

Effect of Blood Transfusion Precautions on Patient's Outcomes Undergoing Open Heart Surgery

Marwa Mohammed Haggag, Ahmed Mohamed Kamal & Mona Aly Mohammed

Demonstrator in Medical-Surgical Nursing Department, Faculty of Nursing, El-Minia University, Egypt.

Professor of Cardiothoracic Surgery, Faculty of Medicine, Assiut University, Egypt.

Assistant Professor of Critical Nursing, Faculty of Nursing, Assiut University, Egypt.

Abstract

Background: Cardiac surgery is the largest consumer of blood products in medicine; although believed lifesaving, transfusion carries substantial adverse risks. **Aim of the study:** evaluate the effect of blood transfusion precautions on patient's outcomes undergoing open heart surgery. **Patients and Methods:** A quasi experimental design was adopted. A total of 60 adult patients post open heart operations divided equally into two groups (study group & control group). **Tools: tool one; Patient Assessment Sheet; Part (I)** Socio-demographic data, **Part (II)** Clinical Data, **Part (III)** Blood Transfusion observation Sheet. **Tool two;** Administering a Blood Transfusion Checklist. **Results:** The study group stayed less duration in the hospital and ICU than the control group with statistical significance difference as regard hospital stay in which $p < .02$ and statistical significance difference as regard ICU stay in which $p < .000$. As regards abnormal reaction during blood transfusion half of the control group had fever compared with one third of the study group. **Recommendation & Conclusion:** it can be concluded that, the applying of blood transfusion precautions on patients undergoing open heart surgery was successful in reducing hospital and ICU length of stay and complications of blood transfusion, and recommended that, hospital should provide ongoing quality programs for health care professionals.

Keywords: *Blood transfusion precaution, Patient's outcomes & Open heart surgery*

Introduction

Blood transfusion is generally the process of receiving blood products into one's circulation intravenously (Win, et al., 2008). Blood transfusion is an important part of day to day clinical practice. Blood and blood products provide unique and life-saving therapeutic benefits to patients. The major concern from the point of view of both user (recipient) and prescriber (clinician) is for safe, effective and quality blood to be available when required (WHO, 2008).

Three accepted benefits of blood transfusion: enhanced oxygen carrying capacity, improved haemostasis associated with blood component therapy, and volume support of cardiac output. (Kautza, et al., 2012). There are main four types of transfusable products that can be derived from blood: red cells, platelets, plasma and cryoprecipitate (Guerrero, et al., 2012)

Every two seconds someone in the U.S. needs blood, approximately 36,000 units of red blood cells are needed every day in the U.S., Nearly 7,000 units of platelets and 10,000 units of plasma are needed daily in the U.S., Nearly 21 million blood components are transfused each year in the U.S. (Scott, et al., 2016). In Egypt, over one million units of blood donations are required for transfusions every year. Without a sufficient supply of the lifesaving resource, many patients would suffer, or die (Arab Republic of

Egypt Ministry of Health & Population National Blood Policy, 2007).

Unnecessary transfusions are likely to be associated with unnecessary morbidity and additional indirect hospitalization costs. Direct costs also are considerable (Ferraris, et al., 2011) However, it is increasingly recognized that transfusion itself contributes to morbidity and mortality in specific patient populations, including critically ill, cardiac surgery and trauma patients (Stanworth, et al., 2011)

Cardiac surgery is the largest consumer of blood products in medicine; although believed lifesaving, transfusion carries substantial adverse risks. (Horvath, et al., 2013) Every year an estimated 1 to 1.25 million patients worldwide undergo cardiac surgery. For these patients bleeding into the chest remains a common life-threatening complication Blood transfusion has been implicated as a major mechanism of harm associated with bleeding after cardiac surgery, based largely on studies that demonstrated an independent association between blood transfusion and mortality. (National Institute for Health & Care Excellence (NICE), 2013). and there is increasing evidence for independent relationships between RBC transfusion and infectious complications, cardiac and respiratory morbidity,

prolonged length of stay (LOS) and mortality after cardiac surgery (Sandeep, & Anupam, 2014)

Decisions about transfusion after operation in ICU-patients are complex. It is obvious that the patient's clinical situation and disease status are important factors in determining the need and indication for transfusion in patients undergoing open heart surgery. (Jorgensen, 2014) Most transfusion indications occur in the first 72 hours after surgery, starting in the operating room, where usually the transfusion indication is due to hemodilution and based on triggers (Gauvin, 2008)

Caring for critically ill patients who require transfusion is challenging and multifaceted. Current transfusion practice guidelines and thresholds are controversial. Strategies should be directed toward deciding the transfusion threshold and minimizing blood loss Concerns about complications related to transfusion. (Marik, et al., 2008) (Karen, 2009).

