TRANSFUSION TREATMENT AT SESTRE MILOSRDNICE UNIVERSITY HOSPITAL CENTER DURING A TWELVE-YEAR PERIOD

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SUMMARY – Transfusion treatment is administered according to clinical and laboratory results, with ongoing patient assessments. Decisions on necessary measures to prevent any adverse and unexpected events and reactions are made on the basis of hemovigilance and ongoing gathering and analysis of relevant data. Information about transfusion treatment at the Sestre milosrdnice University Hospital Center, Vinogradska site, was retrospectively collected for a period of twelve years (2001-2012). In that period, 14137.25±1693.07 units of all blood products were used, where red blood cells (RBC) accounted for 67.34%, fresh frozen plasma (FFP) for 17.55%, and platelet concentrates (PC) for 14.32%. During the study period, the consumption of RBC was even, of FFP decreased by 45% and of PC increased by 58%. RBC transfusions were received by 10.43% of hospitalized patients, 1.46% of them during surgical procedures. Transfusions of all blood products were received by 14.63% of patients. We found 247 adverse reactions to all blood products. Febrile non-hemolytic and allergic reactions were quite equally represented, 49.5% each. As for other reactions (1%), one transfusion associated circulatory overload and one transfusion related acute lung injury were recorded. There were no fatal post-transfusion reactions.

Key words: *Blood transfusion – therapy; Blood transfusion – adverse effects; Blood components; Blood safety; Maximum surgical blood order schedules*

Introduction

New information about the risks of transfusion treatment, in particular fear from blood-borne infectious diseases, has encouraged a restrictive approach to transfusion treatment. A decision to initiate transfusion treatment is made according to the clinical parameters and laboratory results, as well as patient assessments. Transfusion treatment needs to be administered in a targeted and focused manner and adjusted to the specific needs of each patient[1].

Patients were not always treated in accordance with transfusion treatment guidelines and recommendations, thus being exposed to a greater risk of adverse reactions. According to the literature, 20%-40% of red blood cell (RBC) transfusions and 35%-70% of fresh frozen plasma (FFP) products were unnecessarily administered[2,3]. Unjustified RBC transfusions are often found in the treatment of mild anemia with no clinical signs, in non-hemorrhaging chronic patients, and in perioperative transfusion treatment[4].

Preoperative anemia is the leading cause of treatment with RBC transfusion[5]. Mild anemia increases postoperative mortality and morbidity rates by approximately 30%[6]. Diagnosis and preoperative treatment of anemia according to the cause reduces the need of transfusions, duration of treatment, mortality rates and cost of treatment[7]. All these procedures together constitute the patient blood management (PBM) strategy[8]. In addition to avoiding unnecessary transfusions, alternative treatment methods and

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medicines reducing the need of blood and blood derivatives should be used[9]. Decisions about the necessary measures to prevent any adverse and unexpected events and reactions are made on the basis of hemovigilance and ongoing collection and analysis of relevant data[10].

Material and Methods

Data were retrospectively collected on transfusion treatment at all departments of the Sestre milosrdnice University Hospital Center, Vinogradska site, in the period from 2001 to 2012. Consumption of blood products and the number of post-transfusion reactions are presented.

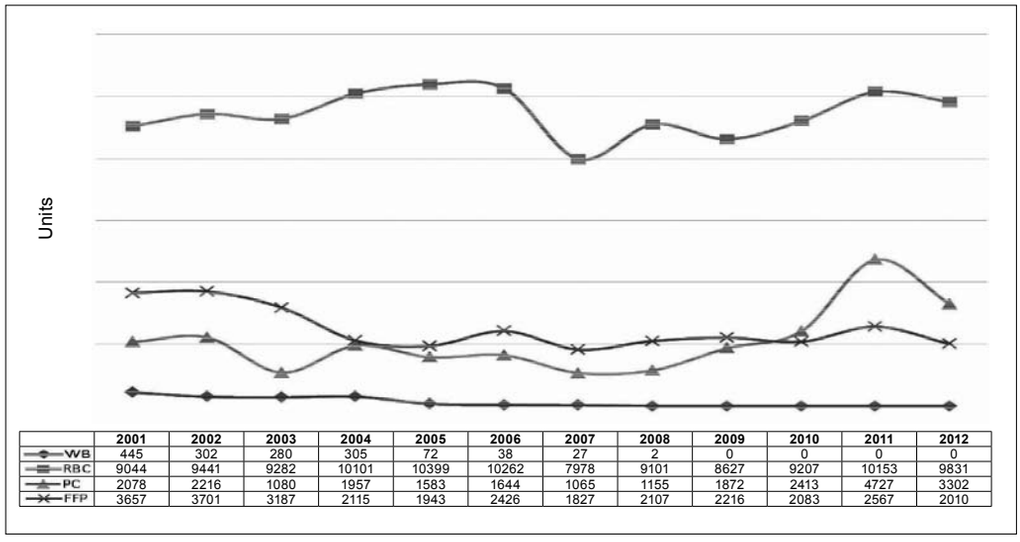
Blood products were dispensed to hospital wards on the basis of the Blood and Blood Product Request Forms. Such a request form is made in triplicate. It is to be signed by the person who collected the patient's blood for pre-transfusion treatment and the physician who conducted transfusion treatment. Such a Request Form should include the patient's personal details, diagnosis, relevant laboratory results, the blood product requested and the number of units.

