

Original Research Article

Knowledge of Nurses Regarding Hemovigilance at Teaching Hospital in Lahore Pakistan

Imtiaz Fatima^{1*}, Zunaira Aziz², Dr.Kabir ozigi Abdullai³ and Muhammad Afzal⁴

Abstract

¹BS Nursing, Lahore School of Nursing, The University of Lahore, PO box 54000, Lahore, Pakistan.

²Assistant Professor ,Lahore School of Nursing, the university of Lahore, PO box 54000, Lahore, Pakistan.

³Assistant Professor ,Lahore School of Nursing, the university of Lahore, PO box 54000, Lahore, Pakistan.

⁴Associate Professor ,Lahore School of Nursing, The university of Lahore ,PO box 54000,Lahore ,Pakistan

*Corresponding Author E-mail:rafiairshad06@gmail.com
Mobile Phone: +92436533969

Blood transfusion is a life-saving and highly effective treatment. Errors in blood and blood product transfusion can lead to unnecessary morbidity and mortality. Nurses have a critical role to play in ensuring patient safety throughout blood transfusions. A descriptive cross sectional study was used in this study. Convenient sampling was used for data collection. Sample size was 120 from the University of Lahore. Conduct and utilization of research in nursing questionnaires was used for nurses' knowledge regarding hemovigilance. Data analysis was done by entering the data on Spss software. The findings of study revealed that the majority of participants 57.5% had an inadequate knowledge regarding blood transfusion, 30% had a moderate knowledge and 12.5% had poor knowledge regarding the monitoring of each step of blood transfusion and adverse blood transfusion reaction management. The majority of nurses had insufficient knowledge of all four phases of blood transfusion, in which nurses played a significant role in monitoring each step of the process and managing adverse blood transfusion reactions.

Keywords: Blood transfusion, Hemovigilance, Knowledge

INTRODUCTION

Hemovigilance is a set of monitoring procedures that represent the entire transfusion chain, from the donation and preparation of blood and its components toward administration and transfusion of blood components to patients, as well as follow-up (Saqlain, 2019). It includes constant monitoring of reporting, investigating, and analyzing adverse occurrences related to blood transfusions and processing, as well as taking steps to prevent them from repeating again (Hussain et al., 2015). The World Health Organization (WHO) has made certain steps to promote and standardize the haemovigilance programme in resource-poor countries (Chowdhary et al., 2020). The primary goal of these programmes is to develop and extend national data collecting and management, risk assessment, monitoring, and monitoring systems in order to inform policy and programme planning for safe blood transfusion (Goyal et

al., 2017). World Health Organization's reported that in Africa Region only, 26% had transfusion incidences (WHO, 2017). In the South West (2016), there were 16,050 adverse reactions, up from 15,050 in 2015 incidence of reporting transfusion reactions (Mayaki et al., 2016). Severe transfusion reactions were found to be as high as 213 per 1000 transfusions, or 17,000 units of blood and blood products each year in Ghana (Bediako et al., 2021). Although, that's well acknowledged globally that human error becomes too responsible for the overwhelming of severe transfusion reaction (Ahmed et al., 2020). Blood transfusions are becoming more common throughout the world, with 85 million units transfused in 2012 and 112.5 million donated in 2016. In 2015, the significant hazard of blood transfusion (SHOT) reported a total of 3,288 incidences. In Pakistan, the estimated rate of adverse transfusion reactions ranges