Guidelines from the Society of Thoracic Surgeons and Society of Cardiovascular Anaesthesiologists emphasize the lack of evidence on transfusion triggers after cardiac surgery (Murphy, et al., 2007) (Roberts, and Prowse, 2013) There have been many advances in transfusion medicine over recent decades. There is also an increasing body of evidence relating to adverse effects of transfusion impacting on short- and long-term outcomes after cardiac surgery. This has also been reported in critically ill patients, those with acute coronary syndrome and trauma patients (Benjamin, 2012)

Recently, the Transfusion Requirements After Cardiac Surgery (TRACS) study prospectively demonstrated the safety of a restrictive strategy of RBC transfusion in patients undergoing cardiac surgery. Also, the studies reported that the higher the number of transfused-RBC, the higher was the number of clinical complications (Tanaka, & Kor, 2013)

It is well known that errors in blood transfusion practices can lead to serious consequences for the recipient in terms of morbidity and mortality. The majority of errors occur due to incorrect sampling of blood from a patient, fetching the wrong unit of blood for a patient and transfusing blood inappropriately (Engelbrecht, et al., 2013)

The ICU nurse plays a vital role in preventing, identifying and then treating cardiac complications (Sharon, et al., 2011) The nurse on the front line of patient's care, she must be adept at administering blood products safely and managing adverse reactions with speed and confidence (Sabrina, 2010)

The skills of transfusing blood products require the critical thinking and knowledge application unique to a nurse. Delegation to assistive personnel includes obtaining vital signs, collecting equipment,

transporting units from the blood bank, and instituting patient's comfort measures. However, the primary responsibility for donor and recipient identification, infusing the unit within the required time, and assessing outcomes remains the registered nurse's responsibility. The nurse is responsible for assessing and monitoring the patient before, during, and after transfusion (Barbara, & Elaine, 2011)

The first 10 to 15 minutes of a transfusion are the most critical, and the client must be monitored by the nurse very carefully during this time. Note that if a major ABO incompatibility exists, the client will usually experience a severe reaction during the first 50 milliliters of transfusion. Therefore, take the client's baseline vital signs before the procedure, begin the transfusion very slowly, and observe the client carefully for the first 15 minutes. Both mild and life-threatening reactions have similar symptoms. Therefore, consider every symptom as potentially serious. Discontinue the transfusion until the cause of the symptom can be determined (Rosdahl, & Kowalski, 2008)

Setting

The study was carried out in cardiothoracic surgery ICU unit at El-Minia university hospitals.

Significance of the study

As the cardiothoracic surgery ICU unit in El-Minia University is new, and blood transfusion was applying to most of patients, and there were many complications of blood transfusion, so the researcher applied a standardized checklist and followed precautions and safety measures of blood transfusion to reduce its complications and to improve patients' outcomes.

Aim of the study

Evaluate effect of blood transfusion precaution on patient's outcomes undergoing open heart surgery to reduce its complications in Cardiothoracic ICU unit in El-Minia University Hospital.

Hypothesis

- There is significant decrease in incidence of complications after blood transfusion intervention group than in control group.
- There is significant decrease in incidence of length of stay in intensive care unit (ICU) in intervention group than in control group.

Patients & methods

Research design: A quasi experimental research design was adopted to meet the aim of this study.

Sample of the study

A convenient sample of 60 patients; undergoing open heart surgery (male and female), this sample was divided randomly into two groups (control group and study group).

Inclusion criteria

- 1st post-operative hour after open heart surgery.
- Maximum age 65 years.
- Patients attached to mechanical ventilator with positive end expiratory pressure
- (PEEP) 5.

Exclusion criteria

- Chronic diseases as Diabetes Mellitus (DM), Hypertension or Chronic lung diseases.
- Any patient with hemoglobin level less than 8 mg/dl in the immediate post-operative.

Technical design

Subjects: A convenient sample of 60 critically ill patients in critical care units. All patients received blood transfusion on cardiothoracic surgery ICU unit. They were divided into equal 30 patients for both study and control groups.

Tools

Tool 1: Patient Assessment Sheet; it includes three parts

Part I: Socio demographic data: This part includes assessment of patient profile data about study subject as age, sex, level of education, marital status, type of operation, ICU date of admission, and ICU date of discharge.

Part (II): Clinical Data

Pre-Operative Assessment

Assessment of Hemodynamic State and Gas Exchange:

Assess hemodynamic changes and vital signs (body temperature, pulse, blood pressure, central venous pressure, and mean arterial blood pressure), Arterial Blood Gases (ABG).

Assessment of Respiratory System

Respiratory rate, and depth, cough, sputum, and pain with breathing.

Assessment of Laboratory Test Findings

This part includes changes in complete blood picture (HB, RBCs, WBCs, HCT, platelets count, INR), liver function test, renal function test, serum urea, serum creatinine, prothrombin time (PT) and concentration (PC).

Intra Operative Assessment

Vital signs (body temperature, pulse, blood pressure), time of bypass, ischemic time, number of blood units, types of blood units, duration of operation, and Intravenous fluid types & amount.

Post-Operative Assessment

Post-Operative Assessment (1st Hr.)

- C.a.1 Homodynamic changes, vital signs (body temperature, pulse, and blood pressure), central venous pressure, and ABG.
- C.a.2 wound, mechanical ventilator, and chest tube (number of tubes, sites, duration, and time of chest tube in, and time of removal).
- C.a.3 laboratory test findings (complete blood counts, Renal and liver function tests).
- C.a.4 Intake and output chart.

