International Journal of Current Research and Review
DOI: https://doi.org/10.31782/IJCRR.2023.152301

Research Article

IJCRR
Section: Healthcare

Retrograde Autologus Priming and its Effects on Intraoperative Transfusion

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ABSTRACT

Introduction: Extreme haemodilution going on with cardiopulmonary pass imposes an vital chance element recollect for blood transfusion in cardiac surgical patients. Priming of the cardiopulmonary bypass circuit with sufferers' own blood [retrograde autologous priming (RAP)] is a system used to restrict haemodilution and decrease transfusion requirements.

Objective: The objective of our study was to evaluate the effects of Retrograde Autologus Priming on reducing intraoperative blood transfusion in cardiac surgery.

Methodology: It was cross sectional study, conducted over a period of six month from august 2021- February 2022 at Peshawar Institute of Cardiology, department of cardiac surgery. We enrolled one hundred and sixty patients, n= (160) through pre-structured Performa by the use of non-probability convenient sampling method technique.

Results: The mean age of the patients (8.77±8.644), mean HB before surgery (13.443±2.9020), after surgery (10.947±2.0891), haematocrit after surgery (34.98±7.697), priming volume (549.32±229.013), effective priming volume (539.69±257.563), extubation time (3.91±1.255) and ICU stay was (2.20±.875). Post-op performance HB level, hematocrit, priming volume, extubation time and ICU stay shows a significant association at p value <0.05.

Conclusion: According to the results of our study, it is concluded that reducing CPB priming volume by the RAP techniques reduces homologous blood transfusion in congenital and valvular defect patients. It also shows that RAP technique shows significant association to the postoperative performance of the patients at p-value <0.05.

Key Words: Retrograde Autologous priming, Congenital, Valvular, Cardiac Surgery, Haemodilution, Priming volume

INTRODUCTION

Extreme haemodilution happening with cardiopulmonary bypass imposes an essential risk factor consider for blood transfusion in cardiac surgical patients. Priming of the cardiopulmonary bypass circuit with patients' vary own blood [retrograde autologous priming (RAP)] is a procedure used to restriction haemodilution and reduce transfusion requirements. Extracorporeal circuitry and components are most important individuals to haemodilution at some stage in open coronary heart surgery.[1] Haemodilution, that's induced by a massive fixed crystalloid high quantity, may additionally lessen haematocrit (HCT) values to a degree that necessitates the management of homologous packed red blood cells (PRBCs).[2] A HCT of less than 20% within the path of cardiopulmonary bypass (CPB) and transfusion of PRBCs are each related to an progressed probability of unfavorable activities in cardiac surgical treatment. [3]

Retrograde autologous priming (RAP) has been established to decrease the form of homologous RBC transfusions related to 'immoderate' haemodilution for the duration of CPB.[4] Although previous studies [5] confirmed a decrease in blood necessities, patients with and nursing staff of workers within the ICU and the postoperative wards have been blinded from the priming approach used for the purpose of that study. The number one endpoint of the take a look at was to evaluate RAP of the CPB circuit with traditional [6] priming in decreasing the proportion of sufferers receiving homologous blood transfusion. Secondary endpoints included the tendencies of HCT and colloid osmotic strain (COP) at a few stage in the preoperative duration,[7] the quantity of homologous blood

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ISSN: 2231-2196 (Print) **ISSN:** 0975-5241 (Online)

Received: 21.08.2023 **Revised:** 08.10.2023 **Accepted:** 19.11.2023 **Published:** 16.12.2023

transfused constant with affected character who received transfusion and postoperative clinical outcomes.

Displacing some of the circuit prime on the initiation of CPB with the affected person's personal circulating blood in each an antegrade route thru the venous cannula and a retrograde path thru[8] the arterial cannula has turn out to be known as retrograde autologous priming (RAP).[9] RAP of the CPB circuit reduces the priming volume of the CPB circuit and consequently limits haemodilution currently. This decreased haemodilution allows a better HCT[10] fee to be maintained at some point of CPB, which can be beneficial as regards to negative effects. After CPB the better HCT may suggest that the affected person is an awful lot less probably to reach a transfusion threshold and gather a homologous blood transfusion.[10]

However, Murphy et al.[11] failed to reveal its benefit on transfusion necessities in a big population of 545 sufferers, present process an expansion of cardiac surgical treatment, in spite of the higher haematocrit on CPB promoted with the resource of the RAP technique.[12] In maximum collection, the problem of RAP application has been addressed as a determinant on itself, irrespective of the quantity eliminated from the CPB circuit.[13] The purpose of our study was to evaluate the effects of Retrograde Autologus Priming on reducing intraoperative blood transfusion in cardiac surgery. We only use blood Cardioplegia, no any other addition for surgical procedures.

