Dyslipidemia in chronic renal failure

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Abstract

Dyslipidemia is a well-documented and a common finding in patients with CRF and its prevalence is higher than in general population. Lipid profile has been studied in 50 patients with CRF excluding patients on hemodialysis or renal transplantation, and in 48 normal subjects of matched age and sex as a control. Also, the proteinuria in GUE was assessed and a history of hypertension was evaluated in patients' group. Dyslipidemia was found in 80% of patients with CRF who have significantly higher s. triglyceride and VLDL-C and lower HDL-C levels than control (P value <0.0005 for triglyceride and HDL-C and < 0.005 for VLDL-C). The commonest abnormality was hypertiglyceridemia (56%). The frequencies of other lipid abnormalities were as follows: low HDL-C level (52%), high LDL-C level (32%), and hypercholesterolemia (22%). Among patients with abnormal lipid profile, 70% of them have hypertension, and the same percentage have proteinuria. The dyslipidemia distributed evenly along the course of renal failure, so it can occur in the early course of CRF as well as in the late one. In conclusion, dyslipidemia is present in a significant number of patients with CRF regardless of the duration of renal failure; also, it is significantly associated with hypertension and/or proteinuria.

Key words: Dyslipidemia; Hypercholesterolemia; Chronic renal failure

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Introduction

Chronic renal failure is a pathophysiological process with multiple etiologies, resulting in loss of the nephron number and function and frequently leading to ESRD [1]. CRF and ESRD associated with disturbances of every organ system, dyslipidaemia represents one of the metabolic disturbances. Abnormalities in lipid metabolism are well documented and a common finding in a patient with CRF [2]. These abnormalities characterize uremia in general and occur regardless of the underlying cause of renal disease [3]. Dyslipidemia is considered as a contributor to accelerated atherosclerosis in patients with CRF, in addition to their role in mesangial proliferation and progression of renal failure [4]. Observations in predialysis patients suggest that abnormalities in lipid metabolism occur early in the course of renal failure before the institution of dialysis [3]. A defect in lipoprotein metabolism may be found in CRF even in

patients with seemingly normal lipid profiles, this occurs in form of abnormal distribution of Apo- C- III and Apo E, which are usually found in HDL, but in CRF 60-80 % of Apo C-III and Apo E are found in VLDL and LDL. The shift of Apo C-III from predominantly HDL particles to predominantly triglyceride-rich particles represents a catabolic defect in triglyceride metabolism that results in the accumulation of a variety of remnant particles including IDL [4]. Accumulating evidence indicates that the kind of dyslipidemia is often related to the type of renal replacement therapy (peritoneal or hemodialysis) [5] with a more atherogenic lipid profile in peritoneal dialysis than in hemodialysis.

Dyslipidemia in hemodialysis

1-Normal or near normal levels of total cholesterol and LDL-C [5].

2-Approximately 20-40%of hemodialysis patients have been estimated to have elevated triglyceride and reduced HDL-C [6, 7].

3-Increased oxidized LDL levels [8, 9, 10].

4-Increased Lp (a) levels have been reported, but less than in peritoneal dialysis.

Dyslipidemia in peritoneal dialysis

1- In reported studies, 20-40 % of peritoneal dialysis patients have been shown to have elevated total cholesterol and LDL-C.

2- 25-50% of patients have been reported to have elevated triglycerides (TG) and Apo B and low HDL-C [11, 12, 13].

3- The LDL has been shown to be qualitatively different from normal LDL in that there is an increased concentration of small and dense particles together with the high Apo B [14].

4- Increased oxidized LDL levels [15, 16, 17] and increased Lp (a) levels have been reported.

Causes of dyslipidemia in CRF

* The activity of lipoprotein lipase is decreased in uremia with a reduction in the conversion of VLDL to LDL and thus hypertriglyceridemia [4]. Reduced lipoprotein lipase activity has been reported with GFR of 50ml/min.

* Triglyceride lipolysis and remnant clearance are both reduced in CRF [18].