from 0.2 percent to 10%, with 1 per 250,000 people dying as a result (Akhter et al., 2019). Adequate nurse knowledge and performance in the hemovigilance procedure can reduce the risk of blood transfusion complications (Roudsari et al., 2021). The hemovigilance system was created with the main purpose of making blood transfusions better (Bisht et al., 2015). Serious adverse reactions are undesired responses that occur in a donor or patient as a result of blood collection or transfusion and lead to some kind of death, life-threatening, disabling, or immobilizing condition, resulting in prolonging hospitalizations or morbidity (Sreekumar et al., 2016). During the first 15 minutes, nurses are required to slowly infuse blood. Because the majority of severe reactions occur at this time, and the severity of a reaction is related to the amount of blood infused. Patients with severe chronic anaemia and those with heart problems should have slow transfusions (Mohd Noor et al., 2021). Nurses should be vigilant about the clinical manifestations of an acute hemolytic transfusion reaction so that they may react immediately if any of them are observed (Lee et al., 2016). An allergic skin rash indicates a minor allergic transfusion, in which case nurses should lower the transfusion rate and report to any medical staff and documented the transfusion reaction (Akhilak et al., 2019). Concentration and putting out effort in their practice help a lot toward preventing adverse blood transfusions reactions (Mehdaoui et al., 2021). Patients' safety is still being threatened by clinical staff, particularly nurses, due to a lack of knowledge regarding blood transfusion adverse blood transfusion reaction (Kibanda et al., 2014). Acute reactions or even mortality rate can occur as a result of inadequately administered blood transfusions. Nurses must be well familiar with each stage of a safe blood transfusion procedure (Beril and Akin, 2019). A nurse must administer a blood transfusion while taking precautions to avoid any adverse reactions (Rudrapan, 2019). Adequate knowledge is required for standard precautions, and one current trend in nursing research highlights the significance of evaluating nurses' clinical knowledge and practices (Sapkota et al., 2018). Nurses are the primary handlers of blood and play a significant role in the safety and proper management of transfusions. Nurses must be skilled and knowledgeable in the safe and proper administration of blood transfusion to ensure their patients' safety (Bediako et al., 2021; Mohammad, 2021). Patients should be provided enough information by nurses. The focus of knowledge must be on the indication for blood transfusion as well as its risks and advantages, and the symptoms of adverse reactions (Haza'a and Odhah et al., 2021). Some of the complication transfusion-related acute lung injury (TRALI) hypotension, decreased oxygen saturation, ABO incompatible transfusion, and transfusion of the inappropriate patient's blood are all issues connected with transfusion error can be reduced them with

monitoring process (Hijji et al., 2012). Several audits in the United Kingdom have shown inappropriate blood transfusion practices, namely in the areas of patient identification, the administration of incorrect blood, and vital sign monitoring (Jogi et al., 2021). Improper patient identification as the primary cause of mistransfusion leading to significant transfusion mortality also indicates a similar lack of knowledge. The majority of commonly used policies highlight the need for correct patient identification, which includes the patient's full name, date of birth, and hospital registration number (Iqbal et al., 2021). Observe the patient for 10-15 mins and Within 30 minutes of starting the transfusion, baseline vital signs should be checked. Administer the normal saline can used during the blood transfusion to reduced the incidence of blood clot formation (Bolton-Maggs et al., 2015). Knowledge about the Acute transfusion reaction helps not only in the rapid detection and treatment of the reaction, but also in alerting us to take preventative and appropriate measures to avoid its occurrence. Nurses' knowledge plays a significant aspect in the transfusion of Blood transfusion and to overcome the transfusion adverse transfusion reaction (Talati et al., 2016). Nurses should have adequate knowledge of blood transfusion and about safe transfusion practices. Their expertise and knowledge are crucial for the safety and efficacy of blood transfusions. If they can perform it properly the chance of blood transfusion complications will be significantly reduced to minimal level. Nurses must be well informed in order to make appropriate decisions regarding their practices and patient care (Al-Saqladi and Albanna 2021). Nurses are primary care providers and are directly involved in every stage of blood transfusion practices. More than half of the transfusion chain's processes rely on the skills and knowledge of nurses. It is important for nurses to have adequate knowledge of blood transfusion practices in a clinical setting. The knowledge of nurses plays a significant role in preventing adverse transfusion reactions (Iyengar et al., 2020).

Aim of Study

The purpose of this study was to evaluate the knowledge of nurses regarding hemovigilance at the University of Lahore of teaching Hospital.

MATERIAL AND METHODS

Study Design: The cross sectional descriptive study design was used.

Setting

The setting of this study was University of Lahore

Teaching Hospital.

Study population

The study population for this research was Staff nurses of University of Lahore Teaching Hospital.

Sampling Method

- Convenient Sampling technique was used for the collection of Data.

