AUDIT SYSTEM FOR BLOOD PRODUCT USAGE IN SANGLAH GENERAL HOSPITAL DENPASAR BALI

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ABSTRACT

Blood transfusion is one of the essential therapy components. One indicator of the blood services quality in Sanglah General Hospital Denpasar Bali Indonesia is achieving the target of unused blood order ≤ 10% per month. These targets have not been achieved. The number of unused blood orders reached 6,719 bags per year (600 bags per month or 21.5%). Unused blood orders were mostly from Department of Internal Medicine (40.9%), followed by Department of Surgical (35.6%), Department of Obstetrics and Gynecology (15.5%), and Department of Pediatrics (8%). The condition can cause several problems such as the disorder of blood supply, the inefficiency of pre-transfusion testing, and decreased quality of blood product. Base on the condition, it is necessary to research audit system for usage of blood product in the Sanglah Hospital. The study aimed to analyze the influence of audit system to reduce unused blood order and to decrease the number of Crossmatch per Transfusion ratio (C/T ratio). Design of study was a pre and posttest intervention study. The population in this study were all forming of blood requests in the Sanglah Hospital. The sample was a blood request form the Department of Internal Medicine of the last two months. Intervention in this study was the development and dissemination of guidelines for the use of blood products, followed by concurrent audit and prospective audit of the sample. The study showed there were decline of the unused blood orders and C/T ratio before and after implementation of the audit system for usage of blood products. Reduction of unused blood order in the Sanglah Hospital was 5.4%, and in the Department of Internal Medicine was 5.2%. The causes of unused blood orders were patient died, overestimation of blood order, transfusion delays because of waiting for the schedule of hemodialysis, the patient had fever, blood product, and the occurrence of administration errors. Reduction of the C/T ratio in the Sanglah Hospital was 0.094 and in the Department of Internal Medicine is 0,072. An audit system for usage of blood products can reduce unused blood orders and decrease C/T ratio.

Key words: Audit system, blood products, the C/T ratio, unused blood orders

INTRODUCTION

Blood transfusion is one of the crucial components of therapy in patient management. Blood transfusions have to adhere to the principle that the benefits accruing to the patient are higher than the risk to be borne. Transfusion will be beneficial if it is administered with the right indication, the right blood type, right dose, right time, right administration, and always be aware of the side effects.[1]

Based on the data in 2012, the use of blood at the Sanglah General Hospital was at an average of 2,155 bags per month. Sixty-six percent of the demand for blood came from the Internal Medicine Department, 12% from the Surgical Department, 10% from the Pediatrics Department, 8% from the Obstetrics and Gynecology Department and 4% from other Departments.[2]

One of the indicators used to determine the rationality demand for blood is a C/T ratio (crossmatch/transfusion ratio). Based on the calculation of the C/T ratio, the monthly average reaches.[2,3] The ideal of C/T ratio is one.[3] Based on this figure, Sanglah Hospital is currently not included in the ideal category. One of the indicators of quality of service set by the Sanglah Hospital to be accredited internationally according to the standards of Joint Commission International (JCI) is the achievement of targets that the unused blood order must be ≤ 10% per month.[2]

However, the facts that occurred in 2012 show the state that did not comply with the target. Total unused blood order reached 6,719 bags per year. If the numbers were distributed to each month, then every month there were 600 bags or 21.5% of unused

blood order. The incidence of unused blood order mostly occurred in the Department of Internal Medicine at 40.9%. The second place was at the Surgical Department, namely 35.6%, Obstetrics and Gynecology Department at 15.5% and the Pediatrics Department at 8%.[2]

The main problem is the disruption of the blood supply, especially when the blood supply decreases. Patients who need the blood can be delayed because of blood stocks are already prepared for other patients who eventually canceled using the blood. Another issue that arises is the inefficiency of the components of the pretransfusion examination and the declining quality of the blood. The decline in the quality of blood is due to the prolonged period of storage of blood products.[2,4]

Given the many problems that arise due to the high amount of unused blood order, then it was necessary to research audit systems of the use of blood products in the Sanglah Hospital Denpasar.

METHODS

Design of the study was an intervention study of pre and posttest. The population covers the entire demand of blood products at Sanglah General Hospital Denpasar, and then the research sample was all the demand for blood for two months at the Department of Internal Medicine of Sanglah Hospital Denpasar. The research was conducted in the Blood Bank and the entire patient-care areas of the Department of Internal Medicine at Sanglah General Hospital Denpasar, which conducted blood transfusions. The research was conducted from January to August 2013. Ethical clearance in this study was obtained from the Commission for Research Ethics at the Faculty of Medicine Udayana University/Sanglah General Hospital Bali with 696/UN.14.2/Litbang/2013.

