Transfusion treatment impact in the improvement of haematological parameters in patients with gastrointestinal bleeding

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Abstract

Introduction: Transfusion treatment (TT) is necessary in patients with gastrointestinal bleeding (GIB) for lost blood substitution. This study was aimed at assessing the changes in haematological parameters (hemoglobin, hematocrit, red blood cell count, white cell count, platelet count and prothrombin time) before and after TT in anaemic patients with GIB in order to analyse the effect of this treatment.

Methods: There have been included 293 patients with GIB (the average age was 57.3, ranged from 18-89 years) who were treated with TT at the Internal Clinic at the University Clinical Center Prishtina during one year period. Data for applied blood product and results of the coagulation screen (PT) were collected from the Kosovo's Blood Transfusion Center (KBTC).

Results: TT has been carried out in 404 episodes, with 714 units of concentrated red blood cells (78.6%), 189 units of fresh frozen plasma (20.8%) and concentrated platelets (0.6%), with an average dose 3.1 for transfunded patients. Average values of Hb before and after TT were 71.8 g/L and 81.4 g/L, respectively; while the average values of hematocrite before and after TT were 22.9% and 25.6%, respectively. The average erythrocytes count before TT was 2.6 respectively after treatment 2.8($p<0.0001$). The PT was carried out in the 43% of patients with GIB before treatment with FFP, but after that only in 2% of cases.

Conclusions: Having in mind difficult clinical and unsustainable situation in patients with gastrointestinal bleeding, the Transfusion Treatment resulted in the considerable improvement of the specific blood indicators.

Keywords: Transfusion Treatment, gastrointestinal bleeding, blood products, hemoglobin, hematocrit.

Introduction

Transfusion treatment (TT) is a basic element in the treatment of acute, persisting gastrointestinal bleeding, which may present a high mortality rate ranging from 5 to 10% according to the various series (1, 2). One of the main aims when treating patients with upper or lower gastrointestinal bleeding is to treat hypovolemia resulting from loss of blood (3, 4). The early management of GIB is based on resuscitative measures of fluid infusion or blood transfusion to reverse the direct consequences of bleeding; prevention of end-organ damage induced by the bleeding, such as hypoxia (5). The amount of transfusion of red blood cells and blood products must be individualized, depending on the characteristics of each specific case (speed of blood loss, state of cardiovascular reserve, other organ or vital system pathology, injury causing bleeding, re-bleeding etc.) (6, 7). According to the guidelines, in the absence of risk factors and symptoms, the patients should not be given a blood transfusion regardless of their haemoglobin level. However, few studies have attempted to validate appropriateness of blood transfusion according to these criteria (8).

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At the present time it is very hard to establish the appropriateness of RBC transfusion in GIB (9). Assessing whether a patient is actively bleeding or not at the time of transfusion is sometimes difficult and the haemoglobin value alone at presentation may not accurately reflect blood loss and or help decision-making about the need for RBC transfusion (10). An Hb of >10g/dL has been used as a cut off for inappropriate transfusion in those patients who did not present with signs or symptoms of shock, as per BSG guidelines (11). RBC transfusion is not indicated in haemodynamically stable patients where no haemoglobin value is available (1). Transfusion in those who are haemodynamically unstable at presentation with acute bleeding is regarded as appropriate (12). For patients who have stopped bleeding but are regarded as being at high risk of re-bleeding or death, a top-up transfusion to the haemoglobin of 10g/dL is reasonable (13-15). Coagulopathy (defined as an international normalized ratio of prothrombin time >1.5) or thrombocytopenia (<50,000 platelets/μl) should be treated using fresh frozen plasma or platelets, respectively (4). Also laboratory investigations: full blood count, urea and electrolytes, liver function tests and coagulation screen should be measured at presentation with acute GIB for transfusion data (16). The initial haematocrit on admission is best interpreted when a recent prior baseline haematocrit is available for comparison. Serial haematocrits are helpful to assess the severity of the GIB but should be integrated with the hemodynamic assessment because overhydration falsely depresses the haematocrit (5). Equilibration of hemoglobin concentration after transfusion has been estimated to take about 24 hours, in persons who have not bled recently (17). This study was aimed at assessing the changes in haematological parameters (hemoglobin, hematocrit, red blood cell count, white cell count, platelet count and prothrombin time-PT) before and after treatment with blood products in anaemic patients with GIB in order to analyse the effect of this treatment.