Post-Operative Assessment (7th day)

Vital signs (body temperature, pulse, blood pressure, central venous pressure, and mean arterial blood pressure), ABG, complete blood counts (HB, RBCs, WBCs, HCT, platelets count, INR) liver function test, renal function test, serum urea, serum creatinine, PT and PC.

Part (III) Blood Transfusion Observation Sheet Before Transfusion

Vital signs (body temperature, pulse, blood pressure, central venous pressure, and mean arterial blood pressure), Blood Unit (Blood group, Rh, Unit time received, Types of blood units, Number of blood units (during operation), intravenous (IV) lines (central, peripheral cannulation, size and type of IV catheter and time of insertion), and Medication.

During Transfusion

Time of start transfusion, Time of stop/ finishing transfusion, Vital signs (5 min, 15 min, 30 min, 2nd hour, 3rd hour, 4th hour), Intravenous fluid administration, Abnormal reaction (fever, back pain, chills, itching, shortness of breath), and its Management (vital signs, medication, comments, and signature)

Post transfusion

Vital signs (immediate, post 1 hour and post 4 hours)

Tool 2: Checklist for Administering a Blood Transfusion

Standardized checklist which is followed by the researcher in applying blood transfusion procedure with study group, **it contains four parts:**

Pre-procedure: Verifies informed consent and physician order, assess the intravenous line, Obtains the blood product from the blood bank according to agency policy, hand washing and wearing gloves, warm the blood bag, labeling the tubes, blood bag and bottle of normal saline 0.9% (NS 0.9%), priming with NS and connect the blood tubing.

During procedure: Hang blood bag, monitor vital signs, hand washing and wearing gloves, follow aseptic technique, start transfusion slowly (10 d/m), monitor patient's vital signs (5 minutes, 15 minutes, 30 minutes, and then hourly while the transfusion infuses), If another unit of blood is required, the second unit can be hung with the new blood

administration set, and after blood has transfused clear IV tubing with normal saline, then disconnects the blood administration set from the IV catheter and discard blood bag and blood transfusion set according to agency policy.

If there is blood reaction: Stops the transfusion immediately if signs or symptoms of a transfusion reaction occur, disconnect IV line of blood, keep vein open KVO with NS 0.9%, monitor vital signs, notify the physician, administer prescribed medications, continue monitoring of vital signs, and return the blood bag to blood bank or according to agency policy.

Post procedure: Discards the empty blood container and administration set in the proper receptacle according to agency policy, Documentation of the date, time (in/out) of infusion, patient's reaction, administration of medication (Pre/Post transfusion), patient's vital signs, and nursing management.

II- Operational design:

The study was carried out on two phases:

Preparatory phase: official approval for data collection was obtained from the head of the cardiothoracic surgery unit, cardiothoracic ICU unit, and informed consent was obtained from the patients for the study after explains the aim and nature of the study.

Content validity: The tools were tested for content related validity by specialists in the field of critical care medicine and critical care nursing from Assiut University, and the necessary modifications were done.

Pilot study: A pilot study was carried out on (10% of the sample) six patients to test the clarity, validity and applicability of the tools. Appropriate modifications were done prior to data collection for the actual study and included in the study.

Ethical consideration

- Research proposal was approved from ethical committee in the faculty of nursing.
- Written consent was obtained from patients or guidance that was willing to participate in the study after explaining the nature and purpose of the study.
- There was no risk for study subject during application of the research
- The study followed common ethical principles in clinical research.
- Confidentiality of patient's data was assured.
- Patients had the right to refuse to participate and/or withdraw from the study without any rational at any time.
- Study subject privacy was considered during collection of data.

Implementation phase

Started from the beginning of January 2015 until the end of January 2016. The data were collected from the admission and the preparation of the patient for operation, intraoperative monitoring, and immediate post-operative condition assessment at 1st hour, monitoring during blood transfusion and finally the seventh post-operative day, three shifts, 7 days; then the data were recorded in the developed tools.

Control group: The researcher assessed the patients' outcomes post open heart surgery in the cardiothoracic surgery ICU who received the routine hospital blood transfusion and routine nursing care (such as assess the patient vital signs; receive the unit of blood before transfusion with 30 to 40 minutes with no hand washing or wearing gloves (in most of cases), it could be received by one nurse not by two qualified nurses, warm the blood unit, If the patient is oriented there are no instructions about the allergic reaction (in most of cases). Hang the blood unit and start the transfusion without priming with normal saline 0.9%, not adjust the drip factor 10 drops at beginning of transfusion; monitor the patient after 1st 5, 15, 30 minutes and then after one hour with close monitoring for the patient at first 15 minutes, finally immediately after finishing the procedure. If reaction happened during transfusion stop transfusion, disconnect the blood unit and begin new tubing with normal saline 0.9% during the different shifts.

