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Electrophoresis patterns of proteinuria in various renal diseases of childhood

If the system of glomerular filtration and tubular reabsorption functions properly, only vestigial amount of fine protein coming from plasma is present in excreted urine. Besides, in urine you can find protein secreted by the tubular cells or protein coming from the upper urinary tract in the amounts that cannot be marked by standard methods (8, 9). Each proteinuria that recurs in screening research may suggest the suspicion of pathology then. The estimation of selectivity of proteinuria is of great diagnostic importance (1, 2, 4, 5, 9, 10, 12, 15).

The purpose of the study was to assess electrophoresis patterns of proteinuria in children with different renal diseases.

MATERIAL AND METHODS

The study comprised 52 children (30 boys and 22 girls) aged 2–18 years (the average 11.9 years) hospitalized in the Department of Nephrology, University Children's Hospital in Lublin. The nephrotic syndrome (NS) was diagnosed in 26 (50%) children. Proteinuria ranged from 51 to 360 mg/kg of body weight/24h – (the average: 105.6 mg/kg/24h) among those patients. It was accompanied by the decrease in the concentration of total protein in serum, which ranged from 3 to 6.2 g/l (the average: 4.1 g/l), albumin concentration from 0.8 to 3.1 g/l (the average: 1.7 g/l) and increased concentration of cholesterol in serum from 191 to 699 mg% (the average: 406.2 mg%).

Table.1. Mean value of selected biochemical parameters in nephrotic children

	Min.	Max	Mean value	SD
Age (year)	2	16.4	10.3	3.1
Proteinuria (mg/kg of body weight/24h)	21.0	360.0	105.,6	10.8
Serum protein level (g/l)	3.0	6.2	4.1	0.9
Serum albumin level (g/l)	0.8	3.1	1.7	0.5
Serum cholesterol level (mg%)	191.0	699.0	406.2	104.3

Among 13 out of 26 children (50%) it was steroid – responsive NS, among 5 out of 26 (19%) steroid resistant NS and among 8 out of 26 (31%) steroid dependent NS. The renal

biopsy was carried out in 7 out of 26 nephrotic children (27%). One child (14%) was diagnosed with minimal change glomerulonephritis. Five children (72%) were diagnosed with mesangio-proliferative glomerulonephrits. One child (14%) with NS was diagnosed with membrano-proliferative glomerulonephritis. In 11 children (21%) glomerulonephritis (GN) was diagnosed. Among these patients proteinuria which did not exceed 50 mg/kg of body weight/24h was observed. Erythrocyturia at the right serum concentration of total protein, albumin, cholesterol and the lack of edema were also observed. In 5/11 children with GN (45.5%) renal biopsy was performed. Rapidly progressive GN and mesangio-proliferative GN were diagnosed in one child (20%) and 4 children (80%) respectively. In 15 children (29%) only isolated proteinuria (IP) was diagnosed. Among all the examined children serum concentrations of urea and creatinine were normal.

Electrophoresis of urinary proteins was evaluated by sodium duodecyl sulphate-polyacrylamide gel electrophoresis (SDS) using the system of SEBIA-Hydrogel Proteinuria set. The samples examined after they had been coloured with acid violet pigment were optically compared with the marker of molecular weight.

RESULTS

Selective glomerular proteinuria was found in 20 examined patients (38.5%), including 13 children with NS (65%), 5 with GN (25%) and 2 children (10%) with IP. Nonselective glomerular proteinuria was found in 27 children (52%), including 13 children with NS (48%), 4 children with GN (15%) and 10 children with IP (37%). Mixed glomerular/tubular proteinuria was found in 5 examined children (9.5%) including 2 children with GN (40%) and 3 children with IP (60%)– Tab.2, Fig.1.