*Reduced activity of LCAT enzyme may contributes to altered HDL-C composition and impaired cholesterol transport in uremic patients [9].

* Contributor factors are frequently present in uremia: hormonal abnormalities (such as insulin resistance and hypothyroidism), diabetes, and drugs (like Beta-blocker and diuretics) that may adversely influence lipid metabolism [20].

Dyslipidemia in CRF and the cardiovascular diseases (CVD)

CRF constitutes a major risk factor for ischemic CVD, including occlusive coronary heart, cerebrovascular, and peripheral vascular diseases. Dyslipidemia is regarded as one of the traditional risk factors that contribute to the high incidence of CVD in patient with CRF {traditional risk factors include: dyslipidemia, hypertension, DM, hyperhomocysteinemia, hypervolemia, and sympathetic over activity} [21]. Regardless of age, heart disease is a major cause of morbidity and mortality among patients with renal failure. Mortality in dialysis patients is higher than in general population and CVD is the leading cause of mortality in these patients [22]. Atherosclerotic heart disease is believed to account for approximately 55 % of mortality and contributes to a 20-fold increase in IHD and to a 10-fold increase in risk of stroke among patients with ESRD [23].

Aim of the study

The aim of our study is to assess the distribution (in relation to the time of diagnosis of CRF), the pattern, and the prevalence of dyslipidemia in patients with chronic renal failure. Also, assesses the association of dyslipidemia in those patients with hypertension and/or proteinuria.

Materials and Methods

Patients

Between January 2016 and September 2017, 50 patients (26 male, 24 female) aged 10-76 years (mean 43.42 ±19.14) with chronic renal failure were involved in this study. Patients on regular hemodialysis; patients with obesity, family history of hyperlipidemia, diabetes mellitus, nephrotic syndrome, acute renal failure, renal transplant recipient, smoking, and those receiving drugs known to alter the lipid profile were excluded from this study. Careful history was obtained about the duration of CRF, type of dialysis if there was, and the association of hypertension with the CRF. While, 48 normal healthy subjects of matched age and sex, chosen from companion of patients were selected as control group. None of them was obese, diabetic, alcoholic, smoker, having history of cardiac or renal disease, or having any disease or drugs known to alter the lipid profile.

Samples

Venous blood (5ml) were drown from patients and control after 12 hours of overnight fasting. A sample of urine was taken from each patient to be examined for proteinuria.

Methods

Total serum cholesterol, s. triglyceride, and HDL-C were estimated by enzymatic kit method, reagents of bioMerieux laboratories [23]. LDL-C was estimated by using the following equation (Friedwald equation):

LDL-C = total cholesterol – (triglyceride/5 + HDL-C). The VLDL-C was estimated by dividing the plasma triglyceride by 5, reflecting the ratio of cholesterol to triglyceride in VLDL particles. This formula is reasonably accurate if test results are obtained on fasting plasma and triglyceride level < 350 mg/dl. The accurate determination of LDL-C levels in patients with triglyceride levels greater than this requires application of ultracentrifugation techniques (beta quantification); therefore, patients with triglyceride level > 350 g/dl were excluded from the study [24]. The dyslipidemia in CRF according to the NCEP and ATP III should be considered to be in highest risk category, with a target LDL-C level < 100mg/dl [25], so the desirable lipid profile is: Total serum cholesterol < 200 mg/dl

Serum triglyceride < 150 mg/dl

LDL-C < 1oo mg/dl

HDL-C > 40 mg/dl for male and >50 mg/dl for female

Proteinuria was detected by dipstick method, in which a chemical assessment of the urine is performed with the "dipstick", a plastic strip impregnated with reagents that detect the protein in the urine. This assay is semi quantitative and is graded on the basis of color changes in the reagent strips [26].

