Golestan University of Medical Sciences
Journal of Clinical and Basic Research
Online ISSN: 2538-3736

Research Article

Evaluation of Blood Consumption Pattern in Imam Ali Hospital in Bojnurd, Iran

Javad Hashemi[1], Saeid Barzegar[1], Hoseinali Soltani[2], Ali Nabavi[3], Mohammadreza Safdari[2]*

1.Department of Pathobiology and Laboratory Sciences, School of Medicine, North Khorasan University of Medical Sciences, Bojnurd, Iran
2.Department of Surgery, School of Medicine, North Khorasan University of Medical Sciences, Bojnurd, Iran
3.Student Research Committee, School of Medicine, North Khorasan University of Medical Sciences, Bojnurd, Iran
***Correspondence:** Mohammadreza Safdari, Department of Surgery, School of Medicine, North Khorasan University of Medical Sciences, Bojnurd, Iran
Email: mohammadreza_safdari@yahoo.com
Tel: +989358674045

Received June 25, 2021 **Accepted** August 9, 2021

ABSTRACT

Background and objectives: Blood transfusion has an important role in medical and surgical procedures. In Iran, a person needs blood or blood products every three seconds. Shortage of blood donors, poor facilities for storing and preparing blood products, lengthy preparation process until transfusion as well as irregular use of blood products are some of the important problems associated with blood transfusions. Given the importance of proper and effective use of blood products, this study was carried out to evaluate the blood consumption pattern in Imam Ali Educational, Research and Treatment Center in Bojnurd, Iran.

Methods: This retrospective study was performed in 2020 on all cases requesting blood products at the Imam Ali Hospital in Bojnurd, Iran. All patient data including age, sex, blood type, requesting ward, type and the number of requested products including packed cell, freshly frozen plasma (FFP) and platelet were extracted from the hospital information system and the daily registry notebooks.

Results: Of 3083 blood requests, 58.6% were for males and 41.4% were for females. The most and least requested blood groups were O^+ (32.9%) and AB^- (0.5%), respectively. Packed cell (27%) and FFP (30%) were the most frequently requested products in the emergency department, while platelets (88.5%) was the most frequently requested product in the oncology department. Cross-matched to transfused blood ratio for packed cell was 1.37. Also, not using blood products index for packed cell, FFP and platelet was 27.5, 0 and 0, respectively. Moreover, transfusion index for packed cell, FFP and platelet were 0.72, 1 and 1, respectively.

Conclusion: The pattern of blood consumption in the studied hospital is relatively favorable. However, in some wards such as neurology and burns, there is a need to review the requesting and consumption of blood products. In the case of O^- blood type, the probability of not using the requested packed cell and cross-matched is above 50%, which highlights the need for reviewing the blood application process due to the scarcity of this blood type and the imposition of workload.

Keywords: Blood Component Transfusion; Blood Cross-matching; Blood Bank; Efficiency of Blood Transfusion

DOI: 10.29252/Jcbr.5.2.57

This work is licensed under a Creative Commons Attribution 4.0 License.
© The authors

[DOI: 10.52547/jcbr.5.2.57]

INTRODUCTION

Blood transfusions play an important role in medical and surgical procedures. Hemoglobin plays an important role in oxygenation and maintenance of tissue metabolism and the proper functioning of various body organs (1). Blood transfusion is a life-saving intervention in many cases, including anemia (2), uncontrollable bleeding such as fractures (3), hypovolemic condition (4), etc.

In Iran, a person needs blood or blood products every three seconds. Proper and effective use of blood products is crucial. Shortage of blood donors, poor facilities for storing and preparing blood products, lengthy preparation process until transfusion as well as irregular use of blood products are some of the important problems associated with blood transfusions (5).

Excessive blood supply is a common problem in hospitals, which can lead to problems such as the improper distribution of blood products, rising hospital costs and increased blood-banking workload. This increase in demand is due to the fear of not having enough access to blood during surgery or to not having a clear pattern for requesting blood, which ultimately leads to anemia and worse. The general state of its storage, which in addition can impose an additional financial burden on centers and patients, may result to reduction of quality or expiration of various blood products (6).