For the intervention group: the patients received a standardized blood transfusion procedure which applied by the researcher as following:

Pre-Procedure

- Verifies that informed consent has been obtained, the physician's order, and any premedication orders.
- Obtains the blood product from the blood bank according to agency policy after Hand Washing, wearing disposable gloves and Rechecks the physician's order with another qualified staff member (as deemed by the institution) verifies the patient and blood product identification
- Explain the procedure to the patient, if oriented discuss the signs and symptoms of reaction and what he will do.
- Administers any pre-transfusion medications as prescribed. Obtains IV fluid containing normal saline solution and a blood administration set.
- Removes the blood administration set from the package and labels the tubing with the date and time. Closes the clamps on the administration set.
- Removes the protective covers from the normal saline solution container port. Hangs the normal saline solution container on the IV pole. Compresses the drip chamber of the administration

set and allows it to fill up half way and primes the administration set with normal saline

- Inspects the tubing for air. If air bubbles remain in the tubing, flicks the tubing with a fingernail to mobilize the bubbles.
- Gently inverts the blood product container several times.
- Removes the protective covers from the blood administration set and the blood product port. Carefully spikes the blood product container through the port and closes the roller clamp.

During-Procedure

- Hangs the blood product container on the IV pole
- Obtains and records the patient's vital signs, including temperature, before beginning the transfusion.
- Remove the disposable gloves, hand washing and wearing a sterile glove.
- Using aseptic technique, attaches the distal end of the administration set to the IV catheter. Slowly opens the roller clamp of the blood product.
- Using the roller clamp, adjusts the drip rate, as prescribed. (Drip factor 10 drops/mL). Remains with the patient during the first 5 minutes to 30 minutes and then obtains vital signs
- Obtains vital signs in 5 minutes, 15 minutes, then again in 30 minutes and then hourly while the transfusion infuses.
- Makes sure that the patient's call bell or light is readily available and tells him alert the nurse immediately of any signs or symptoms of a transfusion reaction, such as back pain, chills, itching, or shortness of breath.
- After the unit has infused, closes the roller clamp of the blood product container and move the spike to the normal saline solution to flush the administration set with normal saline solution.
- Closes the roller clamp and then disconnects the blood administration set from the IV catheter
- If another unit of blood is required, the second unit can be hung with the same administration set (according to the type of product).
- If there is Transfusion Reaction:
 - a) Stops the transfusion immediately. Disconnects the administration set from the IV catheter. Obtains vital signs (temperature, pulse, respiration, and blood pressure from the extremity opposite the transfusion site) auscultates heart and breath sounds.
 - b) Maintains a patent IV catheter by hanging a new infusion of normal saline 0.9% solution, using new tubing
 - c) Notifies physician as soon as the blood has been stopped and patient has been assessed. Places the administration set and blood product container with

the blood bank form attached inside a biohazard bag and sends it to the blood bank immediately.

- d) Continues to monitor vital signs frequently every 15 minutes. Administers medications as prescribed

Post-Procedure

- Discards the empty blood container and administration set in the proper receptacle according to agency policy.
- Documentation of the date, time (in/out) of infusion, patient's reaction, administration of medication (Pre/Post transfusion), patient's vital signs, and nursing management.
- Continuous monitoring of vital signs till 4 hours post transfusion.

Evaluation: both groups evaluated by compare both groups for presence of complications of blood transfusion by using **tool 1 Part (II)** which held at the first (1st) day of admission as a baseline, immediate after operation, finally at the seventh (7th) day for delayed reactions or presence of infection. Tool one **Part (III)**: Blood Transfusion Monitoring Sheet which be held at Before transfusion assessment data and monitoring as a baseline, during procedure handling of blood unit and patient observation, nursing action and monitoring if blood reaction happen, and nursing practice post transfusion.

Statistical design

A compatible personal computer (PC) was used to store and analyze data. The collected data were coded, tabulated and summarized then were computerized and analyzed by used the SPSS program (statistical package for the social science) version 20. Also appropriate descriptive statistics were utilized i.e. frequencies, mean, and standard deviation. Inferential statistical testes were used to test the research questions such as the significance given in standard statistical books were including Chi square, and two-way ANOVA test. The level of significance was accepted at P value < 0.05 .

Results

Table (1): Socio demographic characteristics of the study & control groups (n= 60).

Socio- demographic data	Groups				P
	Study (n=30)		Control (n=30)		
	No	%	No	%	
Age mean \pm SD	31.82 \pm 14.37		33.28 \pm 16.83		0.592 NS
Min- Max	20.0 – 51.0		22.0 – 58.0		
Sex					0.271 NS
Male	22	73.3	25	83.3	
Female	8	26.7	5	16.7	
Marital status					0.336 NS
Single	19	63.3	21	70	
Married	11	36.7	9	30	
Education level					0.228 NS
Illiterate	2	6.7	3	10	
Read & Write	9	30	8	26.7	
Secondary	11	36.7	7	23.3	
University	8	26.6	12	40	
Total	30	100	30	100	

Table (2): Comparison between study & control groups as regards to hospital and ICU stay (n= 60).

Patients stay	Study group	Control group	t	p- value
	Mean \pm SD	Mean \pm SD		
Hospital	5.1 \pm 1.7	6.2 \pm 1.9	2.396	0.02*
ICU	2.1 \pm 0.5	3.3 \pm 1.4	4.324	0.000*

Table (3): Comparison between study & control groups as regards operation data (n= 60).