Variables of this study include the audit system of the use of blood products, the incidence of unused blood order and the C/T ratio. The audit systems of the use of blood products was a method used to evaluate whether the use of blood was folowing the guidelines, and the right criteria, and to improve the quality of the practice of using the blood. The blood products were all blood products removed from the blood bank of Sanglah Hospital, which was used in transfusion practices throughout the treatment room of the Department of Internal Medicine Sanglah Hospital Denpasar. The blood products included Packed Red Cells (PRC) and Thrombocyte Concentrate (TC). Unused blood order is the percentage of blood that had been prepared but had failed to be used per the total of the entire blood demand multiplied by one hundred percent. the C/T Ratio was the ratio of the number of crossmatch inspection divided by the number of transfusions performed during the same period.

Analysis of the results was carried out by analyzing the average decline in the incidence of Unused Blood Order and the C/T Ratio before and after the application of the audit systems of the use of blood products.

RESULTS AND DISCUSSION

In the first month of the implementation audit systems (16 June-15 July 2013) There were 236 request forms, and in the second month of the application of the audit system (July 16 -15 August 2013), there were 274 blood request forms from the Department of Internal Medicine. When it was compared with the results of the request review for blood in 2012, the completeness of the writing of the request form tended to be better although still to be improved. Most of the data had not included a history of previous blood transfusion. From a total of 510 blood, 214 (41.9%) of the request came from the hematology subdivision, 182 (35.7%) from the nephrology subdivision, 51 (10%) from the gastro-hepatology subdivision, 16 (3.1%) from the subdivision of trophic disease, 15 (2.3%) from the subdivision of pulmonary, 11 (2.2%) from the subdivision of Immunology, 6 (1.2%) from the endocrine subdivision and a total of 18 (3.5%) was not known.

A total of 459 (90%) requests only asked for the PRC component, 26 (5.09%) only for TC component and the remaining 25 requests (4.91%) asked for the PRC and TC. The indication of transfusion was based on the levels of hemoglobin. A total of 263 (54.4%) patients had hemoglobin levels <7 g/dL, 87 (17.9%) with hemoglobin levels 7 to 7.9 g/dL, 76 (15.8%) were from 8 to 8.9 g/dL, 19 (3.9%) hemoglobin levels from 9 to 9.9% and the remaining 39 patient hemoglobin levels (8.06%) were not specified in the blood requests. The 51 requests of TC, 29 (56.86%) have included the platelet counts, and as many as 22 (43.14%) have not included the platelet counts. Among the 29 requests for TC, 16 (31.37%) with the platelet counts of ≤ 10,000/μL, 10 (19.6%) with the platelet counts of 10,000-20,000/μL, 2 (3.92%) with the platelet counts of 20,000-40,000/μL, 1 (1.96%) with a platelet count of > 40,000/μL. On platelets of > 40000/μL or more precisely 45,000/μL, platelet

transfusion was done to meet the requirements of operations that require the platelet count of at least 750,000/μL.

It was still found incomplete form filling of the blood requests, especially about the history of previous blood transfusion. It could be due to the recording system in the patient medical record was still done manually. The doctor would find it difficult to retrace it if there was quite far distance between the previous periods of transfusion. Transfusion history discovery difficulty was also common in patients who had the previous transfusion outside Sanglah General Hospital. Patients often did not carry a note or record of their therapy taken outside the Sanglah General Hospital, and transfusion history search through anamnesis of patients was also quite difficult. Patients often forgot or could not provide the information. Transfusion history search

in the Blood Bank also often experienced problems because the recording was still done manually. It takes quite a long time to find the data of the previous transfusion.

Filling the request form completely and correctly is essential knowledge and skills in the practice of transfusion.[5] Proof of blood requests also must be documented in the patient medical record. The accuracy of the recording of blood requests, including documentation of the reasons and type of blood component transfusion is very important for tracking cases in the event of serious side effects of transfusion, or in case of medico-legal cases.[6]

The following is a table which explains the incident of unused blood order before and after the implementation of the audit systems at the Sanglah Public General Hospital.

