

If Hb>10gm/dl, red cells are rarely needed

If Hb <5gm/dl, red cells are usually needed,

If Hb 5-10 gm/dl, red cells transfusion requirement is determined by additional clinical conditions as described above.

Usually one unit of red cells increases the Hb level by 1 g/dL in an adult patient [17-19]. This Hb increment we adopted from different studies and institutional guidelines, but this method of calculation

is not evidence based and there is no such study for the Bangladeshi people. Inappropriate calculation of red cell volume for transfusion causes inaccurate anaemia correction and increases the risk of multiple transfusions, additional cost and resource use. Assessment of haemoglobin level after transfusion of every unit of red blood cells should help us to calculate haemoglobin increment in our people and thus we can develop a formula for red blood cells transfusion for our patients.

This study was conducted to know how much haemoglobin is raised after transfusion of 1 unit (250±30 ml) red blood cells in cancer patient with anaemia.

Material & methods

This was an observational study, done in the Department of Transfusion Medicine of National Institute of Cancer Research and Hospital, Mohakhali, Dhaka, during the period of July 2012 to December 2012 after obtaining a full ethical permission. A total of 160 cancer patients with an age of >18 years of both sexes having a haemoglobin level of <10 gm/dl were included in this study. Haemoglobin level was estimated just before transfusion and one hour after completion of red cell transfusion. Patients who did not give consent or had received infusion of colloid, plasma or platelets within 24 hours or had active bleeding or drain loss were excluded from the study. If any reaction or any problem occurred in patients during data collection period they were not include in our study. Persons with haemoglobin level 12 gm/dl were excluded from donation.

Standard operating procedures were followed for blood donation and transfusion. Before transfusion clinical condition of every patient was monitored. Haemoglobin estimation was done by haemoglobin Colour Scale (HCS) method. From each participating person a capillary blood sample were obtained by finger prick with a single-use lancet after disinfection with alcohol, drying and removal of the first drop of blood. The drop of blood was absorbed onto a filter paper test strip. After waiting about 30 seconds the colour of the blood spot was matched against the scale colour standards provided with HCS. The shades correspond to haemoglobin levels of 4, 6, 8, 10, 12 and 14 g dl.

Data were collected in a structured data collection form. The data were analyzed and necessary tables were made using SPSS for Windows 17 version. Continuous data were expressed as mean ± SD, categorical data were expressed as number and percentage. Paired T-test was done between pre and post transfusion haemoglobin level, one sample T test was done to see the statistical significance of haemoglobin rise after transfusion and ANOVA was done to see the influence of cancer type on Hb increment. $P<0.05$ was considered significant.

Results

Among the 160 patients, male were 57.5% (92/160) and female were 42.5% (68/160) (Fig 1).

Minimum age of the patient was 18 years and maximum age was 76 years with a mean was 48.84 (±14.51) years. Minimum weight was 20 kg and maximum weight was 72 kg with a mean of 45.21 (±10.6) kg (Table I).

The pre transfusion mean haemoglobin was 6.33 (±0.99) gm/dl with a minimum of 4.5 gm/dl and a maximum of 9.7 gm/dl. The mean volume of transfused red cells was 244.30 (±10.08) ml. The mean duration of transfusion was 3.3 (±0.26) hours with minimum 3 hours and maximum 4 hours. The mean post transfusion haemoglobin level was 7.08 (±1.02) gm/dl with minimum of 5.35 gm/dl and maximum of 10.60 gm/dl. The mean haemoglobin increment after transfusion of red cells was 0.74 (±0.11) gm/dl (Table II).

The difference between pre-transfusion and post-transfusion haemoglobin level was significant (Table III).

Difference between the increment in haemoglobin after transfusion of one unit of red blood in this study and the traditional value was significant (Table IV).

The cancer types that needed transfusion in our study were Ca. lung, Ca. Cervix, Ca. Breast, Acute

Myeloid Leukaemia, Acute Lymphoblastic Leukaemia, Ca. Oesophagus, Ca. Tongue and Ewing Sarcoma (Table V). However, statically haemoglobin increment was not influenced by cancer type (Table VI).

