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Transfusion triggers and evaluation of appropriateness of blood transfusion in maxillofacial surgery patients

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ABSTRACT

The aim of this study was to assess powers of haemoglobin in determining the appropriateness of units of blood transfused in maxillofacial surgical patients and the patients socio-economic status. The haematocrit and haemoglobin concentration of one hundred patients, scheduled for elective maxillofacial surgery were determined at presentation in the hospital, pre, intra and postoperatively. Out of 100 patients, 75% of the patients had haemoglobin concentration of 10 g/dl and above while the remaining 25% had below 10 g/dl at presentation. The pre-transfusion haemoglobin concentration ranged from 8 to 12 g/dl. The hemoglobin level 24-h postoperative ranged between 7 and 13.3 g/dl. 20% of the transfusion done was unwarranted. We believed that raising the hemoglobin level of the patient with nutritional and iron supplements, lowering the transfusion trigger and target haemoglobin threshold for blood transfusion has a significant effect on the use of allogeneic blood without compromising patient outcome.

Keywords: Haemoglobin, haematocrit, blood transfusion.

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INTRODUCTION

The surgical team and the patients should be interested in the patients' blood level, expected blood loss and anticipated need for blood transfusion (Rohling et al., 1998). Blood donation should be sourced from low risk donor to avoid the transmission of HIV (during the window period), viral hepatitis A, B, C and D (McDermott, 1992; Raufa, 2000; Madjdpour and Spalyn, 2005). The current world wide Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) pandemic has emphasized the need for cautious and safer blood transfusion (Marcuci et al., 2004).

Both blood suppliers and users agree that blood is overused and often inappropriately but they differ on the extent of usage and the means to promote appropriate use (Marcuci et al., 2004). The real and perceived risks of transfusions associated with infectious diseases have necessitated the reassessment of transfusion practice (Dillinger and Anaye, 2004).

A well-defined criterion can reduce significantly the unnecessary transfusion of blood and blood products (Madjdpour and Spalyn, 2005; Dillinger and Anaye, 2004). The safety of blood is continually threatened from unknown infectious agents (Schreiber et al., 1996; Akinsete, 1998; Micklere and Longnecker, 1992). Transfusion of blood and blood products is an invaluable therapeutic measure. However, its cost and risks are of importance. Some workers reported that considerable number of these transfusion are inappropriate and unwarranted (Klein, 1999).

The screening and correction of anaemia and replacement of depleted iron stores should be a key component of preoperative management of elective surgical patients (Akinsete, 1998). However, to be able to predict the need for blood transfusion in surgical patient, it is essential to determine the haemoglobin concentration preoperatively, intraoperatively and postoperatively. The patient's haemoglobin level can often be raised by iron and vitamin supplementation without resorting to transfusion (McDermott, 1992; Levine et al., 1990).

Good laboratory practice in all aspects of haemoglobin determination; compatibility testing and component preparation, the storage and transportation of blood and

Table 1. Age and sex distribution of patients seen.

Age/years	Male		Female		Total	
	Number	%	Number	%	Number	%
0 – 9	5	7.9	9	24.3	14	14.0
10 – 19	10	15.9	3	8.1	13	13.0
20 – 29	13	20.6	9	24.3	22	22.0
30 – 39	12	19.0	5	13.5	17	17.0
40 – 49	10	15.9	6	16.2	16	16.0
50 – 59	9	14.3	3	8.1	12	12.0
60 - 69	4	6.3	2	5.4	6	6.0
Total	63	100	37	100.0	100	100.0

Table 2A. Socio-economic status of the patients based on occupation.

Class	Occupation	No. of patients	%
i	Senior public servants, professionals large scale traders, businessmen and contractors	11	11.0
ii	Intermediate grade public servants and Senior school teachers	13	13.0
iii	Junior school teachers, drivers and artisans	11	11.0
iv	Petty traders, labourers, messengers and similar grades	21	21.0
v	Unemployed, full-time house wives, students and subsistence farmers	44	44.0
Total		100	100.0

its products are essential. This study aims to define the role of haemoglobin concentration in determining the units of blood transfused in maxillofacial surgical patients and the relevance of socio-economic status of the patients to the need for transfusion.

MATERIALS AND METHODS

Haemoglobin concentrations of one hundred maxillofacial surgical patients who presented at the Maxillofacial Unit of Ahmadu Bello University Teaching Hospital, Zaria with various surgical diseases and requiring blood transfusion over a period of 16 months (July 2005 to October 2006) were determined using calorimetry method. Hospitex Calorimetry Machine, test tubes and standard solutions were used for the haemoglobin determination. Haematocit of the patients were determined with Hawksley Micro-haematocrit Reader. The results were analyzed using Microsoft Excel 2007. Socio-economic status was determined according to Oyedeji (1985).