Among the examined children with NS selective glomerular proteinuria, where the molecular weight of the urinary proteins was within 70–80 kDa (albumin, transferrin) was stated among 76% of children with steroid-responsive NS, and 40% of children with steroid-resistant SN and only 12.5% of children with steroid-dependent NS (Tab. 2). Taking into consideration histological diagnosis, those were the children with minimum change GN and20% of children with mesangio-proliferative GN. Among other patients with SN glomerular nonselective proteinuria was observed. Apart from protein with molecular weight of 70-80 kDa (albumin, transferrin) the presence of protein with molecular weight exceeding 90 kDa (IgG, IgA) was also stated. It was one child who, by means of renal biopsy, was diagnosed with membranoproliferative GN. There were also 4children (80%) who were diagnosed with mesangio-proliferative GN (Tab. 3). Among the children with clinical diagnosis of GN,

Table 2. Patterns of proteinuria in children with different renal diseases

Proteinuria	NS			GN	IP	Total	
	steroid resistant	steroid responsive	steroid dependent			N	%
Glomerular selective proteinuria	2 40%	10 76%	1 12.5%	5 45.5%	2 13.3%	20	38.5%
Glomerular nonselective proteinuria	3 60%	3 24%	7 87.5%	4 36.4%	10 66.7%	27	52%
Mixed proteinuria	0	0	0	2 18.1%	3 20%	5	9.5%
Total	5 100%	13 100%	8 100%	11 100%	15 100%	52	100%

Table 3. Patterns of proteinuria in different pathomorphological changes in children with glomerulopathies

Histopathological picture	Proteinuria				Total	
	glomerular selectivity		glomerular nonselectivity			
	N	%	N	%	N	%
Minimum change GN	1	8.33	0	0	1	8.33
Mesangio-proliferative GN	3	25	6	50	9	75
Membranoproliferative GN	0	0	1	8.33	1	8.33
Rapidly progressive GN	0	0	1	8.33	1	8.33
TOTAL	4	33.33	8	66.7	12	100

selective glomerular proteinuria was found in 45.5% of children. In 36.4% of children from this group glomerular nonselective proteinuria was diagnosed. In this group glomerular nonselective proteinuria and mixed glomerular/tubular proteinuria were diagnosed in 36.4% and 18.1% of children, respectively. In the majority of children with IP (66.7%) the nonselective pattern was revealed. In this group glomerular selective proteinuria and mixed proteinuria were observed in 13.3% and 20% of children, respectively (Tab. 2).

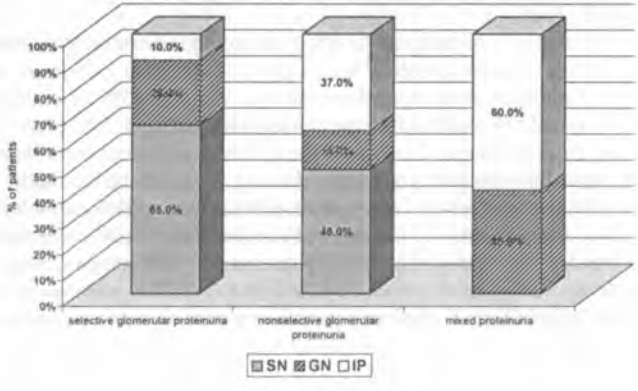

Fig.1. Patterns of proteinuria in studied children

DISCUSSION

Proteinuria is one of the main symptoms of many renal diseases. The damage of the glomerular filtration may be caused by the change of the size of pores in glomerular basement membrane (GBM). The loss of negatively charged albumin is largely due to loss of the negative charge on the GBM (3, 10, 14). The result of this disorder is glomerular proteinuria, in which a protein with molecular weight of 40–90kDa predominates. This is selective glomerular proteinuria. The presence of urinary proteins with molecular weight >90kDa is defined as nonselective glomerular proteinuria (2, 6, 8, 9, 10, 12). According to many authors, highly selective