Methods

Study Subjects

The study included 293 patients with gastrointestinal bleeding during one year period, who had been treated at the Internal Clinic in the University Clinical Center in Prishtina (UCC). The males were represented at 174 or 59.4% of cases with GIB compared to females with only 119 or 40.6% of cases. Average age of patients was 57.3 with SD 16.03 (range 18 to 89 years) (Table 1).

TABLE 1. Mean age of patients with GIB treated with blood products

Statistics parameters	Age (years)
Mean ± SD	57.3 ± 16.03
Sample size	293
Range	18-89
Median	59
Confidence Interval (CI) < 95%	55.8
Confidence Interval (CI) > 95%	58.85

Medical history record, diagnosis and treatment of patients were performed at the Internal Clinic in UCC. The overall treatment of gastrointestinal bleeding included also TT. During bleeding episodes, treatment with transfusion therapy was performed with concentrated red blood cells, fresh frozen plasma (FFP) and occasionally with concentrated platelets. The data were collected from protocols and medical history at Internal Clinic in the UCC in Pristine. Also it was collected the data for prepared and applied units of concentrated red blood cells, fresh frozen plasma and concentrated platelets and results of the coagulation screen from the protocols of Kosovo's Blood Transfusion Center in Pristine (KBTC). In separate database it was evidenced all collected data for the patients with GIB which had been treated by TT. Patients with GIB treated only with FFP or concentrated platelets were excluded. Also there were excluded patients without hematological parameters before and after TT. In addition, the type of used therapy (concentrated erythrocytes, frozen fresh plasma or concentrated platelets) and the type of GIB would be interesting to investigate, with the purpose to have greater experience in order that for the future to draw up a long-term strategy for more successful use of the transfusion therapy. All the patients involved in this work are divided into groups as per their age, gen-

der, and localization of bleeding (the patients with upper GIB and the patients with lower GIB) which were treated with blood product. In addition to this, it's interesting the therapy use percentage studying with blood components and that as per the type of the product (concentrated erythrocytes, frozen fresh plasma and concentrated platelets), overall group of GIB. Also, it was calculated the mean transfused dose per patients for all applied blood products. All this is done with the purpose to have greater experience in order that for the future to draw up a long-term strategy for more successful use of the transfusion therapy. Especially, there were analyzed hematological results (hemoglobin, hematocrit, red blood cell count, platelets count, and white blood cell count) before and after transfusion treatment with blood products (the measurements of hematological results were performed in blood counter Medonic 3200 at the department of biochemistry in Diagnostic Center-University Clinical Center in Prishtina). The patients who were treated with plasma have carried out the haemostatic tests before and after the transfusion of fresh frozen plasma (Prothrombine time - PT was performed in Dia Med-x Haemostasis), at the Department of haemostasis in BTC). Also the patients were divided into groups on the basis of the hemoglobin value (after bleeding episodes): group I Hb level was <50 g/L, group II 50-70 g/L, and group III with Hb >70 g/L, which have been treated with concentrated Erythrocytes.

Statistical analysis

Statistical analysis was performed using INSTAT 2 statistical software system. A *t* test was used to calculate the difference (p value) in the hematological parameters before and after transfusion treatment in the patients with gastrointestinal bleeding. There were calculated average values, standard deviation, minimum values, maximum values, and median, for all hematological parameters. For all blood products were calculated average transfused dose/unit per patient.

Results

Transfusion treatment with blood products it has been carried out in 293 patients with GIB, who received 908 units of blood products with mean transfused unit 3.1 for patient. TT is more often needed in upper GIB (783 units of blood products were used in treatment of 234 or 79.9% patients), than in lower GIB (59 patients received 125 blood product units). Mean transfused units of blood products in upper GIB was higher than in lower GIB (3.3 respectively 2.1), Table 2. Upper GIB is more often recorded than lower GIB in all patients (males and females). This treatment resulted in significant improvement of blood specific indicators (Hemoglobin) after treatment with the concentrated red blood cells of patients with gastrointestinal bleeding. Mean values of Hemoglobin prior to transfusion were 71.8 g/L (with SD 19.2, minimal and maximal values 47-145); and after receiving transfusions of concentrated erythrocytes was 81.35 g/L (with Standard Deviation 18.8 minimal and maximal value 47-130 g/L), with p <0.0001 (Table 3).