Statistical analysis

Descriptive statistics were used to describe the mean, SD, and the range of the age, sex, and the lipid profile parameters in patients and control group. Student t-test was used to assess the difference of mean of the lipid profile between patients and control group and between male and female in patients' group. P value <0.05 significant. The chi-square was used to test the distribution of abnormal lipid profile in relation to the duration of CRF, and also to test the distribution and relationship between hypertension and proteinuria with the abnormal lipid profile. Z-test (test of proportion) was used to check the difference in the frequencies of normal and abnormal lipid profile, the presence or absence of hypertension and proteinuria with normal and abnormal lipid profile and with abnormal level of s. triglyceride, s.cholesterol, LDL-C, and HDL-C.

Results

Table (1) shows the characteristics and distribution of the patients and control groups according to the gender and age. While, table (2) compares the parameters of lipid profile between patients and control groups. It shows that the patients group have significantly higher s. triglyceride (P value < 0.0005) and VLDL-C (P value <0.0005) and significantly lower HDL-C (P value < 0.0005) levels than control. Total serum cholesterol and LDL-C mean in patients' group, although higher than the control group, but statistically non-significant (P value < 0.66, < 0.102 respectively). Table (3) shows that there is no significant difference in comparison of lipid profile parameters in patients' group between males and females. Table (4) proves the even distribution of dyslipidemia in relation to the duration of the CRF [i.e. there is no significant difference between the frequencies of abnormal lipid profile which occur in the early and late courses of renal failure (P value = 0.4)]. Table (5) expresses the frequency of lipid abnormalities in patients' group and as follows:

* 56 % have hypertriglyceridemia, 52 % have low HDL-C level, 32 % have high LDL-C level, 22 % have hypercholesterolemia. Table (6) proves that a highly significant percentage (P value < 0.001) of patients have abnormal lipid profile (abnormal one or more of lipid parameters) which represents 80% of patients, while 2o% of them have normal lipid profile. Table (7) shows the pattern of dyslipidemia (including low HDL-C) and its frequency among patients with abnormal lipid profile in this study, and as follows:

* Type IV phenotype irrespective to HDL-C is the commonest reported one (40%).
* Type II b phenotype irrespective to HDL-C is reported in 27.5% of patients.
* Type II a phenotype irrespective to HDL-C is reported in 12.5% of patients.
* Isolated low HDL-C (in otherwise normal lipid profile) is reported in 20% of patients.

Table (8) clarifies that there is insignificant association between the hypertension and the lipid profile (P value = 0.820) which was explained by the following percentages:

* 70% of patients with abnormal lipid profile have hypertension.
*30 % of patients with abnormal lipid profile don't have hypertension.
*60 % of patients with normal lipid profile have hypertension.
*40 % of patients with normal lipid profile don't have hypertension.

Table (9) denotes to the highly significant difference between the frequencies of presence and absence of hypertension in patients with abnormal lipid profile (P value<0.0007), that's 70% of them have hypertension versus 30% don't have. Table (10) shows that there is highly

significant association between the proteinuria and the lipid profile (P value = 0.002) as clarified in the percentages mentioned below:

*70 % of patients with abnormal lipid profile have proteinuria.

*30 % of patients with abnormal lipid profile don't have proteinuria.

*90 % of patients with normal lipid profile don't have proteinuria.

*10 % of patients with normal lipid profile have proteinuria.

Table (11) expresses that there is highly significant difference between the frequencies of presence and absence of proteinuria in patients with dyslipidemia (P value<0.0007) that's 70% of them have proteinuria versus 30% don't have. Table (12) clarifies that the frequency of patients with abnormal lipid profile who have both proteinuria and hypertension is 52.5 %. Table (13) describes the association of the hypertension with the abnormal parameters of lipid profile in patients' group and as noted below:

* Patients with abnormal s. triglyceride level have a highly significant difference (P value = 0.003) between the frequencies of those with hypertension (71.42 %) and those without hypertension (28.57%).

* 90.9% of Patients with hypercholesterolemia have hypertension versus 9.09% without hypertension (highly significant P value = 0.0006).

