

## **Study on Biochemical Parameters with End Stage Renal Disease (ESRD) and Interrelated Diseases in Relation to Hemodialysis in Bangladesh**

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### **Original Research Article**

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**Abstract:** The present study was carried out to determine the biochemical parameters such as serum creatinine and urea level among the patients at pre and post hemodialysis (HD). A comparative study was also carried out among the patient at different age and sex undergoing dialysis treatment. The different interrelated diseases with end stage renal diseases (ESRD) patients were also studied. A total 133 patients were subjected for the study from the dialysis unit of Gonoshasthaya Nagar Hospital, Dhaka. The highest number of ESRD patient undergoing HD was reported as 50.4% at the age group 40- 59 years while the lowest number was reported as 16.5% at the age group of  $\geq 60$  years. The distribution of ESRD was reported as 63.15% among male patients and 36.84% among female patients. The dialysis was effective to reduce 56% serum creatinine level and 62% of serum urea level in post dialysis state. Study showed that hypertension followed by diabetes mellitus and HCV was the most common interrelated diseases to ESRD. There was a significant increase of diabetes mellitus patient with the increment of age in both sex. A significant difference was also recorded in age-wise distribution of HCV in both male and female, where the HCV was higher at early ( $<39$  years) and old age ( $\geq 60$  years) at male. On the other hand, for female HCV was higher at mid age (40-59 years) but lower at early and old age. However, Asthma and hypothyroidism was not significantly correlated to all age groups between male and female. The study revealed that awareness program and proper monitoring of interrelated diseases can reduce the risk of chronic kidney disease. Initiative to reduce the cost burden of treatment will help the patients to ensure proper treatment.

**Keywords:** ESRD, Interrelated diseases, Hemodialysis, Biochemical parameter.

## **INTRODUCTION**

Kidneys are pair of excretory organ lies behind the peritoneum, one on each side of vertebral column. It is one of the most vital organ, performs some of the critical functions necessary for survival. The function of kidney includes filtering the wastes from body. When glomerular filtration rate (GFR) decreases to 50% of normal, the plasma solutes such as creatinine and urea show a significant increase by doubling that of normal value. It is reported when GFR drops to 50%; the plasma creatinine reaches 1.2 mg/dL from the baseline value of 0.6 mg/dL, it represents halving of the functional nephron mass, although it is still within the defined reference range [1]. When kidneys fail, it means they have stopped working well enough to survive without dialysis or a kidney transplant. Kidney failure, also called end stage renal disease (ESRD), is the last stage of chronic kidney disease (CKD) in which the kidney can no longer function well enough to meet the needs of daily life. People with diabetes or

hypertension have the highest risk of developing ESRD. In chronic or end stage kidney failure, kidneys do not work better and need dialysis for the rest of life. In some cases of acute kidney failure, dialysis may only be needed for a short time until the kidneys get better.

In Bangladesh about 20 million people are suffering from chronic renal diseases out of which 40,000 die of kidney failure in the country every year [2]. Percentage of the renal cause of death according to sex distribution, female - 39.25%, Male - 60.75% by Mortality profile of Bangladesh in 2011 [3].

Dialysis is a treatment that does some of the functions which are done by healthy kidneys. There are two types of dialysis – Hemodialysis (HD) and peritoneal dialysis. In Hemodialysis- an artificial kidney (Hemodialysis) is used to remove waste and extra chemicals and fluid from blood. This is done by minor surgery to arm or leg. Usually each Hemodialysis

treatment lasts about four hours and is done three times per week. In peritoneal dialysis blood is cleaned inside the body. During this treatment abdominal area (called the peritoneal cavity) is slowly filled with dialysate through the catheter. Extra fluid and waste products are drawn out of blood and into the dialysate. Hemodialysis and peritoneal dialysis have been done since the mid 1940's. Dialysis, as a regular treatment, was begun in 1960 and is now a standard treatment all around the world. Thousands of patients have been helped by these treatments.

To assess the degree of kidney functions, biochemical parameters in the body such as serum creatinine, urea and RBC count along with the patient's age group plays important role [4]. Kidney failure leads to the gathering of urea, creatinine and other chemicals in the blood. Also there are interrelated diseases with CKD such as hypertension, diabetes mellitus, asthma, hypothyroidism. Another complication the ESRD patients experienced due to renal failure is anemia. Because when the GFR falls below 40 ml per minute, the erythropoietin production is insufficient to stimulate adequate RBC production by bone marrow [5]. Erythropoietin is a hormone which is the major humoral regulator of red blood cell (RBC). Reports also shows correlation between hepatitis C virus (HCV) infection with Hb, anemia and diabetes mellitus [6-9].

