EVALUATION OF URINARY MONOCYTE CHEMOTACTIC PROTEIN -1 IN CHILDHOOD NEPHROTIC SYNDROME

By

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ABSTRACT

***Background/aim*:** The role of pro-inflammatory cytokines in the immunopathogenesis of idiopathic nephrotic syndrome had been widely postulated. Reports on the release of cytokines, during idiopathic nephrotic syndrome (INS) activation, were conflicting in defining a specific interleukin pattern during relapse and remission of the disease. The monocyte chemoattractant protein -1 (MCP-1) is a member of the CC chemokine family, and a potent chemotactic factor for monocytes. It plays an important role in the recruitment of monocytes/macrophages into renal tubulointerstitium . !

Aim: The present study was designed to check urinary MCP-1 levels in pediatric patients with idiopathic nephrotic syndrome, and to detect effect of disease remission and activity on these levels.

Patients and methods: the present work included fourty children with idiopathic nephrotic syndrome, subdivided into 2 groups: group A(cases in remission) & group B(cases in activity). Also twenty apparently healthy children age and sex matched with the cases have been included as a control group. All patients in this work beside assessment of renal functions were clinically evaluated together with routine laboratory investigations. Levels of urinary monocyte chemotactic protein-1 were measured in the urine of patients during activity and remission of the disease. Urine samples from 20 age- and sex matched controls were checked for the same cytokine.

Results: mean age for the studied cases were 8.14±2.50 years. In the present study, group (B) had the highest level of serum cholesterol and pr/cr ratio then group (A) and control group, the differences between the three groups were statistically significant. In contrast, group (B) had the lowest level of the serum albumin followed by group (A) then control group, again, the differences were statistically significant between the three groups. Also , the mean values of protein of 24 hours urine were significantly lower among group A than group B, and the differences between the two groups were statistically highly significant . this work show that Group (B) had the highest levels of uMCP-1 followed by group (A) then control group. The difference between the three group was statistically highly significant. Our work shows that 40% of cases in activity in group B were in relapse of NS and the remaining -60%- were in the 1st attack of NS, and there was no significant difference between them regarding to uMCP-1. The

current study shows that uMCP-1 level in group B and group A were highly positively correlated with Pr/Cr ratio , Protein of 24 hours urine and serum cholesterol and highly negatively correlated with serum albumin. On the other hand uMCP-1 levels in control subjects were positively correlated with Pr/Cr ratio but not correlated with serum cholesterol or serum albumin.

Conclusion: Our results support the role of monocyte chemotactic protein-1 in the pathogenesis of INS.

Key Words : Childhood Nephrotic Syndrome, Urinary Monocyte Chemotactic Protein -1(uMCP-1), Relapse, Remission.

INTRODUCTION

Nephrotic syndrome (NS) is one of the most common glomerular disorders of childhood. It is characterized by proteinuria that is severe enough to cause hypoalbuminemia and edema (1).The development of kidney disease involves a complex interplay between neurohormonal, inflammatory and biochemical changes which act on either intrinsic or extrinsic renal cells, or both. This can lead to the development of an innate immune response predominantly characterized by the accumulation and activation of leukocytes, particularly monocytes/ macrophages, in the kidney. Chemokine-induced recruitment of peripheral leukocytes into tissues is a critical step in the development of inflammatory responses (2)**.**

The role of pro-inflammatory cytokines in the immunopathogenesis of idiopathic nephrotic syndrome had been widely postulated. Reports on the release of cytokines, during idiopathic nephrotic syndrome (INS) activation, were conflicting in defining a specific interleukin pattern during relapse and remission of the disease (3)

The monocyte chemoattractant protein -1 (MCP-1) is a member of the CC chemokine family, and a potent chemotactic factor for monocytes (4). It plays an important role in the recruitment of monocytes/macrophages into renal tubulointerstitium(5)

The present study was designed to check urinary MCP-1 levels in pediatric patients with idiopathic nephrotic syndrome, and to detect effect of disease remission and activity on these levels and also to compare our results with the urinary levels ofMCP-1 in age and sex matched control group.