* Highly significant difference (P value = 0.001) had been found between the frequencies of those with hypertension (81.25%) and those without hypertension (18.75%) in Patients with abnormal LDL-C level (≥100 mg/dl).

* In patients with abnormal HDL-C level, although the frequency of those with hypertension (65.3 %) is higher than those without hypertension (34.6 %) it does not reach a statistical significance (P value = 0.052).

Table (14) expresses the association of proteinuria with abnormal lipid profile parameters in patients group as described below:

* Patients with hypertriglyceridemia have a highly significant difference (P value = 0.003) between the frequencies of those with proteinuria (71.42 %) and those without it (28.57%).

* It has been found that significant percentage (81.8%) of hypercholesterolemic Patients have proteinuria versus 18.18% don't have (significant P value = 0.01).

* 3/4 of Patients with elevated LDL-C level had been found to have proteinuria, while only1/4of them were without proteinuria (significant P value = 0.01).

* Despite that the frequency of associated low HDL-C level with proteinuria (61.53 %) is higher than those without proteinuria (38.46 %)**,** but the difference between the frequencies

is statistically insignificant (P value = 0.165). Table (15) shows the frequency of the presence of both hypertension and proteinuria in association with abnormal parameters of lipid profile and as follows:

* 60.71% of patients with hypertriglyceridemia have both hypertension and proteinuria.
* 72.72% of hypercholesterolemic Patients have both hypertension and proteinuria.
* 62.5% of patients with abnormal LDL-C have both hypertension and proteinuria.
* 40.15% of patients with low HDL-C level have both hypertension and proteinuria.

Table 1.

Distribution of patients and control according to age and gender

Age groups (years)	Patient group (no.50)				Control group (no.48)			
	Male		Female		Male		Female	
	No.	%	No.	%	No.	%	No.	%
10-20	3	6	3	6	3	6.25	4	8.33
21-30	4	8	7	14	4	8.33	3	6.25
31-40	5	10	1	2	6	12.5	4	8.33
41-50	3	6	3	6	4	8.33	6	12.5
51-60	4	8	5	10	3	6.25	4	8.33
61+	7	14	5	10	3	6.25	4	8.33
Total no.	26	52	24	48	23	47.91	25	52.08
Age								
Mean	43.42				41.18			
SD	19.14				17.52			
Range	10.0-76.0				11.0-75.0			

Table 2.

The comparison of the lipid profile finding between patient and control groups

Lipid profile		Patients	Control	P value
s. Cholesterol mg/dl	Mean	178.08	164.33	P= 0.66 Non significant
	SD	43.84	26.96	
	Range	95.0-328.0	110.0-210.0	
Serum. Triglyceride mg/dl	Mean	164.14	86.60	P<0.0005 Highly significant
	SD	48.69	31.56	
	Range	75.0-300.0	45.0-180.0	
LDL-C mg/dl	Mean	107.34	96.64	P= 0.102 Not significant
	SD	38.10	24.22	
	Range	55.0-242.0	45.0-137.0	
HDL mg/dl	Mean	39.10	50.37	P<0.0005 Highly significant
	SD	11.22	6.79	
	Range	20.0-63.0	34.0-62.0	
VLDL mg/dl	Mean	32.62	17.31	P<0.005 Highly significant
	SD	9.94	6.31	
	Range	15.0-60.0	9.0-36.0	

Table 3.

The comparison of lipid profile finding in patients' group between male and female

Group sex	No.	Serum Triglyceride mg/dl		Serum Cholesterol mg/dl		LDL-C mg/dl		HDL-C mg/dl		VLDL-C mg/dl	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Male	26	165.18	43.90	179.03	47.49	110.62	39.52	37.59	10.30	32.66	9.16
Female	24	162.91	54.77	176.95	40.17	103.47	36.85	40.86	12.20	32.56	11.0
P value		P = 0.871 Not significant		P = 0.869 Not significant		P = 0.514 Not significant		P = 0.308 Not significant		P = 0.972 Not significant	

Table 4.

