Prevalence of Preoperative Anemia in Elective Rheumatic Valve Surgery at a Tertiary Care Center in Nepal

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Abstract

Background: Rheumatic Valvular Heart disease (RVHD) is common in developing countries often associated with anemia; however its burden is often overlooked. Anemic patients undergoing surgery are likely to receive blood transfusion, increasing morbidity and mortality. Prevalence of anemia in cardiac surgical patients are studied extensively, however its burden in RVHD is lacking. This study attempted to investigate the prevalence of preoperative anemia in RVHD and its effect on blood transfusion, morbidity and mortality in patients undergoing valve surgery. **Methods:** This is a retrospective observational study conducted at a tertiary care hospital in Nepal. We considered 340 patients who underwent Rheumatic valve replacement surgery from 2014 January to December 2016 and data on their socio-demographic and clinical characteristics were extracted from the patient's records. The analyses meeting the study objectives were conducted using IBM SPSS v25 for Windows (IBM Statistical Package for Social Sciences, 2015IBM Corporation, New York, United States). **Results:** The prevalence of no anemia, mild, moderate, and severe anemia was 34.1%, 57.7%, 39.6%, 2.5%, respectively. The units of Red Blood Cell used for transfusion were 1.2 units, 2.0 units, 2.3 units, and 1.6 units in patients without anemia, and those with mild, moderate and severe anemia respectively. The incidence of reexploration was higher in patients with severe anemia as compared to the non anemic with an incidence of 66.6%. A proportion of the patients with no anemia, mild, moderate and severe anemia with less than 7 days stay in the intensive care unit were 89%, 82%, 84.7% and 100% respectively. The length of hospital stay more than 10 days was seen in 58.9%, 71.6%, 63% and 100% in patients with no anemia,

mild, moderate and severe anemia. An overall incidence of mortality in anemic patients was 11% while in non anemic patients was 5.3%. **Conclusions:** The prevalence of anemia was high in the Nepalese patients with Rheumatic valvular heart disease planned for elective surgery. There was an increased incidence of blood transfusion, longer hospital stay, and increased mortality in anemic patients compared to their non anemic counterparts.

Keywords

Anemia, Rheumatic Heart Disease, Elective Valve Surgery, Blood Transfusion

1. Introduction

Preoperative anemia is a common entity in patients with chronic illness and a frequent finding during preoperative evaluation of patients undergoing surgery. Non cardiac surgeries like orthopedic, gastrointestinal and lung where anemia has been associated with increased risk of blood transfusion and mortality [1] [2] [3]. Preoperative anemia is also a common entity in patients with different cardiac conditions planned for cardiac surgery, with incidence ranging from (23% - 54%) increasing the incidence of blood transfusion, adverse events, morbidity and mortality [4] [5] [6] [7]. Rheumatic valvular heart disease is a condition caused by streptococcal infection and common in the developing world, with the current estimate of 33.4 million in 2015 [8]. Among its symptoms, Rheumatic valvular heart disease, a chronic sequel of Rheumatic fever, affects the heart valves with varying severity. Preoperative anemia has been frequently seen in patients with RVHD planned for valve surgery, however, the real burden of the problem has not been investigated as the disease is limited to the developing countries and large scale studies in cardiac patients (not including RVHD) with preoperative anemia has shown an increased short term as well as long term mortality in patients with preoperative anemia with or without blood transfusion [9]. An isolated study did make an attempt to explore the prevalence of anemia (33.1%) in RVHD patients and also found significantly higher blood transfusion and mortality in anemic patients compared to the non anemic [4].

Nepal, a developing country, with a still high incidence of Rheumatic fever and heart diseases, with an Echocardiography based screening of RVHD among 5 - 15 yrs to be 10.2 per 1000 person [10]. The burden of RVHD patients undergoing valve surgery is also high with 35% of the valve surgeries associated with RHD are being operated at one of the high volume centers in Nepal [11]. Acute and chronic anemia coexist in Rheumatic fever and its sequel conditions as they share common risk factors, Nevertheless the paucity of data to identify the burden of anemia indicates a lack of initiative to mitigate the problem. Hence the identification of the burden of anemia in RHD patients may be the first step towards taking an initiation in order to take measures to identify the association of anemia with blood transfusion and long term sequel.