Due to the excessive demand for blood and blood products in the 1970s and 1980s, a program called the maximum blood demand pattern for maximum surgical blood ordering schedule (MSBOS) was proposed to improve the consumption of blood products (7). However, many medical centers still have difficulty building sustainable and efficient blood banking systems.

One of the suggested solutions for managing the consumption of blood products is to study the pattern of blood consumption in each medical center separately according to the specialized needs of that center. Periodic evaluation of the blood transfusion process for patients may help discover shortcomings that need to be resolved. This study aimed to evaluate the pattern of blood consumption in Imam Ali Educational, Research and Treatment Center in Bojnurd, to investigate the current situation and effective planning in the management of blood products to ensure adequate product resources in the blood bank.

MATERIALS AND METHODS

This retrospective study was performed in 2020 on all cases requesting blood products at the Imam Ali Hospital in Bojnurd, Iran. The hospital is a trauma center that has emergency departments, intensive care unit, operating room, general surgery, neurology, orthopedics, oncology, burns and hemodialysis wards. After obtaining the approval of the ethics committee and ensuring the confidentially of patients personal information, data were collected from the hospital's HIS system, the daily blood-banking registry in the hospital laboratory and patients records. All patient data including age, sex, blood type, requesting ward and type and number of requested products including packed cell, freshly frozen plasma (FFP) and platelet (PLT), with additional information including consumption state after compatibility testing (cross-match), were recorded and then analyzed. Three parameters of cross-matched to transfused blood ratio (CTR), not using blood products (NUP) and transfusion index (Ti) were used to evaluate the blood consumption pattern. The ratio of cross-matched to transfused blood (C/T) introduced by Boral and Henry in 1975, is an important indicator for examining blood consumption patterns (8). A CTR of less than 2 indicates the ideal use of blood and its products, while a CTR value of more than 2 means that less than 40% of cross-matched blood bags have been transfused (9). The NUP index indicates the probability of not using blood products and for that number is less than 50% (10). Blood transfusion index or Ti is the average number of cross-matched blood units injected into each patient. Values of 0.5 and above indicate the optimal use of ordered blood (11).

The data were entered into SPSS software (version 20.0) and described using mean, standard deviation and percentage. To compare continuous data, the t-test and one-way analysis of variance for normal data were used. For non-normally distributed data, the Mann-Whitney U test and Kruskal-Wallis test were used. In addition, the chi-square test was used to compare discrete data. All statistical analyses were performed at significance of 0.05.

RESULTS

Overall, 3083 requests (58.6% male and 41.4% female) were recorded in the hospital. Mean age of the patients was 46 years (range: 29-63 years). The general characteristics of patients

[DOI: 10.52547/jcbr.5.2.57]

requesting blood products are shown in (table 1). The most and least frequently requested blood groups were O+ (32.9%) and AB- (0.5%), respectively. The demand for packed cell and FFP was highest in the emergency department (27% and 30%, respectively) and lowest in the hemodialysis department (1% and nil, respectively). Regarding PLT requests, the highest and lowest requests were related to oncology (88.5%) and dialysis (0) wards, respectively (Figure 1).

Table 1. General characteristics of the patients requesting blood products

Characteristic		Number (%)
Gender	Male	328 (58.6%)
	Female	232 (41.4%)
ABO blood group	A+	149 (26.7%)
	A-	23 (4.1%)
	B+	132 (23.6%)
	B-	11 (2%)
	AB+	44 (7.9%)
	AB-	3 (0.5%)
	O+	184 (32.9%)
	O-	13 (2.3%)