proteinuria supports the existance of minimum change GN. whereas nonselective glomerular proteinuria occurs in other forms of glomerulopathies. (7, 11, 13, 14). Besides, the disorder of glomerular blood flow may cause proteinuria even if there are no structural changes or disorders of GBM charge (7,14). Among the examined patients the selective glomerular proteinuria occurred mainly among the children with steroid sensitive NS, which preceeds usually in the shape of minimum change GN. Because of the typical clinical picture and a good reaction to the steroid therapy all of the patients underwent the renal biopsy. A minimum change GN with accompanying selective glomerular proteinuria was diagnosed in the case of one patient with steroid dependent SN. As it is known a minimnm change is stated by a histologic test among those patients who react to steroid therapy badly. The clinical index is just selective proteinuria (2, 3, 4, 10, 14). Nonselective glomerular proteinuria, which is mainly caused by ultrastructural damage of GBM (1, 2, 3, 4, 7, 14), was observed in SN mainly among patients with its steroid dependent and steroid resistant form. In some of the patients mesangio-proliferative GN or membranoproliferative GN were histologically diagnosed. The research showed that IP, which was sometimes observed among children, can be not only of glomerular selective and glomerular nonselective proteinuria but also mixed glomerular/tubular proteinuria. In renal tubular disorders β_2-microglobuline and lysozyme urinary excretion we observed. (2, 7, 11). In our material mixed proteinuria was found in 2 children with GN and in 3 children with IP (in those patients renal biopsy was not performed). The study shows that electrophoresis of proteinuria in children with various renal diseases is a method which helps to define the kind of pathology leading to proteinuria. This method also helps to establish an individual course of diagnostic and therapeutic procedure.

CONCLUSIONS

1. Electrophoretic analysis of urinary proteins is useful for the diagnosis and differentation of proteinuria

2. Electrophoresis patterns of proteinuria can be helpful in the diagnosis and management of children with various renal pathology.

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SUMMARY

The purpose of the study was to assess electrophoresis patterns of proteinuria in children with different renal diseases. The study comprised 52 children (30 boys and 22 girls) aged 2-18 years hospitalized in the Department of Nephrology, University Children's Hospital, Lublin. Nephrotic syndrome, glomerulonephritis and isolated proteinuria were diagnosed in 26, 11 and 15 children, respectively. Electrophoresis of urinary proteins was performed using the system SEBIA-Hydragel Proteinuria. Steroid-responsive, steroid-resistant and steroid-dependent nephrotic syndromes were characterized by glomerular selective proteinuria in 76%, 40% and 12.5% of children, respectively. In other nephrotic children glomerular nonselective proteinuria was identified. Selective glomerular proteinuria was found in 45.5% of children with glomerulonephritis. In this group glomerular nonselective proteinuria and mixed proteinuria were diagnosed in 36.4% and 18.1% of children, respectively. In the majority of children with isolated proteinuria (66,7%) nonselective pattern was revealed. In this group glomerular selective proteinuria and mixed proteinuria were observed in 13.3% and 20% of children, respectively.

Elektroforeza białek w moczu u dzieci w przebiegu różnych chorób układu moczowego

Celem pracy była ocena obrazu elektroforetycznego białka, wydalanego z moczem u dzieci w przebiegu różnych chorób nerek. Badaniami objęto 52 dzieci (30 chłopców i 22 dziewczynki) w wieku od 2 do 18 lat (średnio 11,9 lat), hospitalizowanych w Klinice Pediatrii i Nefrologii DSK w Lublinie. U 26 dzieci (50%) rozpoznano zespół nerczycowy (ZN), u 11 dzieci (21%) kłębuszkowe zapalenie nerek (KZN) oraz u 15 dzieci (29%) stwierdzono izolowany białkomocz. Elektroforezę białka wydalanego w moczu dobowym przeprowadzono przy wykorzystaniu zestawu SEBIA- Hydrogel Proteinuria. Białkomocz kłębuszkowy selektywny stwierdzono u 76% dzieci ze sterydowrażliwym ZN, u 40% dzieci ze sterydoopornym ZN i tylko u 12,5% dzieci ze sterydozależnym ZN. U pozostałych pacjentów z ZN obserwowano białkomocz kłębuszkowy nieselektywny. Białkomocz kłębuszkowy selektywny obserwowano również u 45,5% dzieci z KZN i nienerczycową proteinurią. U 36,4% dzieci z tej grupy stwierdzono białkomocz kłębuszkowy nieselektywny i u 18,1% białkomocz kłębuszkowo-cewkowy. U dzieci z izolowaną proteinurią przeważał białkomocz kłębuszkowy nieselektywny (66,7%). Białkomocz kłębuszkowy selektywny obserwowano u 13,3%, a białkomocz mieszany – kłębuszkowo-cewkowy występował u 20% dzieci z tej grupy.