However, factors affecting creatinine and urea concentrations are age, sex, diet, ethnicity, body weight and habits etc. Baseline data on these factors are important to calculate kidney functions more precisely. In case of ESRD many patient cannot transplant their kidney due to low socioeconomic condition, body fitness and unavailable donor. So dialysis is the available choice of treatment. In Bangladesh, baseline data on patients undergoing HD are scarce or unavailable. There is no study so far reported on either efficacy of dialysis or status of serum creatinine, urea and HbsAg at pre and post dialysis condition in this country. Also there is no evident data available on relationship between age, sex, various biochemical parameters and related diseases too. The present study was carried out to determine the serum creatinine and urea level among the patients at pre and post Hemodialysis condition. A comparative study was also carried out among the patient at different age group and sex undergoing Hemodialysis treatment and the status of other interrelated diseases.

## MATERIALS AND METHODS

### Patients and sample collection

A cross sectional type of analytical study was conducted on 133 patients with ESRD requiring dialysis. In the present study samples were collected from the dialysis unit of Gonoshasthaya Samaj Vittik Medical College Hospital (GSVMC), Dhaka during the

period of July, 2017 to Januray, 2018. A patient history that is name, age, sex, occupation was recorded according to record book in data collection form. After dividing into different age groups samples were compared into the dialysis treatment taken and were identified as male or female dialytic patient in the data collection form.

### Group of the samples

Samples were divided into three age groups such as: Group A (age <39 years), Group B (age 40-59 years), Group C (age ≥ 60 years).

### Blood sample collection

After all precaution the blood samples (5 ml) were collected in the test tube from these patients for the analysis of Hb%, serum urea and creatinine at pre and post hemodialysis. Sample containing test tube were tagged which was bearing code number for subsequent identification. Immediately after collection blood samples were centrifuged individually for 10 minutes to separate serum and stored at -20° C for analysis.

### Estimation of serum urea

Serum urea was hydrolyzed in the presence of water and urease to produce ammonia and carbon dioxide. In a modified Berthelot reaction [10] the ammonium ions react with hypochlorite and salicylate to form a green dye. The absorbance was directly proportional to the serum urea. Absorbance was measured by fully automated Humilyzer autoanalyzer (Model- 3000) at 546 nm for the determination of serum urea.

### Estimation of serum creatinine

Creatinine in serum sample reacted with picric acid in an alkaline solution such as alkaline picrate of the reagent and developed an orange color complex. The quantity of creatinine in the test serum sample was calculated against the intensity of the color developed during the fixed time. The intensity of the color was measured using fully automated Humilyzer autoanalyzer (Model- 3000) for the determination of serum creatinine.

### Other diseases

Hypertension, Diabetes mellitus, HbsAg, Asthma, Hepatitis C virus (HCV), Hypothyroidism were analyzed by using diagnostic kits.

### Statistical analysis

Data were analyzed using SPSS statistical packages (version 23.0).

## RESULTS AND DISCUSSION

The last stage of chronic kidney disease (CKD) when the kidneys are no longer in a position to

function is referred to as end stage renal diseases (ESRD). In our current study a total number of 133 patients were analyzed. These patients were randomly selected who attended for hemodialysis. The biochemical parameters of the patients such as serum urea, serum creatinine level was determined before (pre) and after (post) undergoing dialysis.

In the present study, the highest number of ESRD patients undergoing hemodialysis (HD) (50.4%) was reported at the age group 40- 59 years (Table 1). At