METHODOLOGY

Study sample:

Study was conducted over a period of six months from August 2021 to February 2022. Data was collected through prestructured Performa with the help of previous studies which contain both open and close ended questions by the use of non- probability sampling method technique. One hundred and sixty patients (160) were selected after meeting the inclusion criteria.

Study setting and duration:

Study was conducted at Peshawar Institute of Cardiology department of cardiac surgery from August 2021 to February 2022.

Inclusion criteria:

Patients undergoing for cardiac surgery with congenital and valvular defects were included.

Exclusion criteria:

Patients with emergency cardiac surgery were excluded.

Statistical Analysis:

Data were entered in SPSS version 25. Descriptive statistics was used to calculate mean and SD for quantitative variables e.g. age, HB level, Hemotocrit, priming volume, RAP volume and ICU stay. Frequencies and percentages was calculated for qualitative variables e.g. gender and procedure. Chi-square was used to assess the association of RAP with HB and ICU stay.

Retrograde Autologus Technique:

To perform RAP, a hemodilution bag was linked to the arterial filter purge. Mild elevation of the patient's legs (30°) changed into completed and, if essential, a bolus of 50–200μg of phenylephrine became administered with a view to keep the systolic arterial blood pressure above 90 mmHg. When the sign became given to initiate CPB, priming solution inside the arterial line was slowly modified with blood from the patient through gravity drainage and on aortic Pressure. Once the arterial filter became retrograde filled with autologous blood, the arterial line becomes clamped.

A clamp changed into removed from the venous line, and blood became slowly tired into the venous reservoir. Subsequently, the arterial pump becomes initiated, displacing the priming quantity into the hemodilution bag. Once an enough amount of priming was discarded or patients have become hemodynamically risky, RAP changed into stopped, clamps were removed from the arterial line and CPB changed into instituted. The choice to apply RAP became taken in settlement with the anesthesiologist and the surgeon, primarily based on preoperative repute and system associated troubles.

Anesthesia strategy:

The patients have been brought to the operating room, in which a large-bore peripheral intravenous line becomes positioned. A radial artery catheter and the continuous monitors were placed. General anesthesia became precipitated with midazolam, propofol and either fentanyl. After intubation, anesthesia was maintained with isoflurane and neuromuscular blockade. The target mean blood pressure (BP) changed into 70 mmHg before PB and 60 mmHg after CPB. Anticoagulation changed into done with heparin 300 U kg-' earlier than PB. After separation from CPB, 1 mg protamine sulphate for each 100 U overall heparin dose was administered. At the give up of the process, the patients were transferred to the cardiac ICU.

Ethical Consideration:

Ethical consideration was taken from hospital ethical review board committee **(OB-220001-PIC)** of Peshawar institute of cardiology. A written informed consent was also taken from the patients.

RESULTS

A total of one hundred and sixty (160) patients were included in our study for evaluating the effects of retrograde autologus priming after meeting the inclusion criteria.

Table 1: Demographic profile and procedures of the patients (n=160):

Characteristics	Frequency(n)	Percentage (%)
Gender of the patients		
Male	94	58.8%
Female	66	41.3%
Procedure of the patients		
Ventricular Septal Defect	49	30.6%
Atrial Septal Defect	37	23.1%
Tetralogy Of Fallouts	34	21.3%
Glenn shunt	6	3.8%
TAVPR	7	4.4%
PAPVR	5	3.1%
ASD+VSD	5	3.1%
Atrial switch	4	2.5%
Arterial switch	1	.6%
DVR	7	4.4%
AV Canal Repair	3	1.9%
TRV+RVOT	2	1.3%

Table 1 illustrates the demographics and procedures of the patients which were undergoing for congenital and valvular defects. 58.8% males and 41.3% were females, procedure shows that 30.6% VSD, 23.1% ASD, 21.3% TOF, 3.8% Glenn shunt and 2.5% atrial switch were included in our study.

Table 2: Clinical profile of patients (n=160):

Characteristics	Mean	±SD
Age of the patients	8.77	±8.644
Height of the patients	116.66	±35.246
Weight of the patients	24.251	±18.0111
Systolic BP	104.36	±11.791
Diastolic BP	59.84	±11.286
SPO2 level	97.55	±3.467
Pulse level	97.73	±11.906
HB before surgery	13.433	±2.9020
HB after surgery	10.947	±2.0891
RAP volume (ml)	242.31	±99.913
CX time (min)	43.94	±21.497

Table 2: ***(Continued)***

Characteristics	Mean	±SD
CPB time(min)	81.55	±33.001
Cardioplegia volume(ml/kg)	580.66	±366.114
Hematocrit before%	41.17	±9.019
Hematocrit after%	34.98	±7.697
Priming volume(ml)	549.32	±229.013
Effective priming volume(ml)	539.69	±257.563
Extubation time	3.91	±1.255
Blood volume	55.22	±60.538
Urine volume(ml)	317.64	±335.274
ICU stay	2.20	±.875

Table 2 Shows the clinical profile of descriptive data, which shows that mean age of the patients (8.77±8.644), mean HB before surgery (13.443±2.9020), after surgery (10.947±2.0891), haematocrit before surgery (41.97±9.019), haematocrit after surgery (34.98±7.697), priming volume (549.32±229.013), effective priming volume (539.69±257.563), extubation time (3.91±1.255) and ICU stay was (2.20±.875).

