Crossmatch Transfusion Ratio as Indicators Blood Service Quality

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Abstract:- Blood transfusion services are an important part of modern medical services that use human blood as a basic material with humanitarian purposes and not for commercial purposes (Article 86 of Law Number 36 of 2009 concerning Health and in accordance with PP No.7 of 2011 concerning Services Blood Descriptive Method, retrospective, cross-sectional study, transfusion blood requested by the clinician for patients admitted to the hospital during the period of January 2016 to December 2017. Data on blood demand from the Hospital with criteria for age, sex, number of blood crossmatch requests and Crossmatch Transfusion Ratio (C / T ratio), Transfusion Index (TI) and Transfusion Probability (T%) were calculated, Results of 189,751 blood requests at the Surakarta Red Cross City Blood Donation Unit in Surakarta City and crossmatching tests totaling 188,581 bags blood with the amount of blood transfused The 187,620 bags calculated by C / T ratio are 1.005, TI is 0.995% and T% 0, 988%. Discussion: A number of blood requests and crossmatching for blood services and blood data transfused to patients showed good blood service quality indicators with C / T ratio less than 2.5 and Transfusion Index more than 0.5 and Transfusion Probability more than 0, 5. However, the need for handling blood needs to be made and implemented with the aim of efficient use of blood transfusions, minimizing blood loss due to unused blood, cost efficiency, and moral responsibility to donors who have voluntarily donated blood for the patient's blood transfusion.

Keywords:-   C / T Ratio, Transfusion Probability, Transfusion Index.

I.   INTRODUCTION

Blood transfusions are part of the modern health service that uses human blood as the base material for humanitarian purposes and not for commercial purposes of Article 86 of Law Number 36 Year 2009 on Health and in accordance with Regulation No.7 of 2011 on Blood Services. Blood service generally includes the fundamental interests of society is therefore the policy settings in this regulation should be implemented with a fixed based on the principles of humanity, balance, benefits, protection, respect for rights and obligations, justice, non-discrimination and gender and religious norms.

Blood service as one of the health measures in order to cure disease and restore health is in dire need of blood or blood components availability of sufficient, safe, high quality, accessible and affordable to the community. Government is responsible for all the blood service implementation in accordance with the needs of the community (PP No. 7 of 2011).

Blood supply services in Indonesia is conducted by the Blood Transfusion Unit (UTD), which in today's terms as the Blood Donor Unit (UDD) Red Cross Organization pursuant to Rule No. 1 in 2018 and the Hospital Blood Bank (BDRs). Blood Donor Unit is a health care services that organize blood donation, blood supply, and distribution of blood, organized by the government, local governments, or PMI.

Blood is the biological material cannot be produced outside the human body, the availability of blood at a health facility is determined by the participation of the community in donating blood which is supported by the availability of facilities, equipment and infrastructure to ensure the availability of blood in sufficient quantity, quality and safety (Menkes, 2016).

Policy rational blood transfusion services is a factor that bullet considered as efforts to use blood and blood components in an effort to minimize blood and blood components is wasted because it cannot be used (Chavan, 2017).

Based on the WHO standard, the minimum required amount of blood in Indonesia about 5.1 million units of blood per year (2% of the total population of Indonesia), while the production of blood and its components currently about 4.1 million bags from 3.4 million donation. From the amount of blood available, 90% of which came from voluntary donations (WHO, 2016).

Average number of blood donations per year in Blood Donor Unit Red Cross Indonesia Surakarta number of 77 650 bags per year from a number of residents of the city of Surakarta in 2016 was 570 876 inhabitants of Surakarta, is about 12% in excess of the standard WHO (Suwarta, 2016).