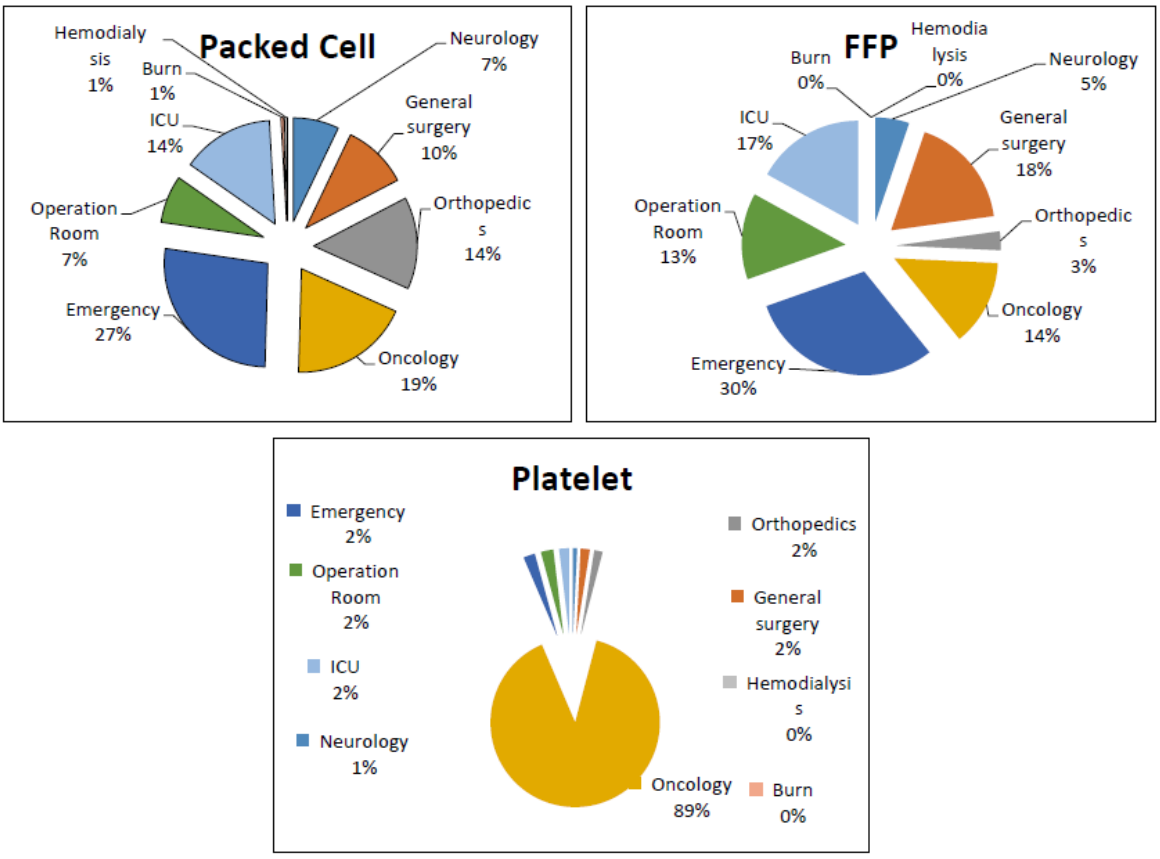

Figure 1. Percentage utilization of packed red blood cells according to hospital wards

[DOI: 10.52547/jcbr.5.2.57]

(Table 2) shows the pattern of blood consumption in each hospital ward. The CTR for packed cell was highest in the burn ward (2.67) and lowest in the dialysis ward (1). The neurology ward did not have a good CTR (2.1), NUP (52) and Ti (0.48) despite being normal, and CTR, NUP and Ti were out of the normal range in the burn department. The overall CTR for packed cell was 1.37 and the overall NUP for packed cell, FFP and PLT was 27.5, 0 and 0, respectively. In addition, the overall Ti for packed cell, FFP and PLT was 0.72, 1, 1 respectively, indicating the favorable status of blood consumption in the hospital. The most requested blood group in the hospital was O+. In this regard, the O- blood group did not have a suitable NUP index (58%) (Figure 2).

Table 2. CTR, NUP and Ti according to the clinical departments

Department/ward	CTR				NUP (%)				Ti			
	Packed cell	FFP	PLT	Cryo	Packed cell	FFP	PLT	Cryo	Packed cell	FFP	PLT	Cryo
Neurology	2.1	1	1	-	52	0	0	-	0.48	1	1	-
General surgery	1.36	1	1	-	27	0	0	-	0.73	1	1	-
Orthopedics	1.38	1	1	-	28	0	0	-	0.72	1	1	-
Oncology	1.21	1	1	1	18	0	0	0	0.82	1	1	1
Emergency	1.36	1	1	-	27	0	0	-	0.73	1	1	-
Operation Room	1.18	1	1	-	15	0	0	-	0.85	1	1	-
ICU	1.32	1	1	-	24	0	0	-	0.76	1	1	-
Burn	2.67	-	-	-	63	-	-	-	0.38	-	-	-
Hemodialysis	1	-	-	-	0	-	-	-	1	-	-	-