Operation data	Study group	Control group	t	P - value
Duration of operation	215.3 \pm 40.5	222.2 \pm 50.2	0.967	0.24 NS
Time of bypass	117.2 \pm 32.2	115.2 \pm 33.3	1.011	0.32 NS
Ischemia time	63.3 \pm 10.4	62.2 \pm 10.7	0.500	0.62NS
Type of blood units				
Whole blood	30 (100%)	30 (100%)	---	---
No. of blood units	1.6 \pm 0.7	1.8 \pm 0.9	0.547	0.32 NS
Intravenous fluid amount	1450 \pm 310.4	1466.7 \pm 260.4	0.754	0.55NS

Table (4): Comparison between study & control groups as regards assessment of wound post-operative (n= 60).

Assessment of wound	Groups				P
	Study (n=30)		Control (n=30)		
	No	%	No	%	
Discharge					0.001*
Yes	8	26.7	21	70	
No	22	73.3	9	30	
If yes amount					0.766 NS
Low amount	5	62.5	13	68.4	
Moderate	3	37.5	6	31.6	
Infection					0.744 NS
Yes	5	16.7	6	20	
No	25	83.3	24	80	

Table (5): Comparison between study & control groups as regards vital signs before, during and after blood transfusion (n= 60).

Vital signs	Before transfusion		During transfusion (after half hour)		After transfusion (immediately after transfusion)	
	Study (n=30)	Control (n=30)	Study (n=30)	Control (n=30)	Study (n=30)	Control (n=30)
	Mean ± SD		Mean ± SD		Mean ± SD	
Body temp.	36.8 ±0.1	36.9 ±0.2	37.0 ±0.2	37.7 ±0.1	36.8 ±0.6	37.4 ±0.3
Sig. test	t =.47	P <0.71 NS	t = 3.98	P <0.00*	t =.39	P <0.69 NS
Pulse	80.7 ± 5.8	81.2 ± 6.1	85.3 ± 6.0	88.3 ± 7.3	90.3 ± 7.8	91.5 ± 9.5
Sig. test	t =.32	P <0.53 NS	t =2.54	P <0.03*	t =.87	P <0.39 NS
Respiratory rate	17.9 ± 1.1	18.1 ± 1.2	19.1 ± 2.2	20.1 ± 2.5	19.3 ± 1.8	19.6 ± 2.2
Sig. test	t =.55	P <0.75 NS	t =2.36	P <0.02*	t =.45	P <0.66 NS
Systolic blood pressure	126.8 ± 13.3	128.1 ±10.1	120.1 ± 11.1	130.8 ± 8.8	124.3 ± 9.7	133.9 ± 6.7
Sig. test	t =.36	P <0.63 NS	t =3.67	P <0.001*	t =4.48	P <0.00*
Diastolic blood pressure	80.8 ± 8.3	81.1 ± 9.1	76.8 ± 5.5	77.3 ± 7.5	76.3 ± 5.8	81.0 ± 5.5
Sig. test	t =1.74	P <0.09 NS	t =.25	P <0.81 NS	t =3.21	P <0.002*

Table (6): Comparison between study & control groups as regards assessment of mechanical ventilator post-operative (n= 60).

Assessment of mechanical ventilator	Groups				P
	Study (n=30)		Control (n=30)		
	No	%	No	%	
MODE					
SIMV	30	100	30	100
FIO2					
70%	11	36.7	9	30	0.01*
75 %	3	10	13	43.3	
80%	16	53.3	8	26.7	
PEEP					
3	3	10	3	10	0.362 NS
4	20	66.7	22	73.3	
5	7	23.3	5	16.7	
TIME in & out / min					
80: 120	27	90	22	83.3	0.095
121: 160	3	10	8	16.7	NS

Table (7): Comparison between study & control groups as regards abnormal reaction during blood transfusion.

# Abnormal reaction during blood transfusion	Groups				Significance test	
	Study		Control		t	P
	No	%	No	%		
Fever	10	33.3	15	50	3.48	0.03*
Back pain	0	0	3	10		
Chills	4	13.3	6	20		
Itching	1	3.3	8	26.7		
Shortness of breath	8	26.7	13	43.3		
Time of start abnormal reaction	25.3 ± 3.2		15.5 ± 2.8		5.12	0.001*

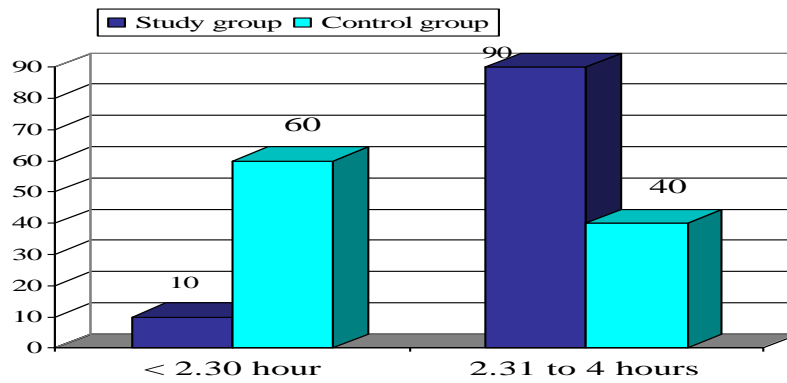


Figure (1): Comparison between study & control groups as regards duration of blood transfusion/ hours (n= 60)

