

# ESTIMATION OF RECIRCULATION IN ARTERIO- VENOUS FISTULA AMONG HAEMODIALYSIS PATIENTS

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## Abstract:

*Recirculation in haemodialysis patients is an important factor as it is a correctable cause of under dialysis. This study was a cross sectional study done in the department of Nephrology Dhaka Medical College and hospital during the period Sept 2010 to Oct 2011 with a view to estimate recirculation in AV fistula among the Haemodialysis patients. This study used two needle urea based method for estimation of recirculation. Total 118 patients were included in this study.*

## Introduction

Recirculation in Haemodialysis patients is an important issue as it is an important cause of inadequate dialysis. Recirculation is defined as the volume of blood that has crossed the dialyzer and is recirculated directly through the extracorporeal circuit again rather than returning to the systemic circulation. Different factors are responsible for recirculation for example inappropriate needle placement either misdirection or close proximity between needles, venous stenosis and low fistula blood flow. Recirculation can be measured by different methods, NFK-DOQI guidelines recommend that any recirculation more than 10% by urea based method and more than 5% by ultrasound dilution method should be investigated extensively to identify the causes responsible for it. Though different guidelines created with the goal of increasing fistula use thereby appropriate surveillance for the vascular access becomes essential<sup>1</sup> because all the permanent access are subjected to complications associated low flow, failure of maturation, venous stenosis and thrombosis<sup>2</sup>. Moreover states of high flow that can result in high output heart failure. By measuring recirculation we can achieve this goal. Some clinical guidelines also suggested for regular monitoring of HD vascular access by different methods one of them is vascular access recirculation cause it is an important tool for early detection and correction of

access dysfunction<sup>3</sup>. In addition access blood flow can also be measured by double recirculation or induced recirculation<sup>4</sup>.

Thus screening for recirculation is important to prevent under dialysis<sup>5</sup>.

In a nutshell according to some guideline the test verifies the correct needle position in patients with arteriovenous fistula (AVF) and also ensures the effective function of central venous catheters and in clinically uncomplicated native fistulae, a normal recirculation test could avoid more complex procedures like blood flow measure or angiography.<sup>8</sup>

The burden of chronic kidney disease (CKD) is increasing day by day, contributed by increased incidence and survival of patients of diabetes and hypertension and stunning improvement of renal replacement therapy like renal transplant and dialysis. With this advent of medical science, a developing country like Bangladesh has to take an extra burden of cost and health care facility to provide care to End Stage Renal Disease (ESRD) patients. Due to cost restrain, many ESRD patients in our country are forced to compromise dialysis quality by receiving only 8 hours dialysis per week and repeated use of dialyzer. All of these factors are responsible for underdialysis. Thus this study intended to the

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estimation of recirculation by two needle urea based method, among the patients who were getting haemodialysis through arterio-venous fistula (A-V fistula) with a objective of estimation of recirculation with a view to deliver maximum benefit to our haemodialysis patient in future with our limited resources.

#### Materials and methods:

This study was a cross sectional study carried out in the Department of Nephrology, Dhaka Medical College and Hospital, during Sept 2010 to Oct 2011. Patients with End Stage Renal Disease (ESRD) who were getting haemodialysis through arterio-venous fistula for more than three months were the study population.

We considered every available ESRD patient on Haemodialysis through A-V fistula at the Department of Nephrology, Dhaka Medical College. Total 118 patients were included as per selection criteria.

#### Sampling method:

Sampling was done by purposive sampling. It was followed as per inclusion and exclusion criteria. Selection criteria: Inclusion criteria: Patients undergoing haemodialysis by arterio-venous fistula for more than three months. Age: More than 18 yrs. Sex: Both sex. Those who gave consent. Exclusion criteria: Patients undergoing haemodialysis by temporary access or permanent catheter was excluded.

#### Methods of data collection

All patients with ESRD on maintenance Haemodialysis (HD) through fistula for 3 months or more from September 2010 to October 2011 were invited to participate. In our center, no patient had A-V graft. Prior to any procedure, informed written consent was taken from all subjects. All of the participants had the autonomy to refuse the study at any time during the study period.

Hemodialysis (HD) was performed for 4 hours, two times a week, using triacetate hollow fiber dialyzer Nipro SUREFLUX-130N, Japan with HD machine Fresenius medical care type 4008B, Germany with bicarbonate-based dialysate at a delivered bicarbonate concentration of 35m Eq/ L. Blood flow was maintained at 250-350 ml/ min and the dialysate flow rate at 500ml/ min.

For the measurement of recirculation we used urea based two needle technique.

Then the degree of recirculation were measured with Urea based two needle method from the following

formula: Percent recirculation =  $\frac{([P - A] \div [P - V]) \times 100}{[P - A] \div [P - V]}$  [Where P, A, and V refer to the urea concentrations in the peripheral blood, predialyzer arterial line, and postdialyzer venous circuit, respectively]

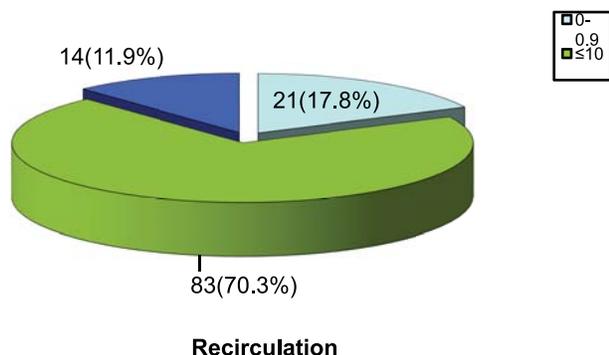
Based on percent recirculation all patients were divided into 3 groups: Group I: 0-9% recirculation. [Most well functioning fistula] Group II: 1-10% recirculation. [Within acceptable limit of recirculation] Group III: >10% recirculation. [Above the acceptable limit of recirculation].