TABLE 2. Transfusion treatment with blood products in patients with Gastro Intestinal Bleeding

Blood products	Upper GIB N (%)	Lower GIB N (%)	Total GIB N (%)
Concentrated Erythrocytes Unit	613 (78.3)	101 (80.8)	714 (78.6)
FFP Unit	165 (21.1)	24 (19.2)	189 (20.8)
Concentrated platelets Unit	5 (0.6)	0	5 (0.6)
Total Units	783 (100)	125 (100)	908 (100)
Total Patients	234 (79.9)	59 (20.1)	293 (100)
Patients-Male	134(72.8)	40(27.2)	174(100)
Patients-Female	100(85)	19 (15)	119 (100)
Mean transfused unit/patient	3.3	2.1	3.1

TABLE 3. Changes of Hemoglobin before and after transfusion treatment in patients with Gastro Intestinal Bleeding

Statistics parameters	Hb g/L before	Hb g/L after
Mean ($\bar{X}$) ± SD	71.9 ± 19.2	81.4 ± 18.8
Sample size	404	402
Range	47-145	47-130
Median	70	81
Confidence Interval (CI) < 95%	70.03	79.5
Confidence Interval (CI) > 95%	73.7	83.2
	p <0.0001	

TABLE 4. Changes of Hematocrit before and after transfusion treatment in patients with Gastro Intestinal Bleeding

Statistics parameters	Htc % before	Htc % after
Mean (X̄) ± SD	22.85 ± 5.4	25.61 ± 5.06
Sample size	404	402
Range	10-45	10-38.6
Median	22.6	26.0
Confidence Interval (CI) < 95%	22.3	25.1
Confidence Interval (CI) > 95%	23.36	26.09
	p <0.0001	

TABLE 5. Changes of Erythrocytes count before and after transfusion treatment in patients with Gastro Intestinal Bleeding

Statistics parameters	Red blood cell count $x10^{12}$/L before treatment	Red blood cell count $x10^{12}$/L after treatment
Mean (X̄) ± SD	2.6 ± 1,1	2,9 ± 0.65
Sample size	404	402
Range	1.06 - 20.5	1.1 – 4.8
Confidence Interval (CI) < 95%	2.5	2.8
Confidence Interval (CI) > 95%	2.75	2.9
	p<0.0001	

TABLE 6. Changes of White blood cells count before and after transfusion treatment in patients with Gastro Intestinal Bleeding

Statistics parameters	White blood cell count $x10^9$/L before treatment	White blood cell count $x10^9$/L after treatment
Mean (X̄) ± SD	11.2 ± 9.04	10.8 ± 9.2
Sample size	404	402
Range	0.9 – 20.5	1.8 – 4.8
Median	10.4	9.9
Confidence Interval (CI) < 95%	10.3	11.7
Confidence Interval (CI) > 95%	12.7	2.9
	p<0.001	

TABLE 7. Changes of platelet count before and after transfusion treatment in patients with Gastro Intestinal Bleeding

Statistics parameters	Platelet count $x10^9$/L before treatment	Platelet count $x10^9$/L after treatment
Mean ± SD	221.98 ± 109.7	230.4 ± 108.1
Sample size	404	402
Range	24 – 696	38 - 631
Confidence Interval (CI) < 95%	211.5	219.9
Confidence Interval (CI) > 95%	232.5	240.99
	p<0.001	

TABLE 8. Application of concentrated red blood cells according to the Hb values after bleeding episodes in patients with gastrointestinal bleeding

Patients No (293) %	20 6.8%	189 64.5%	84 28.7%
Hb level g/L	<50 g/L	50-70 g/L	>70 g/L
No of episode (404)	30	174	200
Mean Hb (X̄) ± SD	42.6 ± 3.8	61 ± 5.6	83.5 ± 10.5