This retrospective study is a first of its kind in finding out the prevalence of preoperative anemia in patients with RVHD either single or double valve planned for Rheumatic valve surgery in Nepal. As transfusion of blood in anemic patients helps in improving organ perfusion, its impact in increasing kidney injury, increasing morbidity and mortality cannot be negated [4] [9]. Emphasis on early identification and correction of the anemia, a preventable entity often overlooked, may help in overcoming the negative impact of preoperative anemia on patients with RVHD. Till date the burden of Rheumatic heart disease among the children at the community level has been identified through studies at various areas of the country however its association with in patients with RVHD, as a long term sequel, not uncommon has not been studied. It is also an initiative taken to categorize the severity of anemia as well as the requirement of Red blood cell transfusion in the intraoperative and postoperative period in different categories of anemia as well as the comparison of ICU length of hospital stay and mortality between the non anemic and anemic patients.

2. Materials and Methods

The retrospective study was conducted at Manmohan Cardiothoracic Vascular and Transplant center (MCVTC), a tertiary care hospital after approval from the Institutional Review Board of the Institute of Medicine. The data were collected from the software licensed under MCVTC. The sample size calculated with 95% CI and 5% margin of error was 340.

2.1. Data Collection

Data of the variables recorded from 340 RVHD patients undergoing valve replacement surgery were demographic details including the type and number of valves (Single or Double). Preoperative baseline hemoglobin level and other variable were categorized and recorded in Microsoft excel (MS office 2013, Microsoft corporation, Washington, United States) as anemic or non anemic, severity of anemia as mild, moderate or severe anemia, the number of blood transfusion received in intraoperative as well as postoperative period, reexploration, duration of ICU and hospital stay and in hospital mortality.

2.2. Data Analysis

The data entered in Microsoft excel (MS office 2013, Microsoft corporation, Washington, United States) was analysed by using the package for Social Sciences version 25.0.0 for Windows Continuous (SPSS Inc., Chicago, USA). Descriptive statistics was used to summarize demographics using mean, standard deviation. Variables described as mean with standard deviation were compared between groups by using Analysis of Variance (ANOVA). Categorical data were presented as percentage and were compared using Chi-Square test. Odd ratio was used to calculate the association of anemia on ICU, hospital stay and mortality with a p value < 0.05% considered significant.

2.3. Statement of Ethics

After approval from the institutional Review Committee (IRC), Institute of Medicine, Tribhuvan University, collection of the data from the database of the hospital was taken after approval from the hospital committee. Data of patients were kept confidential and no data was shared with unauthorized person.

3. Results

Table 1 describes the demographic, baseline hemoglobin and type of valve surgery depending upon the number of valves operated. The overall prevalence of anemia in RVHD according to the (WHO classification) [12] was 34.1%.The prevalence of mild, moderate and severe anemia were 57.7%, 39.6% and 2.5% respectively. The demographic variables in the study found out the average age study population was 43.2 yrs. There was a higher number of females in the study population 204 (60%) as compared to the males 136 (40%). The number of patients operated for single or double valve were nearly similar with 182 (53.5%) patients underwent surgery for single valve lesions while 158 (46.4%) for double valve lesions.

Table 2 describes the average RBC transfusion in patients with no anemia with 1.2 pints and a SD of (1.2 ± 1.3). While Table 3 describes the average intra operative RBC transfusion in patient who received 0.9 units with a maximum of 5 units with a standard deviation (SD) of (0.9 ±0.6) in mild anemic while it was slightly higher in moderately anemic patients who received 1.2 pints with a maximum of 4 pints and a SD of (1.23 ± 0.59).

Table 4 describes post operative period transfusion of average RBC units in patients with mild anemia which was 1.1 units with a maximum of eight units

Table 1. Patients baseline characteristics with categorization as anemia and no anemia.

Variables	No anemia (N = 224)	Mild Anemia (N = 67)	Moderate Anemia (N = 46)	Severe Anemia (N = 3)
Age (years) (Mean ± SD)	38.7 ± 13.4	43 ± 14	41.8 ± 12.7	49 ± 2.6
Male (n) %	(85) 37.9	(38) 56.7	(11) 23.9	(2) 66.6
Females (n) %	(139) 62	(29) 43.2	(35) 76	(1) 33.33
Mean haemoglobin level (gm/dl)	13.69 ± 1.1	11.8 ± 0.5	10.0 ± 0.7	7.4 ± 0.2
Single Valve Replacement (n) %	(124) 54.0	(30) 44.7	(27) 58.6	(1) 33.3
Double Valve Replacement(n) %	(100) 45.9	(37) 55.2	(19) 41.3	(2) 66.6

Table 2. Composite units of RBC transfusion in patients with no anemia.