Inclusion Criteria

Following are included in Data collection

- Both male and female nurses were included.
- Nurses having >1 year experience.
- Nurses working in ICU, Emergency, General Ward (Gynae ward Medical Ward and surgical ward) and general operation theater.

Exclusion Criteria

Following are excluded in data collection

- Nurses who have already taken training, workshops and seminars related to blood transfusion.

Data Analysis

Data was analyzed by using SPSS version 21.

Sample Size

By using the slovin formula the sample size was concluded at 120.

$$n = \frac{N}{1 + N(e)^2}$$

N=population Size

n =Sample Size

e = Margin Of error (5%)

$$n = \frac{170}{1 + 170(5\%)^2}$$

$$n = 120$$

Ethical Consideration

Ethical consideration was fully filled. Ethical Principles were followed while performing research study.

- A participant was informed about the purpose of study. Complete information related to research was provided related to research study.
- Coding was done to make sure that the personal data of participants may not be leaked. Personal data was retained to the primary researcher.
- No incentives were given to participants. All nurses had an open opportunity to participate in research. No one was forced to participate in research.
- Informed consent was signed by participants. Nurses had a right to quit research at any time during or after research.

RESULT

Descriptive Statistics

Demographic Analysis

Table 1 shows that 30%, (n=36) was male, 70 % (n=84) was Female, 15 % (n=18) of Nurses were belong to 20-24 age group, 48.3 % (n=58) of nurses were belong to 25-29 age group and 36.7% (n=44) of nurses were belong to 30-35 age group. Nurses (n=23)19.2% had 1-3years clinical experience, (n=49)40.8% had 3-4year clinical experience and (n=48)40.0% had a 4-5year clinical experience. All nurses were specialized in some category (n=78)65% had a Diploma, (n=13)10.8% had a Post RN and (n=29)24.2% had BSCN Degree. (n=44)36.7% Nurses were Married, (n=74)61.7% Nurses were unmarried and (n=2)1.7% Nurses divorced.

Table 2 shows that majority of nurses (n=72, 60%) selected the incorrect filter size and only (n=48, 40%) nurses aware about the correct filter size of blood transfusion set. (n=62, 51.7%) was not aware about the complications of cold blood transfused. (n=58, 48.3%) nurses were aware about the complication of cold blood transfused. Only (n=47, 39.2%) nurses were known about the maximum duration of continuous blood transfusion. Majority of nurses (n=73, 60.8%) nurses were not aware about the maximum duration of continuous blood transfusion. (n=46, 38.3%) nurses were aware about situations in which slow blood transfused. Majority of Nurses (n=74, 61.7%) were not aware about situation in which slow blood transfused. The number of Nurses who Faulty reported that blood could be safely administer with 5% dextrose water(16.7%),Lactated ringer(3.3%) and with Lasix (17.5%).Majority of Nurses (n=75,62.5%) reported that blood could be safely administer with Normal Saline0.9%.(n=67, 55.8%) Nurses were aware about vital signs monitoring before initiating the blood transfused. (n=48, 40%) were aware about the correct rate to initiate the blood transfusion in Adult patient, (60%) were not aware about this. Only (n=47, 39.2%) Nurses were known about the Correct rate to initiate the slowly blood transfused in paediatric Patients, (n=73,

Table 1. Provide table legend

| Variable: | Category | Frequency N=120 | Percentage (%) |
|--------------------------|-----------------|----------------------------|-----------------------|
| Age: | 1)20-24 | 18 | 15% |
| | 2)25-29 | 58 | 48.3% |
| | 3)30-35 | 44 | 36.7% |
| Educational Achievement: | 1)Diploma | 78 | 65% |
| | 2)Post RN | 13 | 10.8% |
| | 3)BSCN | 29 | 24.2% |
| Gender: | 1)Female | 84 | 70% |
| | 2)Male | 36 | 30% |
| Experience: | 1)1-3years | 23 | 19.2% |
| | 2) 3-4years | 49 | 40.8% |
| | 3) 4-5years | 48 | 40.0% |
| Marital Status | 1)Married | 44 | 36.7% |
| | 2)Un-Married | 74 | 61.7% |
| | 3)Divorced | 2 | 1.7% |