Ratings utilization demand for blood can be done by evaluating the request against the transfused blood crossmatch in surgical and non surgical patients to avoid transfusions are not necessary and a waste of blood components (Rehan, et al., 2016). Although the amount of blood supply in the national scope still within safe limits than ever before, but there are still risks. Safety is still a concern among doctors, patients and their families, and therefore, doctors need to ensure that any risk that there could be justified by the potential benefits of alternative strategies. To reduce the use of allogeneic blood transfusion should be considered as autologos, the use of blood in surgery, autologous transfusion, or the use of pharmacologic agents. Attempts to minimize the need for red blood cell transfusions, such as the use of erythropoietin to raise hemoglobin and aprotinin to reduce bleeding during surgery, inspect and correct anemia before planned surgery. These recommendations describe the clinical situation in which a blood transfusion may be used as the appropriate therapy. (Ayob et al, 2007).

Assessing the use of blood that is by evaluating the ratio of requests to check crossmatch against transfused blood (Crossmath Transfusion Ratio / CTR) in surgical patients and non-surgical / nonsurgical to avoid transfusions are not necessary tekinis and in terms of efficient use of blood and components wastage of blood components. Availability of blood and blood components are not always with the same number requires maximizing the use of blood and blood products rationally. Excessive demand for blood can lead to a waste of time, waste of reagents, and an unnecessary workload on the service unit of blood or blood bank, blood or blood components load is wasted or destroyed because it is not so used to something because, in addition it also adds additional cost to the patient. In the absence of a written policy on the maximum blood ordering blood transfusions are often based on subjectivity anticipation blood needs not evidence based on the estimated average requirement in certain patients (Juma et al, 1990; Liem EJ et al, 1996).

According Belayneh et al (2013) one of the ways for the evaluation of the blood ordering system is the determination of the ratio crossmatch-to-transfusion (C / T), which was first used by Henry Boral, and is regarded as the corresponding index on the threshold of 2.5: 1. The ideal ratio of C / T is 1.0, but the ratio of 2.5 and below are advised to indicate efficiency. While Rehan et al, 2016 using Transfusion Ratio crossmatch ideal value between 2 and 2.5.

With these considerations, a study of "Crossmatch Transfusion Ratio as an indicator of the quality of Blood Services" was conducted in Surakarta Red Cross City Blood Donation Unit for several reasons, namely: (1) High blood demand in the PMI Surakarta Blood Donor Unit; (2) The high amount of waste blood is caused by several reasons (3)

Conditions of bloodstock in PMI Surakarta when experiencing a decline (4) Moral responsibility for donors who have donated blood for the purpose of patient blood transfusion.

Blood services and blood transfusion components are part of modern health services that are increasing along with the progress of treatment for patients needing effort and utilization of community resources.

Blood is a biological material that is alive and produced outside the human body, the availability of blood in the service unit of blood is largely determined by the participation of the community in donating blood which is supported by the availability of facilities, equipment and infrastructure to ensure the availability of blood in sufficient quantity, quality and safety (Minister of Health, 2016).

Blood transfusion service policy rational is the factor that bullet considered as efforts to use blood and blood components in an effort to minimize blood and blood components is wasted because it can not be used (Chavan, 2017).

A good estimation of the parameters available for transfusion crossmatch Transfusion Ratio (C / T ratio), transfusion probability (T%) and transfusion index (TI). Transfusion crossmatch ratio is an important parameter to estimate blood needs for surgical and non-surgical first introduced by Henry and Boral.

It is advisable to C / T ratio is less than 2.5 which indicates the need for blood during surgery. Transfusion probability (T%) was first described by Mead et al in 1980 with a value greater than 30% with the corresponding requirements of blood. Mean indication of the average number of units used by patients with transfusion index is calculated in accordance opinions of Henry and Boral, for operation requires less than 0.5 units of blood (Mead et al, 1980).

Based discovery of Henry and Boral applied in blood services PMI Blood Donor Unit Surakarta in an effort to set the ratio as an indicator transfusion crossmatch blood service standards to evaluate reports of hospital blood use according to standards of Good Manufacturing Practice of lookback in the evaluation of the use of blood. Data and reports obtained from the blood of the request letter, inspection and implementation of the provision crossmatch blood of patients at the Hospital.