RESULTS

There were 63 males and 37 females, a male/female ratio of 1.7:1 (Table 1). The age ranges of the patients were between 7 and 69 years with a mean of 38 years. Majority (22%) of the patients were in their 3rd decade of life (Table 1). Table 2 shows the socio-economic status of one hundred patients seen. Based on occupational status majority, 44% were in class V, 21% were in the class IV, 13% were in class II, 11% were in class III, while 11% were in class I. Based on educational status, majority, 33% were in class IV, 26% were in class II, 24% were in class I, while 17% were in class V (Table 2).

At presentation 75% of the patients had haemoglobin concentration of > 10 g/dl , while 25% of the patients had haemoglobin concentration < 10 g/dl. Eight of the patients with haemoglobin below 8 g/dl presented with malignant lesions (Table 3). Preoperatively, 74 (79.6%) of the patients had a preoperative haemoglobin concentration above 10 g/dl; while the remaining 19 (20.4%) had between 9 and 10 g/dl. No female had haemoglobin concentration greater than 14 g/dl (Table 4). The pre-operative haemoglobin levels of the patients were between 8 to 16 g/dl before (Table 4).

The pre-transfusion haemoglobin concentration ranged from 5 to 12 g/dl with a mean of 8.3 g/dl. The pre-transfusion hemoglobin of 10 (11.8%), 33 (38.8%), 25 (29.4%) and 17 (20.0%) ranged from 5-6 g/dl, 7-8 g/dl, 9-10 g/dl and 11-12 g/dl respectively (Figure 1).

24 hours post-operatively, the hemoglobin level ranged between 7 and 13.3 g/dl with a mean of 9.7 g/dl. Of the ninety-three patients that had surgery, 12 (12.9%) had a postoperative haemoglobin concentration of 7-9 g/dl, 53 (57.1%) had 9-10 g/dl, 24 (25.8%) had a range of 11 – 12 g/dl, 4 (4.3%) had 13–14 g/dl.

DISCUSSION

Patient's age, surgical procedure, co-morbid illness, predicted blood loss and the cause of anaemia as well as the haemoglobin level should be considered before transfusion (Levine et al., 1990; Baele and Vander

Table 2B. Socio-economic status of the patients based on education level.

Class	Education level	No. of patients	%
i	University graduates or equivalents	24	24.0
ii	School certificate with other professional training	26	26.0
iii	School certificate or grade II teachers and equivalents.	13	13.0
iv	Modern three & primary school certificates	20	20.0
v	No formal education, Illiterate	17	17.0
Total		100	100.0

Table 3. Distribution of haemotocrit/hemoglobin at presentation.

Haematocrit by % / haemoglobin in g/dl	No. of patient				Total	
	Male	Avg.	Female	Avg.	Total	Avg.
15 – 19 (5 – 6)	3	0.6	1	0.2	4	0.8
20 – 24 (7 – 8)	4	0.8	3	0.6	7	1.4
25 – 29 (9 - 10)	8	1.6	6	1.2	14	2.8
30 – 34 (11 – 12)	18	3.6	16	3.0	33	6.6
35 – 39 (13 – 14)	20	4.0	10	2.0	30	6.0
40 – 44 (15 – 16)	6	1.2	2	0.4	8	1.6
45 – 49 (17 – 18)	4	0.8	0	0	4	0.8
Total	63	12.6	37	7.4	100	20.0

Table 4. Distribution of preoperative haemotocrit / hemoglobin.

Haematocrit by % / hemoglobin (g/dl)	No. of patients				Total	%
	Male	%	Female	%		
25 – 30 (8.0 – 9.9)	8	13.6	11	32.4	19	20.4
31 – 36 (10.0 – 11.9)	22	39.3	15	44.1	37	39.8
37 – 42 (12.0 – 13.9)	18	30.5	8	23.5	26	28.0
43 – 48 (14.0 – 15.9)	11	18.6	0	0	11	11.8
Total	59	100.0	34	100.0	93	100.0

Linder, 2002). Nevertheless in surgical settings haemoglobin concentration of 7 g/dl is used as a threshold for transfusion (Gallagher and Milliken, 1997). The transfusion threshold of 7 g/dl was used in the study. Oxygen delivery to the tissue usually depends on the haemoglobin concentration and the cardiac output.

When the haemoglobin falls below 7 g/dl; the compensatory mechanism of cardiac output fails, thus necessitating blood transfusion (Murthy, 2002). According to Friedman et al. (1980) factors which precipitated blood transfusion during the preoperative period included a low or falling haemoglobin concentration, and the clinical signs and symptoms of anaemia. The policy in our hospital stipulates a minimum of 10 g/dl haemoglobin concentration for patient undergoing elective surgery under general anaesthesia. Globally, the trend is between 8 and 10 g/dl (Gallagher and Milliken, 1997). We utilized the same support and ceiling haemoglobin level for regulating blood transfusion to men and women. Malignant cells depress bone narrow thereby reducing haemopoesis, therefore cancer patients usually have low haemoglobin level (Murthy, 2002).

Evaluation of transfusion in a general hospital in the United States demonstrated that 40% of the procedures were inappropriate (Mozes et al., 1989). In contrast to this study which showed that 20% of the transfusion done were unnecessary (Figure 1). The difference may be attributed to the fact that this study centered on surgical patients while the study by Mozes et al (1989) included both surgical and non-surgical patients.

