Lipid Profile in Children with Chronic Renal Failure Undergoing Hemodialysis

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ABSTRACT:

BACKGROUND:

Dyslipidemia is common in Patients with chronic renal failure undergoing intermittent haemodialysis and is considered a risk factor of cardiovascular disease in these patients.

OBJECTIVE:

To highlight the lipid profile abnormalities in children with end stage renal disease undergoing maintenance hemodialysis and know whether the hemodialysis duration and frequency of sessions per week has any impact on lipid profile in these patients.

PATIENTS AND METHOD:

A case-control study which was collected in the dialysis unit of (Al Karama Teaching Hospital, Child's Central Teaching Hospital , Al Kadhumia Teaching Hospital and Ibn Al Balady Hospital) for six months started on 1st June 2013 till the 1st of December 2013. Blood samples were obtained from 40 patients with end stage renal disease undergoing maintenance haemodialysis (2-3 sessions per week) and 40 matched healthy controls and analyzed for serum total cholesterol, low density lipoproteins, high density lipoprotein and serum triglyceride.

RESULTS:

A statistically significant decrease was found in serum high density lipoprotein level (Mean= 46.40mg/dl ,$p < 0.025$) in Hemodialysis patients when compared with healthy controls. A significant increase in serum triglyceride content of patients ($p < 0.000$) was also observed. It was found that improvements in lipid profile results were achieved with the use of more frequent (more than 2sessions of haemodialysis per week). There is no any impact of the duration being on HD on the lipid profile in the study.

CONCLUSION:

This study found that normal lipid profile is better maintained in patients undergoing adequate haemodialysis, and the frequency of haemodialysis sessions can affect the atherogenic states of the lipid profile which is probably the responsible for high incidence of atherosclerotic heart diseases among these patients.

KEYWORDS :lipid profile, chronic kidney disease, hemodialysis .

INTRODUCTION:

The term end stage renal disease (ESRD) represents a stage of chronic kidney disease (CKD) where the accumulation of toxins, fluid, and electrolytes normally excreted by the kidneys results in uremic syndrome. ESRD correspond to stage 5 CKD (GFR <15 ml/min per 1.73 m2). (1)

Abnormalities in lipid metabolism can be detected in patients with CKD as early as renal function begins to decline and lipid levels may change during the course of different kidney disease treatments. It is important to note that lipid levels in the general population change with age and puberty and differ by gender and these changes dictate that the definitions of dyslipidemia be different in children and adults.

Dyslipidemia, a known risk factor for atherosclerosis, is frequent among both adults and children with CKD. (2,3)

There is evidence to suggest that dyslipidemia contributes to the initiation and progression of CKD itself.(2) .Approximately (20% - 40%)of

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hemodialysis patients have been estimated to have elevated triglycerides and reduced HDL-C .Increased oxidized LDL levels and increased lipoprotein A levels have been reported, with 34% of patients having levels above the 75th percentile.(4)

While CKD patients are commonly burdened with multiple cardiovascular risk factors, dyslipidemia is an important focus of clinical CKD research since it is both highly prevalent and a potentially modifiable exposure.(5)

AIMS OF STUDY :

This study aimed to highlight the lipid profile abnormalities in children with ESRD undergoing maintenance haemodialysis and to know whether hemodialysis duration and frequency of sessions per week has any impact on lipid profile in these patients.

PATIENTS AND METHODS:

Study setting and design: A case-control study design was adopted in hemodialysis units of (Al Karama Teaching Hospital, Child's Central Teaching Hospital , Al Kadhumia Teaching Hospital and Ibn Al Balady Hospital) to achieve the aims of the present study and the period of data collection was six months started on first of June 2013 till the 1st of December 2013.. Selection of the study samples:

Cases: a randomized group of 40 patients Age ranged between(3-14 years)with ESRD who attend HD unit and were on regular haemodialysis sessions according to special schedules. They were selected according to random digit table

1-child's central teaching hospital (18 patients)
2-Ibn AL-Balady hospital (12 patients)
3-Al-Karama teaching hospital (5 Patients)
4-Al-Kadhumia hospital(5 patients)

The exclusion criteria were patients with ESRD who had one of following: -History of Diabetes Mellitus, receiving drugs which affect the lipid metabolism like beta blocker, anticonvulsant and antiviral drugs, patients already on lipid lowering drugs and hepatitis positive patients. Controls: The control group consists of 40 cases about similar age and sex with no previous history of renal, cardiac or hepatic problems, this group was taken from outpatient clinic at children welfare teaching hospital. Data collection: A preformed questionnaire had been used for those selected patients. It includes ,names, ages, gender, the duration of their disease, the date they started Hemodialysis and frequency of sessions per week. All patients were examined generally and systematically and any positive finding had been recorded.