PATIENTS AND METHODS

This study is a cross-sectional included fourty children with nephrotic syndrome; from those attending the pediatric nephrology clinic, AL HUSSEIN university hospital; And who were under

regular follow up. During the period from July 2016 to April 2017. Diagnostic criteria for INS were based on the International Study of Kidney Disease in Children (6). Also twenty apparently healthy children age and sex matched as control group. The group of patients comprised 40 children; they were 17 males and 23 females. Their ages ranged from 4 years – 14 years.

***Inclusion criteria*:** included children and adolescents with well-established INS with still preserved renal function, followed-up from 2016 to 2017, whose parents gave their consent to participate in the study protocol.

Exclusion criteria: Patients with renal impairment (high serum creatinine level) or patients with any manifestations of systemic disease or patients with secondary nephrotic syndrome.

The patients were classified into 2 groups: **Group A:** This group included 20 nephrotic patients in remission (marked reduction in proteinuria to < 4 mg/m2/h or urine albumin dipstick of 0 to trace for 3 consecutive days in association with resolution of edema)(7)**.** It included 8 males and 12 females, their ages ranged from 4.5 -14 years with a mean age is (8.2+2.6) years. **Group B:** This group included 20 nephrotic patients in activity (1st time or relapser) (recurrence of severe proteinuria > 40 mg/m2/h or urine albumin dipstick > 2 on 3 successive days, often with a recurrence of edema after withdrawal of steroid therapy)(7). It included 9 males and 11 females, their ages ranged from 4.1 -13.1 years with a mean age is (8.5+3) years.

Control group: The control group comprised twenty (20) age and sex matched healthy children 8 males and 12 females, their ages ranged from 5.5 -12 years with mean age of(8.5+2.7) years.

Ethical aspects: The Ethics Committee of the Al – Azhar Univeristy Faculty Of Medicine (Cairo) Pediatric Department approved the study. Informed consent was obtained from parents of all included subjects. The research protocol did not interfere with any medical recommendations or prescriptions. Blood samples in control group were only drawn simultaneously to other routine blood exams. The follow-up of the INS patients and healthy controls was guaranteed even in cases of refusal to participate in the study.

All studied patients were subjected to the following:

1. Detailed history taking laying stress on: Symptoms of nephrotic syndrome, duration of the disease, response to steroid therapy, frequency of relapses, other medications and complications of steroid therapy.
2. Careful clinical examination laying stress on: • Blood pressure measurement and sign of oedema. • Complications of steroid therapy. • Systemic examination include all body systems. • Manifestation of any systemic disease.
3. Laboratory investigations including:
   A) Routine investigations including: • CBC, CRP, ESR.
   B) Investigations for nephrotic syndrome: serum albumin, serum cholesterol, complete urine analysis, urine protein/ creatinine ratio and protein of 24 hrs. urine.
   C) Renal function tests: serum creatinine and serum urea.
   D) Quantitative determination of urinary monocyte chemotactic protein-1 (uMCP-1).

Immunoassays of uMCP-1 cytokine. Freshly voided urine samples were collected by sterile tube and centrifuged at 2000 RPM for 20 minutes.The supernatant was then collected, aliquoted and immediately frozen at -80 C till the time of assessment. Urine samples, collected from patients and controls, were analyzed to determine concentrations of secreted cytokine uMCP-1, were measured by specific enzyme-linked immunoassay (ELISA) kits using Bioassay Technology Laboratory Kits, according to manufacturer's instructions. The mean concentration of cytokine was expressed as picogram per milliliter. Using the abovementioned kits, the minimum detectable concentration of MCP-1 cytokine was 8 pg/mL.

Statistical analysis. The data were coded, entered and processed on computer using SPSS (version 18).The results were represented in tabular and diagrammatic forms then interpreted. Mean, standard deviation, range, frequency, and percentage were used as descriptive statistics.

RESULTS

Table (1): Comparison between cases and control group regarding age and sex.

		Cases		Controls		t. test	P. value
		No.	%	No.	%		
Sex	Male	17	42.5%	8	40.0%	X^2.034	.853
	Female	23	57.5%	12	60.0%		
Age (years)	Range	4.16-14.08		5.66-11.56		-.680	.499
	Mean±SD	8.14±2.50		8.57±1.83			

This table shows that there was no statistically significant difference between cases and controls groups regarding age and sex

Table (2): Comparison between groups A and B (cases) regarding blood pressure and odema.