The frequency of abnormal lipid profile according to the time of diagnosis

Time since diagnosis	Patient no. within the given time	Abnormal lipid profile	
		No.	%
Newly diagnosed-3 months	14	12	85.71
3.5-6.5 months	14	10	71.43
7 months-1 year	13	9	69.2
2-5 years	4	4	100
≥ 6 years	5	5	100
Total	50	40	80
Uncorrected Chi-square	3.78		
P value	0.436241 not significant		

Table 5.

The frequency of lipid abnormalities in patients' group

Lipid profile parameters	S. triglyceride ≥ 150 mg/dl		S. cholesterol ≥ 200		LDL-C ≥ 100 mg/dl		HDL-C mg/dl Male<40 Female<50	
Patients	No.	%	No.	%	No.	%	No.	%
	28	56	11	22	16	32	26	52

Table 6.

The frequency of abnormal (abnormal one or more lipid parameters) and normal lipid profile among patients' group

Patients group (no.50)	Lipid profile				P value
	Abnormal lipid profile		Normal Lipid profile		
Patients	No.	%	No.	%	
	40	80	10	20	P=0.001 Highly significant

Table 7.

Pattern of dyslipidemia (including abnormal HDL-C level) among patients with abnormal lipid profile (no. 40)

Patients group (no.40)	Lipid abnormality													
	Type IV increased VLDL+TG				Type II b increased total s. chol. +LDL				Type II a increased LDL+VLDL+TG				Isolated low HDL	
	Low HDL		Normal HDL		Low HDL		Normal HDL		Low HDL		Normal HDL		Male<40 Female<50	
Patients	no	%	no	%	no	%	no	%	no	%	no	%	no	%
	12	30	4	10	4	10	7	17.5	2	5	3	7.5	8	20
Total	No.		%		No.		%		No.		%		No.	%
	16		40		11		27.5		5		12.5		8	20

Table 8.

The association of hypertension with lipid profile

Hypertension	Lipid profile			
	Abnormal lipid profile (no.=40)		normal lipid profile (no.=10)	
	No.	%	No	%
+ve Hypertension	28	70	6	60
-ve Hypertension	12	30	4	40
P value	P = 0.820 not significant			

Table 9.

The association of hypertension with abnormal lipid profile

Hypertension	Abnormal lipid profile (no.40)	
	No.	%
+ve Hypertension	28	70
-ve Hypertension	12	30
P value	0.0007 Highly significant	

Table 10.

The association of proteinuria with lipid profile

Proteinuria	Lipid profile			
	Abnormal lipid profile(no.40)		Normal lipid profile(no.10)	
	No.	%	No.	%
+ve proteinuria	28	70	1	10
-ve proteinuria	12	30	9	90
P value	P = 0.002 Highly Significant			

Table 11.

The association of proteinuria with abnormal lipid profile

Proteinuria	Abnormal Lipid profile(no.40)	
	No.	%
+ve proteinuria	28	70
-ve proteinuria	12	30
P value	0.0007 Highly Significant	

Table 12.

The percentage of patients with abnormal lipid profile who have both hypertension and proteinuria

Patients group	Abnormal Lipid profile(no.40)	
	No.	%
Patients with both hypertension and proteinuria	21	52.5

Table 13.

The association of hypertension with abnormal level of s. triglyceride (TG) and total s. cholesterol and LDL-C and HDL-C in patients' group

Patients group	Abnormal Lipid profile							
	S. TG ≥150mg/dl (no.28)		S. Cholesterol ≥200 mg/dl (no.11)		LDL-C ≥100 mg/dl (no.16)		HDL-C mg/dl Male<40 Female<50 (no.26)	
	No.	%	No.	%	No.	%	No.	%
Patients with hypertension	20	71.42	10	90.9	3	81.25	17	65.3
Patients without hypertension	8	28.57	1	9.09	3	18.75	9	34.6
P value	0.003 Highly Significant		0.0006 Highly Significant		0.001 Highly Significant		0.052 not Significant	

Table 14.