It was found a significant difference between the mean value of hematocrit before and after blood transfusion treatment in patients with GIB (22.9% respectively 25.6% with p<0.0001) Table 4. The changes were evident in the values of red blood cells count before and after application of blood transfusion in GIB, where, the average values of red blood cells count were 2.65, and after the transfusion of this treatment the values rose in $2.867x10^{12}$/L with value p<0.0001 (Table 5). Mean values of the white cell count before and after transfusion treatment have undergone a slight decrease (11.21 respectively $10.8x10^9$/L) value p<0.001(Table 6). Blood component therapy has resulted in improvement of the situation, causing increased platelet count. Mean values of the platelet count before blood transfusion were 221.99 (SD 109.72; minimal and maximal value 24.0- 696.0) and after transfusion were 230.42 (SD 108.1 with minimal and maximal value 38.0-631) and value p<0.001 (Table 7). Only 6.8% of patients with GIB who were treated with concentrated red blood cells have hemoglobin values lower than 50 g/L, while the most of them (82.9%) have been treated when Hb values was above 50 g/L (Table 8).

TABLE 9. Values of PT before and after application of Fresh Frozen Plasma in patients with Gastro Intestinal Bleeding

No of cases treated with FFP	Statistical Parameters of PT	Before Treatment	After treatment
	Nr	51	2
	%	44.0	1.7
Upper GIB	Mean PT	70.5	80
No 116	SD	24.6	7.1
	Min	10	75
	Max	120	85
	No	10	1
	%	38.5	3.8
Lower GIB	Mean PT	74.8	56
No 26	SD	22.3	56
	Min	40	56
	Max	109	56
	Nr	61	3
	%	43.0	2.1
TOTAL	Mean PT	71.2	72
No 142	SD	24.1	14.7
	Min	10	56
	Max	120	85

In Table 9 have been presented 142 patients who were treated with plasma; only 61 of them were tested with PT, before treatment with Fresh Frozen Plasma, and after that only 2.1% of cases were tested with PT. Fresh Frozen Plasma are given to patients with GIB with average values of PT 71.2% before transfusion and after transfusion this value rise to 72%.

Discussion

GIB should be always appreciated as a major emergency, regardless of the amount of blood lost and gravity of the clinical situation (18). Despite the progress that has been made in past years, in determining the early lesion responsible for gastrointestinal bleeding (19), and in assessing the gravity of the situation accurately and to control its overall, mortality still remains high 10% (20) to 33% (11). It is important to determine the exact amount of blood lost, which is difficult to do at the moment of meeting with the patient. The decline in hematocrit reflects the degree of blood loss after a delay of 24 hours or more from an acute GIB. Serial hematocrits are helpful to assess the severity of a GIB but should be integrated with the hemodynamic assessment because overhydration falsely depresses the hematocrit (5, 21). Anemia is common in the critically ill patients with GIB and results in the frequent use of red blood cell (RBC) transfusions (22, 23). The initial hematocrit on admission is best interpreted when a recent prior baseline hematocrit is available for comparison (5, 24). Other important laboratory parameters include the coagulation profile; routine serum chemistries, especially the blood urea nitrogen (BUN) and creatinine levels; and serum biochemical parameters of liver function, also are helpful to assess the severity of a GIB (5, 11). Application of blood products should definitely be followed by the determination of hematological parameters before and after treatment in order to know when to start and stop the transfusion treatment, considering that this treatment carries the possibility of early and later transfusion complications (25). The transfusion treatment with blood product in patients with GIB has been carried out in 404 transfusion episodes which resulted in improvement of specific blood indicators. Our data showed that the post-transfusion rise of hemoglobin was about 10 g/L after the treatment with the concentrated erythrocytes in patients with GIB. The administration of 2 units of packed red cells elicited a 24-hour increase of 22.4 +/- 6.8 g per L in haemoglobin concentration, data represented by Elizalde et al (26). Hematocrit levels experienced similar changes after TT in patients with GIB. Post transfusion change of hematocrit was 2.8%. Data showed by Khilnani represented post transfusion hematocrit change up to 3% (3). But data showed by other authors represented more changes in hematocrit value after TT (5.8%) (27). The changes of value of red blood cell before and after TT were $0.2x10^{12}$/L in patients with GIB. Data offered by Ho CH presented more post transfusion change of red blood cell count up to 0.7 x 10^{12}/L after the transfusion treatment in patients with chronic anemia. Serious situation in patients with GIB should evaluate not only with determining the red blood cell count, the hemoglobin and hematocrit level, but also through other indicators as the white cell