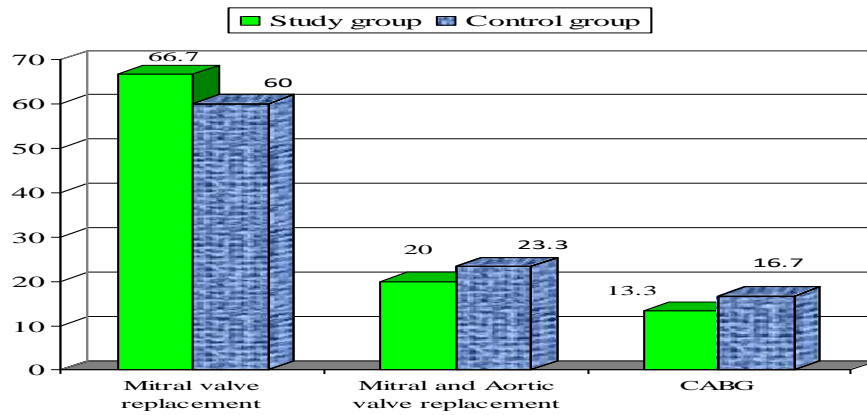


Figure (2): Comparison between study & control groups as regards operation type (n= 60).

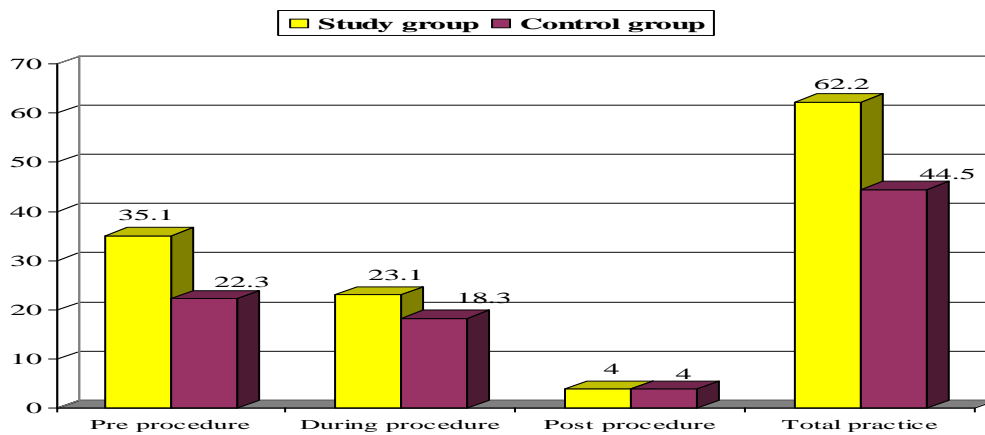


Figure (3): Comparison between study & control groups as regards nursing practice during administering a blood transfusion (n= 60).

Table (1): it was found that, the mean \pm SD were 31.82 ± 14.37 and 33.28 ± 16.83 respectively. For the sex it was found that the highest percentages in both groups were male and single (73.3 % vs 83.3%, 63.3% vs 70% respectively). The two fifth (40%) of the control group were educated and having university degree while in the study group more than one third (36.7%) having secondary degree with no statistical significance differences in both groups in all variables.

Table (2): The study group was stayed less duration in the hospital and ICU (5.1 ± 1.7 & 2.1 ± 0.5) than control group (6.2 ± 1.9 & 3.3 ± 1.4) with statistical significance difference in both groups in which $p < 0.02$ & 0.00 respectively.

Table (3): It was found that, mean time of operation, bypass and ischemia near to them among both groups with no statistical significance differences. All study and control groups receiving whole blood during operation with 1.6 ± 0.7 units in the study group & 1.8 ± 0.9 in the control group and intravenous fluid amount administered were 1450 ± 310.4 & 1466.7 ± 260.4 ml respectively with no statistical significance differences among them

Table (4): For wound discharge the highest percentage of the study group hadn't discharge (73.3%) compared to control group (30%) with statistical significance differences, and patients had wound discharge the highest percentage (62.5 % & 68.4 respectively) in both group had low amount of its. Also, as regard present of wound infection highest percentage (83.3% & 80% respectively) in both group hadn't exposed for it with no statistical significance differences among them.

Table 5: This table observed mean \pm SD of body temperature, pulse, respiratory rate, systolic and diastolic blood pressure were within normal range (36.8 ± 0.1 vs 36.9 ± 0.2 , 80.7 ± 5.8 vs 81.2 ± 6.1 , 17.9 ± 1.1 vs 18.1 ± 1.2 , 126.8 ± 13.3 vs 128.1 ± 10.1 , and 80.8 ± 8.3 vs 81.1 ± 9.1 respectively) in both group with no statistical significances differences before blood transfusion. There were increase mean level of the body temp., pulse, respiratory rate, systolic and diastolic blood pressure (37.7 ± 0.1 vs 37.0 ± 0.2 , 88.3 ± 7.3 vs 85.3 ± 6.0 , 20.1 ± 2.5 vs 19.1 ± 2.2 , 130.8 ± 8.8 vs 120.1 ± 11.1 and 77.3 ± 7.5 vs 76.8 ± 5.5 respectively) in the control group than study group with statistical significance differences in all vital signs except diastolic blood pressure at $\frac{1}{2}$ hour of beginning blood transfusion, also, immediately after blood transfusion there were increase mean level of the body temp., pulse, respiratory rate, systolic and diastolic blood pressure (37.4 ± 0.3 vs 36.8 ± 0.6 , 91.5 ± 9.5 vs 90.3 ± 7.8 , 19.6 ± 2.2 vs 19.3 ± 1.8 , 133.9 ± 6.7 vs 124.3 ± 9.7 and 81.0 ± 5.5 vs 76.3 ± 5.8

respectively) in the control group than study group with no statistical significance differences in all vital signs except systolic and diastolic blood pressure.