This study aims to determine the efficiency of the use of blood and blood components based crossmatch Transfusion Ratio so there is no wastage of blood in blood donation unit PMI Surakarta in the period January 2016 to December 2017.

II. MATERIAL AND METHODS

Data were retrospectively whole blood demand from Hospital from January 2016 to December of 2017 carried den documentation. Confirmation is held against the person in charge of the hospital asking for blood, the data can be summarized to the routine report PMI Services Blood Donor Unit Surakarta. Corresponding indicator PMI UDD blood service in Surakarta no definition of blood service

➢ *Blood Expiry:* units of blood or blood components that must be removed or destroyed because lifespan has exceeded the specified time so as not allowed to be transfused to patients.

➢ *Blood Discard / Destroyed:* units of blood or blood components that have to be destroyed because of outdated or damaged blood during processing into blood components, or during storage, or failure in tapping the blood so it does not correspond specified volume or incompatibilities in blood storage at temperatures above or below the standards prescribed so that blood is not feasible given to patients.

➢ *Crossmatch- (C / T) Ratio Transfusion:*
Total crossmatch unit containing red blood cells
Number of Units containing red blood cells transfused
(Ratio 2.5 significantly to the use of the blood).

➢ *Transfusion Probability (% T):*
The number of patients transfused x 100
The number of patients examined crossmatching
(Score 0.5 considered a significant indication of the use of blood)

➢ *Transfusion Index (Ti):*
The number of units transfused
The number of patients who do crossmatch
(Score 0.5 considered a significant indication of the use of blood)
(Evan et al., 2014)

III. RESULT

Services PMI UDD held in Surakarta, illustrated with UDD profile are:

No.	Year	donor Voluntary	donor Substitute	Total	Percentage
1	2016	78 022	0	78 022	100%
2	2017	77 273	0	77 273	100%
	Total	155 295	0	155 295	100%

Table 1:- Distribusi Donor by type of Donation

In accordance with WHO criteria, blood donors for the benefit of blood transfusions are expected from voluntary blood donors. (Ministry of Health, 2016). The implementation of blood services at UDD PMI Surakarta City from January 2016 to December 2017 is fulfilled by 100% of voluntary blood donors, because it is in accordance with the policy in UDD PMI Surakarta City, that all donors are motivated to become voluntary blood donors, if there are blood donors who want donating blood to his family according to the criteria for a substitute blood donor motivated by the need for blood for the patient to be supplied with the blood stock in PMI, if it is not fulfilled then bring a replacement donor. If the donor donors wants to donate blood to his family motivated when the crossmatching process the patient according to the standard pre-transfusion test can still be given to other patients so that the donor's status is a voluntary donor.

Year	Whole Blood	Packed Red Cells	platelets	Platelet Rich Plasma	Washed erythro cyte	buffy coat	Anti-hemophilic Factor	Fresh Frozen Plasma	Plasma	Aferesis	Total
2016	28.065	69.571	23.036		1002	1	11	4,372	48.943	90	175.091
2017	17.523	71.815	22.476		916	1	8	5945	62.593	176	181.453
Total	45 588	141 386	45 512	0	1918	2	19	10317	111 536	266	356 544
%	12.79%	39.65%	12.76%	0	0:54%	0.0005%	0.053%	2.89%	31.28%	0.075%	100%