Table 2. Knowledge of Nurses toward Hemovigilance

| SR# | Questions | Correct Responses N (%) | Incorrect Response N (%) |
|------------|---|------------------------------------|-------------------------------------|
| 1 | What is the suitable filter size of blood transfusion set? | 48(40%) | 72(60%) |
| 2 | What complication may happen to a patient if rapid administration of cold blood? | 58(48.3%) | 62(51.7%) |
| 3 | For continuous multiple blood transfusions, what is the maximum duration each blood administration set could be used? | 47(39.2%) | 73(60.8%) |
| 4 | Slow blood transfusion should be considered for which of the following patients? | 46(38.3%) | 74(61.7%) |
| 5 | Specify which of the following solutions/agents could be safely mixed with transfusion of blood? | 75(62.5%) | 45(37.5%) |
| 6 | When should the baseline vital signs be recorded before initiating the blood transfusion? | 67(55.8%) | 53(44.2%) |
| 7 | The doctor has prescribed a unit of blood to an adult patient. At what rate would you start this transfusion? | 48(40%) | 72(60%) |
| 8 | In order to initiate a blood transfusion SLOWLY on a 4 month-old infant, at what rate would you start this transfusion during the FIRST 15 minutes? | 47(39.2%) | 73(60.8%) |
| 9 | When and for how long it is essential to physically observe the patient for possible transfusion reaction? | 52(43.3%) | 68(56.7%) |
| 10 | What interventions could minimize the risk of the patient experiencing acute transfusion reaction? | 45(37.5%) | 75(62.5%) |
| 11 | What signs and symptoms indicate that the patient is developing an acute haemolytic transfusion reaction? | 69(57.5%) | 51(42.5%) |
| 12 | What should be done IMMEDIATELY when signs and symptoms of acute haemolytic transfusion reaction are seen? | 81(67.5%) | 39(32.5%) |
| 13 | A patient has sustained a mild allergic transfusion reaction. What is the usual presenting complaint? | 50(41.7%) | 70(58.3%) |
| 14 | What is the FIRST action that the nurse should take to handle the patients with mild Allergic reactions? | 62(51.7%) | 58(48.3%) |
| 15 | What is the commonest cause of the most fatal transfusion reactions? | 41(34.2%) | 79(65.8%) |
| 16 | Monitoring, identification, reporting, investigating and analysis of adverse events related to transfusion and manufacture of blood products is called | 51(42.5%) | 69(57.5%) |
| 17 | What information should a nurse have to ensure collecting the right blood for the right patient provided that the nurse has the patient's full name, date of birth and hospital number? | 39(32.5%) | 81(67.5%) |
| 18 | When collecting a unit of blood from a blood bank for a patient whose blood group is A positive, the nurse noted that the unit is A negative. IF THE COLLECTED BLOOD IS COMPATIBLE WITH THE PATIENT BLOOD, what action should the nurse take FIRST? | 31(25.8%) | 89(74.2%) |
| 19 | Select the most important steps that a nurse has to follow in order to properly identify the right patient prior to initiating the transfusion? | 42(35.0%) | 78(65.0%) |