When a blood product is dispensed, the number of units and the time of dispensing should be indicated, and the person who conducted the cross-match and dispensed the blood product should be signed. The third copy of the Request Form is returned from the ward to the Department of Transfusion Medicine, together with the information on the beginning and end of transfusion, temperature, blood pressure before and after transfusion, and any reactions to the blood product. Reporting on the transfusion of each blood product and the result of transfusion treatment is part of hemovigilance. The patient's transfusion chart should include each dispensed blood product that may be associated with the donor of units (blood product traceability). Any adverse reactions and alloimmunization are recorded in the chart.

Results

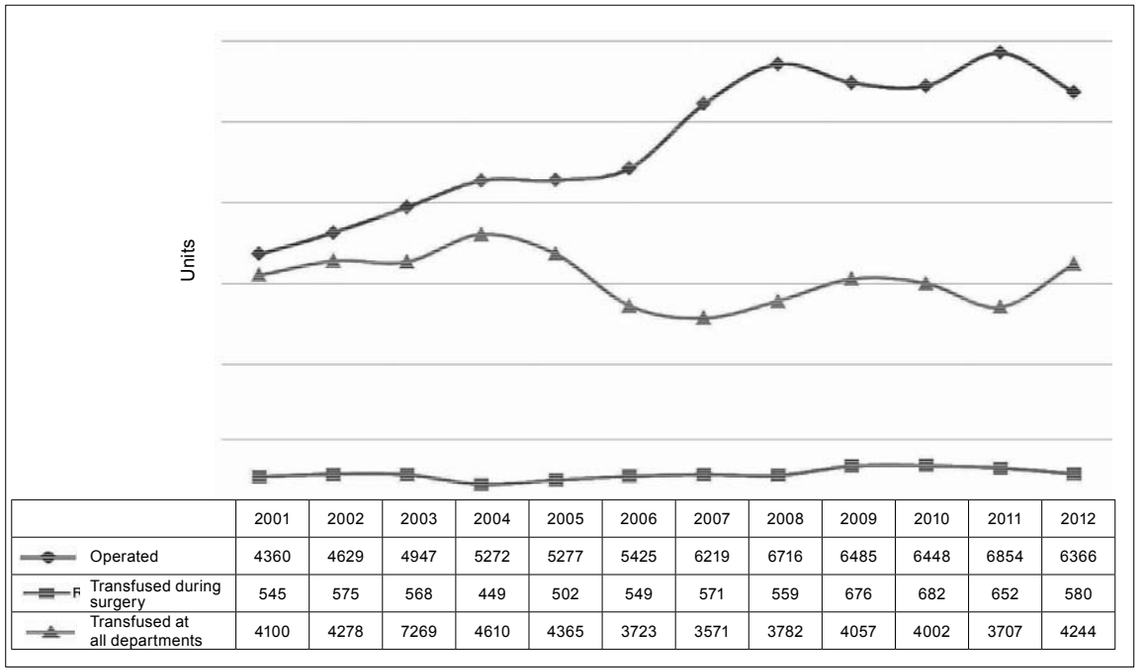
During the study period, 39328±2425 patients *per* year were hospitalized. Every year, 14137.25±1693.07 units of all blood components were used for transfusion treatment, 9452±728.71 RBC units *per* year, 787.68 *per* month and 26 *per* day. Also, 2486.58±662.04 units of FFP were used *per* year, 207.22 *per* month and 7 *per* day, and 2075.92±1052.33 units of platelet concentrate (PC) *per* year, 172.99 *per* month and 5.7 *per* day. Until 2008, 183.88±167.99 units of whole blood (WB) were used *per* year, 15.32 *per* month and 0.4 *per* day, after which it was no longer used. The consumption of blood products during the study period is shown in Figure 1.