This study observed that the mean haemoglobin concentration for men aged 16 to 69 years was 14.3 g/dl (Table 4) while that of women was 12.3 g/dl, this is in close agreement with Friedman et al. (1980), that recorded a mean haemoglobin concentration of men aged 18 to 79 as 15.7g/dl and for women in the same age range as 14.3 g/dl environment. The difference could be attributed to the low socio-economic status of the

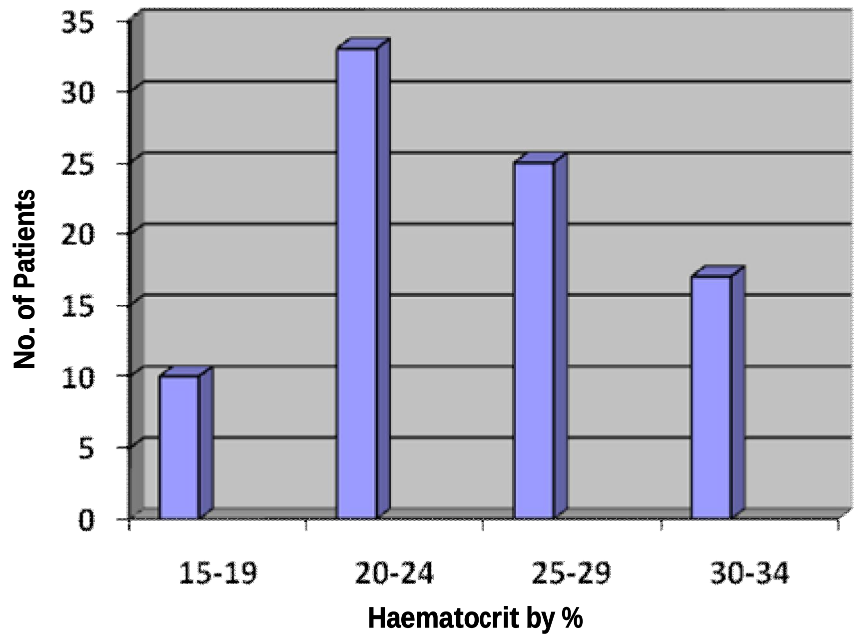

Figure 1. Distribution of haematocrit value just before transfusion.

patients in our study centre. Significant proportion of the patients were in the lower social class (IV & V) using Oyedeji's (1985) classification (Table 2). On the average the mean haematocrit of men is higher than that of women. This could be as a result of the effect of the androgenic hormone in men, which enhances haemopoiesis (Carson et al., 2002). Also, post-pubertal women lose blood with each menstrual period, and this represents a complete loss of iron from the body, thus making women need more iron supplements more than men.

In this study, 25% of our patients scheduled for elective maxillofacial surgery were anaemic (hamatocrit less than 30%) (Table 1). Faris et al. (1999) in their study also reported that 25% of patients for elective orthopaedic surgery were anaemic. Prompt initiation of anaemic corrective measures is therefore essential in these patients management. Ferrous sulphate, folic acid, ascorbic acid and high protein diet were used.

In this study, patients with haemoglobin concentration ranging from 10 to 12 g/dl had a high risk for requiring allogeneic transfusion and benefited more from preoperative iron supplementation. This is similar to Hébert et al.'s (1997) study who noted that patients with haemoglobin of concentration of between 10 and 13 g/dl have a high risk of requiring allogeneic transfusion in the immediate preoperative period.

Protein is essential in the correction of anaemia as it supplies the amino acids, which are the building blocks in the formation of the structure of the red blood cells (Friedman, 1979). Iron is essential in the formation of haemoglobin, also in order to make sufficient numbers of red cells, vitamin B_{12} and folic acid are required (Lundsgaard – Hansen, 1996).

Few patients have signs and symptoms of anaemia when the haemoglobin concentration is greater than 7 to 8 g/dl (Hébert et al., 1997; Friedman, 1979; Lundsgaard – Hansen, 1996; Ukaejifor, 1996; Vincent et al, 2002). Weakness occurs when the haemoglobin drop to 6 g/dl and dyspnea and congestive heart failure supervenes at haemoglobin of 2.0 to 2.5 g/dl (Lundsgaard – Hansen, 1996; Ukaejifor, 1996). In this study, signs and symptoms of anaemia were manifested when the haemoglobin concentration was less than 7 g/dl, the most frequent being weakness (45.0%), palpitations (29.0%) and dyspnea (26.0%).

Conclusion

Haemotocrit have been proven to be the key component of transfusion trigger. The outcome of this study showed that to improve blood ordering system for elective maxillofacial surgical procedures, it is essential to lower the transfusion triggers and provide alternatives to allogeneic blood transfusion through the use of iron supplements. Periodically, it is necessary to audit the blood ordering systems in our teaching hospitals to improve blood usage.

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