Category	Composite RBC transfusion in units (Intraoperative and post operative)	Maximum units of RBCtransfuison
No anemia (Mean RBC units ± SD)	1.2 ± 1.3	5

Mean RBC units± SD: Mean Red Blood Cell units± Standard Deviation.

Table 3. Intraoperative RBC transfusion in mild, moderate and severe anemia.

Category of Anemia	Intraoperative blood transfusion in units	Maximum units of blood transfusion
Mild anemia (Mean RBC units ± SD)	0.9 ±0.6	5
Moderate anemia (Mean RBC units ± SD)	1.2 ± 0.5	4
Severe anemia (Mean RBC units ± SD)	none	None

Mean RBC units ± SD: Mean Red Blood Cell units ± Standard Deviation.

Table 4. Post operative RBC transfusion in mild, moderate and severe anemia.

Category of Anemia	Postoperative RBC transfusion in units	Maximum units of RBC transfuison
Mild anemia (Mean RBC units ± SD)	1.1 ± 0.8	8
Moderate anemia (Mean RBC units ± SD)	1.1±0.6	6
Severe anemia (Mean RBC units ± SD)	1.6 ± 0.6	2

Mean ± SD: Mean ± Standard Deviation.

Table 5. Reexploration, length of ICU stay and hospital stay and mortality

Post operative Variable s	No Anemia (N = 224)	Mild Anemia (N = 67)	Moderate Anemia (N = 46)	Severe Anemia (N = 3)
Reexploration (n) %	(9) 4	(8) 11.9	(4) 8.6	(2) 66
Length of hospital stay < 7 days (n) %	(200) 89.0	(55) 82.7	(39) 84.7	(3) 100.0
Hospital stay > 10 days (n) %	(132) 58.9	(48) 71.6	(29) 63.0	(3) 100.0
Deaths (n) %	(12) 5.3	(8) 11.9	(4) 8.6	None

and SD of (1.1 ± 0.8). While the post operative transfusion in moderately anemic patients in the post operative period was 1.1 units with a maximum of six pints and a SD of (1.1 ± 0.6) and 1.6 units in the severely anemic patients in the post-operative period with a SD of (1.6 ± 0.6) with a maximum of two pints.

Table 5 describes the incidence of reexploration in non anemics, mild, moderate and severely anemic which were 4.0%, 11.9%,8.6% and 66.6% respectively. Length of ICU stay was less than 7 days in non anemic, mild, moderate and severe anemics were 89.0%, 82.7%, 84.7%, 100.0% respectively. Hospital length of stay more than ten days in non anemic, mild, moderate and severe anemic patients with figures of 58.9%, 71.6%, 63.0%, 100.0% respectively.

Table 6 describes the comparison between the anemic as well as the non anemic patients where the preoperative anemics had increased chance of staying in the ICU as compared to their non anemic counter parts with an odd ratio of Odds ratio of 1.57 with 95% CI (0.80 - 3.03) and a p value of 0.2. Similarly there was a significantly longer hospital stay in patients with anemia than in patients without anemia with an odds ratio of 1.6 with 95% CI (1.0 - 2.6) with a p value

Table 6. Association of anemia with ICU, hospital stay and mortality.

Post operative variable	Anemia (OR)	Anemia (CI)	P value
ICU stay > 7 days	1.5	(0.8 - 3.0)	0.23
Hospital stay > 10 days	1.6	(1.0 - 2.6)	0.04
Death	1.7	(0.72 - 4.02)	0.28

OR is Odds ratio and CI is Confidence Interval at 95.

of 0.04. The analysis of association of anemia with mortality showed that patients with preoperative anemia had increased chances of mortality than the non anemic patients with odds ratio of 1.72 with 95% CI (0.7 - 4.0).

4. Discussion

The key finding of the study was that the prevalence of anemia in our patients with Rheumatic valve disease being operated for Rheumatic valve surgery was 34.1%. As per WHO classification [12], incidence of mild, moderate and severe anemia were 57.7%, 39.6% and 2.5% respectively. A higher female anemic patients than male was seen with moderately anemic patients requiring more intraoperative and postoperative blood transfusion with a longer ICU and hospital stay compared to the anemic patients of other categories.