Of the total number (14137.25±1693.07) of all blood products on annual basis, RBC products ac-



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
WB	445	302	280	305	72	38	27	2	0	0	0	0
RBC	9044	9441	9282	10101	10399	10262	7978	9101	8627	9207	10153	9831
PC	2078	2216	1080	1957	1583	1644	1065	1155	1872	2413	4727	3302
FFP	3657	3701	3187	2115	1943	2426	1827	2107	2216	2083	2567	2010

Fig. 1. Consumption of blood products during the study period; WB = whole blood; RBC = red blood cells; PC = platelet concentrate; FFP = fresh frozen plasma.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Operated	4360	4629	4947	5272	5277	5425	6219	6716	6485	6448	6854	6366
Transfused during surgery	545	575	568	449	502	549	571	559	676	682	652	580
Transfused at all departments	4100	4278	7269	4610	4365	3723	3571	3782	4057	4002	3707	4244

Fig. 2. Transfusions during surgery at all departments.

counted for 67.34%, FFP for 17.55% and PC for 14.32%. The results show even consumption of RBC, a drop in the consumption of FFP by approximately 45%, and an increase in the consumption of PC by approximately 58% (Fig. 1).

Table 1. Transfusions of red blood cell (RBC) products at all departments

Year	Hospitalized patients	RBC	%
2001	37584	4100	10.91
2002	35110	4278	12.18
2003	35836	4269	11.91
2004	37187	4610	12.40
2005	38828	4365	11.24
2006	40339	3723	9.23
2007	40320	3571	8.86
2008	42953	3782	8.80
2009	40996	4057	9.90
2010	40031	4002	10.00
2011	41308	3707	8.97
2012	41454	4244	10.24

According to the relevant preoperative requests for ordering and reserving blood units, RBC units were prepared for 5577.8±1476.44 patients *per* year. Transfusion was administered during surgery to 567.6±96.87 patients a year, or 10.11%±1.49% of all preoperative requests (Fig. 2).

During the study period, the number of patients that underwent surgical procedure (according to pre-

Table 2. Transfusions of all blood products

Year	Hospitalized patients	Transfused patients	%
2001	37584	5975	15.90
2002	35110	6234	17.76
2003	35836	5986	16.70
2004	37187	6171	16.59
2005	38828	5868	15.11
2006	40339	5149	12.76
2007	40320	4859	12.05
2008	42953	5219	12.15
2009	40996	5630	13.73
2010	40031	5791	14.47
2011	41308	5776	13.98
2012	41454	5934	14.31

Table 3. Incidence of adverse reactions

Year	Hospitalized patients	Adverse reaction	Incidence
2001	37584	31	0.82
2002	35110	33	0.94
2003	35836	24	0.67
2004	37187	21	0.56
2005	38828	22	0.57
2006	40339	19	0.47
2007	40320	19	0.47
2008	42953	9	0.21
2009	40996	13	0.32
2010	40031	12	0.3
2011	41308	12	0.29
2012	41454	9	0.22

operative requests for reserving blood doses) increased by 46%, while the number of patients that received RBC transfusion during surgery decreased by 3%. Transfusions of RBC products were administered during surgery to 1.46%±0.17% of hospitalized patients *per* year. Transfusions of RBC at all departments of the Sestre milosrdnice University Hospital Center were administered to 4075±69.3 patients *per* year, or 10.43% of hospitalized patients (Table 1).

During the study period, transfusions of all blood products (RBC, PC and FFP) were administered to 5716 patients *per* year on an average, or 14.63% of hospitalized patients (Table 2).

During the study period, 247 adverse reactions to all blood products were reported. Febrile nonhemolytic and allergic reactions were roughly equally represented (49.5% each). As for other reactions (1%), one transfusion associated circulatory overload and one transfusion related acute lung injury were recorded. There were no fatal post-transfusion reactions.