Table (6): shows comparison between study & control groups as regards assessment of mechanical ventilator post-operative the results revealed that, all study and control groups were delivered by SIMV mode, above half (53.3%) of the study group FIO_2 was 80% compared with one fourth (26.7%) of the control group with statistical significance differences, and the highest percentage (66.7% & 73.3% respectively) in both groups were administered PEEP at 4 positive pressure with no statistical significance differences among them. Regarding to time in & out of mechanical ventilator the highest percentage (90% & 83.3%) of both group were ranged between 80: 120 minutes with no statistical significance differences.

Table (7): The highest percentage (50%) of the control group had fever compared with the study group (33.3%), while time of start abnormal reaction during blood transfusion was later in the study group (25.3 ± 3.2 minutes) than control group (15.5 ± 2.8 minutes) with statistical significance differences in which p value < 0.03 & < 0.001 respectively.

Fig (1): results revealed that two third (66.7%) of the study group and 60% of the control group were done mitral valve replacement with no statistical significance differences among both groups.

Fig (2): results reveals that, the majority (90%) of the study group duration of administered blood transfusion within 2.31 to 4 hours compared to the control group (40%) with statistical significance differences in which p value < 0.00

Fig (3): shows comparison between study & control groups as regards nursing practice during administering a blood transfusion. The mean scores of the study group was higher than control group (35.1 ± 1.8 vs 22.3 ± 0.6 , 23.1 ± 0.3 vs 18.3 ± 0.9 , 4.0 ± 0.0 vs 4.0 ± 0.0 , and 62.2 ± 0.4 vs 44.5 ± 1.1) as regard pre, during, post, and totally practice of administering a blood transfusion with statistical significance differences in which p value < 0.00

Discussion

Cardiac surgery is associated with a high rate of allogeneic blood transfusion, varying from 40% to 90% in most reports **Snyder-Ramos, et al., (2008)**. Blood transfusion has been identified as one of the most frequently performed therapeutic procedures, with a significant percentage of transfusions identified to be inappropriate **Morton, et al., 2010** **Spahn, (2013)** is expected that, with the increase in age and comorbidities among patients presenting for

surgery, blood transfusion will further increase (Scott, et al., 2003).

The initial management in the postoperative care after routine cardiac surgery has fundamentally shifted during the past two decades towards a more efficient use of limited postoperative care facilities, early extubation and rapid discharge. Upon arrival in the ICU, an efficient transfer of care from operation room staff to ICU staff is mandated, while at the same time vital signs are to be maintained stable. The initial goals in postoperative cardiac recovery are sufficient analgesia, normothermia, adequate oxygenation and ventilation, control of bleeding, restoration of intravascular volume, optimization of blood pressure and cardiac output to maintain organ perfusion and metabolic stabilization (Paul, Roekaerts & John 2012).

The role of nurses during blood transfusion to promote and safeguard the patient's interests and wellbeing, the Nursing and Midwifery Council (NMC) advises that, the administration of medicines "is not solely a mechanistic task to be performed in strict compliance with the written prescription of a medical practitioner. It requires thought and the exercise of professional judgment. Nurses can demonstrate their skill and competency in this field. This leads to increased compliance when involved in patient identification procedures and record keeping. Further, they improve patient outcomes and reduce clinical risk and error rates (Gray & Illingworth, 2013).

Current study shows socio demographic characteristics of the study & control groups regarding to age it was found that, the mean \pm SD were 31.82 ± 14.37 and 33.28 ± 16.83 respectively. For the sex it was found that the highest percentages in both groups were male and single. The two fifth of the control group were educated and having university degree while in the study group more than one third having secondary degree with no statistical significance differences in both groups in all variables. This confirms that these two groups were homogenous groups prior to the study.

Hypothermic cardiopulmonary bypass is usually terminated after the patient has rewarmed to a core body temperature of at least 36°C . (Ho & Tan, 2009). However, patients usually arrive in the ICU with lower core temperatures. This drop in temperature from end of CPB until arrival in the ICU is due to the cool ambient temperatures in the operation room, poor peripheral perfusion and anesthesia-induced inhibition of normal thermoregulation (Paul, Roekaerts & John 2012). These report similar to current result revealed that, decrease level of body temperature on 1st hour post-operative than pre and 7th day post-operative.

The current study revealed that, there were increase mean of respiratory rate before blood transfusion in the study and control groups than during and immediately after transfusion. These supported by Hajjar, 2010 & Kuduvalli, (2005) mentioned that, there is increasing evidence for independent relationships between blood transfusion and respiratory morbidity after cardiac surgery.

