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IMPACT OF PREOPERATIVE ANEMIA ON OUTCOMES OF CARDIAC SURGERY

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Abstract:
Objective: *It is known that good control of anemia reduces pre-operative mortality and morbidity. That is why we are investigating the effect of preoperative anemia on the result after heart surgery.*
Methods and methods: *This prospective comparative observational study was conducted in the cardiology department of Jinnah Hospital Lahore for one-year duration from January 2019 to January 2020. All operations were performed using peripheral pulmonary circulation (CPB) and the results were recorded in hospital.*
Results: *Of 200 patients, 140 (70%) were male and 60 (30%) were female. The mean age of the patients was 50.63 ± 15.33 years, and the mean hemoglobin level was 12.20 ± 1.98 mg / dl. Coronary artery bypass graft (CABG) patients were 132 (66%) and 68 (34%) patients who underwent valve surgery. The incidence of anemia was 114 (57%). Preoperative anemia was associated with long-term hospitalization (CABG; 15.0 ± 6.38 vs. 7.93 ± 4.7 and valve; 17.28 ± 5.7 vs 8.65 ± 5.31), increased creatinine levels after surgery (CABG; 2.87 ± 0.16 vs 0.98 ± 0.61 and valve); 2.76 ± 0.16 and 0.86 ± 0.14) and in patients with cardiac surgery (CABG; 1.67 ± 0.98 and 1.26 ± 0.60 and faster valve transfusion); 1.65 ± 1.07 and 1.14 ± 1) 06). Patients with anemia before surgery are more likely to get negative results after cardiac surgery. Postoperative wound infection (3.03% vs 2.94%), kidney damage (19.69% vs 10.29%), stroke (3.03% vs 0), postoperative MI (6%, 4.41% compared to patients with CABG) and AF (8.82% compared to 10.6 patients with valve and patients in whom preoperative anemia was again detected (4.54% vs. 14.70%) compared to CABG.*
Conclusion: *Pre-operative anemia is associated with high hospital mortality and serious side effects in patients operated on for coronary and valvular disease.*
Key words: *MI: myocardial infarction, CABG: coronary artery bypass, CPB: pulmonary bypass, HB: hemoglobin, BT: blood transfusion.*

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INTRODUCTION:

Pre-operative anemia is an independent indicator of hospital mortality and morbidity after coronary artery bypass (CABG) or valve surgery. The CABG and valve procedure are often associated with significant blood loss. Patients receive postoperative blood transfusions (CTs), which may increase the risk of postoperative mortality, morbidity and infection. About 54.4% of patients after heart surgery suffer from anemia.

Therefore, preoperative anemia is a useful parameter for assessing the risk of blood transfusion as well as the shorter risk of survival after postoperative complications and coronary artery bypass surgery.

South Asian countries, including Pakistan, are most affected by cardiovascular disease in the world and are considered to be the leading cause of mortality and morbidity. Of the total 7.9 million deaths from non-communicable diseases (non-communicable diseases), 3.6 million (45%) are associated with cardiovascular disease. This study looks at current trends in postoperative outcomes associated with preoperative anemia.

MATERIAL AND METHODS:

This is a prospective comparative study in a hospital involving 200 consecutive patients undergoing cardiopulmonary bypass surgery (CPB). The study was conducted in the cardiology department of Jinnah Hospital Lahore for one-year duration from January 2019 to January 2020.