		Group A (in remission)		Group B (in activity)		X^2	P. value
		No.	%	No.	%		
Blood pressure	within normal	20	100.0%	17	85.0%	3.243	.072
	hypertension	0	.0%	3	15.0%		
odema	Absent	20	100.0%	6	30.0%	21.538	.000
	Present	0	.0%	14	70.0%		

This table shows that **:** No significant difference was found between group A (cases in remission) and B (cases in activity) regarding blood pressure. On other hand , there was statistically significant differance detected between group A (cases in remission) and B (cases in activity) regarding presence of odema which was present in 70% of group B and absent in group A.

Table (3): Comparison between three groups regarding serum creatinine & blood urea .

		Group A (in remission) (No.=20)	Group B (in activity) (No.=20)	Control group (No.=20)	P. value
Serum creatinine (mg/dl)	**Range**	**0.45-0.9**	**0.3-0.9**	**.40-.90**	**0.746**
	Mean±SD	**0.675±0.225**	**0.6±0.3**	**.65±.25**	
blood urea (mg/dl)	**Range**	**24-50**	**18-64**	**17-45**	**0.901**
	Mean±SD	**37±13**	**41±23**	**34±7.11**	

This table shows that : there was no significant difference between Group A (cases in remission), Group B (cases in activity)& Control group as regard to serum creatinine & blood urea .

Table (4): Comparison between cases and control group regarding RBCs, HB, HTC, TLC, PLT and CRP.

		Cases (No.=40)	Control group (No.=20)	t. test	P. value
RBCs	Range	3.72-5.50	3.90-5.22	-.635	.528
	Mean±SD	4.49±.480	4.57±.370		
HB	Range	10.00-13.80	10.80-12.50	1.115	.269
	Mean±SD	11.92±.934	11.67±.503		
HTC	Range	26.40-45.80	32.00-48.00	-.795	.430
	Mean±SD	37.60±3.98	38.50±4.35		
TLC	Range	4.40-39.90	4.20-9.80	1.780	.07
	Mean±SD	9.98±5.49	8.48±4.63		
PLT	Range	228.00-548.00	228.00-425.00	1.040	.46
	Mean±SD	380.50±77.61	360.60±56.62		
CRP	Range	2.00-12.00	2.00-6.00	1.578	.07
	Mean±SD	3.67±2.86	3.90±1.55		

This table shows that there was no statistically significant correlation between cases and control group regarding RBCs , HB , HTC , TLC , PLT counts and CRP .

Table (5): Comparison between groups of cases (group A and B) regarding urine albumin.

		Group A (in remission) (No.=20)		Group B (in activity (No.=20)		X^2	P. value
		No.	%	No.	%		
Urine albumin	++	0	.0%	8	40.0%	40.00	.000
	+++	0	.0%	12	60.0%		
	absent	11	55.0%	0	.0%		
	trace	9	45.0%	0	.0%		

This table shows that: presence of urine albumin was high in patients with activity (group B, ++ & +++), while was absent or trace in patients in remission (group A) , the difference between the two groups was statistically highly significant .

Table (6): Comparison between : group A (cases in remission), group B (cases in activity) & control group regarding serum albumin, cholesterol, pr. / Cr. Ratio and protein of 24 hours urine.

		Group A (in remission) (No.=20)	Group B (in activity) (No.=20)	Control group (No.=20)	P. value	LSD
S. Albumin (g/dl)	Range	2.60-3.40	1.70-3.10	3.10-4.20	.000	P1 < .001 P2 < .001 P3 < .001
	Mean±SD	3.07±.224	2.15±.412	3.60±.336		
Cholesterol (mg/dl)	Range	138.00-184.00	215.00-456.00	60.00-124.00	.000	P1 < .001 P2 < .001 P3 < .001
	Mean±SD	157.70±10.71	285.10±45.87	92.35±17.57		
pr. / Cr. Ratio	Range	.45-1.46	11.20-38.20	0.04-0.1	.000	P1 < .001 P2 < .001 P3 < .001
	Mean±SD	.995±.265	19.69±6.35	0.07±0.03		
Protein of 24 hours urine (gm)	Range	.13-.30	.50-8.50	-	.000	-
	Mean±SD	.164±.042	2.51±1.87	-		

- P1: between group A and control group.
- P2: between group B and control group.
- P3: between group A and group B.