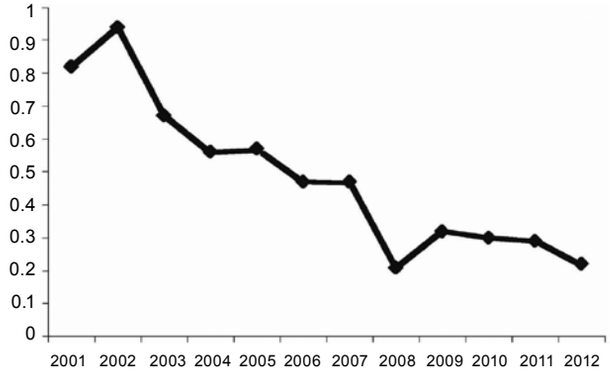


Fig. 3. Incidence of adverse reactions (‰).

During the study period, 78.84% of patients experienced reactions to RBC (46.63% febrile and 32.21% allergic), 10.6% experienced reactions to FFP (0.5% febrile and 10.1% allergic), 6.74% had reactions to PC (1.44% febrile and 5.3% allergic) and 3% to WB (1% febrile and 2% allergic). The incidence of all adverse post-transfusion reactions *per* 1000 units of all blood products was 7.57‰. Reactions *per* units were as follows: WB (4.1‰), RBC (1.77 ‰), FFP (0.87‰), and PC (0.83 ‰). The incidence of post-transfusion reactions *per* 1000 hospitalizations was 0.54‰±0.24‰ (Table 3, Fig. 3). Reactions *per* number of patients were as follows: RBC 0.43‰, FFP 0.06‰, PC 0.04‰ and WB 0.01‰.

The number of post-transfusion reactions reported over years decreased from 31 in 2001 to 9 in 2012 (Table 3, Fig. 3).

Discussion

Transfusion treatment is not equally intensive or common in all hospitals and at all hospital departments. Anemia is very common in heart, lung, kidney and gastrointestinal disease and in malignant tumors. In malignant hematologic patients, anemia is twice as common as in patients with solid tumors. A very significant cause of anemia in oncologic patients is chemotherapy, which additionally increases the need of transfusion treatment[11]. Preoperative anemia is common in patients undergoing elective orthopedic surgery (20%-35%), cardiac surgery (25%-37%) and gastroenterological operations (>75%), and increases with patient age[12,13]. Diagnosis and preoperative treatment of anemia reduces the need of transfusions, length of hospital stay, mortality and cost of treatment[14]. In clinical practice, anemia is still very often treated by transfusions, although transfusion treatment should be supportive, short-lasting and transient. Good transfusion practice is based on restrictive administration of blood and good transfusion practice does not necessarily imply good clinical practice because restrictive administration of blood units does not eliminate the risks of transfusion treatment[15].

Etiologic treatments of anemia and coagulopathies prior to hospitalization, reduction of preoperative blood loss (diagnostics), and use of precise surgical and anesthesiologic techniques with restrictive transfusion treatment are essential components of good clinical practice and good PBM. In practice, PBM implies cooperation among different specialists involved in the treatment of a patient[15].

Analysis of the results for the 12-year study period showed even consumption of RBC, a 45% drop in the consumption of FFP and a 58% increase in the consumption of PC (Fig. 1). Over years, the consumption of FFP decreased as a result of continuous and persistent efforts towards restrictive administration of FFP and treatment according to the accepted indications and guidelines in accordance with global trends. These efforts have changed medical practices in FFP treatment. The present level of FFP consumption for the entire Sestre milosrdnice University Hospital Center has been reduced to the consumption level recorded at the Intensive Care Unit (ICU) in 1995. The ICU alone reduced their FFP consumption 5 times from 1995 to 2000[16].

On the other hand, alternative therapy to FFP is available, focusing on compensating only the factor the patient lacks (concentrates of coagulation factors and prothrombin complex) and causing fewer side effects.

Consumption of ordered and reserved blood products for elective surgical procedures has been monitored at all wards and on all operations. As a result of new surgical techniques and restrictive transfusion treatment, only 10.11%±1.49% of patients received transfusion of reserved RBC products during elective surgical procedures. During the study period, the number of patients that underwent a procedure (according to preoperative requests for reserving blood units) increased by 46% and the number of patients that received transfusion of RBC products decreased by 3% (Fig. 2).

