ORIGINAL ARTICLE

ASSOCIATION OF SERUM TRIACYLGLYCEROL (TAG) LEVEL WITH URINARY TOTAL PROTEIN AND SERUM ALBUMIN CONCENTRATION IN ADULT NEPHROTIC SYNDROME PATIENTS

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ABSTRACT

Dyslipidemia is an important secondary biochemical abnormalities in nephrotic syndrome due to proteinuria and hypoalbuminemia. Higher plasma concentration of triacylglycerol (TAG) in nephrotic syndrome is involved in the cardiovascular risk and also accelerates the progression of glomerular dysfunction. This study is designed to evaluate the association between serum TAG level with 24-hour urinary total protein and serum albumin concentration. This analytical type of observational study was carried out in the department of Biochemistry, Dhaka Medical College, Dhaka. A total number of 100 study subjects, age range from 20-50 years, of both gender were selected. Among them 50 (fifty) study subjects were enrolled as diagnosed adult nephrotic syndrome patients from the department of Nephrology, Dhaka Medical College as cases and 50 healthy age and sex matched adult individuals were selected as controls. For baseline information serum TAG level for both cases and controls were measured. Urinary total protein (UTP) and serum albumin level for cases were also measured. Mean values of the variables were compared between cases and controls by unpaired Student's t test. Categorical variables were analyzed by Chi-square test and correlation between variables were determined by Pearson's correlation test by using SPSS for windows version 20.0. For all the statistical analyses $p < 0.05$ was considered as significant. Mean ($\pm$SD) value of serum TAG in cases and controls were 174.53 ± 18.86 mg/dL and 129.58 ± 23.47 mg/dL respectively. Mean value of 24-hour urinary total protein and serum albumin in cases were 5.65 ± 0.54 gm/day and 1.87 ± 0.54 gm/dL respectively which differed significant ($p < 0.05$). Positive correlation was found between 24-hour urinary total protein and serum TAG ($r = 0.354$) ($p < 0.05$). Negative correlation was found between serum albumin and serum TAG ($r = -0.325$) ($p < 0.05$). Increased level of serum TAG in adult nephrotic syndrome possesses a significant relationship with increased proteinuria and decreased serum albumin concentration.

Key words: Nephrotic syndrome, Serum TAG, Serum albumin, Proteinuria

Introduction

Nephrotic syndrome is a clinical entity with multiple causes characterized by increased glomerular permeability and manifested by massive proteinuria[1]. This disease is represented as urinary total protein excretion more than 3.5 gm/day, low serum albumin level (<2.5 gm/dL) and peripheral edema[2]. Nephrotic syndrome can affect any age, although it is found with a ratio

of adults to children of 26:1[3]. The incidence of nephrotic syndrome is 90-100/ million in the Indian subcontinent including Bangladesh[4]. Nephrotic syndrome is a chronic relapsing disease. Relapse is also higher in children of Bangladesh which is 36.4%. This frequent or infrequent relapse in the nephrotic syndrome may continue even in adult age[5]. Lipid abnormalities have an important biochemical basis in nephrotic syndrome. Although pathophysiological aspects of abnormal lipid metabolism have not been completely identified, urinary protein loss as well as hypoalbuminemia stimulate hepatic overproduction of lipids and decrease lipase activity which are described as the important causal factors[6].

Proteinuria in nephrotic syndrome leading to hypoproteinemia may lead to a coordinated increase in the synthesis of albumin and other proteins, mainly apoprotein B-containing lipoprotein by the liver[7].

In nephrotic syndrome, generally, when edema regresses, lipid abnormalities tend to be normal; but in some cases it may continue after the edema has disappeared. However, it may persist in some cases leading to increased risk of atherosclerosis in later life[7]. The magnitude of the most pronounced secondary changes in lipoprotein metabolism in nephrotic syndrome patients correlates with the severity of the syndrome[8].

Increased level of serum triacylglycerol (TAG) in nephrotic syndrome is not only involved in the cardiovascular risk but also accelerates the progression of glomerular dysfunction[8]. Elevation of serum TAG concentrations is an independent risk factor for coronary artery disease and cerebrovascular disease. Concurrent elevation of this important parameter of lipid profile increases these risks[9].

Abnormalities in serum TAG level has been paralleled by an increase in the incidence of the disease. Glomerular disease is a common cause of ESRD (end stage renal disease) and comprises 25-45% cases of ESRD in developing countries including Bangladesh[10]. These formidable enemies of health are joining forces to impose a double burden of disease. So far limited published data have been found regarding this content, only several studies have been done in abroad to establish the relationship. The present study was designed in a small group of Bangladeshi population to evaluate the correlation between proteinuria and hypoalbuminemia with serum TAG level in adult nephrotic syndrome.