This table shows that: group B (cases in activity) had the lowest level of the serum albumin followed by group A (cases in remission) then control group, the differences between the three groups were statistically highly significant.

In contrast, group B (cases in activity) had the highest level of serum cholesterol and pr. / Cr. ratio followed by group A (cases in remission) then control group, again, the differences between the three groups were statistically highly significant.The mean value of protein of 24 hours urine in group B was significantly higher than in group A, again, the difference between the two groups was statistically highly significant.

Table (7): Comparison between cases and control group regarding uMCP-1.

		Cases (No.=40)	Controls (No.=20)	t. test	P. value
uMCP-1 (pg/dl)	Range	88.00-745.00	25.00-90.00	4.656	.000
	Mean±SD	232.60±175.98	48.20±16.35		

This table shows that : the mean value of uMCP-1 was significantly higher among cases than control group and the difference was statistically highly significant .

Table (8): Comparison between the different studied groups as regards level of uMCP-1.

Variable		Group A (cases in remission)	Group B (cases in activity)	Control group	F test	P value	LSD
uMCP-1 (pg/dl)	Range	88.00-108.00	159.00-745.00	25.00-90.00	65.67	.000	P1=.000 P2=.000 P3=.090
	Mean±SD	99.50±5.83	365.70±161.98	48.20±16.35			

This table shows comparison between studied groups (A, B & controls) in relation to uMCP-1:

Group (B) had the highest level of uMCP-1 followed by group (A) then control group and the difference between the three groups was statistically highly significant .

There was a statistically significant difference between group A and group B regarding uMCP-1 (p1. value= .**000**).

Also, there was a statistically significant difference between group B and control group regarding uMCP-1 (p2. value= .**000**).

There was no a statistically significant difference between group A and control group regarding uMCP-1 (p3. value= .**090**).

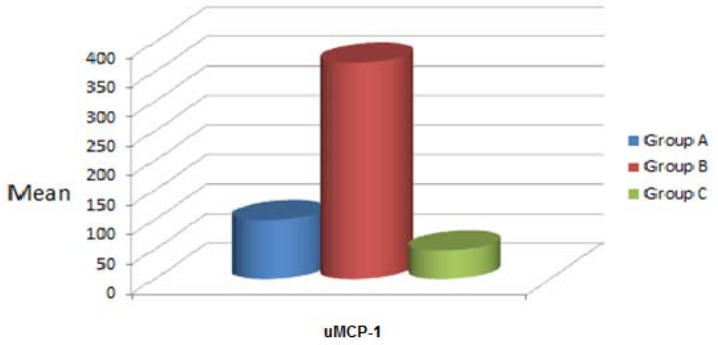


Figure (1): Comparison between groups A, B, and control group regarding uMCP-1.

Table (9): Comparison regarding uMCP-1 between cases with activity (either in relapse or first attack of nephrotic syndrome) in group B:

Group B (cases in activity)	No.	%	uMCP-1 (pg/dl)		
			Mean±SD	t. test	P. value
1st attack	12	60	370.50±130.75	1.040	.46
Relapsers	8	40	342±123.85		

This table shows that : there was no significant difference found between cases with 1st attack and those in relapse among group B.

Table (10): Correlation between uMCP-1 and other variables among group A (cases in remission).

Correlation	Pearson's correlation	
	r	p
S. Albumin * uMCP-1 (g/dl)	-.094	.024
cholesterol * uMCP-1 (mg/dl)	.354	.016
pr. / Cr. ratio * uMCP-1	.289	.017
Protein of 24 hours urine * uMCP-1 (gm)	.008	.043

This table shows : There was a statistically significant positive correlation between uMCP-1 and (**cholesterol, pr./Cr. ratio and protein of 24 hours urine**). On the other hand a negative correlation was found between uMCP-1 and **S. albumin**

Table (11): Correlation between uMCP-1 and other variables among group B (cases in activity)

Correlation	Pearson's correlation	
	r	p
S. Albumin * uMCP-1 (g/dl)	**-.177**	**.021**
cholesterol * uMCP-1 (mg/dl)	**.078**	**.018**
pr. / Cr. Ratio * uMCP-1	**.113**	**.024**
Protein of 24 hours urine * uMCP-1 (gm)	**.113**	**.023**

This table shows that the same correlation found in group A was present in group B with the same statistically significant differences .