The association of proteinuria with abnormal level of triglyceride (TG) and total s. cholesterol and LDL-C and HDL-C in patients' group

Patients group	Lipid abnormality							
	s. TG ≥150 (no.28)		s. Cholesterol ≥200 mg/dl (no.11)		LDL-C ≥100 mg/dl (no.16)		HDL-C mg/dl Male<40 Female<50 (no.26)	
Patients with proteinuria	No.	%	No.	%	No.	%	No.	%
	20	71.42	9	81.8	12	75	16	61.53
Patients without proteinuria	8	28.57	2	18.18	4	25	10	38.46
P value	0.003 Highly Significant		0.01 Significant		0.01 Significant		0.165 Not Significant	

Table 15.

The frequency of both hypertension and proteinuria in association with abnormal level of total s. cholesterol and LDL-C and HDL-C in patients' group

Patients group	Lipid abnormality							
	s. TG ≥150 mg/dl (no.28)		s. Cholesterol ≥ 200 mg/dl (no.11)		LDL-C ≥ 100 mg/dl (no.16)		HDL-C mg/dl Male<40 Female<50 (no.26)	
Patients with proteinuria and hypertension	No.	%	No.	%	No.	%	No.	%
	17	60.71	8	72.72	10	62.5	12	46.15

Discussion

According to the adult treatment panel III (ATPIII) guidelines which was recently issued by the National Cholesterol Education Program (NCEP), patients with chronic kidney disease should be considered to be in highest risk category for ischemic heart disease with a target LDL-C level <100 mg/dl. The prevalence and incidence of lipid abnormalities noted in CKD and ESRD populations depend upon the population studied and the values used to declare a patient hyperlipidemic or dyslipidemic [27, 28]. For this reason, the prevalence of abnormal lipid profile parameters may be somewhat higher in our study than in old studies, because a desirable lipid profile levels for high risk population recommended by ATP III were chosen in our study. The present study shows that dyslipidemia was present in 80 % of studied patients with CRF (table 6) irrespective to the duration of the renal failure. This figure is higher than that of a study in the united kingdom which found that almost two-thirds (~ 66%) of 677 patients with chronic renal insufficiency or ESRD had hyperlipidemia [29], this difference probably because this study choose LDL-C level of > 115 mg/dl as abnormal level, which is higher than the target chosen in our study (≥ 100 mg/dl). In the present study, patients with CRF were found to have significantly higher s. triglyceride and VLDL-C and lower HDL-C levels than control (table 2). Total s. cholesterol and LDL-C levels in patients with CRF were higher than control, but not to a degree sufficient to reach a statistical significance (table 2). There was no significant statistical difference in all parameters of lipid profile between males and females in patients' group (table 3).

Abnormalities of lipid metabolism and abnormal lipid profile appear as soon as renal function begins to decline [30, 1] and occur early in the course of renal failure [31], and this had been proved in our study, that is according to the this study, the distribution of dyslipidemia in relation to the duration of CRF (i.e. time since diagnosis) was even distribution indicating that there was no significant difference in the occurrence of dyslipidemia in early and late courses of CRF (table 4). In ESRD populations, the most common abnormality is an elevated s. triglyceride with a low HDL-C [32, 33] and this is consistent with the finding of the present study (table 5). The commonest reported abnormality in the lipid profile in our study was hypertriglyceidemia which was present in 56% of patients, this is consistent with the results of other studies which reported that hypertriglyceridemia is found in 33-70 % of patients [34]. On the basis of recent data, an elevated fasting triglyceride level is now an accepted independent risk factor for CVD and warrants treatment. The NCEP ATP III has decreased the desirable range of triglyceride from <200 to <150 mg/dl, so a level of ≥150 mg/dl is regarded as abnormal in our study, this explains why the prevalence of hypertriglyceridemia in this study is higher than in some studies such as a study which reported a prevalence of 40% [35]. Low HDL-C level which is also an independent risk factor for CVD was reported in 52 % of patients with CRF, so it is the second most common reported abnormality in the lipid profile after hypertriglyceridemia in our study. This figure is comparable to the reported prevalence of low HDL-C in patients with CRF in other studies which is 50-70 % [36]. Although in another study, the reported prevalence of low HDL-C level was 35% [37], this is because the level of abnormal HDL-C level (<35 mg/dl) is lower than in the present study (<40 for males and <50 mg/dl for females), so more patients were included as having abnormal HDL-C level in our study.