In Table 1, the average incidence of unused blood

Table 1. The unused blood order incidents before and after the blood audit system was applied in the Sanglah General Hospital

Month	Σ Numerator*	Σ Denumerator**	Result (%)
January	614	2613	23%
February	586	2023	29%
March	654	2590	25%
April	593	2553	23%
Mei	631	3093	20.5%
Juni	533	2773	19.2%
July	538	2856	24.1%
Mean before implementation of the audit system			18.51%
The first month of audit	500	2701	18.90%
The second month of audit	473	2502	18.71%
Mean after implementation of the audit system			

* Numerator: Number of unused blood ordered in a month (bag)
**Denumerator: Number of all blood ordered within a similar month (bag)

Table 2. Incidents of unused blood order before and after the blood audit system applied in the Internal Medicine Department

Month	Σ Numerator*	Σ Denumerator**	Result (%)
January	304	1824	16.67%
February	322	1777	18.12%
March	326	1706	19.11%
April	223	1263	17.65%
Mei	246	1318	18.66%
Juni	233	1769	13.17%
July	216	1597	13.52%
The first month of audit	164	1295	12.68%
The second month of audit	175	1338	13.07%

* Numerator: Number of unused blood ordered in a month (bag)
**Denumerator: Number of all blood ordered within a similar month (bag)

order before the implementation of the audit system was 24.1%, and the average after the audit system application was 18.705%. Therefore, the average decrease in the incidence of unused blood order before and after the audit system was 5.395%.

The incidence of unused blood order, especially in the Department of Internal Medicine before and after the implementation of audit systems is shown in Table 2.

Just as the target of the Hospital, the target of unused blood order at the Department of Medicine was also 10%. The average of unused blood order before the audit was 18.042%, and after the application of the system and after the implementation of audit systems was 12.875%. Thus, the average decrease amounted to 5.167%.

Some causes of unused blood order in the Department of Internal Medicine is illustrated in Figure 1.
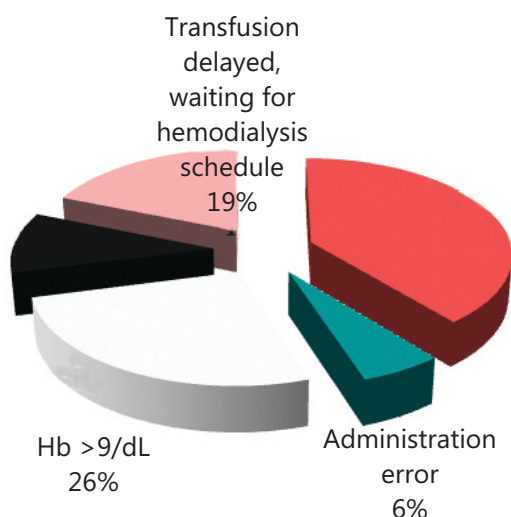
Figure 2. The causes of unused blood order PRC in internal medicine (the second month of audit)

Figure 1. The causes of unused blood order PRC in internal medicine (the first month of audit)

The most common cause of unused blood orders was the patient's death (39%), followed by the achievement of hemoglobin levels (26%), transfusion on delayed due to patients fever 10% and waiting for hemodialysis schedule 19%. Six percent is caused by administrative errors such as incorrect prescriptions (Figure 2).

The first cause of unused blood order on the PRC component was the achievement of hemoglobin levels (49%), followed by transfusion on delayed due to patient waiting for hemodialysis schedule 29% and the patient died 22% (Figure 3).
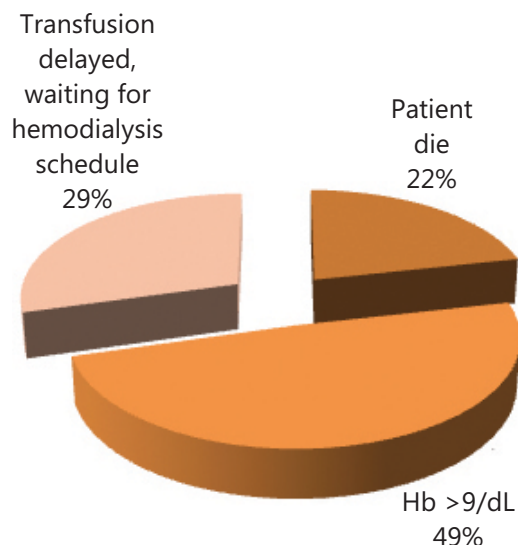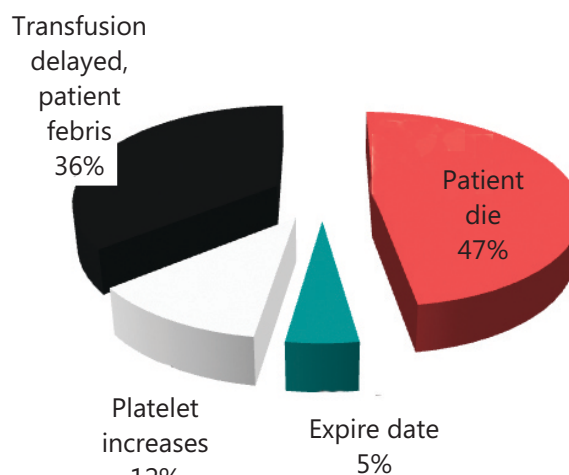
In the first month of the audit, the causes of