#### Result:

A total of 118 patients were included in the study. Maximum of the patients were found in the age group of three groups 41-50 years, which was 11(52.4%) in group I and 25(30.1%) in group II and 6(42.9%) in group III. The mean age was found 43.81±11.95 years in group I and 43.58±12.89 years in group II and 44.36±11.45 years in group III. The mean age difference was not statistically significant ( $p > 0.05$ ) among the three groups. Male was found 18(85.7%) in group I, 67(80.7%) in group II and 7(50.0%) in group III. Female was found 3(14.3%) in group I, 16(19.3%) in group II and 7(50.0%) in group III. The difference was statistically significant ( $p < 0.023$ ) regarding the gender incidence of the patients. Male female ratio was 2.5:1. Among the cause of ESRD, DM was found 9(42.9%) in group I, 39(47.0%) in group II and 4(28.6%) in group III. GN was found 7(33.3%) in group I, 25(30.1%) in group II and 3(21.4%) in group III. Hypertension was found 4(19.0%) in group I, 3(3.6%) in group II and 2(14.3%) in group III. ADPKD and obstructive nephropathy was not found in group I, 3(3.6%) in group II and 2(14.3%) in group III. In group I, group II and group III, 1(4.8%), 10(12.0%) and 1(7.1%) were unknown etiology. There difference was not statistically significant ( $p > 0.05$ ) among three groups in chi square test. Radiocephalic was found 19(90.5%) in group I, 66(79.5%) in group II and 9(64.3%) in group III. Brachiocephalic was found 2(9.5%) in group I, 17(20.5%) in group II and 5(35.7%) in group III. The difference was not statistically significant ( $p > 0.05$ ) among the three groups in chi square test. The mean percent recirculation was found 0.09±0.27 % with range from 0 to 0.9 % in group I, 4.15±2.56% with range from 1 to 9 % in group II, 21.29±15.07 % with range from 11 to 66 % in group III and mean recirculation 8.1±5.5 % with range from 0 to 66 % in the whole study patients. The mean difference was statistically significant ( $p < 0.001$ ) between three groups in ANOVA test.

**Table-I**  
The percent recirculation of the study patients (n=118).

	Total	Group I(n=21)	Group II(n=83)	Group III(n=14)	P value
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD	
Percent of recirculation (%)	8.1±5.5	0.09±0.27	4.15±2.56	21.29±15.07	0.001 <sup>s</sup>
Range (min-max)	(0 - 66)	(0 -0.9)	(1 -9)	(11 -66)	



Sky blue:0-0.9%,Green:1-10%,Blue:>10% recirculation

**Fig.-5:** Pie diagram showing the recirculation of the study patients

**Discussion**

Recirculation is an important issue in haemodialysis to prevent underdialysis.<sup>2</sup>

In current study, it was found that 82.7% had recirculation and among them 11.9% had unacceptable range of recirculation that is more than 10% recirculation. The mean recirculation was 8.1±5.5 with a range 0-66%. Though the group I and II had acceptable range of recirculation the group III had significant level of increased percent recirculation.

According to Kumar it is a correctable cause of underdialysis.<sup>5</sup> In a study Burr showed that recirculation should be 0% in a well functioning peripheral vascular access, even with urea based method.<sup>9</sup> NFK-DOQI guidelines recommend extensive investigations for any recirculation more than 10% by two needle urea based method<sup>1</sup>. In this current study it was observed that 17.8% and 82.2% patients almost without recirculation and with recirculation respectively, which is consistent with Salami et al in 2008 where the investigators showed 80.4% had patient had recirculation. On the other hand, Beladi Mousavi et al in 2010 showed 17.0% and Abdollahi et al in 2010 found 15.0%, which may be due to their health professional are well trained as well as their availability of modern facilities in their hospital.<sup>12,16</sup> In this current series it was observed that the mean percent recirculation was

8.1±5.5% with range from 0 to 66 % in the whole study patients. Whereas in group I, the mean percent recirculation was 0.09±0.27 % with range from 0 to 0.9 %, in group II it was 4.15±2.56% with range from 1 to 9 % in group II and in group III it was 21.29±15.07 % with range from 11 to 66 %, which was significantly higher in group III. Vanstone et al in 1995, Salimi et al in 2008 and Rafique et al in 2007 found the mean percent recirculation were 6.4%, 8.75% and 9.55±5.5% respectively.<sup>13,14,15</sup> The mean of which are closely resembled with the current study. Though the mean were within acceptable range group III had an unacceptable range of recirculation. According to one study recirculation can reach up to 15- 70 % if the needles are misdirected and in presence of Stenosis in fistula<sup>11</sup>. In another study by Atapatour show recirculation might increase to 17-60% if improper arterial and venous needles occur.<sup>10</sup> Beladi in 2010 showed that recirculation and be increased by low ejection fraction, low fistula blood flow, increase duration of fistula use and relatively less wait after fistula construction.<sup>12</sup>

**Limitation**

The study was a single center study conducted over a short duration.

**Conclusion**

This cross sectional study was carried to determined the A-V fistula recirculation among the HD patient . the mean recirculation was 8.1±5.5 with a range 0-66%. According to this study recirculation is a common finding in haemodialysis patients and 11.9% had an unacceptable range of recirculation.

**Recommendation**

A large multicenter study is demanded to verify the existence of such high percentage of recirculation found in the present study and to evaluate the risk factors associated with recirculation found in this study as well as other risk factors ascertain in large study group.

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