Elevated LDL-C level was found in 32% of patients with CRF. There is a wide discrepancy in comparing the prevalence of high LDL-C with other studies and as follows: One of the previous studies showed that the prevalence of high LDL-C is 10% [38] which is lower than the prevalence in our study. This may be attributed to the different LDL-C level which is regarded as abnormal in both studies (>130 mg/dl in the previous study versus ≥ 100 mg/dl in our study). Another, study of almost 1800 patients with chronic renal insufficiency found that 64% of patients had elevated LDL-C level (>130 mg/dl) [38]. Although the target of LDL-C level is more than that in our study, the prevalence of elevated LDL-C level in previous study was higher than that in the present study. This may be attributed to the exclusion of diabetic

patients from our study, since diabetic ESRD is associated with higher level of LDL-C than non-diabetic ESRD [39]. Also the difference in the prevalence of high LDL-C level could be attributed to the fact that the prevalence of lipid abnormalities noted in CKD and ESRD populations depend on the population studied [40] and the fact that total cholesterol and LDL-C levels in ESRD population may be normal, elevated, or actually low [41], so there is already unpredictable value for LDL-C level. However, we must keep in mind that LDL-C may be also qualitatively different from normal LDL-C in form of increased concentration of small dense particles and increased oxidized LDL-C level [8].

The prevalence of hypercholesterolemia in the present study was 22% of CRF patients. This figure is consistent with the prevalence of some studies which reported that elevated total cholesterol level is found in up to 20% of patients [3], but it is less than the prevalence reported in another study which is 30% [42], despite that the abnormal level of cholesterol in this study is higher (> 240 mg/dl) than in our study (≥ 200 mg/dl). Again, this may be explained by the variable level of total s. cholesterol which may be normal, elevated, or low [43] in different studied population. The pattern of dyslipidemia in studied patients was as follows (table7); type IV phenotype (increased VLDL+ TG) irrespective to HDL-C level was the commonest pattern and reported in 40 % of CRF patients with dyslipidemia. This is consistent with the finding of other reports [44]; type II b (increased total cholesterol + LDL-C) irrespective to HDL-C level was reported in 27.5 % of dyslipidemic CRF patients; type II a (increased VLDL+ TG + LDL-C) irrespective to HDL-C level was reported in 12.5 % of dyslipidemic CRF patients; isolated low HDL-C level was reported in 20 % of CRF dyslipidemic patients.

Because hypertension add more risk for CVD (as it is a traditional risk factor for CVD), in addition to its role in increasing the rate of progression of renal failure, its association with dyslipidemia had been assessed in the present study. We found that there is insignificant association between the hypertension and the lipid profile that is 70 % of patients with dyslipidemia have hypertension and 60 % of patients with normal lipid profile also have hypertension (i.e. the occurrence of hypertension is not strongly related to the presence of dyslipidemia, but it is related primarily to the CRF), but among patients with dyslipidemia there is highly significant difference between the frequencies of the presence and the absence of hypertension that is 70 % of patients with dyslipidemia have hypertension versus 30% without hypertension (table 8 and 9).This means that 70 % of patients with dyslipidemia are at more increased risk for CVD and for increasing the rate of progression of renal failure.