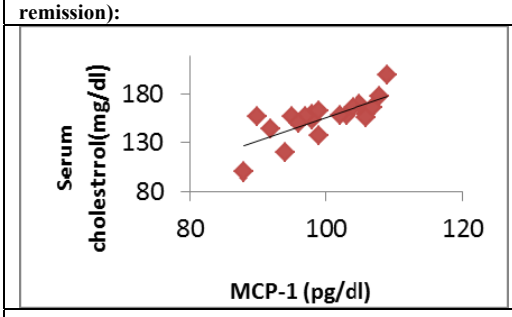
Table (12): Correlation between uMCP-1 and other variables among the control group

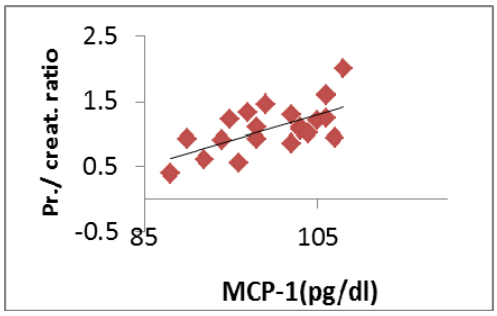
Correlation	Pearson's correlation	
	r	p
S. Albumin * uMCP-1 (g/dl)	**-.238**	**.214**
cholesterol * uMCP-1 (mg/dl)	**.298**	**.228**
pr. / Cr. Ratio * uMCP-1	**.81**	**.001**

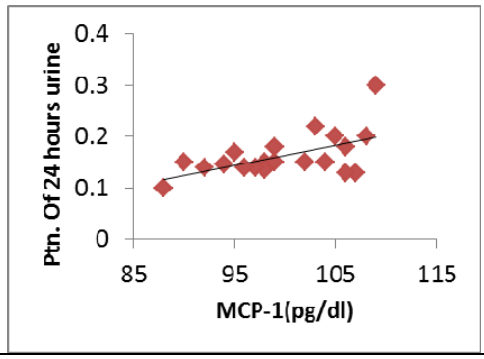
This table shows no statistically significant correlation between uMCP-1and (S. albumin, cholesterol) in control group.

On the other hand, there was a statistically significant positive correlation between uMCP-1 and (**pr./Cr. ratio**)

Figure (2): Correlation between uMPC-1and serum cholesterol, pr./Cr. ratio, Protein of 24hours urine and serum albumin among group A(cases in remission):







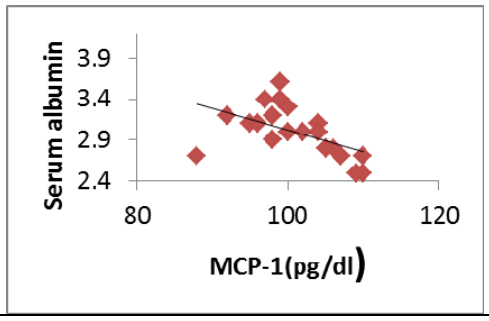
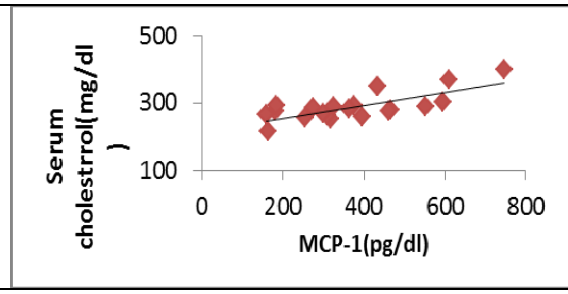
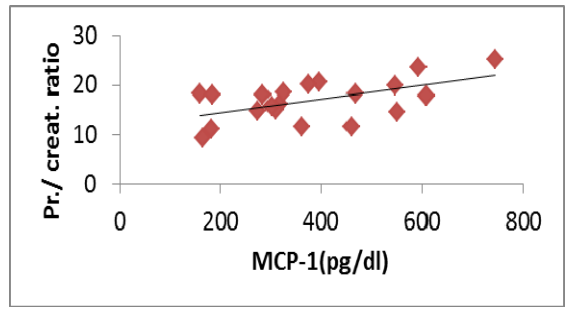
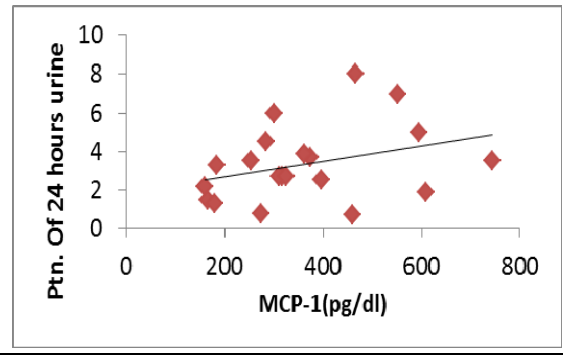