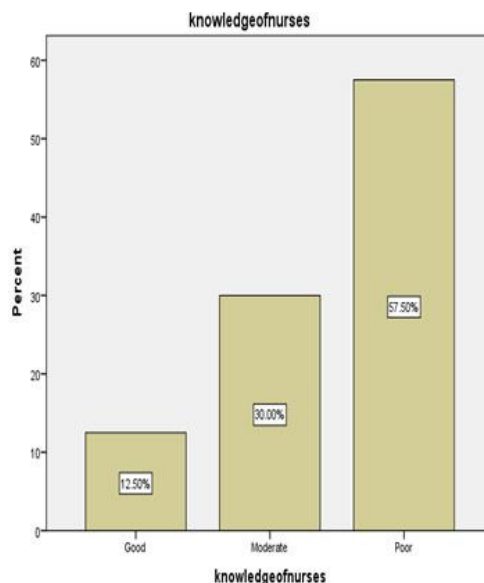


Figure 1. Knowledge score of Nurses Regarding Hemovigilance

60.8%) were not aware about correct rate to initiate the slowly blood transfused in paediatric patients. Only (n=45, 37.5%) nurses were aware about the intervention to minimize the risk of acute transfusion reaction. (n=75, 62.5%) were not know on intervention to minimize the risk factor. (n=69, 57.5%) nurses aware about the sign and symptom of Actue haemolytic transfusion reaction. Majority of nurses (n=81, 67.5%) have knowledge on how to manage the AHTR.(n=50, 41.7%). Nurses were familiar with clinical picture about the mild allergic transfusion reactions. (n=62, 51.7%) were conscious about how to handle the patients with mild allergic reactions. Only (n=41, 34.2%) nurses were aware that identification errors of patients are the most common cause of fatal transfusion reaction. (n=79,65.8%) were not familiar that identification errors of patients are the most common cause of fatal transfusion reaction. (n=31,25.8%) nurses were aware about the ABO terminology. (n=89,74.2%) were not aware about the ABO terminology. (n=42,35%) nurses were aware about the all step they must follow to identify the patients. (n=78, 65%) were not familiar with the all steps to identify the patients.

Figure 1 shows that overall knowledge of nurses regarding hemovigilance were scaled to 100% range $\geq 70\%$ (Good knowledge), 50-69% (Moderate Knowledge) and $< 50\%$ (Poor knowledge). Overall knowledge of nurses regarding this range 12.5% had good knowledge, 30.5% had moderate knowledge and 57.5% had poor knowledge.

DISCUSSION

In the current study majority of nurses (74.2%) had a lack

of knowledge regarding ABO terminology, 67.5% were not aware about the patient's preparation for blood transfusion and 44.2% participants had insufficient knowledge regarding records of baseline vital signs before transfusion. According to a study undertaken in Iraq, the majority of nurses (66.7 %) lacked knowledge about how to properly prepare patients for blood transfusions (Mohammad, 2021). Another study was carried out in Malaysia. According to the findings of this survey, 71.75% of nurses were unable to give the correct answer to a knowledge question about patient preparation (Lee et al., 2016). Nurses require more training, and courses should be conducted to help them increase their knowledge. The present study showed that majority of nurses (51.7%) were not aware about the complications of cold blood transfusion.48.3% are aware about the complication of blood transfusion. 62.5% participants were unaware who intervention could the reduced the risk of Acute blood transfusion. 57.5% were well aware of the clinical manifestation of an acute hemolytic transfusion reaction. 67.5% contributor were well aware about the management of Acute hemolytic transfusion reaction. Another survey was carried out in Malaysia. The results of this study revealed that 57.0 % were aware of the risks associated with cold blood transfusion. Nurses had a moderate level of knowledge (55.0%) on intervention to minimize the severity of blood transfusion reaction and the signs and symptoms of an acute hemolytic transfusion reaction. They have an influence on 80 % of the knowledge about how to handle an Acute hemolytic transfusion reaction (Mohd Noor et al., 2021). In our current study 38.3% contributor are known that slow blood transfused should be anemia patients.62.5% nurses are well known that normal saline should be safely mixed with transfusion of blood. In

Turkey, another research revealed the finding of this study (75.4%) of the study participants were aware that only normal saline (0.9% NaCl) solution may be administered simultaneously with a blood transfusion (Encan and Akin, 2019). Another previous study carried out in Iraq the finding of this study 35% participants were known about the indication of Slow Blood transfused (Shakor and Salih, 2020). During a blood transfusion, no medicine or fluids other than a normal saline (0.9 percent NaCl) solution should be administered through the venous routes or through the blood units under any conditions (Oxford University Hospitals, 2012). Our study 43.3% nurses aware that most severe reaction occurs for the first 10-15minutes of start a transfusion.40% aware that the correct rate for starting transfusion of one unit of blood in an adult patient was 120 ml/hour.39.2% participants are known that about the initiation rate during first 15 minutes of Blood transfusion in infant. Another study in Ghana found that 47 (17.47 %) of participants would adequately monitor the patient for a possible transfusion reaction during the first 15 minutes after the transfusion (Bediako et al., 2021). The findings of a study undertaken in Yemen revealed that the majority of nurses had inadequate or moderate knowledge of post-transfusion nursing responsibilities (Haza'a et al., 2021). According to a recent survey of Jordanian nurses, 33% of participants are aware of the initiation rate of transfusion in adult patients.51% were well known about the rate to initiate the blood transfusion in infant patient.45% aware that observe the patient for 10-15minutes is essential after the transfusion (Hijji et al., 2012).