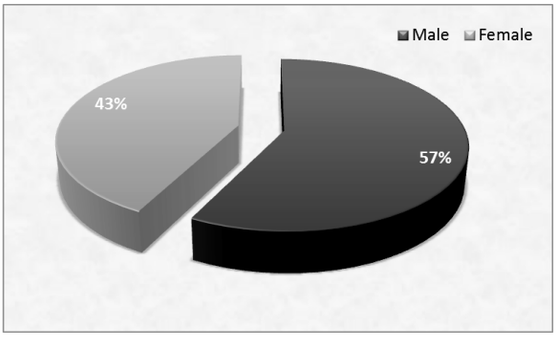

Fig 1 : Gender distribution of the patient

Table I : Age and weight of the patients (n=160)

Variable	Range	Mean	SD
Age (in years)	18-76	48.84	14.51
Weight (in kg)	20-72	45.21	10.6

Table II : Pre and Post transfusion Haemoglobin level with Hb increment and transfused red cell volume

Variable	Mean	SD
Pre transfusion Hb gm/dl	6.33	.99
Post transfusion Hb gm/dl	7.08	1.02
Hb increment (gm/dl) †	0.74	0.11
Volume of red blood cells transfused (in ml)	244.00	10.08

† Post transfusion minus pre transfusion

Table III : Pre transfusion and post transfusion haemoglobin level

Variable Pre transfusion	Number	Mean	P value
Hb gm/dl	160	6.33	<0.01
Post transfusion Hb gm/dl	160	7.08	

Table IV : Hb increment after one unit of RBC transfusion

Hb increment	Mean	P-value
In traditional method	1.00	<.001
In this study	0.74	

TableV : Common Cancer type those required transfusion

Type of Cancer:	Frequency	Percent
Ca lung	36	22.5
Ca cervix	21	13.1
Ca breast	18	11.3
AML	14	8.8
ALL	13	8.1
Ca esophagus	11	6.9
Ca tongue	10	6.3
Ewing sarcoma	6	3.8
Osteosarcoma	4	2.5
Others	27	16.9
Total	160	100.0

Table VI : Correlation of Haemoglobin increment and Cancer types.

Haemoglobin increment	Mean Square	F	p-value
Between Groups	.007	0.513	0.863
Within Groups	.013		

Discussion

Anaemia impairs the quality of life of the cancer patients [20]. Red blood cell transfusion is the most reliable method of treatment of anaemia especially when anaemia is moderate to severe. One study showed that 52.7% of the patients received red cell transfusion when there was Hb <9.0 gm/dl [21]. The use of erythropoiesis stimulating agents (ESA) epoetin or darbepoetin is recommended as a treatment option and considered for patients with chemotherapy-associated anaemia when haemoglobin concentration has decreased to less than 10 g/dl, to decrease transfusions but evidence showing that ESA use is associated with a statistically significant increased risk of mortality and venous thromboembolism [22]. For this reason use of ESA therapy should be based on clinical judgment of patients' individual risks and benefits.

Red blood cells transfusion may cause some adverse reaction. Among these transfusion associated haemolytic reaction, infection and even

circulatory overload are remarkable. A study conducted in 60 US medical centres between 1995 and 2003 found 7.2% cancer patient with anaemia receiving red cell transfusion developed venous and 5.2% patients developed arterial thromboembolism [23]. So appropriate calculation of red blood cell for transfusion is a vital matter.

Usually patients with haematological malignancies need transfusion frequently but in our study patients with ca. lung, ca. cervix and ca. breast were more in number. The reason was when any patients develop anaemia during anticancer therapy they usually transfused in the outpatient department and we consider OPD for collecting patients for the study. Among the study population 87 patients were under chemotherapy, 31 were under radiotherapy and 42 were under both the chemo and radiotherapy.

In the current study, male patients (57.5%) were more than female. This finding may be due to more number of male patients attending NICRH in comparison to female and it was consistent with finding of cancer registry of NICRH [24]. We estimated haemoglobin level of every patient before and 1 hour after completion of transfusion because the study was done in the outpatient department and a study shows that the haemoglobin rise at 1, 2 and 24 hours of red cell transfusion were same [25]. Moreover, cancer should have no effect on haemoglobin change within this short period. Also statistically haemoglobin increment was not influenced by cancer type in our study.

The post-transfusion haemoglobin rise for one unit of red cells was 0.74±0.11 gm/dl was not consistent with studies that showed the Hb increment were 1 gm/dl [8,26].

We excluded patients with blood transfusion reaction in our study. For this reason no information was provided regarding transfusion reaction.

Conclusion

After transfusion of one unit of red blood cells, haemoglobin level was raised but this increment of haemoglobin (0.74 ± 0.11 gm/dl) was much lower than the value we used, i.e. 1 gm/dl/per unit of red blood cells transfusion. Therefore, the traditional calculation for correction of anaemia in cancer by red cell transfusion is not suitable for the people of our country. This study was conducted in a single centre with small number of patients. Further multi-centre study in our country with large number of cases with longer duration can explore more reliable and accurate inference.

Disclosure

All the authors declared no competing interest.

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