CTR= requested/consumed

NUP= non-consumed/requested

Ti= consumed/requested

[DOI: 10.52547/jcbr.5.2.57]

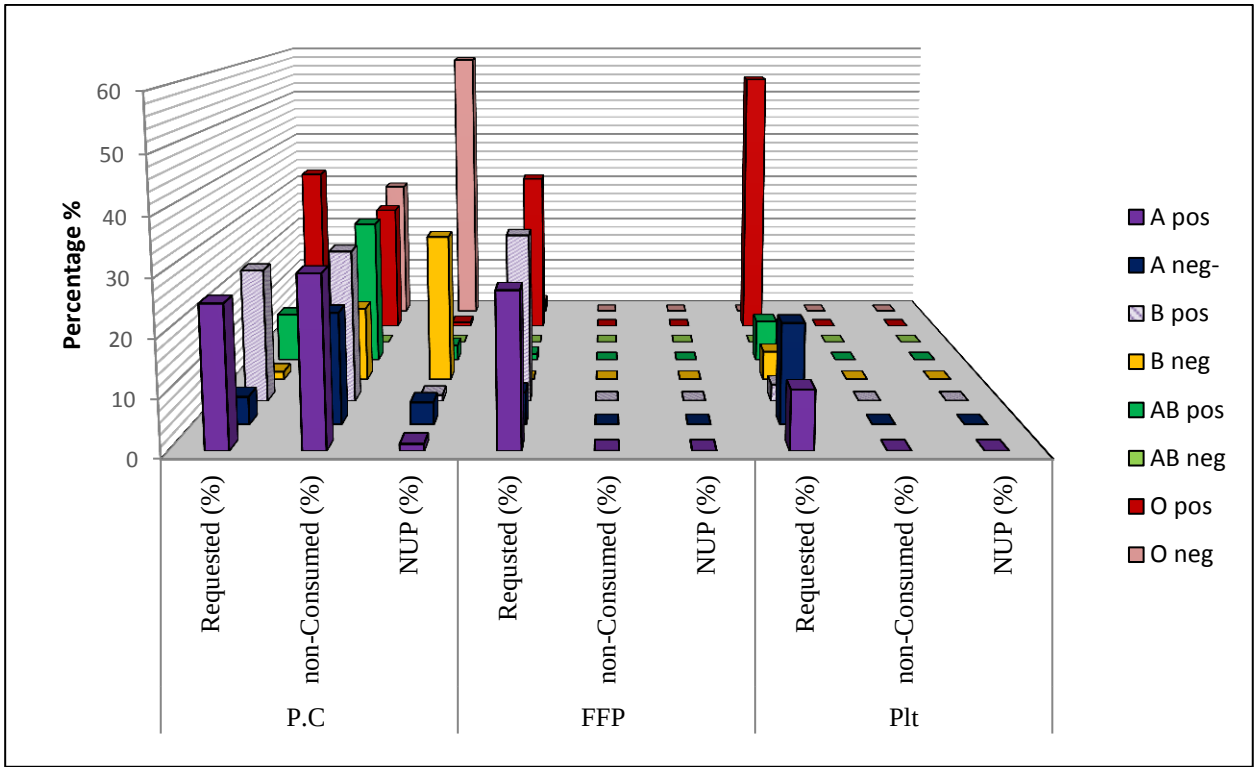

Figure 2. The relationship of the requested blood group and the NUP

DISCUSSION

Blood transfusion is an important treatment that should be done with caution otherwise it may lead to serious complications such as infections and blood transfusion reactions (12). In developing countries, much attention is paid to medical expenses, which imposes a heavy financial burden on both patients, the government and insurance companies. In many studies, inappropriate blood consumption patterns have been reported from both public and private hospitals (13). It seems that with a team approach consisting of physicians, nurses and hospital laboratory technicians, the number and pattern of ordering blood products can be greatly reduced (14). At present, in many hospitals, a standard method in the blood bank for selecting blood products is used, and based on it; an attempt is made to manage its consumption pattern.