In the current study all study and control groups received whole blood and blood units ranged between one to two units during operation and not be occurred any case of death. These results supported by study conducted in Denmark by (Jakobsen et al., 2012) whose investigate transfusion of blood during cardiac surgery is associated with higher long-term mortality in low-risk patients, they stated that, transfusion of more than six units and most likely 5–6 units as well has undoubtedly been a life-saving treatment during the perioperative phase. Noteworthy is that more than half of the patients only received 1–2 units, a practice that might be argued and is controversial as it seems to have the same negative impact on the long-term survival.

In the current study as regards to hospital and ICU stay. The study group was stayed less duration in the hospital and ICU than control group with statistical significance difference in both groups in which $p < 0.02$ & 0.00 respectively. (Galas et al., 2013). this study in similar with current results which found that, the study group was stayed less duration in the hospital and ICU than control group with statistical significance differences in which all study and control groups received one – two units but control group suffering from the highest percentage of wound discharge with low amount after open heart surgery with a statistical significance differences.

In contrast to this results (Hajjar, 2010 & Kuduvalli, 2005) who reported that, there is increasing evidence for independent relationships between blood transfusion and prolonged length of stay (LOS) and after cardiac surgery, in a retrospective analysis of 11, 963 patients who underwent isolated CABG surgery, Koch et al., (2006) showed that, perioperative RBC transfusion was associated with a dose-dependent increased risk of postoperative prolonged hospital stay. In a similar retrospective study, Murphy et al., (2007). showed that, RBC transfusion was strongly associated with prolonged hospital stay, and hospital costs.

As regards to infectious complications and serious infection Koch et al., (2006) reported that, blood transfusions have been associated with high rates of morbidity and mortality in critically ill patients, and there is increasing evidence for independent relationships between blood transfusion and infectious complications and serious infection.

This reports contradict with current result which found that, the highest percentage of the control group had wound discharge with low amount compared to study group with a statistical significance differences but as regard present of wound infection highest percentage in both group hadn't exposed for it that's may related to medical staff in the ICU try to follow precautions after open heart disease especially when wound discharge started (as a signs of infection), in addition not increases number of blood units administered.

The present results revealed that, all study and control groups were delivered by SIMV mode, above half of the study group FIO2 was 80% compared with one fourth of the control group, and the highest percentage in both groups were administered PEEP at 4 positive pressure. Regarding to time in & out of mechanical ventilator the highest percentage (90% & 83.3%) of both group were ranged between 80: 120 minutes. These results similar to a retrospective analysis of 11, 963 patients who underwent isolated CABG surgery, **Koch et al., (2006)**. showed that, perioperative RBC transfusion was associated with a dose-dependent increased risk of prolonged ventilator support.

As regards to abnormal reaction during blood transfusion it was found that, the half of the control group had fever compared with one third of the study group, while 43.3% of the control group suffering from shortness of breathing compared with 26.7% of the study group, and 20% of the control group had chills compared with 13.3% of the study group also, as regards to time of start abnormal reaction during blood transfusion was later in the study group (25.3 ± 3.2 minutes) than control group (15.5 ± 2.8 minutes) with a statistical significance difference in which p value <0.001 . These results were supported by **Faed, (2014)** who mentioned that, most febrile non hemolytic reactions are common; although some may cause significant discomfort and hemodynamic or respiratory changes, occur 1- 3: 100 received blood transfusion. Temperature rise of $\geq 1^\circ\text{C}$ (2°F) during or within 4 hours following transfusion, without any other obvious cause Chills/rigors with or without fever, associated or secondary symptoms may be present: tachycardia, headache, nausea/ vomiting, flushing, anxiety, hypertension, or occasionally hypotension. **Tinegate et al., (2012)** reported that, acute transfusion reactions can present with a range of symptoms and signs of varying severity. These include: Fever and related inflammatory symptoms or signs such as chills, rigors, myalgia, nausea or vomiting. Cutaneous symptoms and signs including urticaria (hives), other skin rashes and pruritus Angioedema (localized edema of the subcutaneous or submucosal tissues).

Conclusions

Based on the results of the present study it can be concluded that, the applying of blood transfusion guidelines in patients undergoing open heart surgery was successful in reduced stayed duration of the study group in the hospital and ICU than control group with statistical significance difference in both groups as regard hospital stay in which $p <0.02$ and statistical significance difference as regard ICU stay in which $p <0.000$. As regards abnormal reaction during blood transfusion the half of the control group had fever compared with one third of the study group with statistical significance differences in which p value <0.03 , while time of start abnormal reaction during blood transfusion was later in the study group than control group with a statistical significance differences in which p value <0.001 . Also, the mean scores of the study group was higher than control group as regard pre, during, post, and totally nursing practice of administering a blood transfusion with statistical significance differences in which p value <0.00 . This shows the difference between clinical practice between the current study according to guidelines and the hospital routine.

Recommendations

- All health care professionals who directly involved in patient's care should receive quality education on the benefits, and risks of blood transfusion, indications, and uses of other blood products.
- Hospitals should provide ongoing quality programs for all health care professionals who directly involved in patient's care on available evidence-based blood conservation techniques and blood alternatives types and its indications.
- Ongoing assessment and evaluation of nursing staff knowledge, and practice in infection control skills with blood transfusion procedure.

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