Because of all this, each hospital should have its own Maximum Surgical Blood Order Schedules (MSBOS) program for ordering and reserving blood for elective surgeries. This program has been defined by experts (surgeons and anesthesiologists) on the basis of knowledge and experience and is based on objective data on the consumption of blood reserved for each operation. In this way, an optimal number of blood product units are ordered for each surgical procedure, patient safety is enhanced, and the cost of treatment is reduced[17]. MSBOS is planned for elective operations according to the average consumption of RBC products for each operation, including the clinical condition of each patient. Each patient and each operation is different and a single transfusion treatment is not applicable to all patients. The recommended ratio between the ordered and reserved blood products for intraoperative patient transfusion is 2:1. Such a blood consumption ratio indicates good management of transfusion treatment and blood inventories.

There are no common side effects of transfusion treatment. If they do occur, they may affect patient morbidity and mortality, length of hospital stay and cost of treatment. The number of post-transfusion reactions reported over years decreased for several reasons. WB has not been used since 2008 and RBC have been used since 2004 without a leukocyte and platelet layer (RBC products with reduced leukocyte count in nutrient solution, filtered). These changes have significantly improved the quality of blood products[8] and this is why the number of febrile and allergic reactions to RBC products has decreased.

During the 12-year study period, the number of FFP units decreased by 45%, so the number of allergic reactions to these products also decreased as expected. In addition, it is highly likely that mild post-transfusion reactions were not reported, identified and/or associated with transfusion treatment.

The quality of transfusion treatment is assessed according to its success and safety, identification of the risk of adverse reactions, their seriousness and association with transfusion treatment.

Conclusion

Clinical and economic indicators recommend restrictive administration of blood and good transfusion treatment management. The implementation of European and national hemovigilance and PBM programs promotes the culture of transfusion treatment. Namely, each unjustified transfusion is considered to be a human error. By incorporating it in the national e-Delphyn information system, all information about transfusion treatment of patients in the Republic of Croatia have been transparent and easily available as of 2013.

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Sažetak

TRANSFUZIJSKO LIJEČENJE U KBC SESTRE MILOSRDNICE TIJEKOM DVANAEST GODINA

D. Sović, J. Dodig, M. Banović i *A. Jularić*

Transfuzijsko liječenje se provodi prema kliničkim i laboratorijskim nalazima uz stalnu procjenu bolesnikova stanja. Nadzorom transfuzijskog liječenja (hemovigilancija) uz kontinuirano prikupljanje i analizu podataka o neželjenim i neočekivanim događajima i reakcijama prosuđuje se o potrebnim mjerama kojima bi se oni spriječili. Retrogradno su prikupljeni podaci o transfuzijskom liječenju bolesnika u KBC Sestre milosrdnice, lokacija Vinogradska, tijekom dvanaest godina (2001.-2012.). Potrošeno je godišnje 14137,25±1693,07 doza svih krvnih pripravaka. Udio eritrokoncentrata (KE) bio je 67,34%, svježe smrznute plazme (SSP) 17,55% i trombokoncentrata (KT) 14,32%. Tijekom promatranog razdoblja potrošnja KE bila je ujednačena, SSP smanjena za 45% i KT povećana za 58%. Transfuzije KE je primilo 10,43% hospitaliziranih bolesnika. Tijekom kirurških zahvata transfuzije KE je primilo 10,11% bolesnika, odnosno 1,46% hospitaliziranih bolesnika. Transfuzije svih krvnih pripravaka primilo je 14,63% bolesnika. U promatranom razdoblju prijavljeno je 247 poslijetransfuzijskih reakcija na sve krvne pripravke. U zbroju svih reakcija podjednako su zastupljene febrilne nehemolitičke i alergijske reakcije (49,5%). Od ostalih (1%) jedna je bila preopterećenje kardiovaskularnog sustava i jedna akutna plućna insuficijencija uzrokovana transfuzijom. Nije bilo poslijetransfuzijskih reakcija sa smrtnim ishodom.

Ključne riječi: *Transfuzija krvi – terapija; Transfuzija krvi – štetni učinci; Krvni pripravci; Sigurnost; Shema naručivanja količine krvi za operaciju*