As a trauma center, the Imam Ali Hospital in Bojnurd has a very active blood banking department in which all blood products needed by patients are prepared and used by the Blood Transfusion Organization. Among various blood products, the three most commonly used products in this hospital were packed cells, FFP and PLT. Inconsistent with this finding, a study by Singhal et al. in India reported that whole blood had the highest demand compared to other blood products (15). In our study, the demand for blood products was higher for men than for women. Also, the highest and lowest demand was related to blood group O+ and blood group AB-, respectively, which was predictable according to the prevalence of blood groups in the community (16). In our study, the highest demand for blood products was related to the emergency department and oncology ward. Among the factors that cause Packed cell request are chronic anemia, leukemia, dialysis and decreased oxygen-carrying capacity after bleeding (12). Therefore, considering that Imam Ali Hospital, as a trauma center, receives random patients, and has dialysis and oncology wards, so Packed cell has the highest rate of use. These results are almost comparable to that of Geißler study at the university hospital of Münster,

[DOI: 10.52547/jcbr.5.2.57]

Germany; in which compressed red blood cells were the most widely used blood product (17). In another study, 67.8% of cases requesting blood products were related to packed cell (18). Nevertheless, it should be noted that the demand for blood products in a hospital usually depends on the departments. For example, a study in India reported whole blood as the most sought-after product in hospitals (15).

Freshly frozen plasma is prepared from whole blood and frozen at the appropriate time and temperature to maintain sufficient coagulation factors. This product contains coagulation factors, albumin and immunoglobulins (12). Patients with conditions such as deficiency of coagulation factors including thrombocytopenic thrombotic purpura (TTP), hemolytic uremic syndrome (HUS) (19), apheresis treatment and hemolytic anemia elevated liver enzymes and low PLT count and blood exchange may require FFP (20). In a study by Venkatachalapathy et al., FFP ranked second in blood bank requests at RI Jalappa Hospital, India (21). Similarly, a study in India reported FFP as the third most commonly requested blood product (15), which is in line with our findings.

Platelet concentrate can be obtained from fresh whole blood. Platelet transfusion is used for prevention and/or treatment of thrombocytopenia or PLT dysfunction. The request for a PLT should not be based solely on the patient's PLT count. Instead, acute thrombocytopenia with bleeding should be considered (12). In our study, PLT was the second most frequently consumed blood product. This result contradicts with results of the Venkatachalapathy study in India, which showed that PLT has the least used blood product (21). There was a significant difference in the request for PLT between the oncology ward and other wards, which explains the reason for the high demand for this product compared to other studies.

The hospital blood banking must be able to provide the required blood products in the shortest time possible while evaluating the current process of requests. This is important to prevent improper use of blood products that may lead to shortage of blood supply for the patients. Regarding the pattern of blood consumption in the studied hospital, we found that the CTR parameter was appropriate in most wards. The Ti index was also good, although the neurology and burn departments need to review and modify their blood consumption patterns. The CTR index for packed cell was 1.37, which is significantly lower than the values reported from other studies (10). A low CTR value indicates optimal use of blood. The main reasons for the high CTR are the lack of clear and reliable instructions for requesting blood in hospitals, clinical audits and proper communication between doctors, nurses and blood banking staff. Inadequate blood transfusion, characterized by high CTR and NUP, leads to blood loss and unavailability of blood to patients in need (13).

Inadequate Ti in the neurology and burn departments may be due to premature transfusion requests from some physicians or delays in patients' surgery. Such cases increase the workload of blood banking personnel and the preparation costs. Dialysis and operating room wards had a higher Ti, which indicates the optimal use of blood. Examination of blood transfusion guidelines shows that most surgical procedures do not require blood transfusions, which supports the results of the present study (22).