Enquiry about investigations included: fasting blood sugar, serum albumin, blood urea and serum creatinine.

Blood samples of ten milliliters of venous blood were drawn from each fasting patient (8-12 hours fasting). Slow aspiration of the venous blood sample via the needle of syringe to prevent hemolysis with tourniquet apply about 5 cm above the cubital fossa from the fistula site All the samples that were grossly hemolysed, were neglected and other samples were taken for lipid profile. The sample taken early in morning prior to haemodialysis session. The lipid content determinations were performed immediately after sample collection in the laboratory of these Hospitals.

Total cholesterol and triglyceride (TG) content were determined enzymatically using spectro photometric device. Total cholesterol level was determined by using **CHOD-POD Enzymatic** colorimetric method. While triglyceride (TG)level was determined by using **GPO-PAP enzymatic** colorimetric method(6) Serum HDL was determined using(C-HDL Pre) kit. The concentration of LDL and VLDL cholesterol were calculated according to the Friedewald formula:(7)

Statistical analysis: Data were computerized using Microsoft Excel program 2007, statistical analysis was done using the (SPSS) software for windows, and the t-test was used to compare the means of different groups for continuous variables. Study confidence intervals was 95% and the significant P-value was <0.05.

RESULTS:

Characteristic variables of study population:

The whole populationstudied (cases 40 and controls 40) is represented in Table (1), the general characteristics of the two groups are shown including their (were ranged between 3 and 14 years), sex, BMI, serum albumin and mean level of blood urea and serum creatinine .

Table 1: Characteristic variables of study group .

Variables	Cases	Controls
Age (years) (means ±SD)	9.85±4.5	8.70± 3.9
Gender	Male cases No.(%)	Male control No.29 (72.5)
	Female cases No.(%)	female control No.11 (27.5)
BMI(Kg/m2) (means ±SD)	19.11±5.14	22.18 ± 2.15
Urea (mg/dl) (means ±SD)	154.68±55.86	24.61± 10
Creatinine (mg/dl) (means ±SD)	5.45 ±3.55	0.47 ± 0.16
Albumin(mg /dl) (means ±SD)	30.53 ±6.75	39.9± 3.5

Data are means ±SD ,or n (%).

2- Serum Lipid Profiles in ESRD Patients and Healthy Controls:

The concentration of different serum lipid component from ESRD patients undergoing haemodialysis , compared to healthy control results are shown in Tables (2).

A profound increase in serum TG concentration (P <0.000) in cases is evident. In addition the levels of HDL-C are significantly lower in cases (P < 0.025).

Table 2: Lipid profile of cases and control group.

Lipid profile		mean	St deviation	P value
Total cholesterol mg/dl	case	172.83	57.39	0.71
	control	169.9	27.18	
LDL mg/dl	case	88.23	21.673	0.20
	control	93.93	18.19	
TG mg/dl	case	159.88	86.23	<0.000
	control	58.88	30.905	
HDL mg/dl	case	46.60	26.70	0.025
	control	56.73	9.271	

3- Distribution of the cases according to frequency of HD and serum lipid profile as shown in Tables (3)

A statistically significant improvement in TG level in 3 sessions per week compared with 2 sessions per week.(p value =0.04).

A very statistically significant improvement in HDL level in 3 sessions per week compared with 2 sessions per week.(p value = 0.005).

Table 3: Distribution of the cases according to the frequency of HD and serum lipid profile

Lipid profile		mean	St deviation	P value
Total cholesterol mg/dl	2 times /week	179.45	65.52	0.13
	3 times /week	157.17	27.55	
LDL mg/dl	2 times /week	89.36	22.67	0.60
	2 times /week	85.58	19.824	
TG mg/dl	3 times /week	170.50	95.139	0.04
	2 times /week	135.08	56.458	
HDL mg/dl	2 times /week	40.43	28.996	0.005
	3 times /week	60.33	12.759	

4- Distribution of the cases according to the duration of HD and serum lipid profile as shown in Tables (4).
There is no statistically significant change in lipid profile regarding the duration of HD [below one year (28 patients) and above one year (12patients)].

Table 4: Distribution of the cases according to duration of HD and serum lipid profile.