In our present study 40% Nurses aware about the suitable filter size of transfusion set.39.2% are aware about the maximum duration for continuous multiple blood transfusion. Study conducted in Egypt found that in this survey Nurses' Knowledge Assessment Regarding Blood Transfusion to Ensure Patient Safety the blood transfusion set can be used for continuous multiple transfusion for the maximum of 24 hour. Majority of participants had inadequate knowledge regarding pre-transfusion initiation nursing intervention as suitable filter size of transfusion set (Elhy and Kasemy, 2017). In the present study only 34.2% are well aware that identification error is the commonest cause of Blood transfusion. Only 35.0% contributors are aware that proper identification is the most important before initiating the blood transfusion. Another study in Malaysia reported that only 49.0 % are aware that proper identification is the most critical step before starting a blood transfusion. The most common cause of blood transfusion error is improper identification of patients who are scheduled for transfusion. Proper bedside identification of patients who are scheduled for transfusion is crucial to avoid new errors and identify those that may have occurred before (Mohd Noor et al., 2021). The majority of transfusion errors happened at the patient's bedside, as a result of ward staff unable to accurately identify the patient and/or

unit prior to administering a blood transfusion. One of the most common causes of inappropriate blood transfusion was the incorrect placement of the label on the phlebotomy specimen.

In present study, nurses have 12.5% good knowledge, 30% have a moderate knowledge and 57.5% have a poor knowledge. Another study conducted in India, 53.3% had fair knowledge, 41.7% had poor knowledge, and only 5% of staff nurses had good knowledge regarding blood transfusion (Iqbal u et al., 2021).

CONCLUSION

On the basis of result, it is concluded that the majority of nurses (57.7%) had inadequate knowledge regarding blood transfusion procedure in all four stages, in which nurses played a key role. 30% had a moderate level of knowledge and 12.5 had good knowledge regarding monitoring of each step of blood transfusion and about the management of the adverse blood transfusion reaction.

ACKNOWLEDGMENT

First and foremost, I would like to thank Allah who is beneficent and merciful, the source of knowledge and wisdom of mankind, who blesses us with the ability to fulfill this task in a limited time period. The respect of our last prophet Hazrat Muhammad (S.A.W) who showed us way of learning and knowledge. I would like to thank my dear parents Irshad Perveen and Allah Ditta who gave me the permission and support for higher education. I would like to give great thanks to Mam Zunaira Aziz, without her support, I could not have completed my project. She encouraged and supported me in my study. She did not only supervised me but also supported me when I lose my courage in difficult tasks. She guided me throughout the thesis work. Special thanks to Dr.Kabir Ozigi Abdullai and Principles of Lahore School of Nursing Mr. Muhammad Afzal who gave me permission to complete this project. I would also like to thank my friends and colleagues for their encouragement during difficult times.

REFERENCES

- Agnihotri N, Agnihotri A (2016). Active hemovigilance significantly improves reporting of acute non-infectious adverse reactions to blood transfusion. *Ind. J. Hematol. Blood Transfusion*, 32(3), 335-342.
- Ahmed M, Yasmin N, Faruquee MH, Nessa S (2020). Knowledge on safe blood transfusion practice of senior staff nurses working in tertiary hospital. *Asian J. Med. Biol. Res.* 6(3), 587-593. doi: 10.3329/ajmbr.v6i3.49812
- Akhilak SM, Abdullah N. A. M, Mohammad, N. A. A. (2019). Know-