The prevalence of anemia found in our study is similar to the findings of multiple studies carried out in preoperative patients planned for cardiac surgery. A study [13] evaluated the prevalence of anemia in preoperative cardiac patients and found out that 36.5% of the patients were anemic according to the WHO classification [12]. Similarly another study [14] found the prevalence of anemia to be 31.0% among the cardiac patients planned for cardiac surgery. The prevalence of preoperative anemia in our study is slightly higher than that found in other studies [6] [15] where the prevalence was 26.0% and 23.9% respectively. However two separate studies [4] [5] evaluated the level of preoperative hemoglobin level in patients with a variety of cardiac lesions (CABG, CABG with valve and others) found a prevalence of 54.4% while the latter study studied the prevalence of anemia in Rheumatic Heart disease patients planned for Rheumatic valve surgery and found out a higher level of prevalence of anemia in their study population which was 51.9%. Since the population in ours was similar to the study [4] however, the difference in their prevalence and ours may be due to higher prevalence of anemia in their general population. In our study, anemia was further categorized into mild, moderate and severe where the findings were similar to the findings observed in the study [4] where the prevalence of mild anemia was more than moderate with 33.1% and 18.8% respectively.

Cardiac surgical patients receive blood transfusion intraoperatively which is mostly to prevent fall in hemodynamics due to severe anemia which can be seen in patients with prior anemia, dilutional anemia due to intraoperative fluid transfusion as well as during cardiopulmonary bypass. Our study showed that the

moderately anemic patients had a higher transfusion as compared to the other patients with a value of (1.23 ± 0.59). This finding is similar to the findings by [4], where moderately anemic patients had a higher transfusion in the postoperative period (1.13 ± 0.66), however two out of three patients in the post operative period received blood transfusion, where two patients experienced blood loss in the postoperative period and underwent reexploration. Due to small representation of the population, the impact of severe anemia in RHD patients may not to be extrapolated to the general population. Many studies [5] [6] [13] carried out in preoperative cardiac cases have failed to categorize anemia depending upon its severity while one study [4] did not find any case of severe anemia among patients with Rheumatic Heart Disease, however their study found a higher requirement of transfusion of RBC among the moderately anemic patients as compared to non anemic patients. An overall transfusion in non anemic patients in our study was (1.23 ± 1.33) units of RBC.

In the post operative period the effect of preoperative anemia and its association with post operative morbidity and mortality were studied, where anemic patients were exposed to reexploration to a greater extent than the non anemic patients, maximum being for severely anemic. It was found that patients with preoperative anemia had increased chance of staying in the ICU longer as compared to their non anemic counter parts with an odd ratio of Odds ratio of 1.57 with 95% CI (0.80 - 3.03) with a p value of 0.23. Similarly there was a significantly longer hospital stay in patients with anemia than in patients without anemia with an odds ratio of 1.60 with 95% CI (1.00 - 2.61) with a p value of 0.04. The analysis of association of anemia with mortality showed that patients with preoperative anemia had increased chance of mortality than the non anemic patients with 1.72 with 95% CI (0.72 - 4.02) as shown in Table 6. The findings in our study is similar to other study [5] where anemic patients had longer stay in ICU as compared to the non anemic (19.6%) patients in the anemic group vs (13.7%) in the anemic group with a p < 0.001, OR 1.3 (1.0 - 1.6) as well as the death in anemic patients was more than in non anemic patients (3.1%) vs (1.1%), p = 0.0005, OR 2.4 (1.2 - 4.5). Another study [6] found a tripling of the risk of death in anemic patients as compared to the non anemic patients (4.6% vs 1.5%, p < 0.0001), also an increased hospital length of stay in the anemic patients than the non anemic patients (54% vs 36.7%, p < 0.0001). Our study showed an increased risk to the outcome measures, however lacked a significant association which could be due to inclusion of a single type of cardiac surgical as compared to multiple cardiac lesions in the other studies. However a study [4] evaluated the association of preoperative anemia with post operative morbidity and mortality in Rheumatic Heart disease patients where, patients with moderate anemia had higher chances of RBC transfusion in the intraoperative and post operative period with increased mortality as compared to their non anemic counter parts. As there are very few studies addressing the association of anemia and mortality in patients with Rheumatic valve disease hence literature to support the findings

are less. A study by [16] evaluated anemia in patients undergoing valvular surgery and found out that the OR of mortality was 1.8 as compared to the non anemic patients.

5. Conclusion

Patients with anemia is common in our population due to malnutrition along with this the association of Rheumatic Heart disease with poor socioeconomic status, malnutrition and young age negatively influences the hemoglobin level. The association of anemia in Rheumatic heart disease especially valve lesion are poorly studied hence this is an initiative at an early stage, a first of its kind in our population to explore the association as well as its effect on the morbidity and mortality in these patients.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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