Figure 3. The causes of unused blood order TC in internal medicine (the first month of audit)

unused blood order in thrombocyte concentrate were patient died 47%, followed by transfusion delayed due to patient fever 36%, platelet increases 12% and expires date on product 5% (Figure 4).

In the second month of the audit, unused blood order mostly cause by platelet increases by 72%, followed by the expiry date of product 14% and 14% unknown causes.

The decline in C/T Ratio before and after the implementation of audit systems in Sanglah Hospital
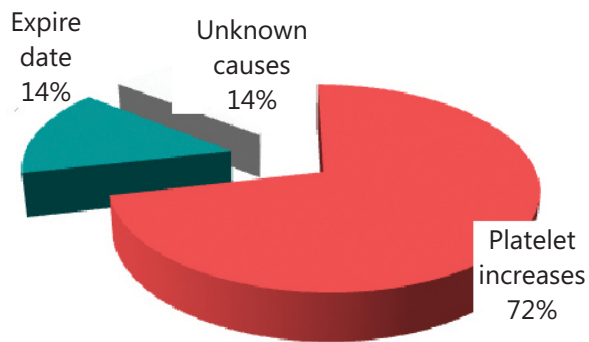
Figure 4. The causes of unused blood order TC in internal medicine (the second month of audit)

is shown in Table 3.

From Table 3, the mean of C/T Ratio before the application of the system is 1.324 and the mean after the audit system implementation is 1.23. Thus, the mean decrease is 0.094. Specifically, in the Department of Internal Medicine, the decline in C/T Ratio before and after the implementation of audit systems is shown in Table 4.

From Table 4, the mean of C/T Ratio before the implementation of the system was 1.22, and the mean after the audit system implementation was 1.148. Thus, the mean decrease is 0.072.

Reduction in the incidence of Unused Blood Order that occurred after the implementation of audit systems at the Sanglah Hospital and especially in the Internal Medicine Department was 5.4% and 5.2%. Despite the decline achieved was not too big, but it helps in regulating blood supply and in preventing the costs for pre-transfusion examination. More than 80 units of blood could be used to help regulate blood stocks and reduce the waste of some costs for pre-transfusion testing.

The incidence of unused blood order which caused by the patient's death is difficult to prevent. However, communication between the room attendant and the Blood Bank must be maintained. The room attendant should immediately inform the blood bank that patients who needed blood has died, and the blood that has been ordered not to be used. Thus the blood can be immediately circulated to other patients. This research greatly helps to regulate blood stocks and maintain the quality of the blood, because the storage time becomes shorter.

In the transfusions of PRC and TC, the incidence of overestimation of the high demand for blood. What is meant by overestimation is the excess demand on

Table 3. C/T Ratio before and after the blood audit system was applied in Sanglah General Hospital Month

Month	The number of unit crossmatched	The number of units transfused	C/T Ratio Sanglah Hospital
January	2613	1999	1.307
February	2023	1437	1.408
March	2590	1936	1.338
April	2553	1960	1.303
Mei	3093	2462	1.256
Juni	2773	2240	1.238
July	2856	2318	1.232
The first month of audit	2701	2201	1.227
The second month of audit	2502	2029	1.233

Table 4. The C/T Ratio before and after blood audit system applied in the Internal Medicine Department

Month	The number of unit crossmatched	The number of units transfused	C/T Ratio Sanglah Hospital
January	1824	1520	1.200
February	1777	1455	1.221
March	1706	1380	1.236
April	1263	1040	1.214
Mei	1318	1072	1.229
Juni	1769	1536	1.152
July	1597	1381	1.156
The first month of audit	1295	1131	1.145
The second month of audit	1338	1163	1.150

the number of units of blood compared with the patients' needs. This case can be caused as a result of non-optimal dissemination guidelines for rational use of blood and the need for periodic re-education. Some cases of elevated levels of hemoglobin > 11 g/dL are found. The increase of Hb levels by more than 11 g/dL of post-transfusion is regarded as over-transfusion incidence.[7]

The persistently high incidence of unused blood order was caused by a delay of transfusion in patients who were awaiting hemodialysis, might be caused by a lack of communication between medical officers, the incompleteness of the information on blood requests and constraints in the hemodialysis service system.

