Original Article

LOW HAEMOGLOBIN LEVEL AS POSITIVE PREDICTOR FOR FUNCTIONAL MATURATION OF NATIVE ARTERIOVENOUS FISTULA.

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ABSTRACT:

OBJECTIVES: To assess the impact of low haemoglobin (Hb) concentration on maturation of arteriovenous fistula (AVF).

MATERIALS AND METHODS: This is a prospective observational study conducted in the Department of Vascular Surgery Combined Military Hospital Peshawar and Lahore from January 2015 to March 2016. A total of 96 patients fulfilling the inclusion criteria were included in the study. Based on their Hb levels, patients were divided into two groups; group A with Hb less than 8 g/dL (n=50) and group B with Hb more than 8 g/dL (n=46). All patients were assessed for maturation of AVF as per Kidney Disease Outcome Quality Initiative (KDOQI) guidelines.

RESULTS: In group A, 92% (n=46) AVFs became functionally mature, whereas maturation rate in group B was 67.3% (n=31), with a P value of 0.004 between the two groups.

CONCLUSION: Low level of Hb has statistically significant positive impact on functional maturation of AVF.

RUNNING TITLE: Low Hemoglobin as predictor for fistula maturation

KEYWORDS: AVF, haemoglobin, fistula maturation

INTRODUCTION:

All patients with end stage renal disease (ESRD) require haemodialysis or renal transplant. For haemodialysis, a good vascular access is mandatory and native AVF is the best answer to that. All native AVF needs time to functionally mature before they can be used for haemodialysis[1-3]. This maturation is affected by a vast array of factors like age, sex, smoking, diabetes, hypertension, obesity, hyperthyroidism and haemoglobin levels[4,5].
ESRD results in decreased production of erythropoietin which causes anaemia. The European Best Practice Guidelines and KDOQI guidelines recommend Hb levels of more than 11g/dL for improved quality of life[6,7]. Such Haemoglobin levels improve cerebral and cardiac functions and also decrease the length of hospital stay[8-10]. On the contrary, studies suggest that high Hb levels also increase the chances of failure of maturation of AVF due to increased risk of thrombosis[11]. Our study is categorically designed to evaluate the impact of level of Haemoglobin on functional maturation of native AVF.

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PATIENTS AND METHODS:

All consecutive patients with ESRD requiring renal replacement therapy and opting for a brachiocephalic AVF between January 2015 and March 2016 were included in this study. Inclusion criteria were age less than 60 years, on haemodialysis for more than four weeks, non-smoker, well controlled diabetes (150-180 mg/dL fasting), well controlled Hypertension (Systolic 120-140 mmHg and Diastolic between 80 and 90 mmHg) and duplex scan showing a preoperative venous diameter of >2.5 mm and no atheroma in arteries. All patients had their Haemoglobin level checked preoperatively. Patients in whom a distal fistula was created in forearm or patients requiring brachiobasilic fistula were excluded from the study. Included patients were divided into two groups depending upon their Haemoglobin levels. Group A included patients with Hb of less than 8 g/dL and Group B with 8 g/dL or more.

All patients underwent standard Brachiocephalic AVF in cubital fossa by a consultant vascular surgeon who had a minimum of 5 years experience of doing such procedures under local anaesthesia. All patients were given oral antibiotics and analgesia on discharge. They were provided written instructions about the care of the AVF and were explained hand and forearm exercises.

All patients were regularly followed up in clinic at 2 weeks, 4 weeks, 2 months and 3 months. A functionally mature AVF is defined as per Kidney Disease Outcome Quality Initiative (KDOQI) guidelines as one that can be easily cannulated and has at least six successful consecutive dialysis sessions. The time taken for the fistula to be functionally mature was recorded.

The data was analysed using Statistical Package for Social Sciences (SPSS) version 20. The numerical outcomes e.g. age was calculated as mean. Gender was recorded as frequency and percentage. Chi Square test was applied to assess the association between two groups. Logistic regression analysis was also done to assess the effect of age, gender, diabetes mellitus, hypertension and low Hb on fistula failure rates. The results were considered statistically significant if the P value was found to be less than or equal to 0.05.

RESULTS:

In this study, a total of 96 patients fulfilling the inclusion criteria were included. The minimum age of patients was 26 years and maximum age was 59 years with mean age of 40.1 years. Out of 96 cases, 79 (82.3%) were males and 17 (17.7%) were females. Male to female ratio was 4.6:1 (Table 1).

Out of the total 96 patients, 77 (80.2%) had functionally mature fistulae. Of these, 46 patients belong to Group A and 31 were in Group B. Hence the maturation rate was 92% in patients with Hb less than 8 g/dL when compared to the patients in Group B who had a maturation rate of 67.3% (P-value = 0.004).