Figure (3): Correlation between uMPC-1and serum cholesterol, pr./Cr. ratio, Protein of 24hours urine and serum albumin among group B(cases in activity):







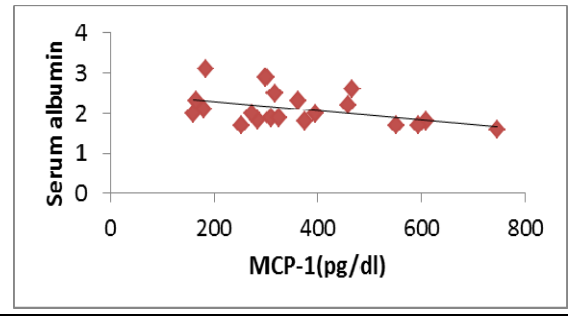


Table (13): Validity of uMCP-1 in prediction of nephrotic syndrome.

Marker	AUC	Sensitivity %	Specificity %	PPV %	NPV %	Accuracy %	Cut off
uMCP-1 (pg/ml)	**.10**	**98.5%**	**100%**	**100%**	**96%**	**95%**	**93.5**

This table shows Validity of uMCP-1in prediction of nephrotic syndrome:

This shows that the uMCP-1 is considered highly valid marker in case of idiopathic nephrotic syndrome . Urinary MCP-1 was reliable to predict idiopathic nephrotic syndrome patients P<0.0001 and AUC (area under the curve) is 1.

The best cut off value was 93.5 pg/ml with a sensitivity of 98.5%, specificity 100%, PPV 100% and NPV 96% with a diagnostic accuracy of 95% (i.e. patients with uMCP-1 > 93.5 pg/ml will be considered as nephrotic patient).

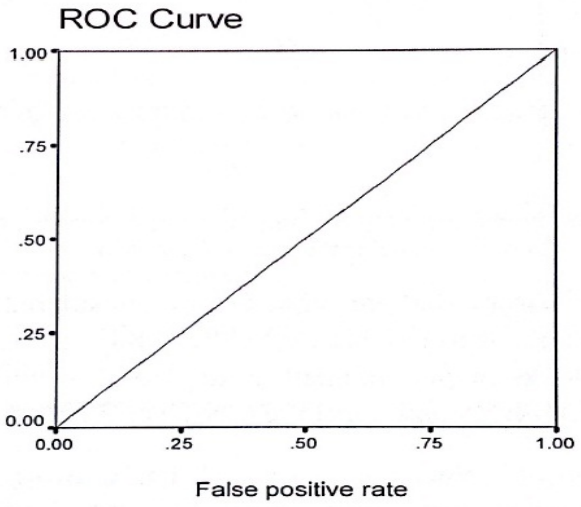


Figure (4): Receiver Operating Characteristic (ROC) curve to define the best cutoff to uMCP-1 patients with nephrotic syndrome.

DISCUSSION

The pathogenesis of INS still remains obscure. The immune system is thought to play a pivotal role, and there is a lot of evidence that supports this theory (8-10). In 1974, Shalhoub(11)developed a hypothesis that INS was an immune disorder, with increased levels of a lymphocyte-derived permeability factor. Since then,

several groups have studied possible factors that could be responsible, at least in part, for the physiologic abnormalities of INS (9,12). In this study, we specifically focused on the evaluation of urinary concentration of MCP-1/CCL2 in children with INS, since previous reports described alterations of these immune mediator in diverse renal diseases, including glomerulopathies (13-15).