count, platelet count, PT and other indicators (28). Transfusion treatment with blood products has resulted in declining the leucocytes average count after transfusion: (11,2 x 10^9/L before transfusion, i.e. 10,8x10^9/L after transfusion). Data showed by Barkun - International consensus recommendations on the management of patients with GIB (5) represented that leukocytosis may be secondary to the stress of acute bleeding. The transfusion treatment with blood products, erythrocytes and platelets, was not marked by significant increase of average values of platelet count before and after transfusion, where the post transfusion change was 7,5x10^9/L. Data from other authors indicate decrease in the platelet count with post transfusion change, -40x10^9/L (27). There are many recommendations about Application of concentrated red blood cells according to the Hb values: Hebert et al. (28) (Canada, 1993) with pretransfusion hemoglobin mean level 8.6 g/dl; Vincent et al.(29) (Western Europe 1999) with pretransfusion hemoglobin mean level: 8.4; Rao et al.(30) (UK 1999) with pretransfusion hemoglobin median level: 8.5 g/dl; Corwin et al.(31) (USA 2000 – 2001) with pretransfusion hemoglobin mean level: 8.6; Walsh et al.(32) UK (Scotland 2001) with pretransfusion hemoglobin median level: 7.8 g/dl; French et al. (33) (Australia and NewZealand 2001) with pretransfusion hemoglobin median level: 8.2 g/dl; Vincent et al. (34) (Western and Eastern Europe 2002) with pretransfusion hemoglobin median level: 8.2 g/dl; Westbrook et al.(35) (Australia and New Zealand 2008) with pretransfusion hemoglobin mean level: 7.7 g/dl.

Erythrocytes will be transfused when the patients had Hb less than 70 g/L with stable homodynamic condition without bleeding; then when the patients had Hb below 80g/L with over 65 years, with stable homodynamic condition and without bloodshed; and patients with various serious cardio respiratory diseases, patients who received blood transfusion with Hb values over 100 g/L and who had stable homodynamic condition counted as unnecessary transfusions (10). The application of transfusion therapy in patients with GIB according to data of some authors (36), is made in the average values of hemoglobin 84 g/L while other authors referred mean values of Hb 94 g/L before application of TT (37). Other data from the literature (38), have resulted in greater participation of patients (up to 92%), who as a criterion for treatment with blood transfusion had Hb levels below 70 g/L, compared with our data where this participation of the patients was 71.3%. The data showed by Mathoulin-Pelssier et al, represented TT in patients with GIB in 175 hospitals in France. They found that transfused mean dose of blood product was 3.7 per patient. Patients with GIB were treated with concentrated erythrocytes (83.4%), FFP (14.8%) and concentrated platelet (1.73%) (39). The similar data we found in our patients, who were treated with blood products: erythrocytes, FFP and concentrated platelet (78.6%, 20.8%, and 0.6%) with mean transfused dose 3.1 per patient. Data showed by other authors (29, 30, 33) found the mean transfused dose between 4.8-6.75 per patient. The data from UK wide audit of GIB showed inappropriate transfusion more common for platelet and FFP transfusion than for red blood cells. In this study, PT testing was performed in 71% of patients with GIB who have received FFP. 27% of the tested patients have had normal values of PT and INR 1,5 and these are regarded as unnecessary transfusions (10). Therefore the application of Fresh Frozen Plasma should be used when the values of PT are prolonged for 3 seconds and INR is under 1,5. PT testing was performed in 43% of our patients (61/142) before transfusion treatment with Fresh Frozen Plasma, but after that, only 2, 1% where retested, with minimal and maximal value of PT 20% respectively 120%. But Lee et al found INR values of PT 2,1 plus SD 0,11 in patients (68/71) with gastrointestinal bleeding (40). Also and data showed by Defreyne Luc et al presented PT < 50% in 25 % of patients with GIB (41).

Conclusions

Based on this study it can be concluded that the transfusion treatment with blood and blood products is more than necessary for the patients with gastrointestinal bleeding. Having in mind difficult clinical and unsustainable situation of these cases the treatment of the patients with gastrointestinal bleeding with blood respectively with blood products has resulted in the considerable improvement of the specific blood indicators.

Competing interests

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