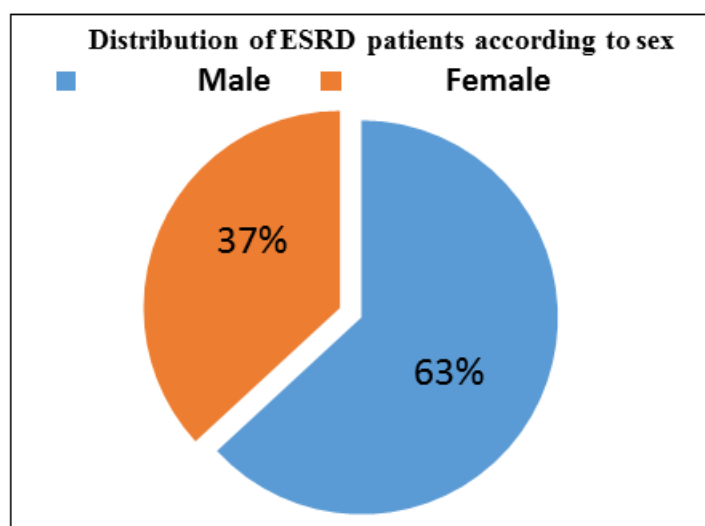
the same time the lowest number ESRD patients (16.5%) was reported at the age group  $\geq 60$  years (Table-1). However, the patients was found 33.1% at the age group of  $<39$  years (Table-1). Several reasons might be attributed to explain current findings because recent studies reported that old people with CKD have more chances for dying than the chances for undergoing dialysis [11]. In Bangladesh the socio-economic condition might be another reason that elderly patients may refuse long-term dialysis because it is very expensive and there is no social security for the poor.

**Table-1: Distribution of the respondent by age**

Age group (year)	Frequency	Percentage
$< 39$	44	33.1
40- 59	67	50.4
$\geq 60$	22	16.5
Total= 133		

The distribution of ESRD patients according to sex the male patients were higher (63.15%) than that of

female (36.84%) in the present study (Figure-1). Similar findings also reported by Amin *et al.*, [12].



**Fig-1: Distribution of ESRD patients according to sex**

A high value of serum creatinine ( $10.296 \pm 2.94$ ) was reported for the patients before undergoing hemodialysis in the present study. However, a significant reduction of serum creatinine value was recorded for the patients after hemodialysis (Table-2). After dialysis the serum creatinine level reduced to

$4.488 \pm 1.485$  mg/dl (approx. 56% reduction). Statistical analysis shows that t value was 32.412 and p value was 0.00 after paired sample t test of serum creatinine. The results of the serum creatinine of pre and post hemodialysis patient are statistically significant (Table-2).

**Table-2: Distribution of the respondent by blood serum creatinine before and after hemodialysis (paired t test)**

Serum Creatinine	Serum Creatinine levels (mg/dl)			
	Pre hemodialysis	Post hemodialysis	t value	P value
	$10.296 \pm 2.94$	$4.488 \pm 1.485$	32.412	0.00

In the present study, the serum urea level in ESRD patients at pre-dialysis condition serum urea level was significantly higher than normal range (20-40 mg/dl). In pre-dialysis condition the mean serum urea

level was  $190.926 \pm 60.58$  mg/dl (Table-3). After dialysis a clear reduction in serum urea level was recorded ( $71.452 \pm 32.684$  mg/dl). Data represents almost 62% reduction in post dialysis state (Table-3).

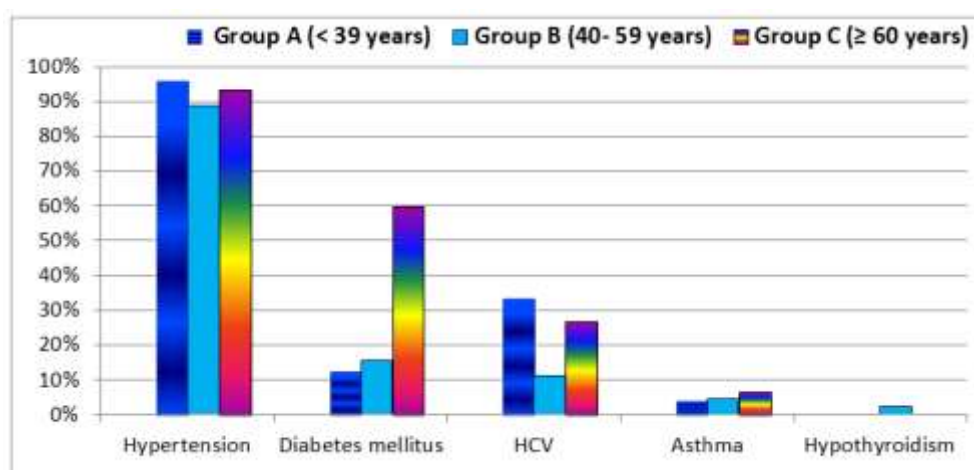
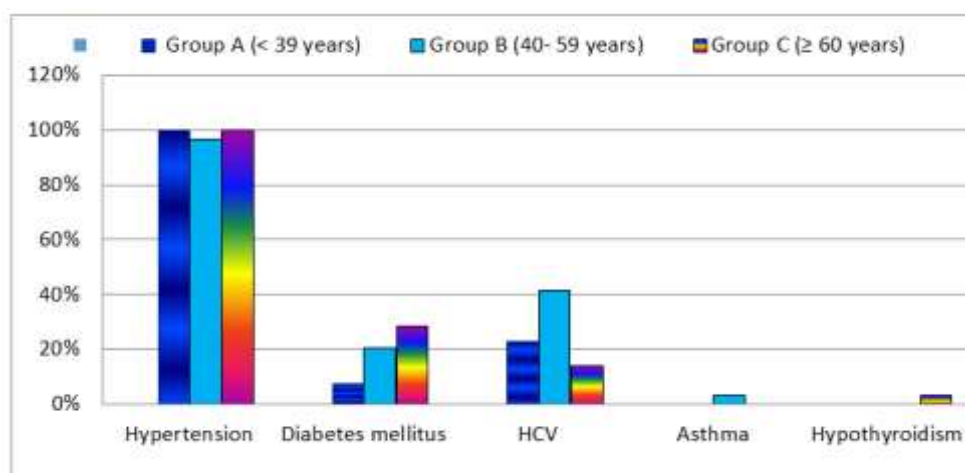
**Table-3: Distribution of the respondent by blood serum urea before and after hemodialysis (paired t test)**