Materials and Methods

This analytical type of observational study of one year duration was designed to evaluate the serum TAG level and its relation with proteinuria and hypoalbuminemia among the adult patients with nephrotic syndrome. The study protocol was approved by the institutional ethical committee. Informed written consent was obtained from all the study subjects. Study samples consist of 50 adult nephrotic syndrome patients who were selected as diagnosed and admitted patients in department of Nephrology of Dhaka Medical College Hospital on the basis of inclusion and exclusion criteria (Inclusion criteria: both male and female with age range 20-50 years, diagnosed cases of nephrotic syndrome. Exclusion criteria: patients with history of any acute or chronic systemic illness, history of taking lipid lowering drugs, malignancy and pregnancy) and 50 age and sex matched healthy controls.

Along with the baseline information, 3 mL of fasting (at least 12 hours devoid of meal) blood sample of both cases and controls were collected and analyzed for TAG. Serum albumin level and

the 24-hour urine samples were analyzed for protein of 50 adult nephrotic patients. Serum triacylglycerol (TAG) and serum albumin levels were assayed by semi-automated biochemical analyzer.

Statistical analysis was performed by using the SPSS version 20.0 for windows. All data were processed to compute mean and standard deviation and expressed as mean±SD. Mean values of the variables were compared between cases and controls by unpaired Student's t test, categorical variables were analyzed by Chi-square test. Pearson's correlation coefficients were used to analyze linear correlations between variables. For all the statistical analyses $p < 0.05$ was considered as significant.

Results

In this study there were age-matched 50 cases and 50 controls. For cases, mean age±SD was 34.62±6.45 years and for controls mean age±SD was 37.82±6.93 years. Table I shows the distribution of subjects according to age range.

Table II shows the distribution of cases and controls by sex. The study participants were categorized into two groups according to sex. In cases, there were 21 males and 29 females and in controls there were 27 males and 23 females. The sex groups (male and female) of study subjects (cases and controls) were matched.

There was no significant difference ($p > 0.05$).

Table I: Distribution of cases and controls by age (years) group

Age group (years)	Cases (n=50)	Controsl (n=50)	p value
20–30	12	8	
31–40	31	26	0.878[ns]
41–50	7	16	
Total	50	50	

Table II: Distribution of cases and controls by sex

Sex	Cases (n=50)	Controls (n=50)	p value
Male	21	27	
Female	29	23	0.317[ns]
Total	50	50	

Level of significance, $p < 0.05$; ns, not significant; Comparison of the different age group and sex of the study subjects was carried out by Chi-square test.

The comparison of mean age of case and control was calculated by unpaired Student's t test.

n = Number of study subjects

Table III shows the comparison of serum TAG levels between cases and controls and serum albumin levels and UTP in cases. The mean±SD of TAG of cases and controls were 174.53±18.86 mg/dL and 129.58±23.47 mg/dL respectively. Serum TAG level was found significantly ($p < 0.05$) increased in cases compared to controls.

Table IV shows the correlation of UTP and serum albumin levels with serum TAG levels in cases (adult nephrotic patients). UTP maintained significant positive correlation with serum TAG ($r = 0.354$) ($p < 0.05$) and serum albumin maintained significant ($p < 0.05$) negative correlation with TAG ($r = -0.325$).

Table III: Comparison of serum TAG and albumin levels between cases and controls UTP levels in cases

Parameters	Cases (Mean±SD)	Controls (Mean±SD)	p values
Serum TAG (mg/dL)	174.53±18.86	129.58±23.47	<0.0001*
Serum albumin (gm/dL)	1.87±0.54	3.6±1.2	<0.0001*
UTP (gm/day)	5.65±0.54	-	

*significant

Table IV: Correlation of UTP and serum albumin levels with serum TAG levels in cases

Variables		r values	p values
(gm/24 hours)	(mg/dL)		
UTP	TAG	0.354	0.0117*
Serum albumin	TAG	-0.325	0.0086*