Lipid profile		mean	St deviation	P value
Total cholesterol mg/dl	<1 year	182.62	63.28	0.15
	>1 year	166	55.95	
LDL mg/dl	<1 year	89.55	23.552	0.46
	>1 year	84.73	16.131	
TG mg/dl	<1 year	169.62	90.041	0.21
	>1 year	134.18	72.779	
HDL mg/dl	<1 year	42.76	24.972	0.21
	>1 year	56.00	29.933	

DISCUSSION:

In our study we define dyslipidemia in children using lipid levels with reference to percentiles of normal reference range for age and gender.[2] The present study shows significant changes in lipid profile of ESRD patients when compared with that of healthy matched controls. These results were similar to the results observed in other studies(ex. the studies done by Jeffrey M Saland et al [8].and

Mohamed Ragab et.al[9] were all found that dyslipidemia is common among children with Chronic kidney disease.It is well known that patients with impaired renal function exhibit significant alterations in lipoprotein metabolism resulting in the development of severe dyslipidemia and this is attributed to the non -traditional risk factors in patients with ESRD , such as, inflammation, oxidative stress, anemia, malnutrition, vascular calcification (due to alterations in calcium and phosphorus metabolism) and endothelial dysfunction that have been proposed to play a central role in lipid metabolism abnormalities [10,11]Most patients with end stage renal disease (ESRD) have malnutrition due to anorexia, medications (ex. oral iron and phosphate binders) and the adverse effects of Hemodialysis that is attributed to cardiovascular instability for these patients , nausea, vomiting causing insufficient feeding (insufficient energy and protein intake), abnormal nutrient metabolism, nutrient losses of amino acids due to dialysis procedures , repeated line infections, acidosis increasing muscle catabolism) and according to the (Clinical Practice Guidelines)for chronic kidney disease ,Serum albumin concentration, and the BMI has been used as an important markers to estimate nutritional adequacy[12]In this study serum albumin was low in case group which is a valid measure of nutritional status [12] and the BMI values of the two groups (patients & controls) differ secondary to poor nutritional status ,A finding that was similar to that observed in Basaleem Ho et al.study (13)

The study revealed that most of patients with ESRD who undergo maintenance HD had normal level of total serum cholesterol, a slightly low LDL-C which is a reflection of the malnutrition state of these patients. A critical decrease in serum HDL level was observed in patients when compared with controls and a significant increase in serum TG content of patients was also observed, These findings are in agreement with the result obtained from previous similar reports done by El-Tigani et al (14) Alaupovic et al (15) and Mohamed R.et al. (16)

The high level of TG in end stage renal disease is believed to be mainly due to consequence of increased production and impaired removal of TG, and low HDL-C level as well as their major apoprotien (A-1and apoprotien A-2)is characterized of HDL and these defects may lead to reduced cholesterol esterfication in HDL particles and a subsequent inability to form mature HDL particles[17]other causes of reduction in HDL level may relate to reduce activity of Lecithin—cholesterol acyltransferase (LCAT), which is an enzyme that converts free cholesterol into cholesteryl ester which is then sequestered into the core of a lipoprotein particle and Hepatic lipase, also called hepatic triglyceride lipase (HTGL) One of the principal functions of this enzyme whichconverts intermediate-density lipoprotein (IDL) to low-density lipoprotein (LDL) [18] The second factor responsible for the tendency to increased atherosclerosis in patients on chronic HD is the low level of HDL-C. Kimlove et al. [19] have reported a protective effect of HDL against the LDL oxidative modification; so decreased HDL antioxidant capacity of HD patients contribute to the accelerated development of atherosclerosis in HD patients. In the present study the frequency of HD in patients with ESRD has been studied in relation to the levels obtained for TG and HDL-C. in the study we found that patients on frequent HD sessions have normal TG and HDL levels. There are substantial data from observational studies suggesting that better results have been achieved with the use of longer session(3 Hr and more) and especially with increase in the frequency (3 time per week) of HD.

In the study done by Wood J.et al , patients were changed from thrice weekly to six time weekly dialysis, blood pressure and lipid profile improved and patients, survival at 2 years was 100%, so it is possible to improve both quality and duration of life in dialysis patients by increasing the frequency of dialysis sessions. That's why HD should take place at least three times per week in nearly all patients and any reduction of dialysis frequency to once or twice weekly because of insufficient dialysis facility is unacceptable (20)

The study showed that the duration of patients being on HD (less than one year or more than

one year) have no influence on the levels of TG and HDL obtained and most of the patients who have longer duration of HD have the same results of high TG and low HDL levels. This may be due to that our study sample was small and most of them were on dialysis for less than one year.

CONCLUSION:

Dyslipidemia was a common finding in our ESRD patients on maintenance HD. Most of the patients in our study had malnutrition as shown by BMI and serum albumin. Some of the patients have suboptimal dialysis sessions with high lipid profile. The patients, who received more frequent dialysis sessions (3 times per week), has better lipid profile results. There is no any impact of the duration being on HD on the lipid profile in the study.

Recommendations: All patients with CKD should have lipid profile before dialysis and follow up together with nutritional status after starting dialysis to stratify the cardiovascular risk. Controlling hyperlipidemia, body weight normalization, regular exercise and education about diet should be applied. More efficient and frequent HD program is recommended to our ESRD patients for better quality of life . Further studies should be done to assess the value of lipid lowering drugs in the treatment of dyslipidemia in ESRD.

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