Serum urea	Serum urea levels (mg/dl)		t value	p value
	Pre hemodialysis	Post hemodialysis		
	190.926±60.58	71.452±32.684	35.389	0.00

Table-3 shows that t value was 35.389 and p value was 0.00 after paired t test of serum urea. The results of the serum urea of pre and post hemodialysis patient are statistically significant. Generally urea accumulation in blood arises from degradation of food and tissue in kidney failure patients. During hemodialysis the excess urea from patient's blood is removed in order to prevent accumulation. In our present study, it was perceived that the hemodialysis will be an efficient way to reduce serum urea and creatinine in ESRD patients. The report shows that hemodialysis in the present study was much more efficient than some other studies [12].

Another study reported there is a increasing number of young population who are diagnosed with ESRD on hemodialysis and the causes are hypertension with diabetes [13].

In our present study hypertension was reported almost in all patients with respect of both sex (male and female) and in all age group (Figure 2 & 3). High blood pressure (hypertension) is one of the leading causes of CKD. Due to hypertension blood vessels in the kidney may get damaged which in turns affect the secretion of waste products in the body. As a result waste may accumulate in extra cellular fluid and further raise in blood pressure cause ESRD.

**Fig-2: Diseases associated with ESRD male patient undergoing hemodialysis****Fig-3: Diseases associated with ESRD female patient undergoing hemodialysis**

The present study showed that there was a significant increase of diabetes mellitus patient with the increment of age in both male and female. A study

carried out by Hussein and others, 2016 [14] reported that serum sugar level had increased in the age group of 51-70 years. Several other studies also reported that

blood glucose level were significantly ( $P < 0.05$ ) increased in older patients [15, 16].

The study shows a significant difference in age wise distribution of HCV in both male (Figure-2) and female (Figure-3). Where the HCV was higher at early (<39 years) and old age ( $\geq 60$  years) at male (Figure-2), on the other hand HCV was higher at mid age (40- 59 years) for female but lower at early and old age for female (Figure 2 & 3). However, Asthma and hypothyroidism was not significantly correlated to all age groups between male and female in the current study (Figure 2 & 3). To improve the effectiveness of dialysis report says that the duration of dialysis for the patients tested positive for the viral markers was longer

than for those who tested negative for viral markers [17].

### Erythropoietin

The complication for ESRD patients experienced due to renal failure is anemia. When the GFR falls below 40 ml per minute, the erythropoietin production is insufficient to stimulate adequate RBC production by bone marrow [5]. Erythropoietin is a hormone which is the major humoral regulator of red blood cell (RBC). Therefore Erythropoietin injection is recommended for ESRD patients as an external support for sufficient RBC production. In the present study a significant number of patients comprising both male and female did not take Erythropoietin regularly or at all (Figure 4 & 5).