According to the guidelines of the World Health Organization (WHO) classification8 patients fulfilling the criteria of preoperative anemia were defined as having hemoglobin level <13 g/dl for men and < 12 g/dl for women. Patients who underwent CABG and valvular surgery were included, while patients with repair of complex congenital abnormalities, without cardiopulmonary bypass, patients undergoing urgent or emergency procedures, pre-operative critical state i.e. ventricular tachycardia or fibrillation or aborted sudden death, preoperative cardiac massage, preoperative ventilation before arrival in the anesthetic room, preoperative inotropic support, intra-aortic balloon counterpulsation or preoperative acute renal failure (anuria or oliguria<10 ml/hour) were excluded from study. Surgical procedures are classified as single coronary artery transplant (CABG), valve (single-valve procedure, double-valve procedure and CABG + valve). The purpose of this study was clarified before surgery and informed consent was obtained from each patient. All patients were routinely given 2000 mg of tranexamic acid after induction of general anesthesia. Tranexamic acid infusion was also used in procedures with a high risk of bleeding until the end of surgery. Hemoglobin was maintained at -8.0 g. The trigger of dl-1 transfusion was <7.0 g.dl-1 during and after peripheral pulmonary circulation.

Study parameters included demographic and clinical features of the procedure, and perioperative endpoints were collected prospectively. Regarding mortality and postoperative complications, clinical results or clinical conditions of all patients were obtained during hospitalization. Hospital mortality (defined as any death within 30 days of surgery) and postoperative complications such as wound infection, superficial bridge wound infection (SSWI) were only defined as skin infection. Deep sternal wound infection (DSWI) has been identified by the Center for Disease Control and Prevention, a disease involving the following tissue spaces. Patients with subcutaneous tissue and meeting at least one of the following criteria were diagnosed with deep sternal wound infection (DSWI): (1) the organism was isolated from tissue culture or mediastinal fluid; (2) symptoms of mediastinitis were observed during surgery; or (3) chest pain, sternal instability or fever (> 38 ° C).

Postoperative MI was based on> 25% reduction of new Q waves and / or R waves> 0.04 ms. At least 2 adjacent skins were observed daily until discharge with continuous monitoring of the electrocardiogram and CPKMB increase. Ren 10.10% Renal failure was defined as 100 µmol / L in women and 110 µmol / L in men (> 1 mg / dl) (equivalent to 1.1 to 1.2 mg / dl).

The new appearance of postoperative AF was defined as the absence of P-wave before QRS syndrome with irregular ventricular rhythm in rhythmic stripes and it lasted ≥ 5 minutes within 96 hours after surgery based on 12 ECG leads. If new findings emerged regarding neurological deficit with morphological history confirmed by computed tomography, a postoperative cerebrovascular accident was performed. Re-examination was determined according to the criteria of Kirklin and Barratt-Boyes.

The data was analyzed using the SPSS statistics package (statistical package for social sciences) in version 20.0 for Windows. The mean ± standard deviation is given for quantitative variables. Frequencies, percentages are given for qualitative variables. Using an independent quantitative t-test variable, a chi-square test and Fisher's exact test (if the cell frequency is less than 5) were performed to

observe the association of qualitative variables with anemic and anemic groups. The level of significance was accepted as 5% 5. All tests took place on both sides.

RESULTS:

200 patients were included in the study. Valve surgery was performed on 132 (66%) and 68 (34%) patients who underwent isolated coronary bypass surgery; 14 (7%) for the single valve procedure (repair or replacement), 32 (16%) for the mitral valve procedure (repair or replacement), 22 (11%) for the double valve procedure (repair or replacement). 200 of 140 patients (70%) are male and 60 patients (30%) are females of 200 patients. The average Hb level was higher in men than in women (12.87 ± 1.98 and 10.63 ± 0.62 mg / dl). Table 1. The average age of patients was 50.63 ± 15.33. The overall incidence of anemia was 114 (57%). Occurrence of anemia between CABG P = 0.001) and valve (4.07 ± 0.59 vs. 4.67 ± 0.41; P value = 0.001) compared to the non-anemic group. In general, the average Hb level was 12.20 ± 1.98 mg / dL. The average Hb level was significantly lower in the valve group than CABG (11.67 ± 1.88 vs. 12.48 ± 1.98; p value = 0.006) Table 1.