- ledge and Practice of Blood Transfusion among nursing students in UiTM Puncak Alam Campus. *Healthscope: The Official Research Book of Faculty of Health Sciences, UiTM, 1*.
- Akhter N, Samad A, Nudrat F, Umme H, Maliha A, Sabeen F (2019). Acute blood transfusion reaction in a tertiary care hospital in Southern Punjab, Pakistan.
- Aneke JC, Ezeama N, Okocha CE, Onyeyili AN, Onah CE, Ibeh NC, Egbunike GC (2017). Knowledge, attitude and practice of haemovigilance among healthcare professionals in a Nigerian Tertiary Hospital. *The Egypt. J. f Haematol.* 42(3), 108.
- Bediako AA, Ofosu-Poku R, Druye AA (2021). Safe Blood Transfusion Practices among Nurses in a Major Referral Center in Ghana. *Adv Hematol*, 2021.
- Bisht A, Gupta S, Singh S (2015). Transfusion Reaction Reporting Culture in Hemovigilance Program of India since its Inception. *JRFHHA*, 3(2), 69-70.
- Bolton-Maggs PH, Wood EM, Wiersum-Osselton JC (2015). Wrong blood in tube–potential for serious outcomes: can it be prevented? *Brit. J. Haematol.*, 168(1), 3-13.
- Borhany M, Anwar N, Tariq H, Fatima N, Arshad A, Naseer I, Shamsi T (2019). Acute blood transfusion reactions in a tertiary care hospital in Pakistan - an initiative towards haemovigilance. *Transfus Med*, 29(4), 275-278. doi: 10.1111/tme.12541
- Chowdhary R, Khajuria V, Sawhney V (2020). Knowledge, attitude, and practice of reporting transfusion reactions in hemovigilance among health-care professionals in a tertiary care teaching hospital of northern India. *Nat. J. Physiol. Pharmacy and Pharmacology*, 10(11), 970-975.
- Elhy A, Kasemy ZAA (2017). Nurses' knowledge assessment regarding blood transfusion to ensure patient safety. *IOSR J. Nur. Health Sci.*, 6(02), 104-111
- Encan B, Akin S (2019). Knowledge of blood transfusion among nurses. *J. Cont. Educ. Nurs.* 50(4), 176-182.
- Goyal M, Bindal J, Jain B (2017). Prevalence of adverse events related to blood transfusion at tertiary care center of central India. *IOSR J Dent Med Sci*, 16(10), 21-28.
- Haza'a AA, Odhah MA, Al-Jaradi A (2021). Knowledge of Nurses Regarding Blood Transfusion at Public Hospitals in Sana'a City-Yemen. *Assiut Scientific Nursing Journal*, 9(26), 1-10.
- Hijji BM, Oweis AE, Dabbour RS (2012). Measuring knowledge of blood transfusion: A survey of Jordanian nurses. *Am Int J Contemp Res*, 2(10), 77-94.
- Hussain S, Moiz B, Ausat FA, Khurshid M (2015). Monitoring and reporting transfusion reactions as a quality indicator—a clinical audit. *Transfusion and Apheresis Science*, 52(1), 122-127.
- Iqbal U, Wani D, Annu S, Hassan S, Bharti K, Nabi R (2021). Assessment of Knowledge and Practice regarding Blood Transfusion among Staff Nurses. *Trends in Nursing Administration and Education (2348-2141)*, 10(1), 7-13.
- Iyengar V, Parekh A, Natu S (2020). Audit of transfusion practices in pediatrics in a tertiary care hospital.
- Jogi IE, Mohanan N, Nedungalaparambil NM (2021). Bedside Blood Transfusion—What Nurses Know and Perform: A Cross-Sectional Study from A Tertiary-Level Cancer Hospital in Rural Kerala. *Asia-Pacific J. Oncol. Nurs.* 8(2), 197.
- Kafando E, Koumare A, Sawadogo S, Nebie Y, Tinto A (2017). Improving blood transfusion safety: a survey on the knowledge and attitudes of Health professionals in blood transfusion at the Yalgado Ouedraogo University hospital center, Burkina Faso. *Hematol Transfus Int J*, 4(1), 00070.