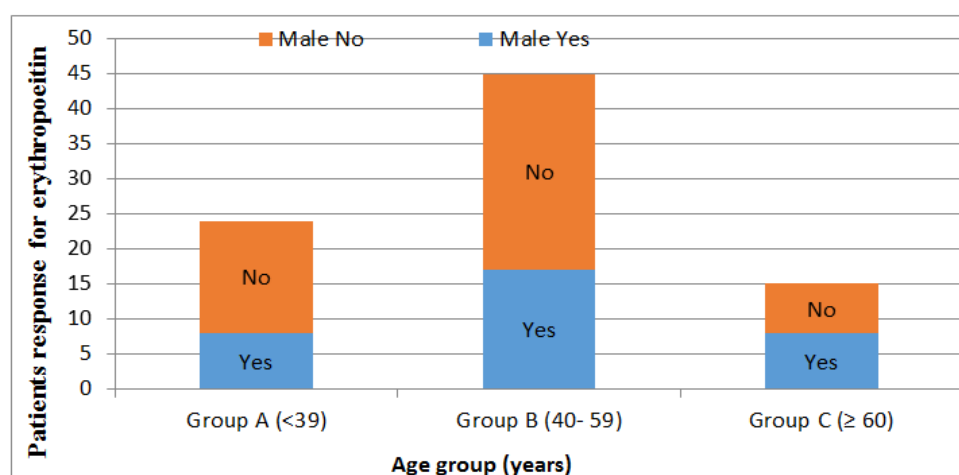


Fig-4: Patient's response for erythropoietin (male)

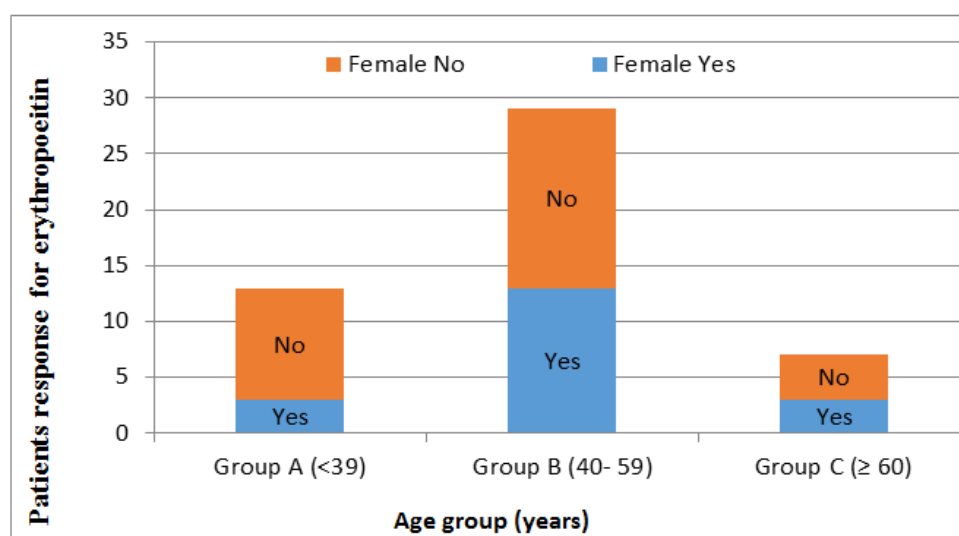


Fig-5: Patient's response for erythropoietin (female)

A large number of patient's (over 50%) responses towards erythropoietin were negative (no) for all respect age, sex. It might be due to being

erythropoietin highly expensive or the cost could be an additional burden for them.

## CONCLUSION

The 50.4% of ESRD patient undergoing hemodialysis (HD) was reported at the age group 40- 59 years and only 16.5% patient was at the age group  $\geq 60$  years. At the same time 63.15% patients was male. The quality of hemodialysis at Gonoshasthaya Nagar Hospital was better compared to other published reports in India and Pakistan. At post-dialysis, 56% reduction in serum creatinine level and 62% reduction of serum urea level was recorded. Hypertension and diabetes mellitus was the most common interrelated diseases found in the present study for both male and female. The HCV was higher at early ( $<39$  years) and old age ( $\geq 60$  years) for male. However, for female HCV was higher at mid age (40- 59 years) but lower at early and old age. Asthma and hypothyroidism was not significantly correlated to all age groups between male and female. In the present study a significant number of patients comprising both male and female did not take Erythropoietin at all or regularly. Further studies can be carried out to assess the quality of dialysis in relation to the people involved in health service providing and patient's satisfaction during dialysis.

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