Table-1: Descriptive statistics with respect to mean hemoglobin level.

variables		Hemoglobin level (Mean ± S.D)	P-value
Gender	Male (n=140)	12.87±1.98	0.001
	Female(n=60)	10.63±0.62	
Procedure	CABG (n=132)	12.48±1.98	0.006
	Valvular(n=68)	11.67±1.88	

In the non-anemic group, in the non-anemic group CABG (1, 67 ± 0.89 vs, 1.26 ± 0.60; p-value = 0.019), valve (1.65 ± 1.07 vs. 1.14 ± 1.06; p-value = 0.056) (table -2).

Table-2: Demographical and clinical characteristics of anemic and non-anemic patients with respect to procedure type.

			Group		P-value
			Anemic (n=114)	**Non anemic (n=86)**	
Gender	Male(n=98)	CABG (n=132)	32(32.7%)	66(67.3%)	0.001
	Female(n=34)		34(100.0%)	0	
	Male(n=42)	Valvular (n=68)	22(52.4%)	20(47.6%)	0.001
	Female(n=26)		26(100%)	0	
Age		CABG(n=132)	60.42±7.19	59±8.21	0.291
		Valvular(n=68)	33.70±10.97	31.3±7.96	0.378
Weight (kg)		CABG(n=132)	72.65±17.74	71.51±12.98	0.676
		Valvular(n=68)	55.12±14.92	54.3±7.14	0.185
RBC		CABG(n=132)	4.0242±0.63	4.4121±0.52	0.001
		Valvular(n=68)	4.07±0.59	4.67±0.41	0.001
Urea		CABG(n=132)	31.93±9.78	31.96±13.34	0.988
		Valvular(n=68)	30.62±8.56	26.9±9.25	0.115
Creatinine		CABG(n=132)	2.8718±.16	0.9818±.61	0.207
		Valvular(n=68)	2.76±0.161	0.86±0.14	0.058
CPB time		CABG(n=132)	107.1±30.48	119.2±36.79	0.045
		Valvular(n=68)	126.0±49.56	128.2±49.3	0.786
Cross clamp time		CABG(n=132)	59.31±26.52	63.69±25.84	0.342
		Valvular(n=68)	78.79±34.53	78.0±33.22	0.946
Blood transfusion		CABG(n=132)	1.67±0.98	1.26±0.60	0.019

	Valvular(n=68)	1.65±1.07	1.14±1.06	0.048
Hospital stay	CABG(n=132)	15.0±6.38	7.93±4.7	0.793
	Valvular(n=68)	17.28±5.7	8.65±5.31	0.149

Patients undergoing cardiac surgery have an increased risk of postoperative complications associated with preoperative anemia. In the anemia group, postoperative wound infection (3.03% and 2.94%), kidney damage (19.69% to 10.29%), stroke (0 to 3.03%), postoperative myocardial infarction (6, 06% - 4.41%) and AF (10.6% - 8.82%) were larger than valvular, the difference was statistically significant (p value <0.05). Also, in the non-anemic group, postoperative MI was more common in the valvular group than CABG (5.88% vs. 1.51%). The rediscovery trend in the anemic group was higher in the valvular group than in CABG (14.70% relative to Table 3; p value <0.05) (Table 3).

Table-3: Association of in hospital outcome with anemic and non-anemic patients according to procedure type.

In-hospital outcomes		**Anemia (n=114)**	**Non-Anemic (n=86)**	**P-value**
Wound Infection	CABG(n=132)	4(3.03%)	1(0.75%)	0.048
	Valvular(n=68)	2(2.94%)	0	0.037
Renal Injury	CABG(n=132)	26(19.69%)	15(11.36%)	0.039
	Valvular(n=68)	7(10.29%)	1(1.47%)	0.041
Re-exploration	CABG(n=132)	6(4.54%)	0	0.012
	Valvular(n=68)	10(14.70%)	2(2.94%)	0.036
Post MI	CABG(n=132)	8(6.06%)	2(1.51%)	0.042
	Valvular (n=68)	3(4.41%)	4(5.88%)	0.048
Stroke	CABG (n=132)	4(3.03%)	1(0.76%)	0.056
	Valvular (n=68)	0	0	1.00
AF	CABG (n=132)	14(10.6%)	4(3.03%)	0.011
	Valvular (n=68)	6(8.82%)	1(1.47%)	0.039
Mortality	CABG (n=132)	2(1.5%)	0	0.039
	Valvular(n=68)	2(2.9%)	0	0.046