Many studies have evaluated the pattern of blood consumption in hospitals by calculating CTR and Ti. The discrepancy in results of these studies may be due to the availability of blood or transfusion symptoms as considered by requesting physicians (10, 23)

In the present study, O+ was the most requested blood type, which also had a good NUP index. However, this index was not suitable for the O- blood group. The results in Imam Ali hospital, showed that the probability of not using the requested packed cell blood product and cross-matching is above 50%, which highlights

[DOI: 10.52547/jcbr.5.2.57]

the necessity to review the blood request process due to the scarcity O- blood group and the imposition of workload and cost. In our study, we observed incomplete blood application forms with missing information of the physician's name, diagnosis and blood acceptance time, which should be resolved to help efficiency of the blood services. Moreover, observing the correct principles of blood request can reduce the number of unnecessary requests, false blood deficiency and workload of the hospital and blood transfusion organization personnel.

CONCLUSION

Establishing and following blood transfusion instructions will reduce unnecessary blood requirements. In our study, CTR and NUP values were favorable. However, there was improper transfusion practice in some wards that needs to be resolved. The most requested blood type was O+, and the demand for packed cell and FFP was highest in the emergency department. In addition, the demand for PLT was highest in the oncology department. The proper use of this information can help implement a suitable strategy for the correct and fast delivery of blood products to these departments. In general, for achieving a appropriate blood consumption pattern, some in-service education must be planned for medical doctors and paramedics while monitoring how blood and its products are applied in the hospitals.

ACKNOWLEDGEMENTS

The authors would like to thank all the esteemed colleagues in the hospital wards and blood bank of Imam Ali Hospital, Bojnurd, Iran.

DECLARATIONS

Funding

The authors received no financial support for the research.

Ethics approvals and consent to participate

All patient information remained confidential and published anonymously. The study was approved by the ethics committee of North Khorasan University of Medical Sciences (ethical code: IR.NKUMS.REC.1398.016).

Conflicts of interest

The authors declare that there is no conflict of interest.

REFERENCES

1. Aliyu I, Michael G, Ibrahim H, Ibrahim ZF, Aliyu G, Isaiah AT. Blood transfusion request pattern in a medical center in Northwestern Nigeria. Glob J Transfus Med. 2017; 2(1):52. [View at Publisher] [DOI] [Google Scholar]

2. English M, Ahmed M, Ngando C, Berkley J, Ross A. Blood transfusion for severe anaemia in children in a Kenyan hospital. The Lancet. 2002; 359(9305):494-5. [View at Publisher] [DOI] [PubMed] [Google Scholar]

3. Burlew CC. Preperitoneal pelvic packing: A 2018 EAST master class video presentation. J Trauma Acute Care Surg. 2018; 85(1):224-8. [View at Publisher] [DOI] [PubMed] [Google Scholar]

4. Yang Q, Wang T, Ai L, Jiang K, Tao X, Gong D, et al. Clinical outcomes of blood transfusion to patients with pelvic fracture in the initial 6 h from injury. Exp Ther Med. 2020; 19(3):2252-8 [View at Publisher] [DOI] [PubMed] [Google Scholar]

5. Musa AU, Ndakotsu MA, Hassan A-A, Kilishi A, Kwaifa IK. Pattern of blood transfusion request and utilization at a Nigerian University Teaching Hospital. Sahel Med J. 2014; 17(1):19. [View at Publisher] [DOI] [Google Scholar]

6. Dashab M, Solhjou K, Erfanian S. Comparing the demand for blood in hospitals of Jahrom and standard blood transfusion indices. J Jahrom Univ Med Sci.

[DOI: 10.52547/jcbr.5.2.57]

2014; 12(1):63-69. [View at Publisher] [DOI] [Google Scholar]

7. Khalili AK, Zare MA, Jalilvand A. Maximum surgical blood ordering schedule (MSBOS) in elective surgery cases: an original study in Firoozgar Hospital. Razi Journal of Medical Sciences. 2005; 11(44):939-944. [View at Publisher] [Google Scholar]

8. Khoshrang H, Madani AH, Roshan ZA, Ramezanzadeh MS. Survey on blood ordering and utilisation patterns in elective urological surgery. Blood Transfusion. 2013; 11(1):123. [View at Publisher] [PubMed] [Google Scholar]