Since the severity of lipid abnormalities correlates with the degree of proteinuria [45] and it has been established that proteinuria contributes to the progression of renal failure, and the effect of statins in reducing the decline in GFR was more significant in patients with proteinuria [46], the association of proteinuria with dyslipidemia in CRF patients had been assessed in our study. The present study showed that there is highly significant association between the proteinuria and the lipid profile that is 70 % of patients with dyslipidemia have proteinuria versus 10 % of those with normal lipid profile have proteinuria (i.e. there is a strong evidence of the possible concomitant presence of both dyslipidemia and proteinuria in patients with CRF).

Also, among patients with abnormal lipid profile there is highly significant difference between the frequencies of the presence and absence of proteinuria that is 70 % of dyslipidemic patients have proteinuria versus 30% don't have (table 10 and 11). This means that most patients with dyslipidemia are at an increased risk for progression of renal disease.

There is a synergistic effect for increasing the rate of decline in renal function in association of hypertension or proteinuria with dyslipidemia and we found that 52.5 % of CRF patients with abnormal lipid profile have both hypertension and proteinuria making them at very high risk for rapid deterioration in renal function (table 12). Furthermore, the decline of renal function is significantly associated with the baseline concentrations of cholesterol LDL-C, and HDL-C, but not with that of triglycerides [47], so the frequency of presence of hypertension, proteinuria, and both in patients with abnormalities of these lipid profile parameters had been assessed (table 13, 14, 15).

It has been found that significant percentage of Patients with hypercholesterolemia have hypertension (90.9 %) versus 9.09 % don't have (highly significant P value 0.0006). This means that 90.9 % of those patients are at increased risk for progression of renal failure. Highly significant association (P value 0.001) between abnormal LDL-C level and hypertension was found. While 81.25 % of patients with high LDL-C levels have hypertension, only 18.75 % don't have. Although, 65.3 % of Patients with abnormal HDL-C level have hypertension versus 34.6 % without hypertension, the association between low HDL-C and hypertension was statistically insignificant (P value 0.052).

Despite that hypertriglycerdemia has less evident role in the decline of renal function, its association with hypertension was also assessed because both of them regarded as risk factors for IHD and it has been found that 71.42 % of hypertriglycerdemic Patients have hypertension versus 28.57 are free of hypertension (highly significant P value 0.003), so the majority of

patients with hypertriglycerdemia have an associated elevated blood pressure making them at high risk for CVD.

Regarding the association of proteinuria with abnormal lipid profile parameters; 81.8 % of hypercholesterolemic Patients were found to have proteinuria, while the percentage of those who don't have protein in urine was 18.18% (significant P value 0.01), ¾ of Patients with abnormal LDL-C level have proteinuria versus 25% without proteinuria (significant P value 0.01).

Although that the percentage of those who have proteinuria in association with low HDL-C level (61.53%) was higher than those without proteinuria (38.46%), the difference doesn't reach a statistical significance. The presence of both hypertension and proteinuria in association with dyslipidemia add more risk for progression of renal disease and it has been found that: 72. 72% of hypercholesterolemic Patients have both hypertension and proteinuria; presence of both elevated blood pressure and protein in urine found in 62.5% of those with high LDL-C level; 46.15% of patients with low HDL-C level have both hypertension and proteinuria.

Conclusions

There is high prevalence of dyslipidemia among studied group of patients with CRF. Lipid abnormalities can occur early as well as late in the course of renal failure with an even distribution of dyslipidemia in relation to the duration of chronic renal failure. This might be explained by the possibility of the presence of long period of clinically unapparent renal impairment before renal failure had been diagnosed. Hypertriglyceridemia is the commonest reported abnormality in studied patients with chronic renal failure. Low HDL-C level is the second most common abnormality in our patients, and it might be the sole abnormality in lipid profile. Type IV phenotype is the commonest pattern among dyslipidemic chronic renal failure patients. High percentage of dyslipidemic patients have hypertension or proteinuria, so there is an increased risk for cardiovascular disease and increasing progression of renal failure. More than half of patients with dyslipidemia have both hypertension and proteinuria, so they are at very high risk for deterioration of renal function.

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