- Kibanda J, Miyanga SA, Donnen P, Van den Ende J, Dramaix-Wilmet M (2014). Knowledge, attitudes and practices of medical and paramedical staff in blood transfusion in the Democratic Republic of Congo.
- Lee ELS, Rahim A, Arzuar N, Din T, Azdiana S (2016). Knowledge of Blood Transfusion among Nurses at Hospital Pulau Pinang: Nursing Responsibilities and Patient Management Related to Transfusion Reactions. *Education in Med. J.* 8(4).
- Mayaki Z, Kabo R, Moutschen M, Albert A, Dardenne N, Sondag D, Gérard C (2016). Knowledge, attitudes and clinical practice of blood products prescribers in Niamey. *Transfusion Clinique et Biologique*, 23(2), 78-85.
- Mehdaoui FE, Soulaymani A, Khiari ME, Laghawati SB, Alami R (2021). *Knowledge of health professionals in transfusion and transfusion safety in Morocco*. Paper presented at the E3S Web of Conferences.
- Mohammad O. S. A. S. (2021). Assessment the Nurses Knowledge towards Blood Transfusion Procedure in Karbala City Hospital/Iraq. *Annals of the Romanian Society for Cell Biology*, 25(6), 10021-10029.
- Mohd Noor NH, Saad NH, Khan M, Hassan MN, Ramli M, Bahar R, Zulkafli Z (2021). Blood Transfusion Knowledge among Nurses in Malaysia: A University Hospital Experience. *Int. J. Environ. Res. Pub. Health*, 18(21), 11194.
- Mukhlif H, Saad Khalil N (2017). Assessment nurses' knowledge level about procedure of blood transfusion. *Mosul J. Nurs.* 5(2), 65-69.
- Nessa S, Faruquee M, Yasmin N, Ahmed M (2020). Knowledge on safe blood transfusion practice of senior staff nurses working in tertiary hospital. *Asian J. Med. Biol. Res.* 6(3), 587-593.
- Organization WH (2017). Regional status report on blood safety and availability 2016: World Health Organization. Regional Office for the Eastern Mediterranean.
- Panchawagh SJ, Melinkeri S, Panchawagh MJ (2020). Assessment of knowledge and practice of blood transfusion among nurses in a tertiary care hospital in India. *Indian J. Hematol. Blood Transfusion*, 36(2), 393-398.
- Roudsari DM, Feizi S, Maghsudlu M (2021). Nurses' hemovigilance knowledge and performance after teach-back, concept map, and lecture: A quasi-experimental study. *Heliyon*, 7(1), e05982.
- Rudrappan RB (2019). Evaluating the knowledge and practices of nurses and paramedics in blood transfusion services—A survey in the states of Tamil Nadu and Pondicherry, India. *J Educ Health Promot*, 8.
- Sapkota A, Poudel S, Sedhain A, Khatiwada N (2018). Blood transfusion practice among healthcare personnel in Nepal: an observational study. *J Blood Transfus*, 2018.
- Saqlain N (2019). Hemovigilance-Application in Tertiary Care Hospitals. *Nat. J. Health Sci.*, 4(2), 49-51.
- Shakor SQ, Salih HS (2020). Blood Transfusion Knowledge And Practices Among Nurses In Kirkuk City Hospitals. *Mosul J. Nur.*, 8(1), 14-24.
- Sharma N, Sharma K (2015). Transfusion-related acute lung injury (TRALI)-Blood transfusion complication. *Int J Med Sci Public Health*, 4, 1343-1346.
- Sree Kumar P, Kumar T, Sarathi G, Gupta D (2016). Pallavi. Haemovigilance and its significance in transfusion safety. *Int J Drug Res Technol*, 6(4), 245-249.
- Talati S, Gupta AK, Jain A (2016). Knowledge and awareness among nurses regarding the blood transfusion services and practices in a tertiary care teaching hospital. *Asian J. Transfusion Sci.* 10(2), 166.
- Vaghar MI (2018). The impact of an educational program on blood and blood products transfusion on nurses' level of knowledge and performance. *J. Med. Life*, 11(3), 238.