9. Teremahi AM, Golvardi YM, Sobhani G, Abroushan H, Roonema R. Analyzing ordering schedule of blood and its products in Shahid Mohammadi hospital, Bandar Abbas, Iran. Hormozgan Med J. 2015; 19(3):159-164. [View at Publisher] [Google Scholar]

10. Ebose EM, Osalumese IC. Blood shortage situation: An audit of red blood cells order and pattern of utilization. Afr J Biotechnol. 2009; 8(21):5922-5925. [View at Publisher] [DOI] [Google Scholar]

11. Soomro R, Rizwan Javed M, Ahmad Ali S. Arrangements and use of blood in elective surgical procedures. Prof med j. 2011; 18 (2): 212-214. [View at Publisher] [DOI] [Google Scholar]

12. Alcantara TY, Alresheid AA, Al Shammary SAM. A Comparative Study on Blood Components Utilization in Selected Hospital-Blood Banks in Hail, KSA. Journal of Nursing and Health Science. 2015; 4:28-33. [Google Scholar]

13. Kumari S. Blood transfusion practices in a tertiary care center in Northern India. J Lab Physicians. 2017; 9(2):71. [View at Publisher] [DOI] [PubMed] [Google Scholar]

14. Thabah R, Sailo L, Bardoloi J, Lanleila M, Lyngdoh N, Yunus M, et al. Maximum Surgical Blood Order Schedule'in a newly set-up tertiary care hospital. Anaesth pain intensive care. 2019:28-32. [View at Publisher] [Google Scholar]

15. Singhal M, Patel M, Kapoor D, Mittal D. A research analysis on blood component usage and wastage in blood bank and blood component center. J Physiol Pathophysiol. 2013; 4(2):23-8. [View at Publisher] [Google Scholar]

16. Pourfathollah A, Oody A, Honarkaran N. Geographical distribution of ABO and Rh (D) blood groups among Iranian blood donors in the year 1361 (1982) as compared with that of the year 1380 (2001). Sci J Iran Blood Transfus Organ. 2004; 1(1):11-7. [View at Publisher] [Google Scholar]

17. Geißler G, Franz D, Buddendick H, Krakowitzky P, Bunzemeier H, Roeder N, et al. Retrospective analysis of the blood component utilization in a university hospital of maximum medical care. Transfus Med Hemother. 2012; 39(2):129-38. [View at Publisher] [DOI] [PubMed] [Google Scholar]

18. Kaur P, Basu S, Kaur G, Kaur R. An analysis of the pattern of blood requisition and utilization in a tertiary care center. Natl J Integr Res Med. 2013; 4(2): 2230 - 9969. [View at Publisher] [Google Scholar]

19. Mackie I, Kitchen S, Machin S, Lowe G. on behalf of the Haemostasis and Thrombosis Task Force of the British Committee for Standards in Haematology. Guidelines on fibrinogen assays. Br J Haematol. 2003; 121(3):396-404. [View at Publisher] [DOI] [PubMed] [Google Scholar]

20. Gibson BE, Todd A, Roberts I, Pamphilon D, Rodeck C, Bolton-Maggs P, et al. Transfusion guidelines for neonates and older children. Br J Haematol. 2004;

[DOI: 10.52547/jcbr.5.2.57]

124(4):433-53. [View at Publisher] [DOI] [PubMed] [Google Scholar]

21. Venkatachalapathy T, Das S. A Prospective Audit of Blood Transfusion Requests in Rl Jalappa Hospital and Research Centre for Blood and Blood Components. J Blood Lymph. 2012; 2(106):2. [Google Scholar]

22. Kaur P, Basu S, Kaur G, Kaur R. Transfusion issues in surgery. Internet J Medical Update. 2013; 8(1):46-50. [Google Scholar]

23. Fasola F, Shokubi W. Audit of the red cell units supply of a busy hospital blood bank in Nigeria. Niger J Clin Pract. 2009; 12(2).. [PubMed] [Google Scholar]

How to Cite: Hashemi J, Barzegar S, Soltani H, Nabavi A, Safdari M. Evaluation of blood consumption pattern in Bojnurd Imam Ali Hospital in 2020, North Khorasan province. Journal of Clinical and Basic Research. 2021; 5 (2) :57-66.

[DOI: 10.52547/jcbr.5.2.57]