*significant

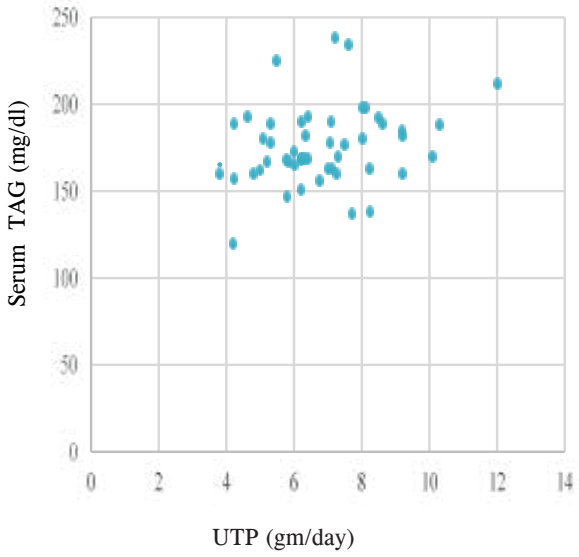

Fig 1. Correlation between UTP and serum TAG in cases

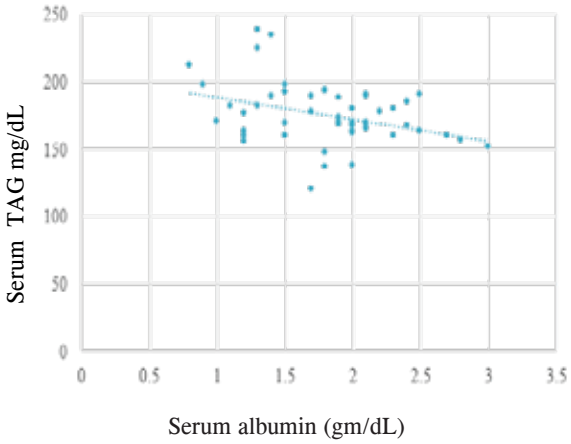

Fig 2. Correlation between serum albumin and serum TAG in cases

Discussion

The present study established the increased serum level of TAG and positive correlation between proteinuria and serum TAG concentration and also negative correlation between serum albumin and serum TAG level in adult nephrotics. In nephrotic syndrome, protein loss through urine results in hypoproteinemia that stimulates protein synthesis in the liver, resulting in the overproduction of lipoproteins. This pathophysiological phenomenon is involved for dyslipidemia in adult patients with nephrotic syndrome. Lipid catabolism is decreased due to lower levels of lipoprotein lipase, the main enzyme involved in lipoprotein breakdown. Both of these two pathophysiological phenomena are involved for dyslipidemia in adult patients with nephrotic syndrome[6]. The result of present study showed that the serum TAG level in cases and controls had highly significant difference. The mean±SD of TAG of cases and controls were 174.53±18.86 mg/dL and 129.58±23.47 mg/dL respectively. It increased significantly ($p<0.0001$) in cases when compared to controls. This result is consistent with the other studies done by Adu[1], Adekoya et al[11], Prerna et al[7] and Chan[6]. Hypoalbuminemia and loss of regulatory protein in the urine of nephrotic patients have been suggested as driving stimulus for TAG packaging with proteins into different types of lipoproteins by the liver. Besides, in hepatic tissue, expression and activity of diacylglycerol acyltransferase, an enzyme that catalyzes the final step in TAG biosynthesis is increased[12].

Passage of plasma proteins larger than 70 kDa across the glomerular basement membrane is believed to be normally restricted by a charge selectivity barrier[13]. It is thought to be mainly the result of polyanionic glycosaminoglycans in the glomerular basement membrane, which restrict the passage of small polyanionic plasma proteins (70 to 150 kDa). Investigations have

revealed that the defect in minimal-change glomerulopathy results mainly from a loss of charge selectivity whereas the defect in membranous glomerulonephritis results mainly from a loss of size selectivity. Both these phenomena in nephrotic syndrome cause massive protein loss through urine[14].

This present study found that urinary total protein (UTP) maintained significant ($p<0.05$) positive correlation with serum TAG ($r=0.354$) in adult nephrotic syndrome patients. This result is consistent with the other studies done by Bulucu et al[15] and Viswanathan et al[16].

In nephrotic syndrome, hypoproteinemia stimulates protein synthesis in the liver, resulting in the overproduction of lipoproteins. On the other hand lipid catabolism is decreased due to lower levels of lipoprotein lipase, the main enzyme involved in lipoprotein breakdown. Both these two pathophysiological phenomena are involved for high serum TAG in adult patients with nephrotic syndrome[6]. The present study found negative correlation between serum albumin and serum TAG ($r=-0.325$, $p<0.05$) in patients with nephrotic syndrome. This result is similar to findings in the other studies (Khanna et al[17], Prerna et al[7], Thomas et al[18], Krishnaswamy et al[19]).

Conclusion

Increased serum level of TAG along with positive correlation with proteinuria and negative correlation with serum albumin level in adult nephrotic syndrome patients implies the most important indicator for progression of this disease with dyslipidemia. The patients with nephrotic syndrome are at higher risk of cardiovascular and cerebrovascular complications. So, regular screening of lipid profile should be done for early diagnosis for increased serum TAG level to prevent further complications in adult nephrotic syndrome patients.

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