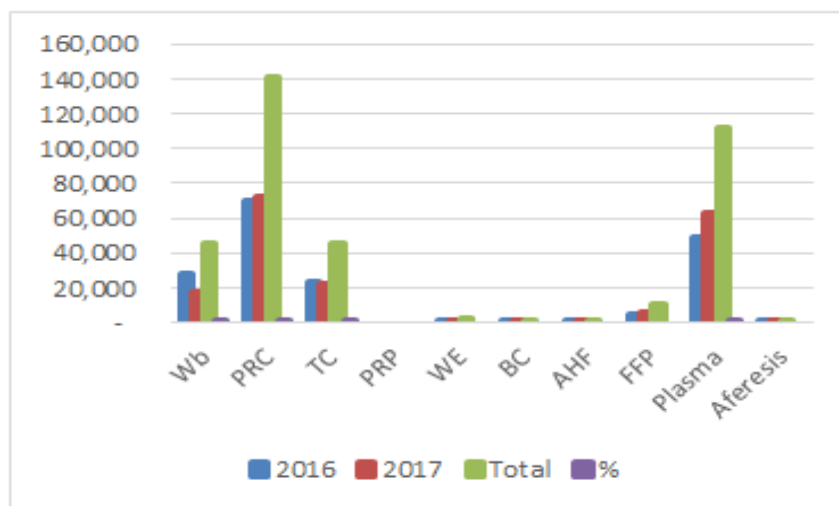Table 2:- Distribution Production of Blood and Blood Components

Fig 1:- Production distribution of blood and blood components

Total blood production in UDD PMI Surakarta City period January 2016 to December 2017 155,295 bags of blood obtained from donors were processed into blood components totaling 356,544 bags of blood components with the least number of components were Platelet Rich Plasma 0 (0%), then Buffycoat 2 (0.0005%),

Antihemophilic Factor 19 (0.053%), Aferesis 266 (0.075%), Washed Erythrocyte 1918 (0.54%), Fresh Frozen Plasma 10317 (2.89%), Thrombocytes 45,512 (12.76%), whole blood 45,588 (12.79%), Plasma 111,536 (31.28%), Packed Red Cells 141,386 (39.65%).

No	Hospital Care Section	Total Number of Blood Requests	Amount of blood request that can be fulfilled / crossmatching (bag)	Number of Used Blood Requests (bags)	Percentage			Ti	% T
					Fulfillment	Used	C/T ratio		
1	Child	19.528	19.452	19.379	99.61 %	99.625	1.003	0.996%	0.992%
2	Surgery	31.237	31.153	30.931	99. 73%	99.29%	1.007	0.993%	0.990%
3	Internal disease	97.905	96.991	96.203	99.06 %	99.195	1.008	0.9925	0.982%
4	Womb	27.065	27.016	26.800	99.81%	99.20%	1.008	0.992%	0.990%
5	Etc	14.016	13.969	13.874	99.66 %	99.40%	1.007	0.998%	0.990%
		189.751	188.581	187.620	99.38%	99.49%	1.005	0.995%	0.988%

Table 3:- Amount of Blood Demand and Blood Service indicators in PMI Surakarta City UDD January 2016-December 2017

PMI's Surakarta City Donor Unit provides 56 (74.7%) Hospital and 19 (25.3%) hospital requests from outside the city of Surakarta. From the number of blood requests from January 2016 to December 2017 a total of 189,751 requests can be made with blood fulfillment of 188,581 or 99.38%. The number of blood requests fulfilled is the amount of blood demand carried out crossmatching examination with consideration of pre-analytic factors in the form of completeness and suitability of blood demand identity and adequacy of the patient's blood sample, bloodstock available at UDD PMI Surakarta City, and several considerations for canceling blood requests from the hospital before crossmatching was examined at UDD PMI Surakarta City. There were 1170 requests for blood transfusions that were not fulfilled constituting 0.62% of all blood requests.

Of the 189,751 requests for blood entering the UDD PMI in Surakarta City, the Internal Medicine section was the most part asking for blood transfusions for patients with 97,905 (51.60%), followed by Surgery section 31,237 (16.46%) then part content 27,065 (14.26%) followed by the Children section 19,528 (10.29%) and the last another was 14,016 (7.39%).