As regard nephrotic syndrome clinical presentations, Our results showed no significant difference was found between cases & control group regarding blood pressure, but there was statistically significant difference detected between cases and control group regarding presence of odema. On other hand, 70% of cases in activity (group B) were presented by facial &L.L oedema, and no one of cases in remission (group A) or in control group presented by oedema. ***Khan & Javaid***, ***2001*** reported that 65% of cases in active nephrotic syndrome presented by facial & L.L. oedema (16).

As regards routine laboratory investigations (CBC & CRP) for the studied cases & controls, there was no statistically difference between cases and control group. Also, no significant difference was found as regard to serum creatinine & blood urea. ***Yao and Mao, 2010, Tahar and Aymen 2011*** reported normal renal function (serum craetinine & blood urea) in many cases with idiopathic NS(17,18), Which agree with our study. Also, this result agrees with ***Souto et al. (2008),*** who reported that no differences were detected, in nitrogen waste levels (urea and creatinine) between INS groups and controls(19).

As regard to proteinuria (urine albumin), presence of urine albumin was higher in patients with activity (group B) than patients in remission (group A), and the difference between the two groups was statistically highly significant. These results agree with the study conducted by ***Bakkaloglu et al. (2005),*** they observed a significant positive correlation between nephrotic syndrome in activity and massive proteinuria in contrast to nephrotic syndrome in remission (20).

In the present study, group (B) had the highest level of serum cholesterol and pr/cr ratio then group (A) and control group, the differences between the three groups were statistically significant. In contrast, group (B) had the lowest level of the serum albumin followed by group (A) then control group. Again, the

differences were statistically significant between the three groups. Also, the mean values of protein of 24 hours urine were significantly lower among group A (cases in remission) than group B (cases in activity) , and the differences between the two groups were statistically highly significant. These results agree with the study conducted by ***Bakkaloglu et al. 2005*(20).**

The current study findings show a highly significant difference in uMCP-l levels between the cases and controls. Similar findings were also observed in ***Woroniecki et al. (2008)*** study(21). Our findings in this work show that Group B (cases in activity) had the highest levels of uMCP-1 followed by group A (cases in remission) then control group. The difference between the three groups was statistically highly significant. Similarly ***Cho et al (2003)*** reported high concentrations of IL-8 and MCP-1 in the urine and plasma of pediatric patients with MCNS during activity in comparison to patients in remission and healthy controls(22).

Our work shows that 40% of cases in activity in group B were in relapse of NS and the remaining -60%- were in the 1st attack of NS, and there was no significant difference between them regarding to uMCP-1. These results agree with those reported by ***Iyengar et al. (2011)***(23).

The current study shows that uMCP-1 level in group B and group A were highly positively correlated with Pr/Cr ratio , Protein of 24 hours urine and serum cholesterol and highly negatively correlated with serum albumin. These results agree with many previous reports (24-26)**.**

Morii et al (2003) suggested that increased urinary excretion of MCP-1 in the patients with glomerulopathy is probably due to the enhanced production of MCP-1 in renal tubules(27). From the previous studies, the renal tubules secretion of uMCP-1 is expected to be increased simultaneously when urinary MCP-1 excretion is increased induced by up regulation of MCP-1 gene and its protein expression due to excessive exposure to plasma protein filtered from the damaged glomeruli(24-27).

CONCLUSION

Urinary MCP-1 highly sensitive and specific biomarker in childhood nephrotic syndrome for early detection of disease activity as its level is markedly elevated early in the course of the disease. Also, this biomarker can be used for

prediction of disease remission when its level started to decrease.

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تقييم البروتين الأول المسئول عن الانجذاب الكيميائى للخلايا الموحدة فى بول الأطفال المصابين بالمتلازمة النفروزية

الهدف من البحث : يهدف هذا البحث لمقارنة مستوى البروتين الأول المسئول عن الانجذاب الكيميائى للخلايا الموحدة فى بول الأطفال المصابين بالمتلازمة النفروزيه أثناء التحسن والانتكاسة لمحاولة إيجاد علاقة بين مستوى البروتين الأول المسئول عن الانجذاب الكيميائى فى البول وطبيعة وشدة المرض .