The delays of transfusion for patients experiencing febrile were sufficiently contributing to the incidence of unused blood order. No literature says if a transfusion can be given while the patient is on fever or it has to wait for the normal body temperature. In some sources mention that before, during, and after the transfusion is done, the temperature monitoring should be carried out. If the temperature changes significantly during the monitoring, it should be considered that a transfusion reaction can cause the increase in temperature. If there are medications that need to be given prior to a blood transfusion, it must be given before the transfusion is done. If the medicine is given orally, the transfusion should be done 30-60 minutes after administration. If the medication is given intravenously, transfusion shall be conducted 10 minutes after the drug administration.[8]

Administrative errors that were found in this study was due to two things. Firstly because the same patients had two different names, and the information on the blood's request forms was not the same as those included in the billing system of the hospital. The second cause was due to an error on the writing of the request type of blood component. It was supposedly the Wash Red Cells (WRC) but at the written request was the PRC. Although the administrative errors that found in this study were not fatal, the completeness and accuracy of the writing of blood requests remained to be fixed.

The unused blood order incident happened because the platelets underwent expired products likely to be caused by a lack of communication between the room attendant and the officers of the Blood Bank. Another possibility that the implementation of the rules was not monitored, e.g., TC, which was not used within 2x24 hours after the pretransfusion tests could be circulated to other

patients. This is because the storage life of TC is so short that it lasts only for five days.

The researcher had not found any similar studies that evaluated the effect of an audit system on the decline of unused blood order, but other studies that evaluated the effect of an audit system on the decrease in inappropriate transfusion had been done. Tuckfield *et al.* Conducted the study that results showed the auditing system of blood product usage was capable of lowering the inappropriate transfusion in the PRC component of 81%, 52% of FFP and TC of 81%.[9]

Other research conducted by Giovanetti *et al.* who found a decline in the inappropriate transfusion in the PRC component of approximately 67% after application of the audit system and the use of blood product usage guidelines as instruments of research.[7] Sarode *et al.* conducted a prospective audit by providing education to clinicians on the use of components of Pack Red Cells (PRC), Fresh Frozen Plasma (FFP), Thrombocyte Concentrate (TC). Results of the study significantly lowered the amount of 60% of plasma transfusions and platelet transfusions by 25% and cost savings, amounting to $ 3 million over four years.[10]

From the results of this study, it was found a decline in the C/T ratio, both in Sanglah General Hospital and particularly in the Department of Internal Medicine. The decline in the C/T Ratio before and after the implementation of audit systems was respectively of 0.094 and 0.072. Based on the research conducted at the Royal Glamorgan Hospital, South Wales, the C/T ratio was high, in addition to causing an increasing amount of expiry blood, it also led to an increase in the workload of the blood bank personnel.[11]

A crossmatch transfusion ratio, or can be abbreviated as CTR 2.5: 1 is generally accepted as the highest limit related to the efficiency of the use of blood products.[7,12,13] Maximum crossmatch to transfusion ratio 2:1 is recommended by another guidelines.[14] In addition to improving patient safety due to a reduced risk of transfusion, lower C/T ratio also saves the cost, time and energy.[10] At the Army Hospital, Delhi, C/T Ratio that deemed to be acceptable is 2: 1 and C/T Ratio 1: 1 is considered the most ideal and most efficient although it is never reached.[15,16]

CONCLUSION AND SUGGESTION

During the application of audit system for blood products usage, a decline in the incidence of unused

blood order was at 5.4% in the Sanglah General Hospital and 5.2% in the Department of Internal Medicine of Sanglah General Hospital. The causes of the occurrence of unused blood orde at the Department of Internal Medicine. Were the patient died, overestimation of the request for blood, the delay of transfusion because of the waiting time for the schedule of hemodialysis, transfusion was delayed because patients experienced febrile, expired products, and the administrative errors.

For the indicator of C/T Ratio, either in general at the Sanglah General Hospital, and specifically in the Department of Internal Medicine had been a decrease at the time before and after the application of the audit system. The decline were respectively 0.094 and 0.072.

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