Evaluation of blood service indicators by calculating C / T ratio with a result of 1.005 and Transfusion Index (Ti): 0.995% and Transfusion Probability (5T): 0.988 shows that blood demand services have been going well, blood requests that are not in accordance with the blood service indicator standards can be minimized, the risk of waste is insignificant and the cost efficiency of human resources can be maximized and moral responsibility for donors who have donated blood can be done well.

No	Years	Failure of blood tapping		IMLTD Reactive		Expired		Production problems (lipemic, more volume)		Problems with storage (Lisis)		Direct Coomb Tes Positive		Plasma Unused		Total
		2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	
1	Whole Blood	513	383	857	673			1229	1239	25	28					3693
2	Packed Red Cells	-	-	359	326					3	19	102	118			789
3	Trombosit	-	-	281	244	282	539									**1346**
4	Platelet Rich Plasma	-	-													
5	Washed Erythrocyte	-	-													
6	Buffy coat	-	-													
7	Anti Haemophilic Factor	-	-													
8	Fresh Frozen Plasma	-	-	78	83											**161**
9	Plasma	-	-											77256	83642	129442
10	Apheresis	-	-													
	Totaal	896		2901		831		2468		75		220		160838		166887
	%	0.54%		1.7%		0.50%		1.48%		0.0004%		0.13%		96.37 %		100%

Table 4:- Analysis of Blood and Components of Disposed Blood based on Whole Blood type and Blood Component

Analysis of the blood production of the PMI Surakarta Blood Donor Unit from January 2016 to December 2017 which is not used or as waste blood for various reasons. The least amount is caused by problems in storage or lysis 75 (0,0004%) followed by positive direct comb test results 220 (0.13%), blood expires 831 (0.50%), blood with failed tapping 896 (0.54%), blood with results reactive infections transmitted through blood transfusion 2901 (1.7%) and unused plasma with the highest number 160,838 (96.37%).

Plasma is the largest amount of waste blood according to plasma blood demand in UTD PMI Surakarta City with a number of very little less than 1%, this is also a national policy with plasma fractionation to provide plasma raw material for plasma products used for therapy patients according to Minister of Health Regulation 72 of 2015 so that it is hoped that plasma in large quantities is wasted because it cannot be used can be processed into products for therapy. Blood bags that are removed or in this case the blood in the bag is destroyed by working with third parties to destroy them (PMK, 2015)

The evaluation of blood waste in the form of Whole Blood was 3693 (2.74%) compared to the number of blood components removed was 131,097 (97. 26%). This is because the production of Whole Blood in Surakarta PMI UDD was 12.79% compared to the blood component production of 87.21%. The use of whole blood is 4.08% of all blood transfusion needs in the period January 2016-December 2017 compared to the use of blood components.

IV. DISCUSSION

The importance of blood transfusion for patient safety. In the absence of blood and blood donations from donors, all the needs for blood transfusion cannot be served well. The difference in the amount of blood demand and crossmatching with the amount of blood transfusion use by the clinician shows that there is an inappropriate use of transfusion blood.

The use of blood that is not in accordance with the request will cause waste in the cost of crossmatch examination or also the process of providing blood and blood components and also the implementation of unnecessary staff work. Given that not all blood products can be used for patients with several considerations of blood and blood products that must be removed or destroyed, for a variety of reasons that emphasize more efficient use of blood and blood products (Patil P, Bhake A, Hiwale K. 2016).

The results of the evaluation of blood service indicators at PMI Surakarta City UDD related to the implementation of blood requests, crossmatching and blood transfused to patients showed good results. But it still needs coordination with stakeholders requesting blood transfusions at the hospital to maintain and increase the commitment to use blood as efficiently as possible so that the goal of blood services as a health effort to cure illness and health recovery is in dire need of adequate, safe blood

or blood components. quality, easily accessible and affordable by the community as well as possible (PP Number 7 of 2011).

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