Logistic regression analysis of the variables was also done. The effect of age, gender, hypertension, diabetes mellitus and low Hb was assessed on AVF failure. Only low Hb had statistically significant effect on fistula failure rate with a P value of <0.003 (Table 2).

Table 1: Group comparison of patient's characteristics.

	GROUP A (Hb< 8g/dL)	GROUP B (Hb => 8g/dL)	P-Value
Average Age (in Years)	40.3	39.9	0.30
Gender ratio (M:F)	4.8:1	4.4:1	0.38
Diabetics	64%	62%	0.27
Hypertensive	29%	30%	0.14
Average Venous diameter (in mm)	2.60	2.65	0.33
Average Maturation time (in days)	44 +/- SD 2	43 +/- SD 3	0.36
Maturation rate	92%	67.3%	0.004

Table 2: Logistic regression analysis of variables.

Variable	95% Confidence Interval		Odd Ratio	P value
	Lower	Upper		
Age	0.652	1.221	0.782	0.717
Gender	0.484	1.573	0.625	0.691
Diabetes	0.856	1.321	0.878	0.739
Hypertension	0.357	1.871	0.934	0.425
Low Hb	4.458	49.624	19.541	<0.003

There were 18 (18.75%) patients who developed superficial surgical site infection which resolved with oral antibiotics. Six (6.2%) patients had to be re-explored within first 24 hours due to bleeding from the operation site. In all such patients bleeding was from minor small vessels and there was no anastomotic leakage or disruption. Four (4.1%) patients had swelling at the operation site and were diagnosed as a case of non-expanding hematoma. All these patients had spontaneous resolution and uneventful recovery afterwards.

DISCUSSION:

A good vascular access for haemodialysis is paramount in patients with ESRD[12,13]. Native AVF is considered as the best vascular conduit for haemodialysis[3,14-16]. Native AVF needs time to functionally mature and a functionally mature AVF is defined as per KDOQI guidelinesas one that can be easily cannulated and has at least six successful consecutive dialysis sessions[7]. However not all the AVFs mature and the failure rate is estimated as 20-50% due to multiple patient related factors[1,2,17]. Factors such as age more than 60 years, female gender, diabetes, hypertension, thrombophilia, smoking, hyperparathyroidism, small diameters of vein and arteries and high Hemoglobin level; all exert a negative impact on functional maturation of the AVF[4,5]. Conflicts are there between studies about the impact of these factors on functional maturation of AVF[18,19]. In order to reduce the bias we set a strict inclusive criteria to control these patient related factors so that their effect on our results are minimized and we can concentrate primarily on the effect of Hb levels on maturation of AVF.

In our study 80.2% of the total AVF created became functionally mature. Group analysis revealed that the maturation rate in group A (with Hb less than 8g/dL) was 92% when compared to Group B where it stood at 67.3%. These results are comparable with study conducted by Bashar K et al who reported that the most statistically significant predictor of functional maturation of laboratory variables was Haemoglobin and lower Hb was associated with higher maturation rate of arteriovenous access[20]. However there are studies which contradict and suggested that lower Hb is associated with higher failure rates. Such conflicting results were reported by M. Khawanin Zadeh et al in their study, where low Haemoglobin level (< 8 g/dL) decreased maturation rate of AVF and resulted in higher failure rate[21]. Garrancho et al in 2005 also reported higher vascular access failure with low Hb and suggested that patients should benefit from anemia correction without incurring any significant risk of failure of fistula[22].

CONCLUSION:

Functional maturation rate of AVF is a complex process and is affected by many factors. We found that Hb level of less than 8 g/dl has positive impact on functional maturation rate of AVF. However In light of conflicting evidence and lack of studies with large volume of patient, we recommend multicentre randomized control trials to see the impact of Haemoglobin level on functional maturation rate of AVF.

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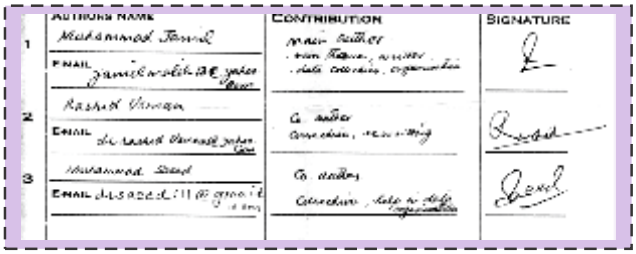

WEALTH CONVERTS A STRANGE LAND INTO HOMELAND AND POVERTY TURNS A NATIVE PLACE INTO A STRANGE LAND

Hazrat Ali (Karmulha Wajhay)