المرضي وطرق البحث: أجريت هذه الدراسةِ على أربعين طفلا يعانون من المتلازمة الكلوية والمترددين على وحدة كلى الأطفال بمستشفى الحسين الجامعى بالقاهرة تم تقسيمهم إلى مجموعتين:

- **المجموعة الأولي:** تضم هذه المجموعة عشرون طفلا (8 ذكور و 12 إناث) أثناء التحسن من المتلازمة النفروزية تتراوح أعمارهم من 4,5 إلى 14 سنة.
- **المجموعة الثانية:** تضم هذه المجموعة عشرون طفلا (9 ذكور و 11 إناث) أثناء الانتكاسة بالمتلازمة النفروزية تتراوح أعمارهم من 4,1 إلى 13 سنة.

بالإضافة إلى **مجموعة ضابطة :** تضم هذه المجموعة عشرون طفلا من الأصحاء (8 ذكور و12 إناث) تتراوح أعمارهم من 5,5 إلى 12 سنة ، كمجموعة ضابطة للمرضى من حيث العمر والجنس.

جميع الحالات أُخضعتْ إلى الآتى (بعد أخذ الموافقة من الأهل) :

1) أخذ التاريخ المرضى الكامل.
2) الفحص السريري الشامل .
3) أبحاث طبية هى : صورة دم كاملة ، تحليل بولِ ، وظائف كلى (بولينا ، وكرياتنين بالدم) ، نسبة الألبيومين بالدم , نسبة الكوليستيرول بالدم ، نسبة الببروتينات فى 24 ساعة بول أو نسبة البروتين / الكرياتنين بالبول ، بالإضافة إلى قياس نسبة البروتين الاول المسئول عن الانجذاب الكيميائى للخلايا الموحدة بالبول وذلك بواسطة (ELISA).

النتائج :

- أوضحت الدراسة عدم وجود علاقة بين المرضى أثناء التحسن أو الانتكاسة من ناحية ومدة المرض أو العمر الذى ظهر به من ناحية أخرى
- اشتملت نَتائِجَ التحليل الإحصائي للبيانات على أنّ الأعراضَ الأكثر شيوعاً عند المرضى أثناء الانتكاس كانت تورم الوجه والقدمين (70 % من المجموعة الثانية) على العكس من المجموعة الأولى - مرضى أثناء التحسن- التى لم يوجد بها هذا العرض.
- لوحظ أن وظائف الكلى (بولينا ، وكرياتنين بالدم) لكل الحالات كانت فى المعدلات الطبيعية.
- لوحظ أيضا انخفاض ملحوظ فى نسبة الألبيومين بالدم بالمجموعة الثانية أكثر من المجموعة الأولى والتى بدورها تقل عن معدلاتها الطبيعية فى المجموعة الضابطة .
- كما لوحظ ارتفاع ملحوظ فى نسبة الكوليستيرول بالدم و نسبة البروتينات فى 24 ساعة بول أو نسبة البروتين / الكرياتنين بالبول بالمجموعة الثانية أكثر من المجموعة الأولى .
- أوضحت الدراسة ارتفاع ملحوظ فى نسبة البروتين الأول المسئول عن الانجذاب الكيميائى للخلايا الموحدة ببول المجموعة الثانية عن المجموعة الأولى والتى بدورها – المجموعة الأولى – تزيد عن المجموعة الضابطة .
- أظهرت الدراسة بوضوح وجود علاقة طردية بين البروتين الأول المسئول عن الانجذاب الكيميائى للخلايا الموحدة بالبول وكلا من البروتين / الكرياتنين بالبول و نسبة البروتينات فى 24 ساعة بول والكوليستيرول بالدم ؛ وعلاقة عكسية مع مستوى الالبيومين بالدم فى المرضى أثناء التحسن أو الانتكاسة .

التوصيات:

1- الاهتمام بأخذ التاريخ المرضى بدقة,الفحص السريرى,الفحوصات المعملية للأطفال الذين يعانون من المتلازمة الكلوية ضرورى للتشخيص السليم.

2- قياس نسبة البروتين الأول المسئول عن الانجذاب الكيميائى للخلايا الموحدة بالبول اختبار له أهمية فى تشخيص حدوث المتلازمة النفروزية وحدوث الانتكاسات بها.

3- تكثيف الأبحاث لقياس نسبة البروتين الأول المسئول عن الانجذاب الكيميائى للخلايا الموحدة بالبول فى مختلف أمراض الكلى الأخرى .