Table 3: Association of Retrograde Autologus priming towards post-op performance (n=160).

Variables	x^2 value
Post-op HB level	2137.962[a] (df= 992, *p* value=000)
Post-op hematocrit level %	1412.849[a] (df=1120, *p* value= .000)
Priming volume (ml)	844.563[a] (df=448, *p* value=.000)
Extubation time	274.505[a] df=192, *p* value= .000)
ICU stay	144.300[a] df=128, *p* value=>0.05)

Table 3 illustrate the association of retrograde autologus priming with post-op performance, which shows that HB level, hematocrit, priming volume, extubation time and ICU stay has a good association at p value <0.05.

DISCUSSION

According to the result of previous study which indicates that Multivariable's, which includes affected person and technique-associated elements, are related to blood transfusion within the route of Cardiopulmonary Bypass (CPB).[14] Review of published reports identified that small body size (low preoperative RBC extent) is related to expanded intraoperative blood transfusion. Recent proof based evaluates[14] of the exercise of CPB in adults, focusing with regards to haemodilution, concluded that 'efforts must be made to reduce haemodilution, such as reduction of high extent, to avoid subsequent allogeneic blood transfusion.

RAP has been reported to reduce allogeneic blood transfusion, in addition to produce a synergistic impact with other prime reduction techniques.[15] However, most reviews focused on RAP in patients having a BSA of more than 1.7m^2. In the previous prospective cohort examine of 60 RAP small adults sufferers (BSA<1.5m2), the authors found a lower transfusion ratio and transfusion volume in the RAP group.[16] These findings propose that RAP, as a blood conservation method, is an efficient, well tolerated and inexpensive method in small adult patients.

According to the result of our study it shows that 58.8% males and 4.3% were females, procedure of the surgery, 30.6% VSD, 23.1% ASD, 21.3% TOF, 3.8% Glenn shunt and 2.5% atrial switch were included in our study. Most of the patients done with VSD and ASD. If we discuss about the mean age of the patients which shows that (8.77±8.644), mean HB before surgery (13.443±2.9020), after surgery (10.947±2.0891), haematocrit before surgery (41.97±9.019), haematocrit after surgery (34.98±7.697), priming volume (549.32±229.013), effective priming volume (539.69±257.563), extubation time (3.91±1.255) and ICU stay was (2.20±.875). RAP shows good post-op outcomes.

It shows significant association with post op HB at p-value <0.05. If we discuss it with post-op haematocrit level and extubation time it also has a significant association at p - value <0.05. ICU stay did not shows a significant association p-value >0.05.In some other study, a low baseline hematocrit become diagnosed as hazard factors for intraoperative transfusion and turned into an impartial predictor for in hospital blood transfusion in well known. According to the brand new 2017 EACTS/EACTA Guidelines on affected person blood control for person cardiac surgical operation.[17] 48% of their RAP managed patients and 45% of the control group had a mild anemia (women, Hb 100– 120 g/L; mens, Hb 100–130 g/L).

For further ideal preoperative control of preoperative anemia in line with the steering and to be had data[18] they need to clarify reasons for preoperative anemia (e.g. Iron deficiency, vitamin D or folate deficiency) and put in force erythropoietin (EPO) remedy without or with iron supplementation (magnificence IIa, level B advice) in our next paintings.[19] The effects in their randomized trial are consistent with information suggested by Rosengart et al. And modern-day records from Teman et al.,[20] Trapp et al. And a Meta evaluation by means of way of Sun et al. The growing body of information supports the findings in their findings that RAP decreases intraoperative and postoperative blood transfusion expenses without increasing peri- or postoperative complications, leading to similar or maybe favorable results.[21]

CONCLUSION

According to the results of our study, it is concluded that reducing CPB priming volume by the RAP techniques reduces homologous blood transfusion in congenital and valvular defect patients. This reduction is mainly due to the reduction in haemodilution with an associated increase in HCT value. It also shows that RAP technique shows significant association to the postoperative performance of the patients at p-value <0.05.

Conflict of interest:

All authors hereby declare that there is no conflict of interest.

ACKNOWLEDGEMENT

The authors wish to thanks the department of cardiac surgery of Peshawar Institute of cardiology. Authors also wish to thanks the Swaminathan M, Rosengart TK, and all other authors for their support in literature search and citation.

Author's contribution:

AS conceptualized and wrote the first draft of manuscript. MZK, BM and KA helped in data collection. AHK performed the data analysis. SR helped in editing the manuscript. All authors have read and approved the final manuscript.

Funding

This study did not receive any funding.

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