DISCUSSION:

Our results showed that the group of women with anemia was larger than the patient without anemia, which showed that women are more likely to experience pre-operative anemia. Karkouti11 found that anemia was 47% in women. Hung13 et al. Another anemia study showed that anemia was more common in women than men (32.1% vs. 22.8%). This study showed similar results. Carrascal8 et al. There was no significant gender difference in preoperative anemia (53.6% vs. 46.3%). The conflict may be caused by bias in patient selection. Karski14 et al. The incidence of preoperative anemia in patients undergoing cardiac surgery was 37.3%, Carrascal8 et al. Preoperative anemia was 41.9%. Hung13 et al. In patients undergoing cardiac surgery (57%), the incidence of preoperative anemia was 54.4% and high preoperative anemia. Karkouti11 et al. Pre-operative anemia was 26% in patients undergoing cardiac surgery. This difference may differ from the sample size of this test. Hung13 analyzed that anemia was associated with blood transfusion (54.1% vs. 22.4%). According to Karski14 et al., They analyzed that preoperative anemia is associated with an increased risk of perioperative blood transfusion (75% vs. 25%). Our study highlights the particular importance of preoperative anemia as a risk factor in heart surgery, where red blood cell transfusions are often required, and expose patients to the additional risk of red blood cell transfusions. Carrascal8 and colleagues determined that preoperative anemia is not an independent risk factor for perioperative transfusion (p-value = 0.931).

Carrascal et al. The length of hospital stay was longer in the anemic group than in the anemic group (15.65 ± 14.52 and 3.64 ± 10.61 days), but did not differ significantly. Miceli15 et al. In the preoperative study of anemia, it was found to be significantly associated with hospital stay (54% and 36.7%) for over 7 days.

Carrascal et al. Hospital mortality and postoperative complications were higher in the anemic group than in the non-anemic group (18.9% vs 9.0%) and (46.3% vs 43.1%). The complications in the anemic group were: FA 18.9%, MI and wound infection 4.2%, low cardiac output 12.6%, FA without anemic group FA 15.9%, MI 1.5% and wound infection 3 %, 7 low cardiac output 9.8%. Karkouti11 et al. In another study conducted by non-patients, a negative result of preoperative anemia patients, namely death (1.4% vs. 6.6%), stroke (2.8% vs. 1.1), or acute kidney damage (% 10.6 and 3.6) with anemia. Cladellas16 et al. Their study found that mortality in patients with anemia increased fourfold, and severe complications increased 2.5 times. Miceli15 et al. Anemia, kidney damage (18.5% vs 6.5), stroke (1.9% vs 1.9%), AF in patients (36.7% vs 33%), significantly higher mortality in patients (4, 6% vs 4.6%) 1.5) and with an incidence rate. and MI (1.9 vs. 2). Baron17 et al. Preoperative anemia has been shown to be associated with negative results. Kulier6 et al. They found that pre-operative anemia showed a strong correlation with non-cardiac complications in a study by. At hemoglobin levels, a decrease of 1 g / dl below 14 g / dl led to an increase in adverse events. Bell18 et al. Preoperative hemoglobin below just 10 g / dL has been shown to be an independent risk factor for death only in patients undergoing CABG surgery. However, in multivariate analyzes, preoperative hemoglobin is not significant as an independent risk factor for mortality and is only slightly important in the incidence of morbidity.

CONCLUSION:

We can conclude that patients with anemia have a much higher risk of death or serious postoperative complications than patients without anemia after heart surgery.

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